
A Statistical Perspective on

Birdsong Suppression under Recreational Disturbance by Humans and Dogs

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01

Introduction

Project Summary and Background Information



Project Background

- **Our problem is:**

Recreational activity in natural areas can disrupt birdsong singing during critical periods of learning or courtship, increasing the risk of fitness and population declines in sensitive species.

- **Why it matters:**

Local data on birdsong disturbance caused by recreational activities can guide management efforts to protect wildlife, such as signage, leash laws, and dog walking bans. This study assessed how birds respond to user groups with and without dogs in urban greenspaces.



02

Client Needs

Address Main Goal and Question/Hypothesis



Main Goal and Hypothesis

1) Our Goal is:

Understand how different user group factors such as dog presence, human presence, and noise levels affect bird vocal behavior in urban parks. Results aim to inform both academic research and park management policies.

2) Hypothesis:

Birdsong decreases in the presence of user groups, particularly those with dogs or higher noise levels. Birds may respond differently across sites, and observation duration and time of day may influence outcomes.



03

Data Summary

Dataset Overview and Visualized Summary



Dataset Overview

Predictor Variable (X)	Data Description
Park Site (categorical)	Oaks (n=141), Sellwood (n=135), Smith Bybee (n=105)
Total Dogs (numeric)	One Dog (n=36), Two Dogs (n=19), Three Dogs (n=5)
Dog Presence (by park)	Oaks (n=12), Sellwood (n=48), Smith Bybee (n=0)
Dog Noise Level (numeric)	Level 1 (n=41), Level 2 (n=15), Level 3 (n=1), Level 4 (n=3)
Total Humans (numeric)	One Person (n=84), Two (n=37), Three (n=7), Four (n=1)
Human Presence (by park)	Oaks (n=56), Sellwood (n=56), Smith Bybee (n=16)
Human Noise Level (numeric)	Level 1 (n=58), Level 2 (n=23), Level 3 (n=45), Level 4 (n=3)
Observation Period (numeric)	Total (n=381), Min=9s, Max=191s, Median=55s, Mean=53.4s

Dataset Overview

Bird Species with Vocal Observations:

- 1) Song Sparrow ~274
- 2) Black-capped Chickadee ~181
- 3) Spotted Towhee ~103
- 4) Bewick's Wren ~67
- 5) Golden-crowned Sparrow ~26
- 6) Ruby-crowned Kinglet ~14
- 7) Lesser Goldfinch ~13

Outcome Variables:

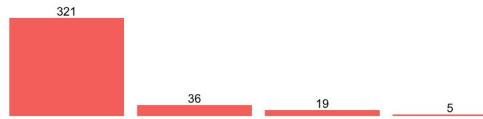
- Chipping (binary 1/0)
- Chipping Cessation (binary 1/0)
- Singing (binary 1/0)
- Singing Cessation (binary 1/0)

Consideration:

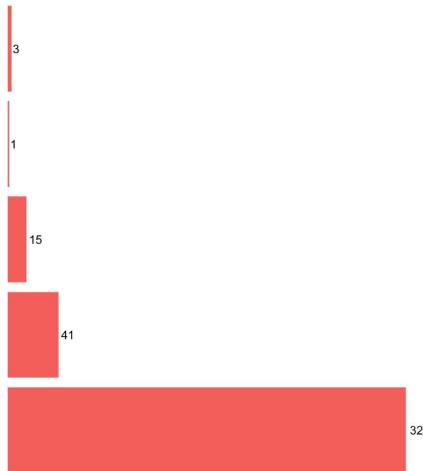
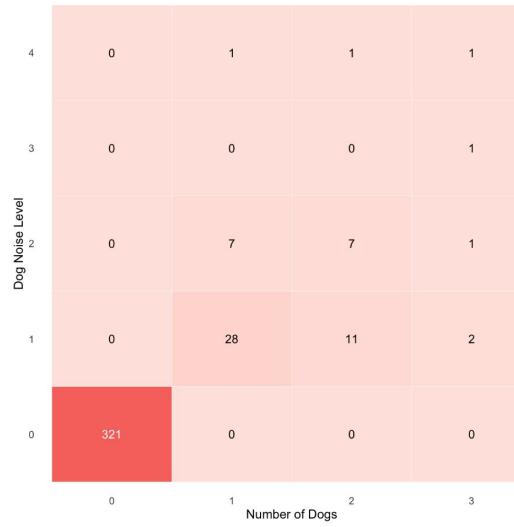
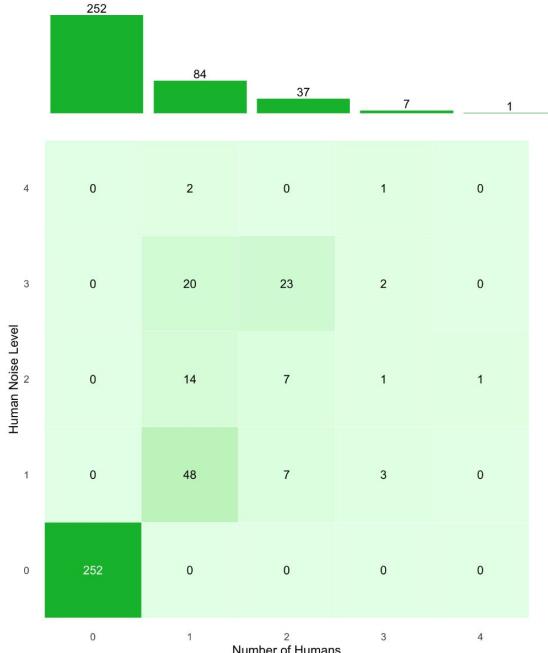
Since the Song Sparrow accounts for about 80% of the birdsong data, we have conducted a special analysis on them and treated them separately from other species.

Summary of Noise Disturbance

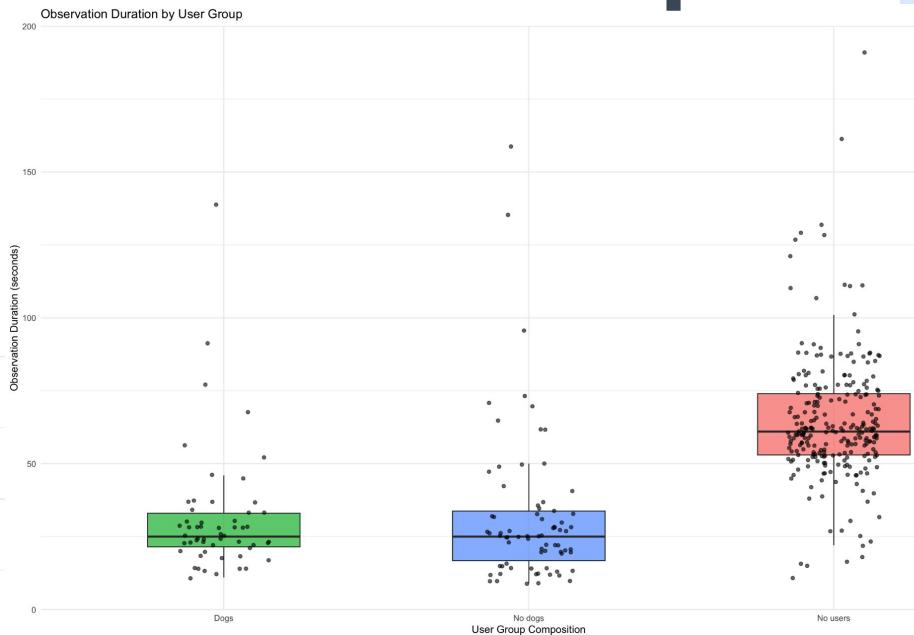
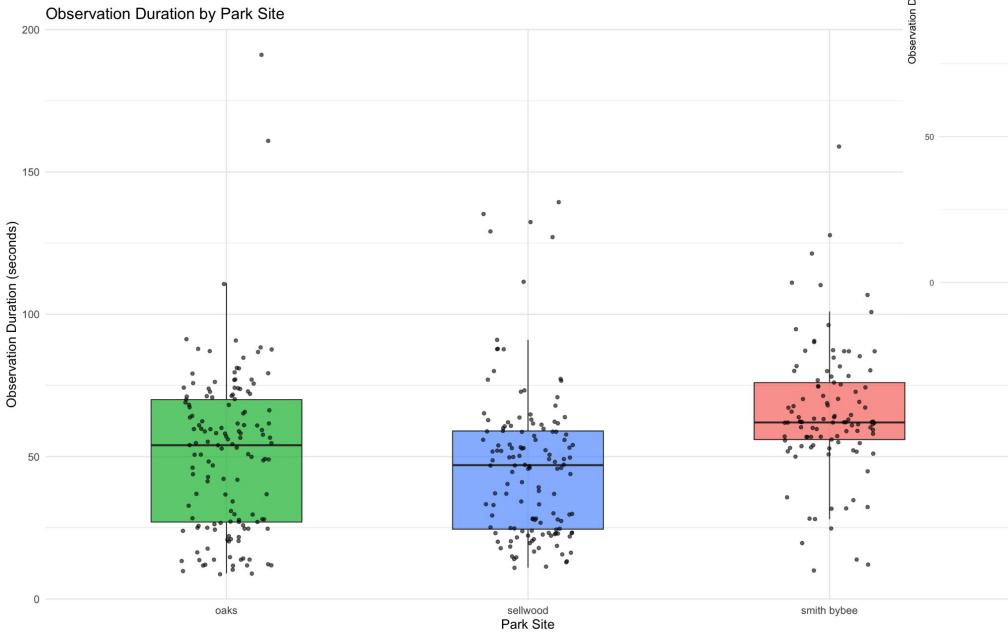
Marginal Histogram of Dog Count vs Noise Level



