

Roadside Surveys for Calling Amphibians in Montana

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Background

- ▶ Amphibians are experiencing population declines - 43% globally
 - ▶ 3 main hypothesis as to why:
 - ▶ Habitat loss, disease, climate change
- ▶ 10 species of anurans in Montana
 - ▶ 3 Species of Concern
 - ▶ Great Plains Toad
 - ▶ Western Toad
 - ▶ Northern Leopard Frog (only in west)
- ▶ Variety of methods to determine presence and distribution
 - ▶ Nocturnal Calling Surveys
 - ▶ 6 species advertise breeding east of continental divide



Boreal Chorus Frog



Northern Leopard Frog



Woodhouse's Toad



Plains Spadefoot



Great Plains Toad



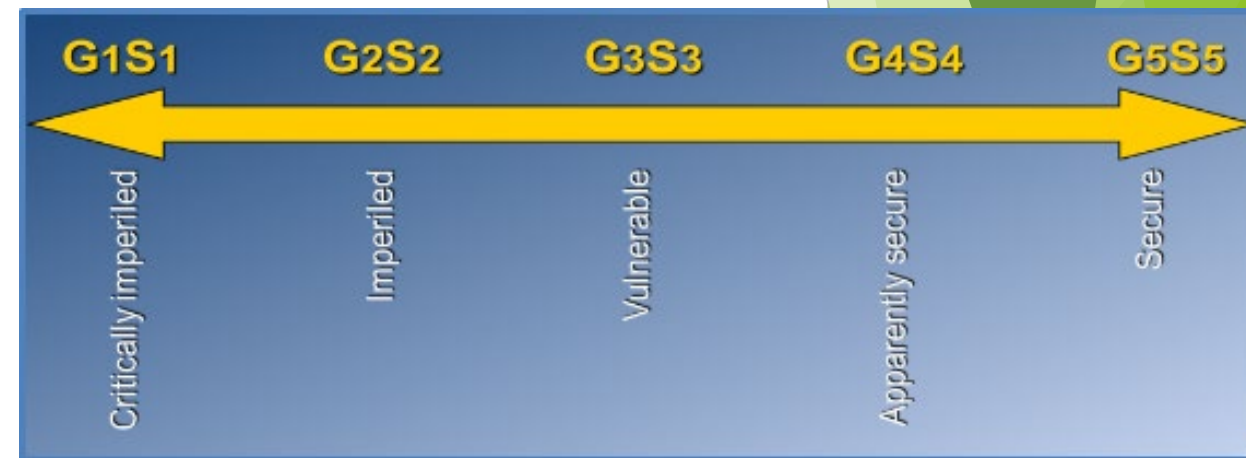
American Bullfrog

Purpose

- ▶ Data can help inform current populations in Montana
 - ▶ Degree of risk to population continuance through change in occurrence
 - ▶ Arbitrarily quantify number, size, and quality of known occurrences or populations
 - ▶ Determine changes in species/population
 - ▶ Distribution within the state
 - ▶ Population trends
 - ▶ Habitat quality/quantity over time
 - ▶ Threats to population/species stability
- ▶ Work in 2016:
 - ▶ Determine baseline indices
 - ▶ Future monitoring
 - ▶ Theoretical occupancy across species range
- ▶ Work in 2022:
 - ▶ Comparison of species composition and trends
 - ▶ Data can infer range extensions
 - ▶ Inform State Status Ranks