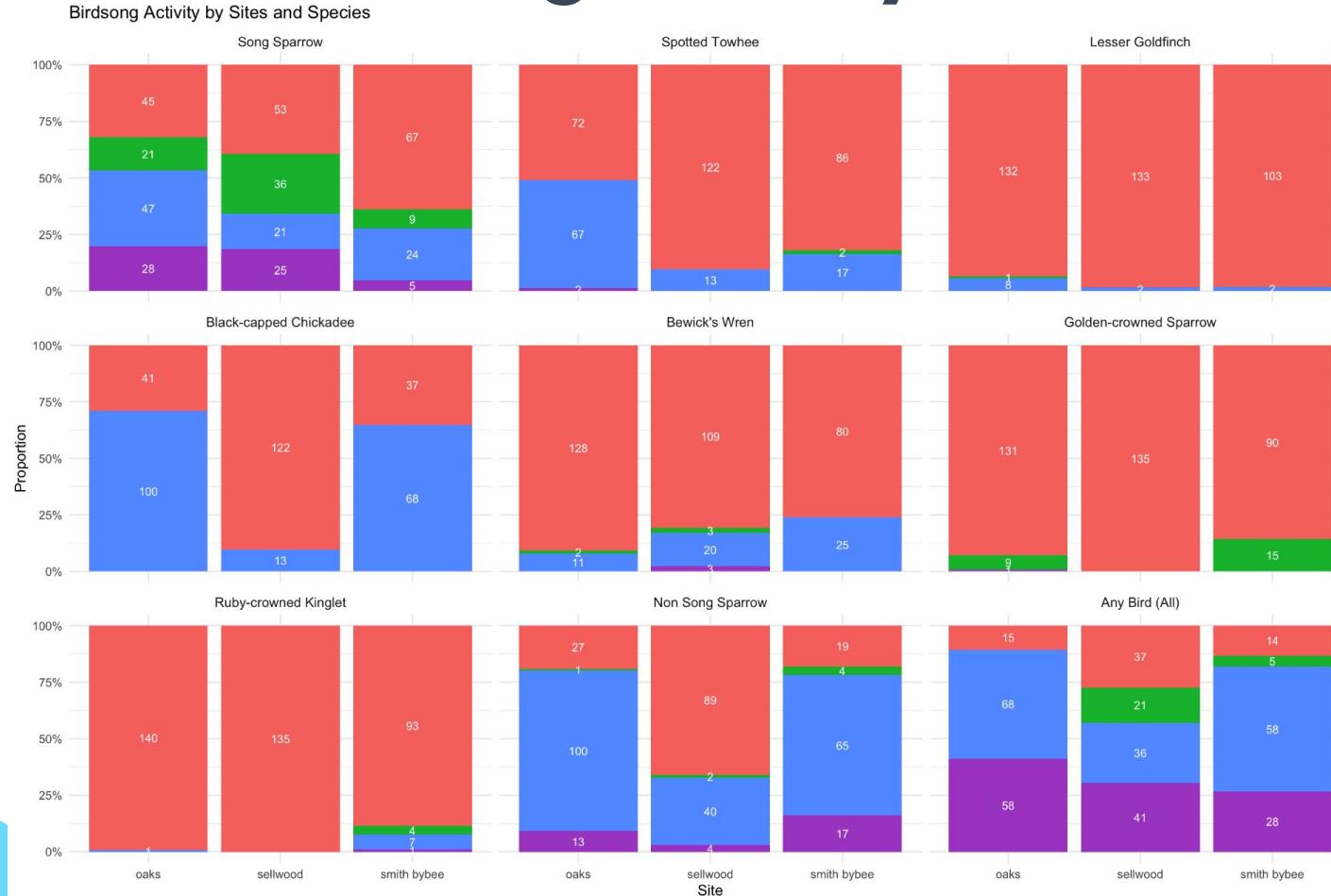
Marginal Histogram of Human Count vs Noise Level