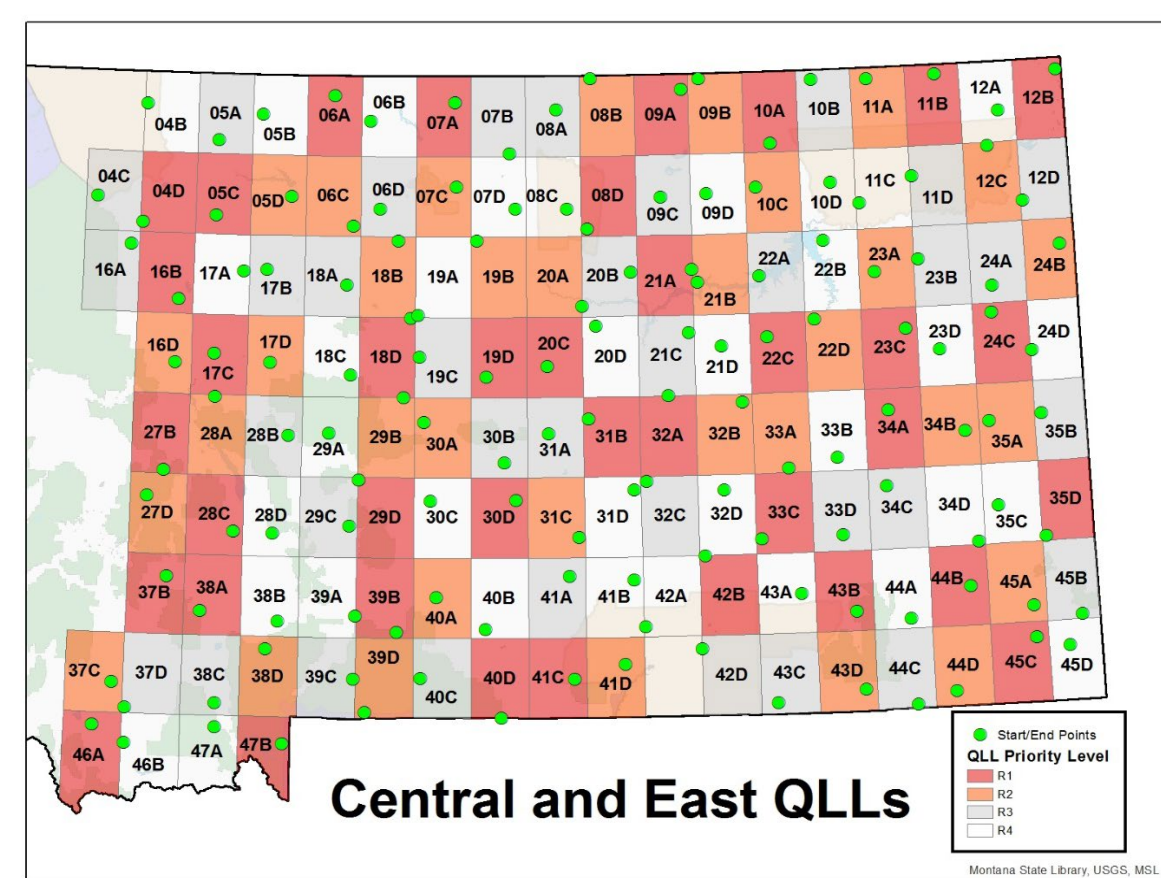


Male Great Plains Toad, photo by B. Maxell



Study Design

- ▶ Focus was in Central and Eastern Montana
 - ▶ QLLs broken into ‘Priority Ranking’
 - ▶ QLL single point selection with a rank
 - ▶ Start locations randomly assigned within QLL
 - ▶ Only 1 route/QLL
 - ▶ Allows for balanced coverage over all habitat and ownership types
- ▶ Routes:
 - ▶ 19 pre-defined routes in 2016
 - ▶ Added 5 new routes in 2022
 - ▶ Routes are 19 miles with 20 stations



Priority ranking and start locations for each survey route in QLLs for central and eastern Montana.