Duration of Observations in Boxplot



Birdsong Activity Pattern





04

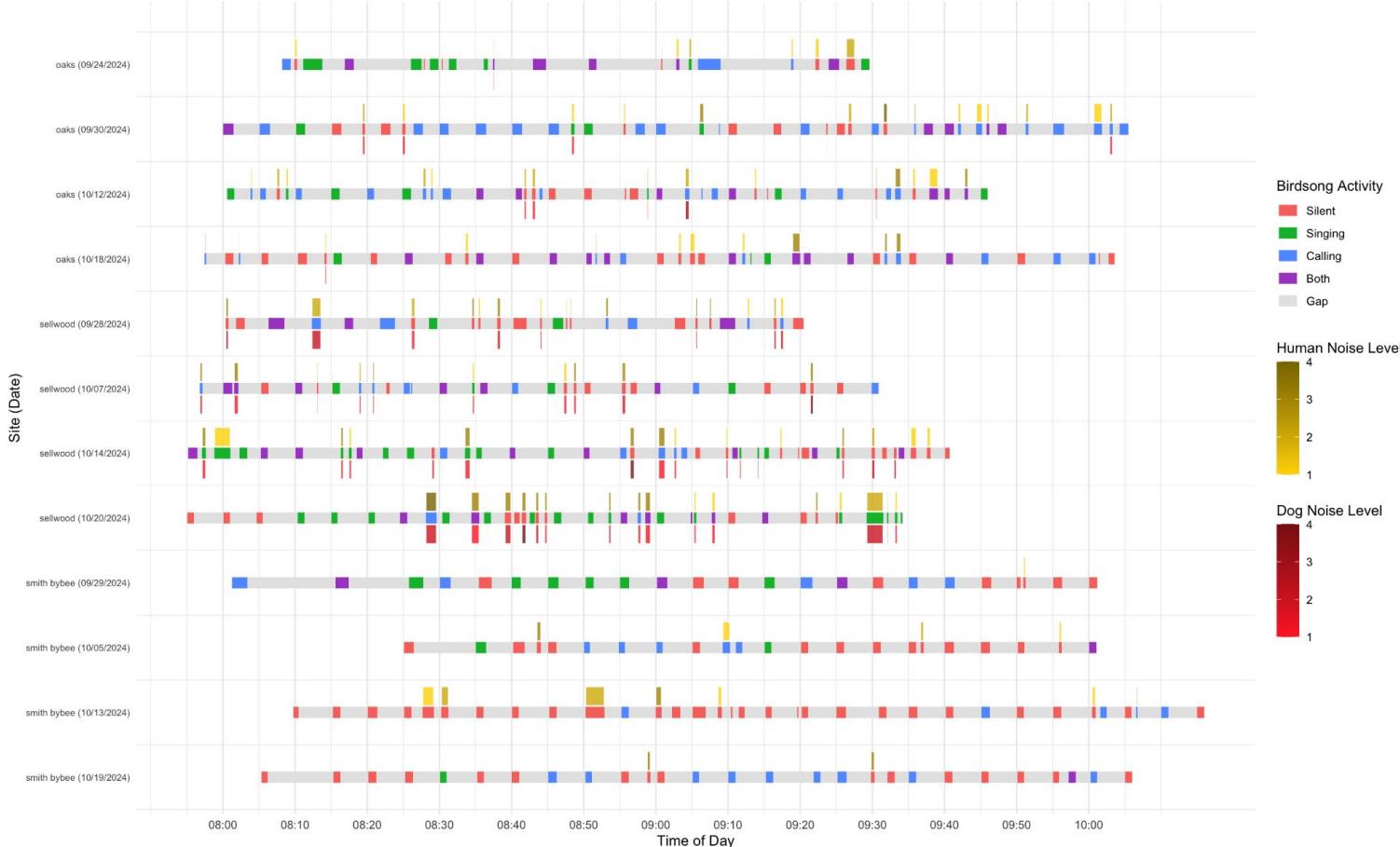
EDA Approach

Time-Series Plot and Species Radar Plot



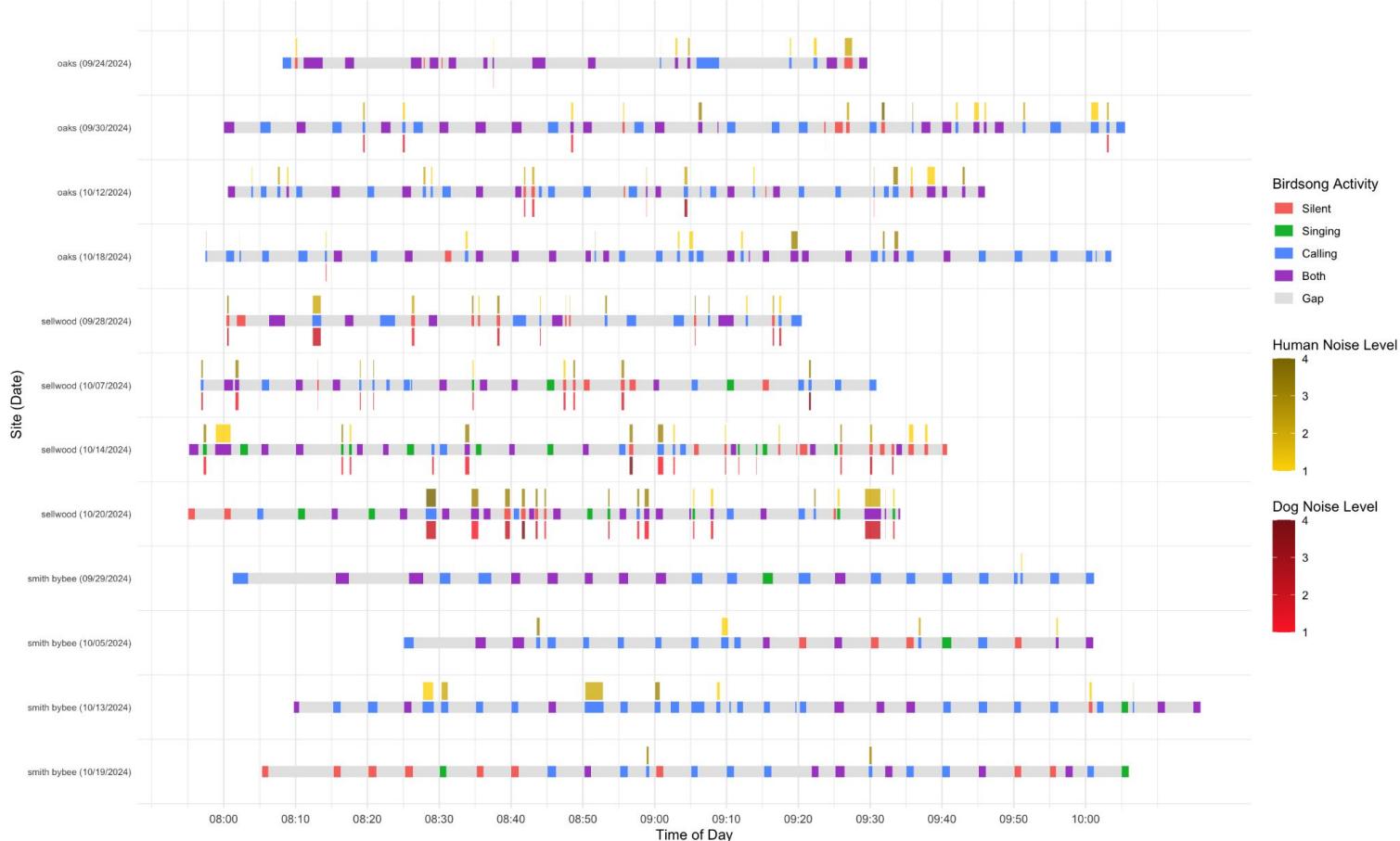
Time-Series Plot by Focal Species

Song Sparrow Activity with Human and Dog Noise Bands



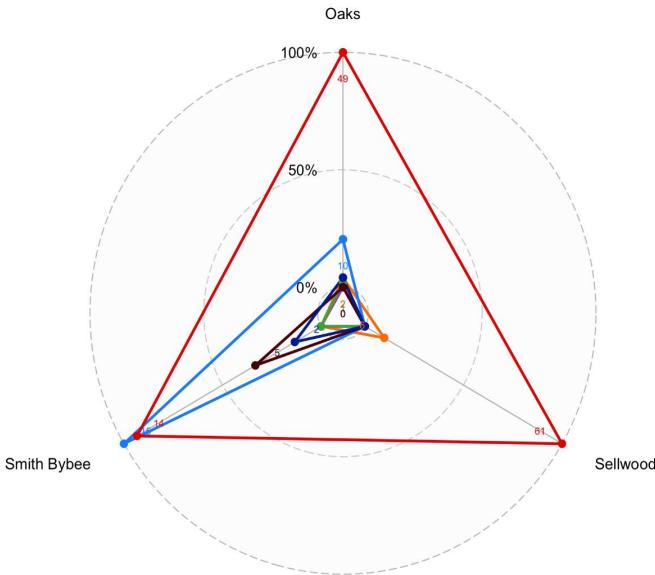
Time-Series Plot by Overall Species

Overall Birdsong Activity with Dog and Human Noise

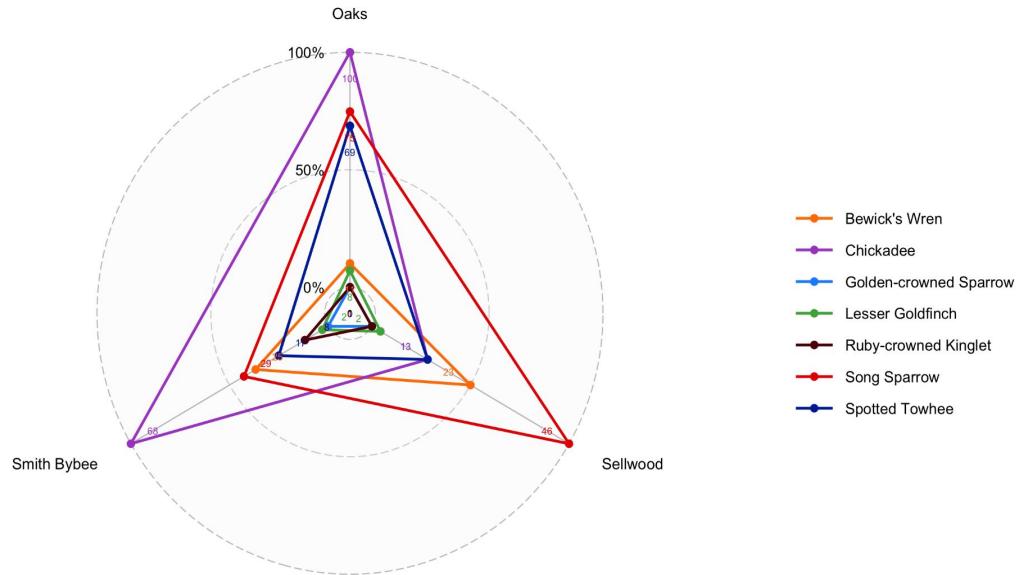


Singing & Calling Activity

Singing Activity by Sites and Species (Radar Chart)



Calling Activity by Sites and Species (Radar Chart)



- Bewick's Wren
- Chickadee
- Golden-crowned Sparrow
- Lesser Goldfinch
- Ruby-crowned Kinglet
- Song Sparrow
- Spotted Towhee



05

Analysis

Modeling Disturbance Effects and Prediction



What We Did

- Used GLMMs (Generalized Linear Mixed Models) to study bird behaviors like singing and chipping.
- GLMMs account for variation across parks, dates, and observation windows.
- Studied how birds respond to humans and dogs in Portland parks.

Why we used a cloglog model

- Cloglog is better than logistic regression for rare events.
- Stopping behaviors like ending a song are rare and need a model suited for that.
- An offset accounts for observation duration as longer sessions give more chances for events.

What We Tested

- Built four models: calling, singing, singing cessation, calling cessation
- Tested effects of: number of people, number of dogs, human noise, and dog noise.
- Controlled for park, date, and observation window to remove background variation.

Analysis Results

Singing Model	Confidence Interval	Hazard Ratio
# Humans	(0.698, 1.268)	0.940
# Dogs	(0.991, 1.984)	1.402
Human Noise	(0.561, 1.373)	0.877
Dog Noise	(0.095, 0.911)	0.295

Calling Model	Confidence Interval	Hazard Ratio
# Humans	(1.008,1.339)	1.162
# Dogs	(0.747, 1.247)	0.965
Human Noise	(0.808, 1.318)	1.032
Dog Noise	(0.373, 1.068)	0.631

Analysis Results

Singing Cessation Model	Confidence Interval	Hazard Ratio
# Humans	(0.907, 6.201)	2.372
# Dogs	(0.401, 4.721)	1.376
Human Noise	(0.393, 5.042)	1.407
Dog Noise	(0.065, 4.828)	0.56

Calling Cessation Model	Confidence Interval	Hazard Ratio
# Humans	(0.76, 3.64)	1.662
# Dogs	(0.634, 4.175)	1.626
Human Noise	(0.385, 3.395)	1.144
Dog Noise	(0.229, 3.705)	0.921

Chi-Squared test on all Birds

Sellwood Park			
Singing		Chips	
Chi_Squared_Test	P_Value	Chi_Squared_Test	P_Value
Dog presence vs singing cessation	0.03952	Dog presence vs chips cessation	0.09345
Dogs noise VS singing cessation	0.03536	Dogs noise VS chips cessation	0.08343
Leash VS singing cessation	0.7506	Leash VS chips cessation	0.3431
Human presence VS singing cessation	0.8033	Human presence VS chips cessation	0.1248
Human noise VS singing cessation	0.7967	Human noise VS chips cessation	0.123

Oaks Park			
Singing		Chips	
Chi_Squared_Test	P_Value	Chi_Squared_Test	P_Value
Dog presence vs singing cessation	0.861	Dog presence vs chips cessation	0.06798
Dogs noise VS singing cessation	0.861	Dogs noise VS chips cessation	0.06798
Leash VS singing cessation	NA	Leash VS chips cessation	NA
Human presence VS singing cessation	0.006399	Human presence VS chips cessation	0.02891
Human noise VS singing cessation	0.007353	Human noise VS chips cessation	0.03287

Smith Bybee Park			
Singing		Chips	
Chi_Squared_Test	P_Value	Chi_Squared_Test	P_Value
Human presence VS singing cessation	0.204	Human presence VS chips cessation	0.4187
Human noise VS singing cessation	0.1744	Human noise VS chips cessation	0.1305

Sellwood: The presence/noise of dogs primarily affects bird singing.