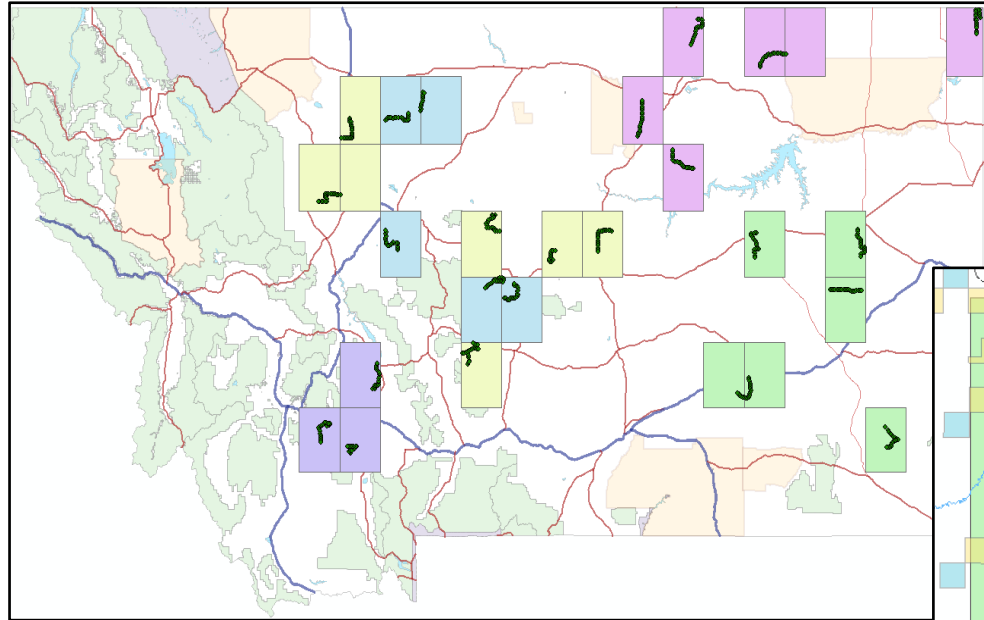
Protocols

► Conditions

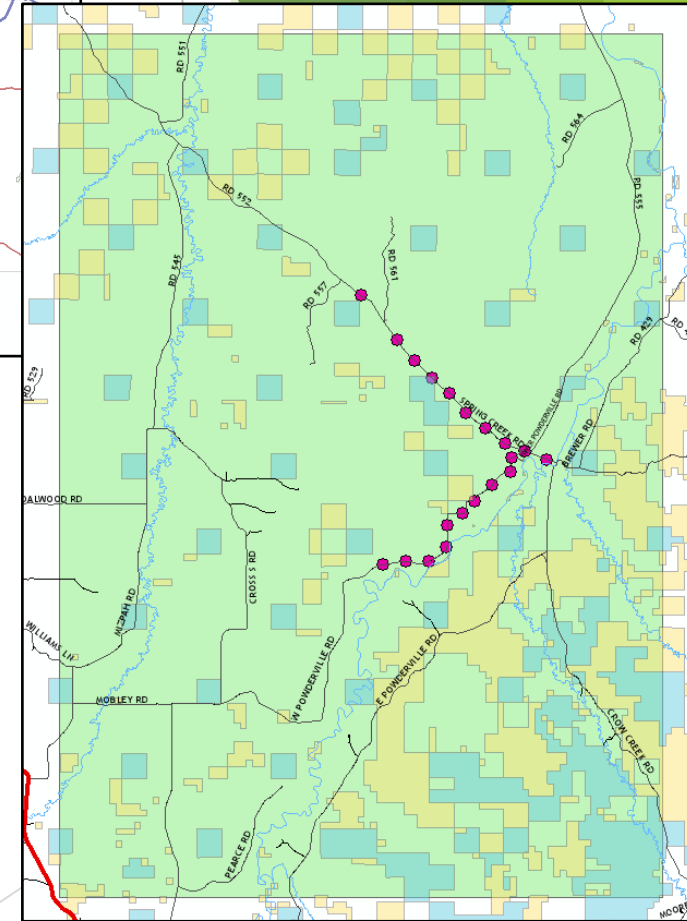
- During peak activity
 - May-June
- Periods of wet weather
 - Within 1-2 nights after heavy rains
- Evening temperatures $>10^{\circ}\text{C}$
- Between sunset and 4am

► Stations:

- Wait 3-5 minutes prior survey start
- Listen for 5 minutes and record species with distance and bearings
- Attempt to quantify # of males calling
- Report other nocturnal wildlife
- Record weather, moon, & ambient noise



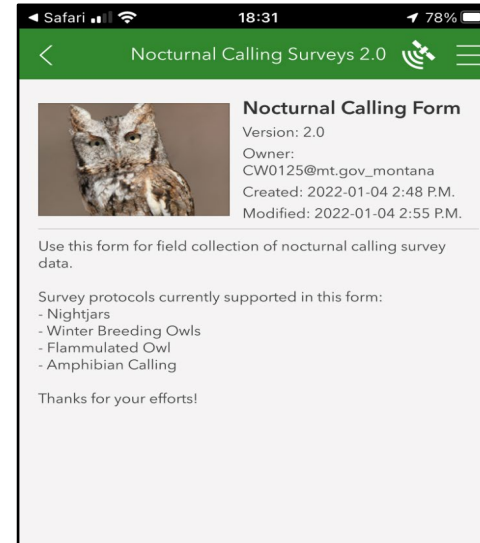
Locations of QLLs surveyed in 2022, blue QLLs were new routes added to FWP Region 4 in 2022.