Oaks: The human activity (presence and noise) primarily affects bird song.

Smith Bybee: No variables have shown significant effects (insufficient data or effects not clearly discernible).

Chi-Squared Test Results: Sellwood Song Sparrow Only

Sellwood Park Song Sparrow Only			
Singing		Chips	
Chi_Squared_Test	P_Value	Chi_Squared_Test	P_Value
Dog presence vs Song Sparrow singing cessation	0.01804	Dog presence vs Song Sparrow chips cessation	0.1007
Dogs noise VS Song Sparrow singing cessation	0.03536	Dogs noise VS Song Sparrow chips cessation	0.09367
Human presence VS Song Sparrow singing cessation	0.9671	Human presence VS Song Sparrow chips cessation	0.3411
Human noise VS Song Sparrow singing cessation	0.05299	Human noise VS Song Sparrow chips cessation	0.339

The presence of dogs ($p = 0.018$) and dog noise ($p = 0.036$) significantly increased the probability of songbirds ceasing to sing.

The presence of humans had no significant effect on vocalization behavior ($p > 0.05$).

Probabilities on all Birds

Oaks Park Conditional Probabilities			
Singing	Probability	Chipping	Probability
P(Singing Dogs)	31.46%	P(Chipping Dogs)	83.15%
P(Singing No Dogs)	47.50%	P(Chipping No Dogs)	93.68%
P(Singing Cessation Dogs)	12.36%	P(Chipping Cessation Dogs)	38.2%
P(Singing Cessation No Dogs)	7.19%	P(Chipping Cessation No Dogs)	6.25%
P(Singing Humans)	25.95%	P(Chipping Humans)	79.64%
P(Singing No Humans)	54.96%	P(Chipping No Humans)	98.33%
P(Singing Cessation Humans)	19.46%	P(Chipping Cessation Humans)	20.58%
P(Singing Cessation No Humans)	2.81%	P(Chipping Cessation No Humans)	3.16%

Singing cessation almost 7 times more likely with humans present.

The probabilities were calculated from the combined 4 days at each park using all bird species.

Approximately 20% of the observations are unknown.

Probability given no humans equates to the probability given no user.

Across all parks: The probability of Singing and Chipping is higher **without humans** and **without humans and dogs**. The probability of Singing Cessation and Chipping Cessation is higher **with humans** and **with humans and dogs**.

Sellwood Park Conditional Probabilities			
Singing	Probability	Chipping	Probability
P(Singing Dogs)	32.49%	P(Chipping Dogs)	46.6%
P(Singing No Dogs)	54.46%	P(Chipping No Dogs)	68.05%
P(Singing Cessation Dogs)	18.39%	P(Chipping Cessation Dogs)	18.39%
P(Singing Cessation No Dogs)	6.32%	P(Chipping Cessation No Dogs)	12.47%
P(Singing Humans)	27.54%	P(Chipping Humans)	47.31%
P(Singing No Humans)	58.99%	P(Chipping No Humans)	69.84%
P(Singing Cessation Humans)	14.77%	P(Chipping Cessation Humans)	14.57%
P(Singing Cessation No Humans)	6.85%	P(Chipping Cessation No Humans)	13.70%

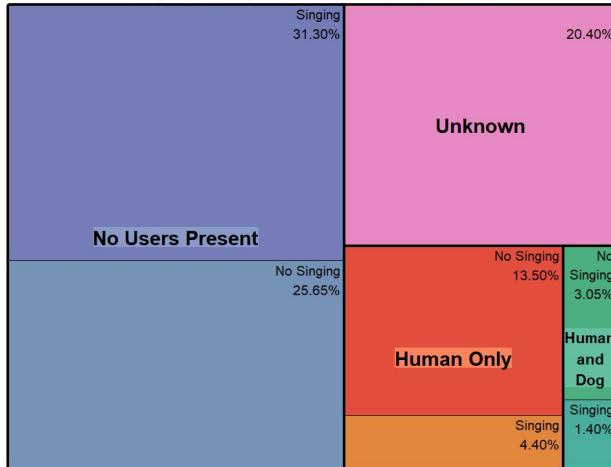
where it is Chickadees.

Unique to Smith Bybee, chipping 19.5% MORE LIKELY with humans than without humans.

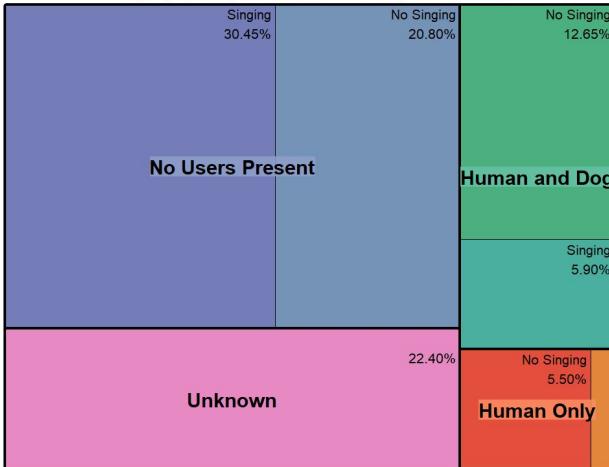
Smith Bybee Park Conditional Probabilities			
Singing	Probability	Chipping	Probability
P(Singing Dogs)	NA	P(Chipping Dogs)	NA
P(Singing No Dogs)	34.30%	P(Chipping No Dogs)	80.1%
P(Singing Cessation Dogs)	NA	P(Chipping Cessation Dogs)	NA
P(Singing Cessation No Dogs)	4.84%	P(Chipping Cessation No Dogs)	11.69%
P(Singing Humans)	12.08%	P(Chipping Humans)	93.96%
P(Singing No Humans)	36.67%	P(Chipping No Humans)	78.63%
P(Singing Cessation Humans)	9.4%	P(Chipping Cessation Humans)	7.38%
P(Singing Cessation No Humans)	4.36%	P(Chipping Cessation No Humans)	12.15%

Singing Probability on all Birds

Singing Activity in Oaks Park by User Group



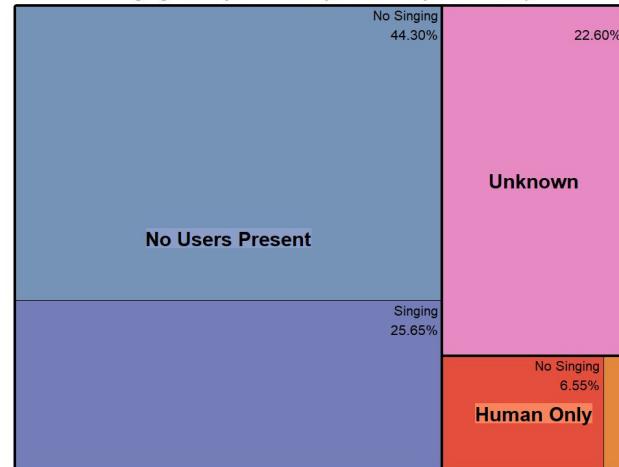
Singing Activity in Sellwood Park by User Group



Sellwood has the most dog activity.

No dog presence at Smith Bybee Park.

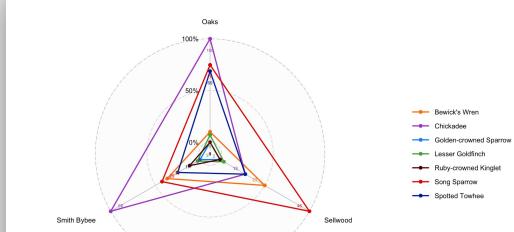
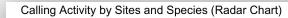
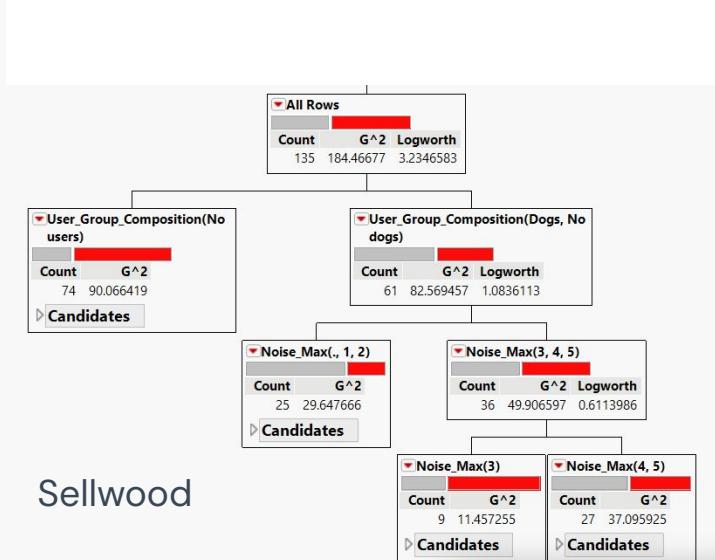
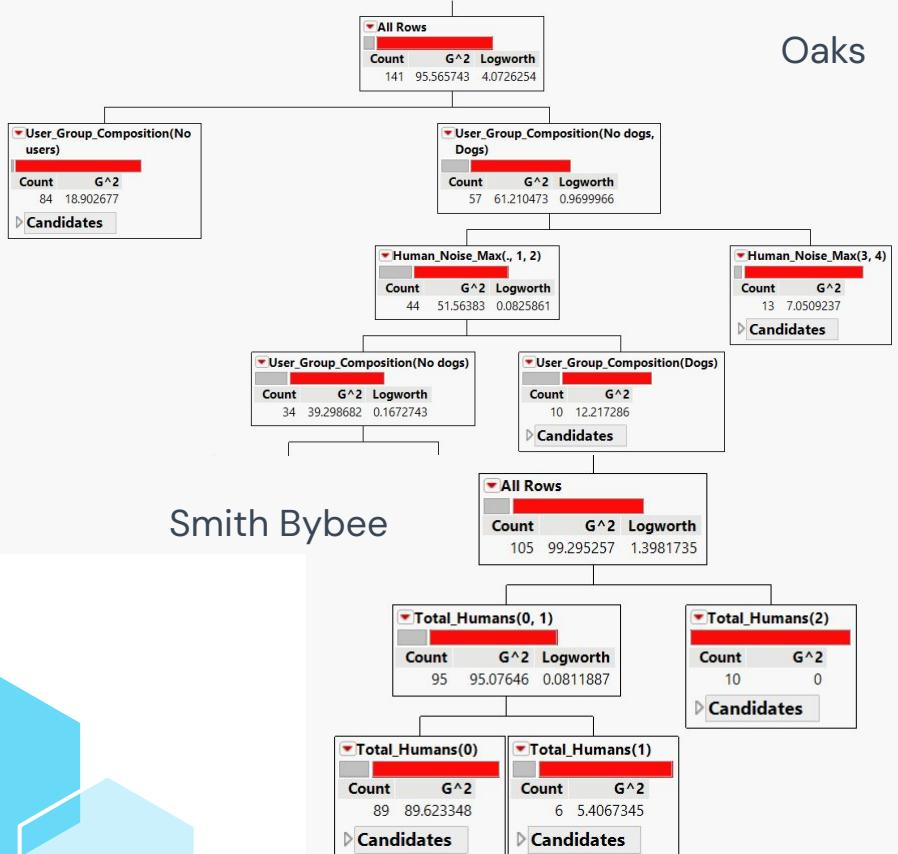
Singing Activity in Smith Bybee Park by User Group



The probabilities were calculated from the combined 4 days at each park using all bird species. Approximately 20% of the time, the bird activity and user presence is unknown.

With the 2-hour time interval standardized to 1 minute lengths, it can be said that within a random minute at each park, these are the probabilities of bird activity and user presence that can be expected.

Chips and Calls by Park





06

Key Insight

Statistical Result and Discussion/Conclusion



Conclusions

- Dog noise consistently reduces bird singing.
- More people increase bird calling, likely as alert behavior.
- Human presence shows potential trends, but further research is recommended to confidently draw conclusions.
- Patterns vary by park, highlighting the need for site-specific strategies.
- Results can inform noise and leash policies in urban parks.



Thank You!

Feel free to ask questions on your mind.





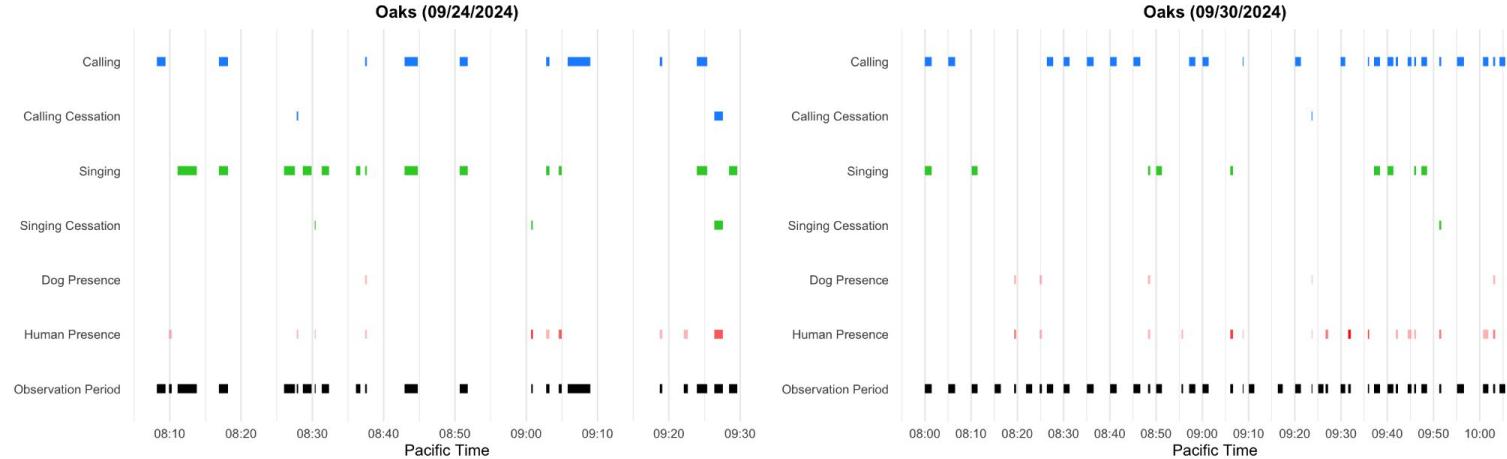
Backup slides...

For all those questions



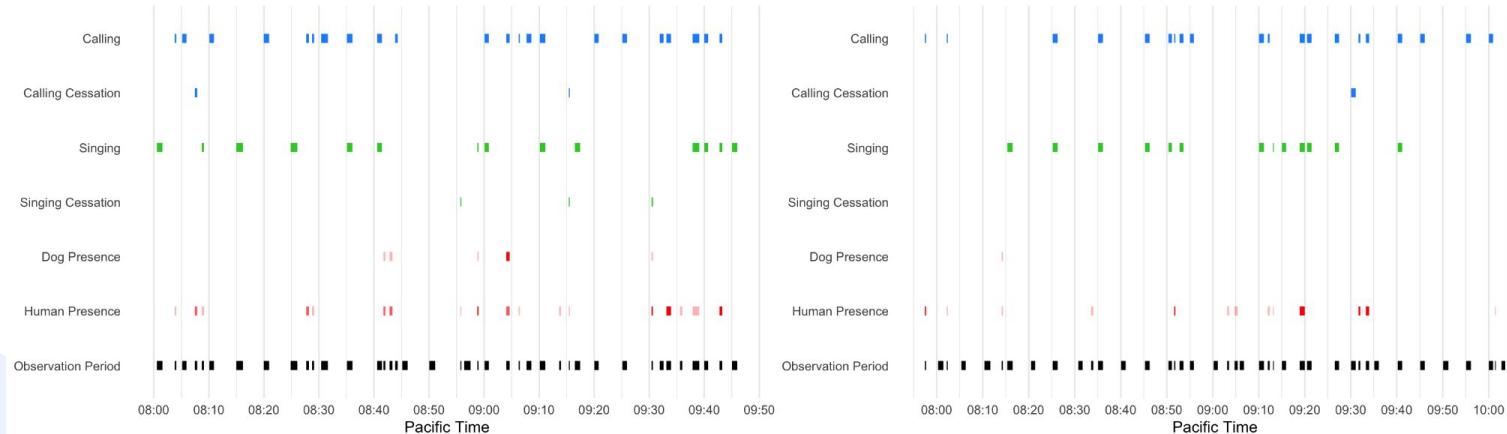
Time-Series Plot (Oaks)

Oaks - Song Sparrow Activity



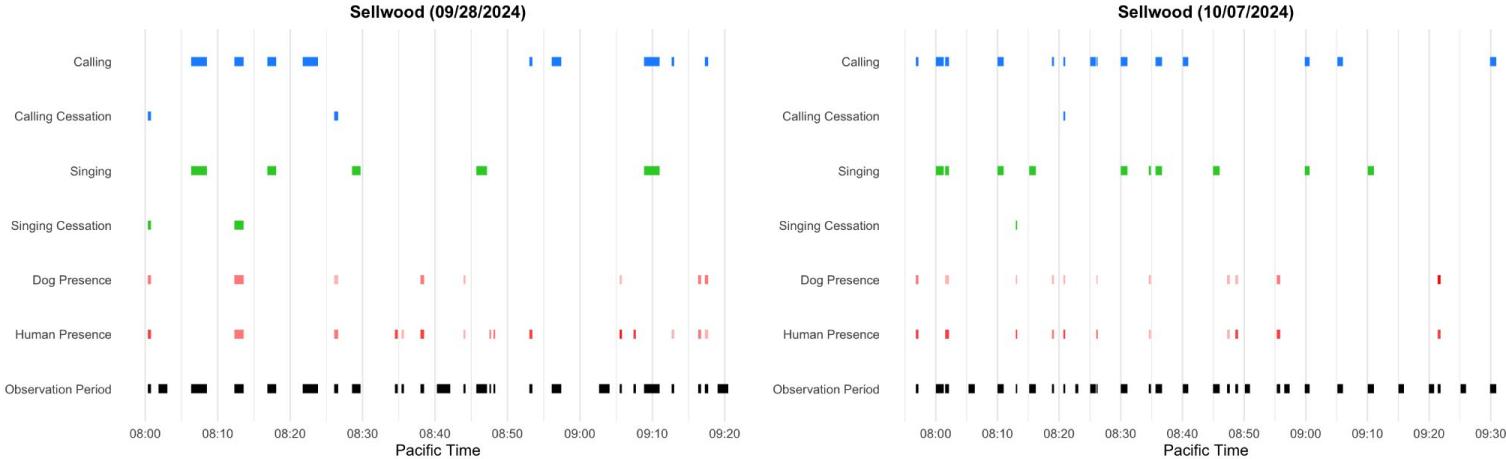
Oaks (10/12/2024)