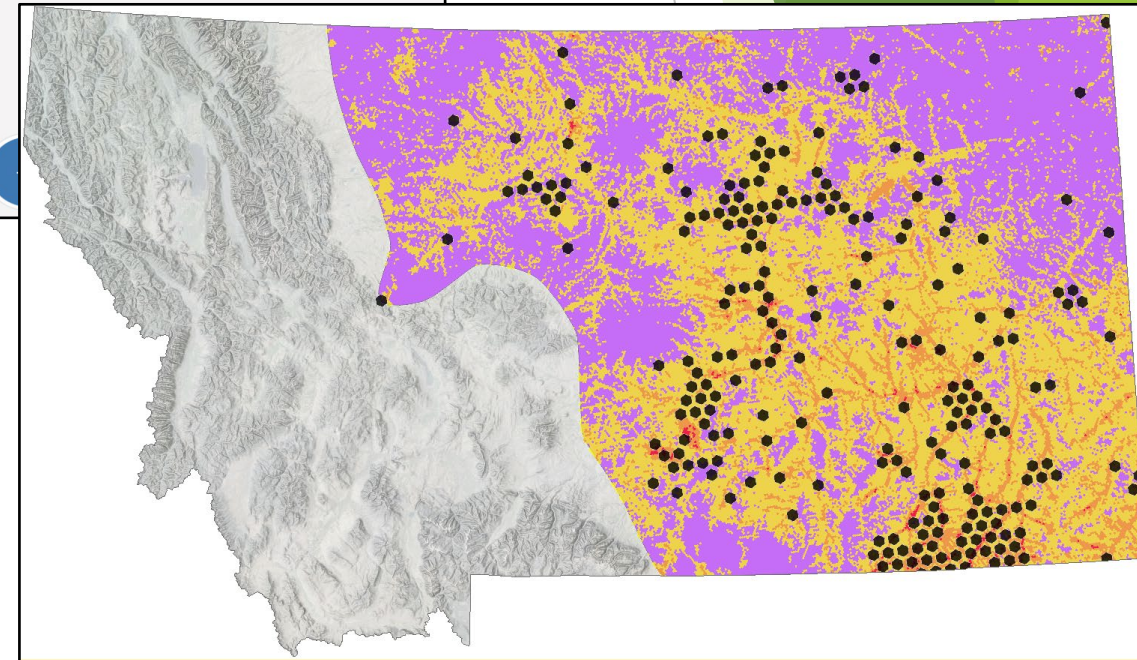
Example of QLL Route, 44B in SE Montana with Stations

Data Processing

- ▶ Amphibian and incidental species detections were entered into Survey123 apps:
 - ▶ Nocturnal Calling Surveys (amphibians)
 - ▶ MTNHP's Observation Collector
- ▶ Data were reviewed and entered in the MT Natural Heritage Program's Point Observation Database
 - ▶ Once entered, range expansions?
 - ▶ Increased the number of known occurrences across the state and potentially in places not previously identified as occupied
 - ▶ Helps to better inform the Predicted Habitat Suitability Model for amphibians, specifically Great Plains Toad (SOC and SGCN2)



Survey123 Nocturnal Calling Form for calling amphibians



Predicted Habitat Suitability Model for the Great Plains Toad with point observations (black dots) and range map (purple polygon).

Data Modelling

- ▶ Data modeled as detection/no-detection and were summarized by station and QLL
 - ▶ 44B: 00010000110000011000
- ▶ QLLs outside of a known range were removed from analysis
- ▶ Dynamic Multi-season Occupancy Model implemented using the “unmarked” package in Program R
 - ▶ QLL grid cell = “site”
 - ▶ Survey stations = “surveys” with non-zero probability of detection
 - ▶ Seasons = 2016 and 2022 survey efforts
- ▶ Covariates
 - ▶ Detection: dominant landcover within 400m of point, temperature, and year
 - ▶ Initial Probability of Occurrence: fixed
 - ▶ Extinction: fixed
 - ▶ Colonization: fixed
- ▶ Models ranked by AIC and the lowest scored model was selected