Oaks (10/18/2024)

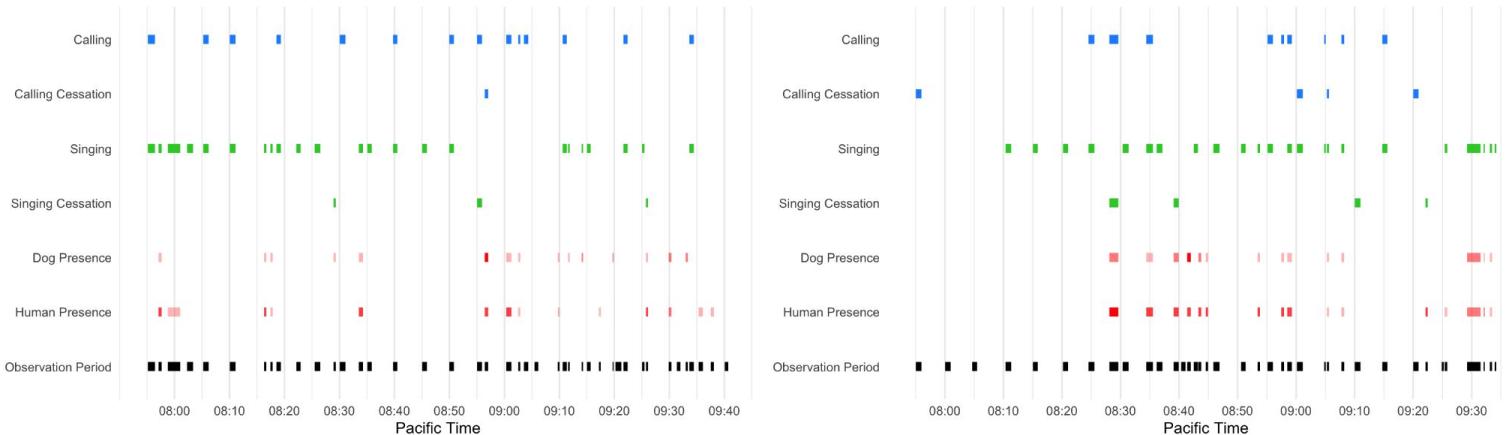


Time-Series Plot (Sellwood)

Sellwood - Song Sparrow Activity

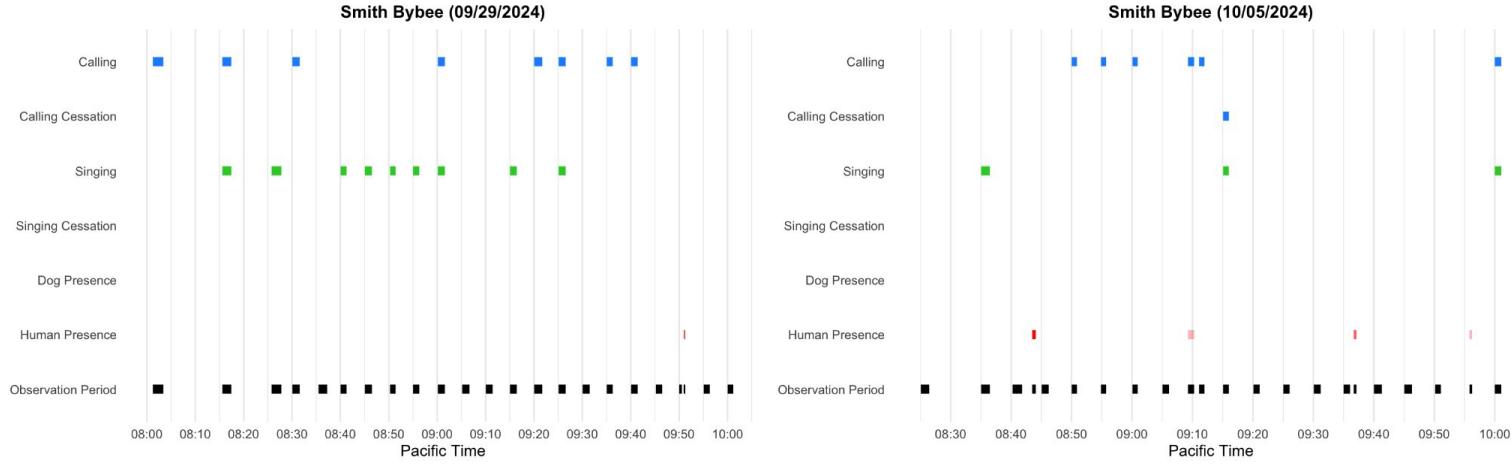


Sellwood (10/14/2024)

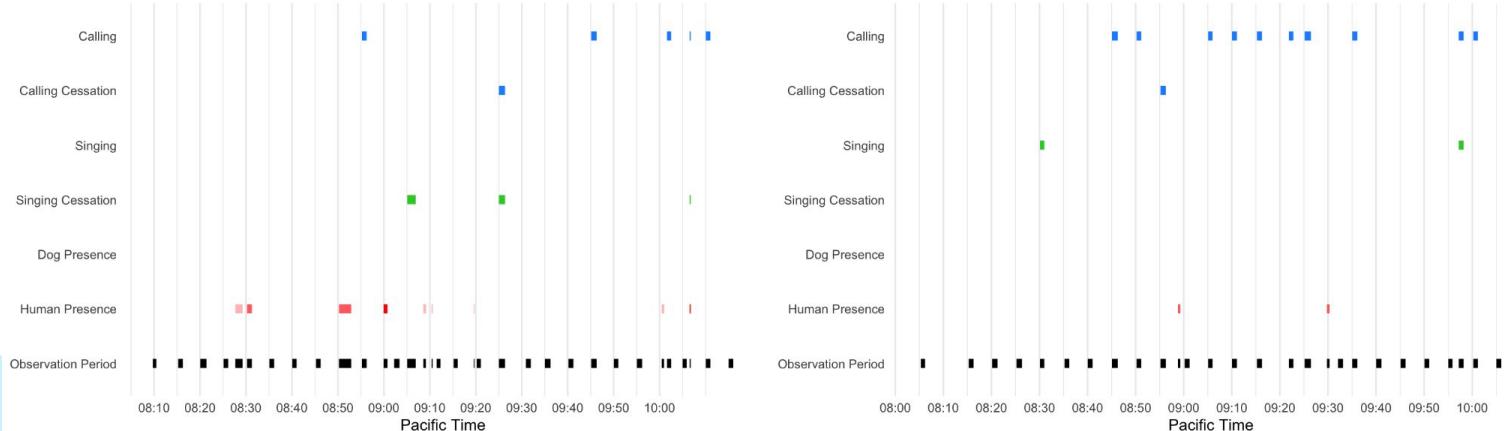


Time-Series Plot (Smith Bybee)

Smith Bybee - Song Sparrow Activity

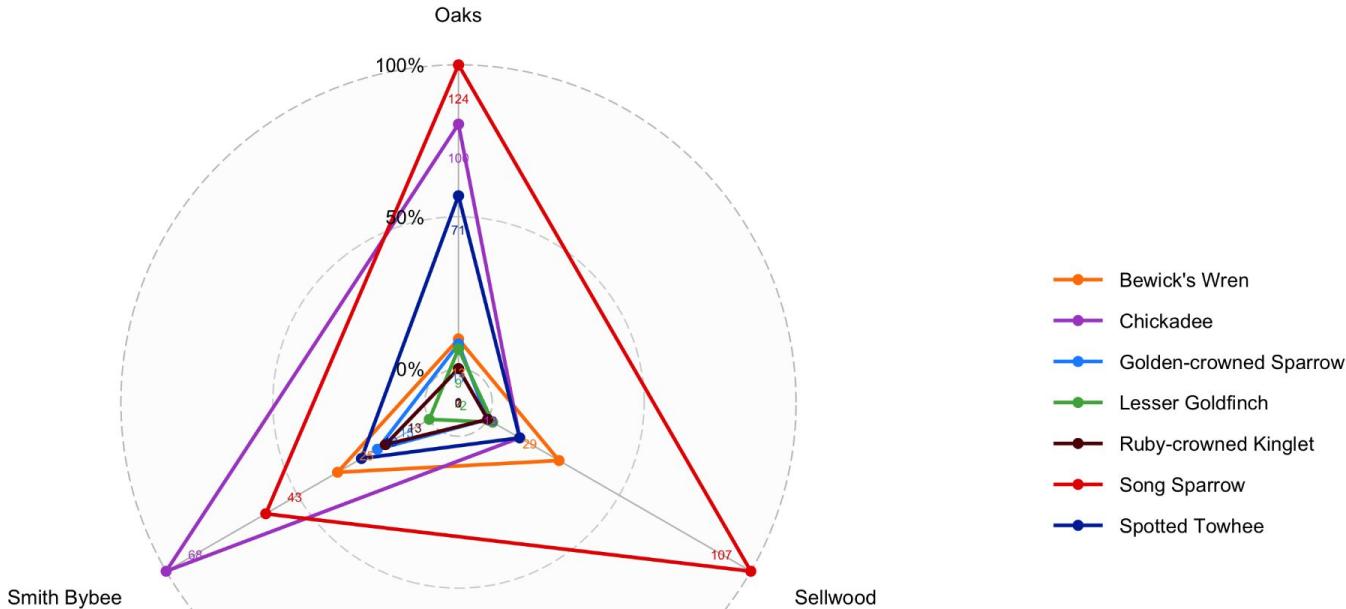


Smith Bybee (10/13/2024)



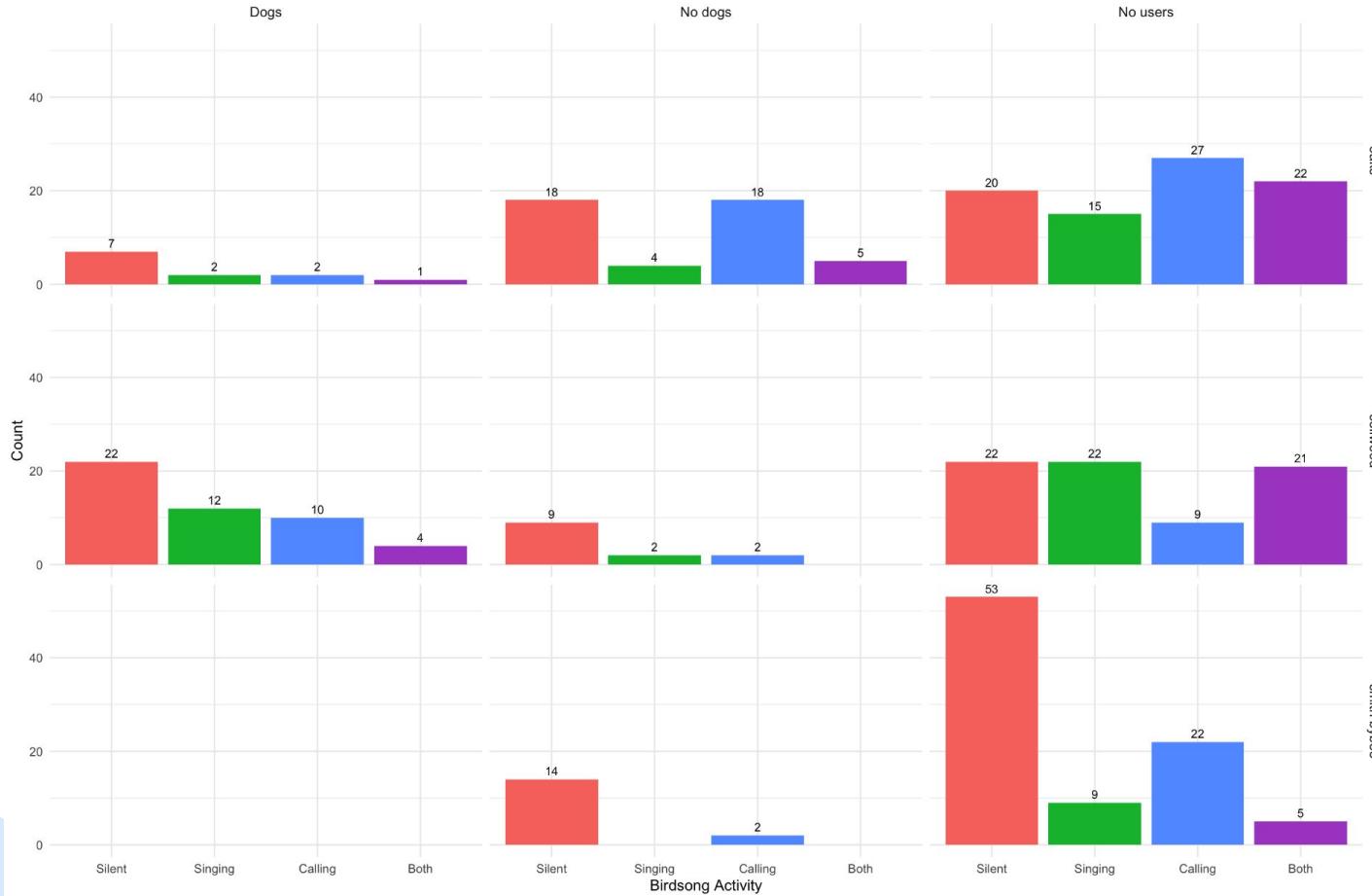
Total Vocal Activity

Total Vocal Activity by Sites and Species (Radar Chart)