Results

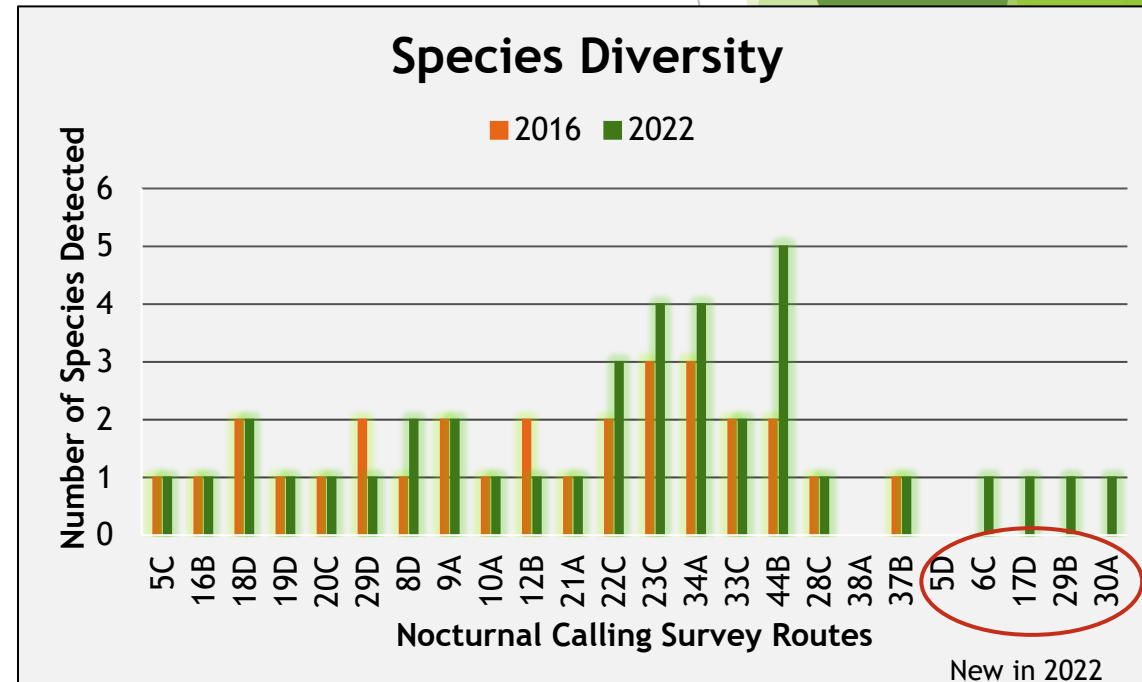
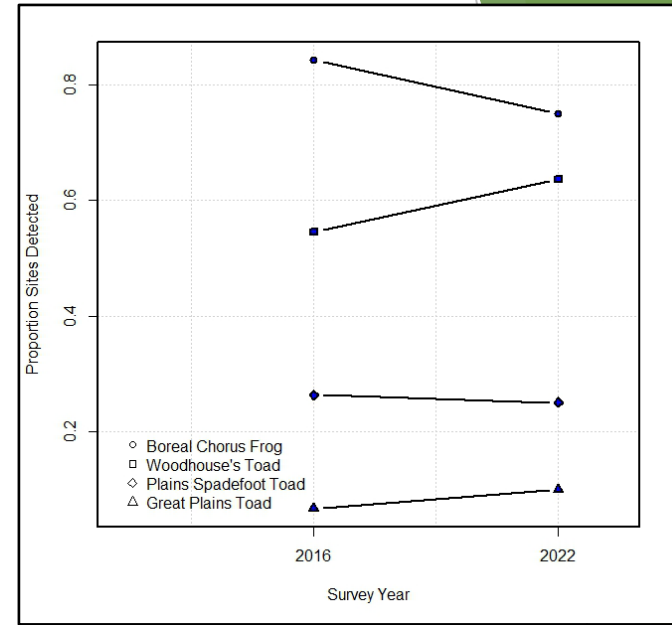
2016

- ▶ 19 Routes
- ▶ 5 spp. detected
- ▶ Most common - Boreal Chorus Frog (**664**)
 - ▶ PSMA - 17 Routes
 - ▶ ANWO - 6 Routes (**50**)
 - ▶ SPBO - 4 Routes (**139**)
 - ▶ ANCO - 1 Routes (**1**)
 - ▶ LIPI - 2 Routes (**2**)
- ▶ Species Diversity: 0-3
 - ▶ 1 route, no detections

2022

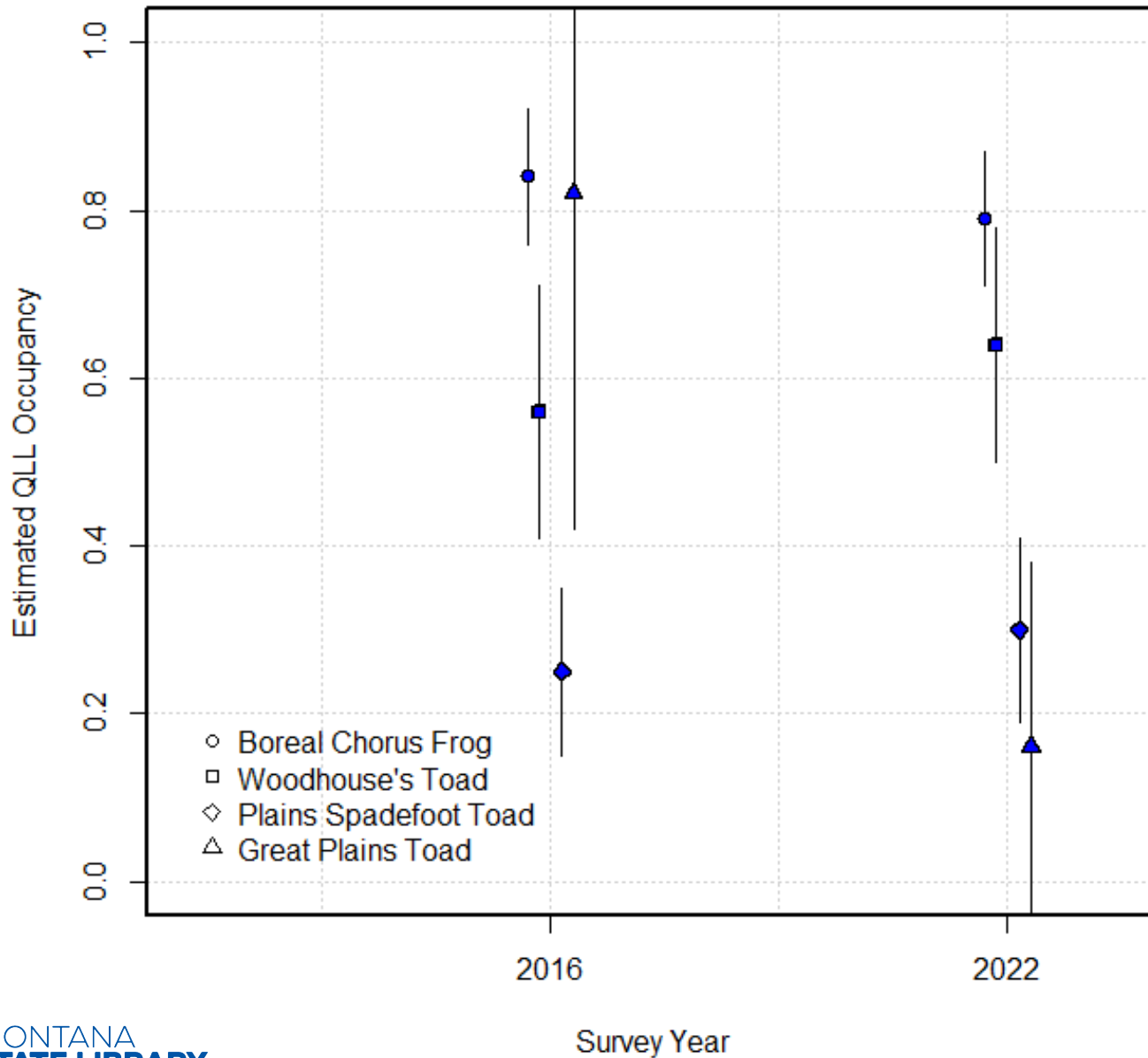
- ▶ 24 Routes
- ▶ 5 spp. detected
- ▶ Most common - Boreal Chorus Frog (**568**)
 - ▶ PSMA - 19 Routes
 - ▶ ANWO - 7 Routes (**48**)
 - ▶ SPBO - 6 Routes (**39**)
 - ▶ ANCO - 3 Routes (**14**)
 - ▶ LIPI - 3 Routes (**8**)
- ▶ Species Diversity: 0-5
 - ▶ 2 routes, no detections

*Numbers in brackets = # individuals detected across surveys for that year.



New in 2022

Results



Species	Model P	Ψ_{2016} (SE)	Ψ_{2022} (SE)
PSMA	Habitat + Year	0.84 (0.07)	0.79 (0.08)
ANWO	Year	0.59 (0.15)	0.64 (0.15)
SPBO	Null	0.25 (0.10)	0.30 (0.11)
ANCO	Temperature + Year	0.82 (0.40)	0.16 (0.22)

Results

- ▶ Incidental Observations:
 - ▶ 161 Observations of 26 species
 - ▶ 2 Species of Concern
 - ▶ 2 Potential Species of Concern
 - ▶ 2 Species of Greatest Conservation Need
 - ▶ 1 Species of Greatest Inventory Need



Long-billed Curlew
photo by Tyler Pockette



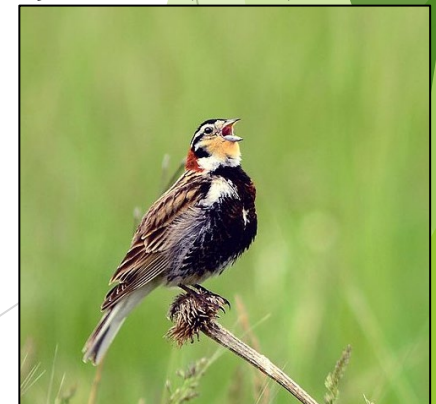
Common Poorwill
photo by Dan Bachen

Species	Status Rank	# Observations
Long-billed Curlew	SOC; *SGCN3	2
Short-eared Owl	PSOC	1
Common Poorwill	PSOC; **SGIN	2
Chestnut Collared Longspur	SOC; SGCN2	1

*Species of Greatest Conservation Need (SGCN)
 **Species of Greatest Inventory Need (SGIN)



Short-eared Owl
photo by Merle Ann Loman



Chestnut Collared Longspur
photo by USFS Mountain-Prairie,
public domain

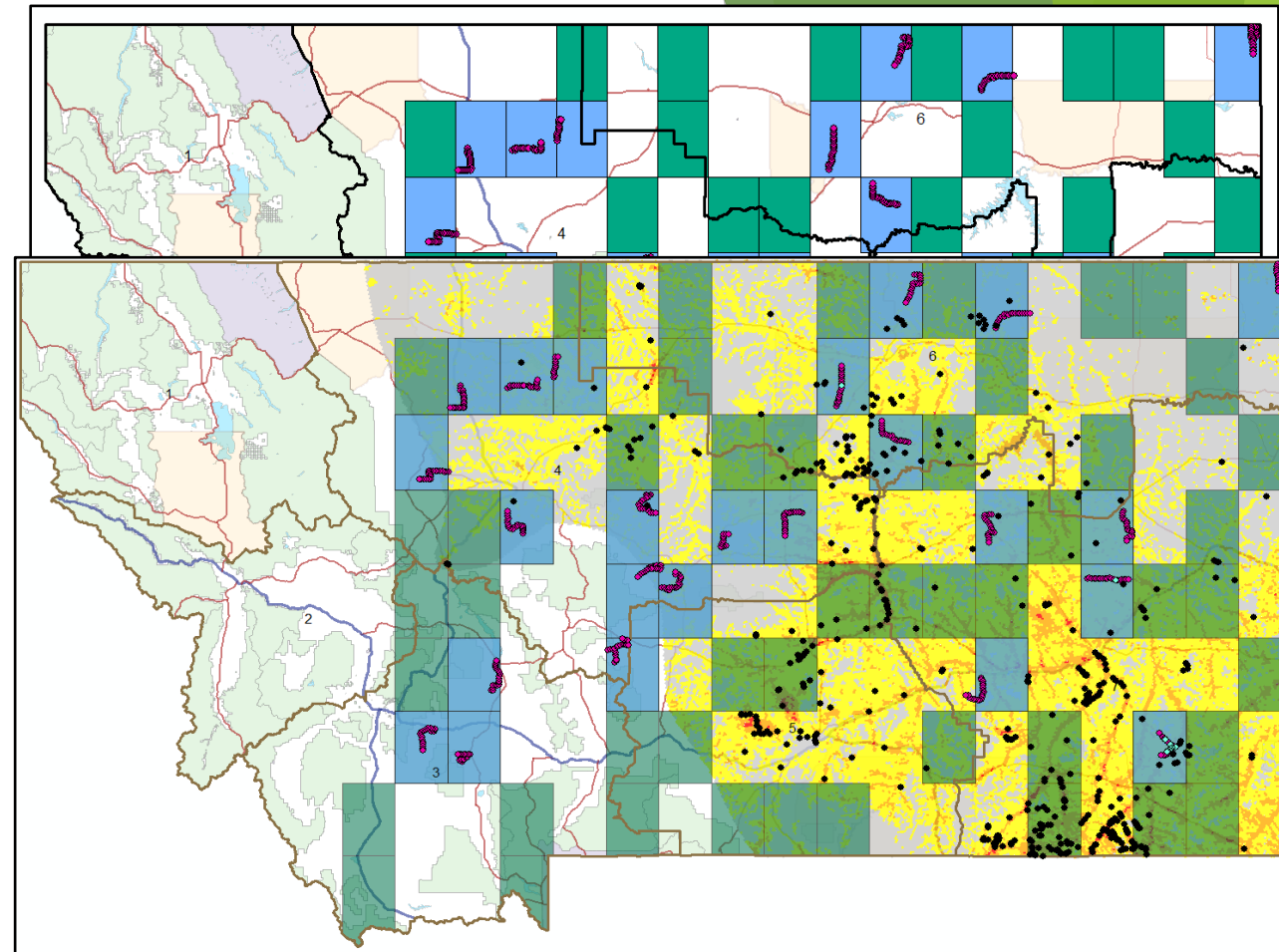
Conclusion

- ▶ Successful implementation of inventory and monitoring protocols for calling amphibian species and SOC/PSOC species
- ▶ Able to quantify proportions of Montana that have calling, or observations detected for breeding amphibians
- ▶ Proportion of sites occupied (raw data) seemed to change little for these species
- ▶ The estimated proportion of QLLS occupied within each species range was different between 2016 and 2022 for each species, however the degree of uncertainty in these estimates was sufficient that there was little support for any positive or negative trend.



Future Efforts

- ▶ Better sense of trend in populations or occupancy/distribution???
 - ▶ Increase coverage across east, south- and north-central Montana
 - ▶ Reducing uncertainty around occupancy
- ▶ Spring of 2023
 - ▶ Surveys along some routes in eastern Montana
 - ▶ Establish routes in FWP Region 5
 - ▶ fill in some holes in species occurrences or recency of observations (SPBO and ANCO)
- ▶ Better Models?
 - ▶ Establishing better coverage with increased visits = better data to model!



Map demonstrating known occurrences (black dots) and Predicted Habitat Suitability Model for the Great Plains Toads with respect to QLLs that have established routes (blue rectangles) and QLLs that have no route established (green rectangles).

Acknowledgements

- ▶ Without the help of Non-Game Biologists from Fish, Wildlife and Parks, their technicians, and volunteers this work could not have been completed.



Male calling Chorus Frog - Image from US Fish and Wildlife, public domain

THANK-
YOU!!

Questions

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PSMA

Model Ψ	Model P	AIC	Ψ_{2016} (SE)	Ψ_{2022} (SE)
~1	~1	917.6		
~1	~ Habitat	899.4		
~1	~ Temperature	911.9		
~1	~Habitat + Temperature	901.2		
~1	~Habitat + Temperature + Year	898.8		
~1	~Habitat + Year	896.8	0.84 (0.07)	0.79 (0.08)
~1	~ Temperature + Year	911.7		
~1	~Year	910.5		

ANWO

Model Ψ	Model P	AIC	Ψ_{2016} (SE)	Ψ_{2022} (SE)
~1	~1	267.3		
~1	~ Habitat	275.2		
~1	~ Temperature	269.0		
~1	~Habitat + Temperature	275.6		
~1	~Habitat + Temperature + Year	272.4		
~1	~Habitat + Year	274.3		
~1	~ Temperature + Year	267.0		
~1	~Year	266.3		

SPBO

Model Ψ	Model P	AIC	Ψ_{2016} (SE)	Ψ_{2022} (SE)
~1	~1	206.5	0.25 (0.10)	0.30 (0.11)
~1	~ Habitat	212.0		
~1	~ Temperature	207.6		
~1	~Habitat + Temperature	213.3		
~1	~Habitat + Temperature + Year	215.3		
~1	~Habitat + Year	213.7		
~1	~ Temperature + Year	209.6		
~1	~Year	208.5		

ANCO

Model Ψ	Model P	AIC	Ψ_{2016} (SE)	Ψ_{2022} (SE)
~1	~1	99.01		
~1	~ Habitat	106.5		
~1	~ Temperature	96.6		
~1	~Habitat + Temperature	105.6		
~1	~Habitat + Temperature + Year	101.7		
~1	~Habitat + Year	105.1		
~1	~ Temperature + Year	93.7		
~1	~Year	96.9		