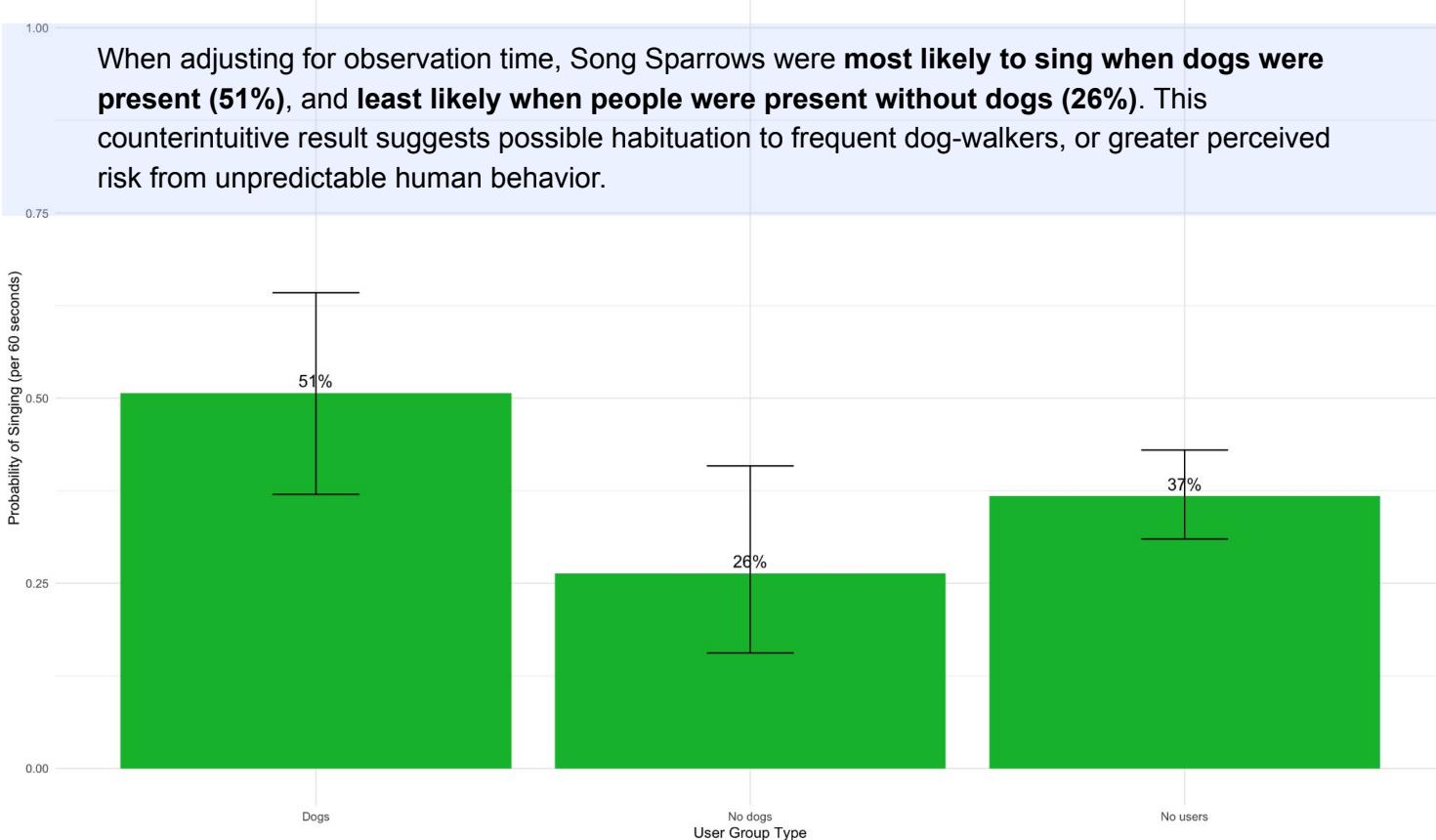
Song Sparrow Activity Pattern

Song Sparrow Activity by User Group and Park Site



Abnormal Phenomena

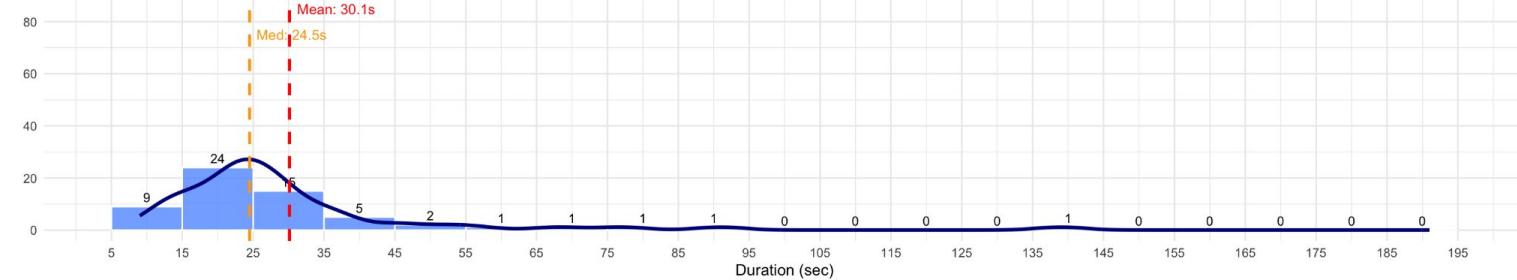
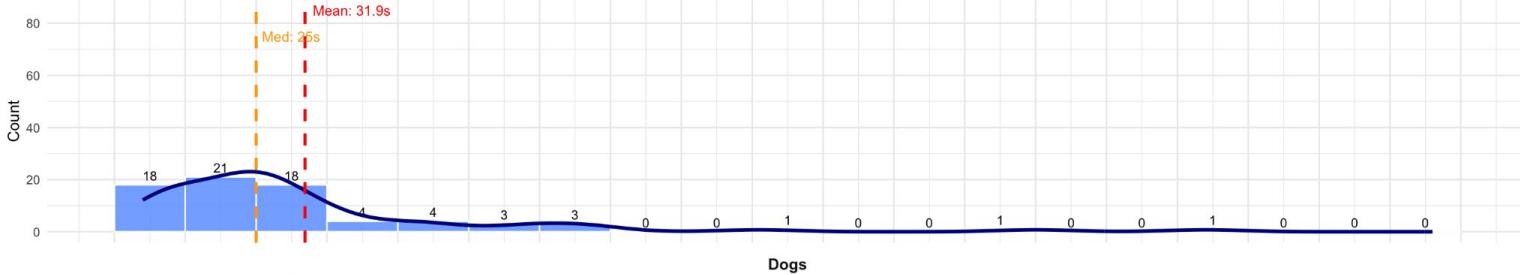
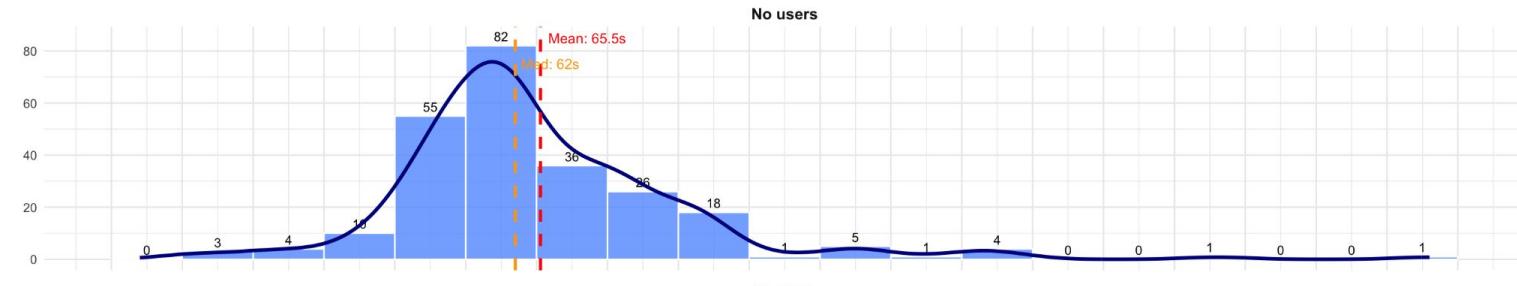
Predicted Probability of Song Sparrow Singing
(by User Group, adjusted to 60s Observation Time)



Duration of Observations by User Type

Observation Duration by User Group Composition

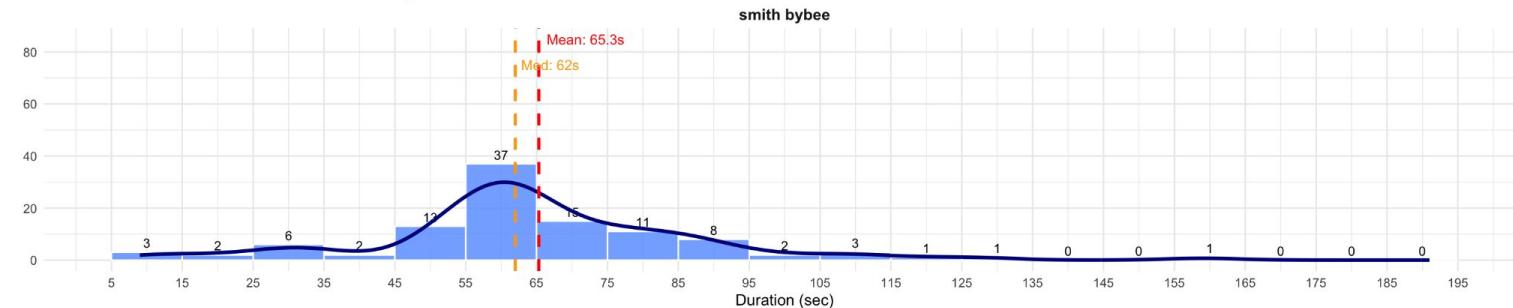
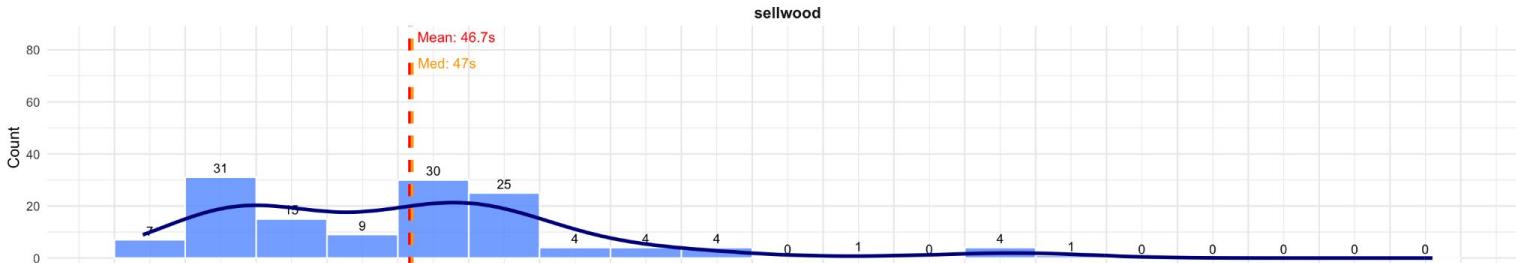
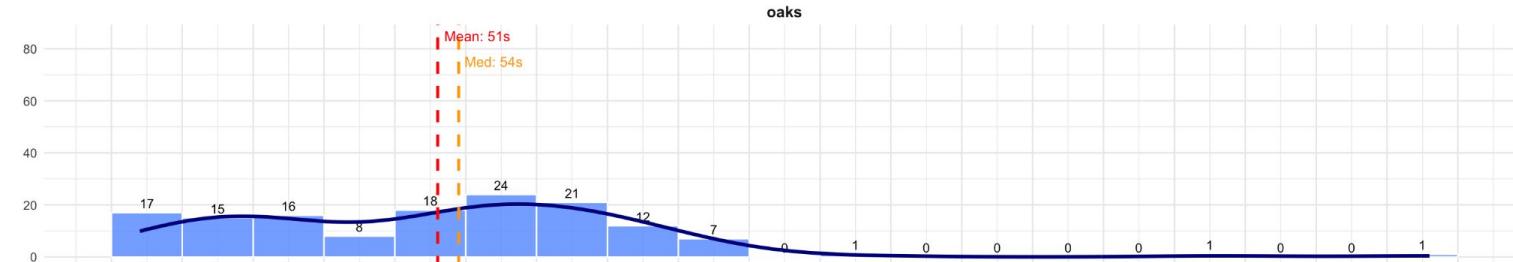
Reference Line | Mean | Median



Duration of Observations by Park Site

Observation Duration by Park Site

Reference Line | Mean | Median



Chi-Squared Test Results: Song Sparrow and Chickadee

Sellwood Park Song Sparrow Only

Singing		Chips	
Chi_Squared_Test	P_Value	Chi_Squared_Test	P_Value
Dog presence vs Song Sparrow singing cessation	0.01804	Dog presence vs Song Sparrow chips cessation	0.1007
Dogs noise VS Song Sparrow singing cessation	0.03536	Dogs noise VS Song Sparrow chips cessation	0.09367
Human presence VS Song Sparrow singing cessation	0.9671	Human presence VS Song Sparrow chips cessation	0.3411
Human noise VS Song Sparrow singing cessation	0.05299	Human noise VS Song Sparrow chips cessation	0.339

The presence of dogs ($p = 0.018$) and dog noise ($p = 0.036$) significantly increased the probability of songbirds ceasing to sing.

The presence of humans had no significant effect on vocalization behavior ($p > 0.05$).

Smith Bybee Park Black-capped Chickadee

Singing		Chips	
Chi_Squared_Test	P_Value	Chi_Squared_Test	P_Value
Human presence VS Black-capped Chickadee singing cessation	NA	Human presence VS Black-capped Chickadee chips cessation	NA
Human noise VS Black-capped Chickadee singing cessation	NA	Human noise VS Black-capped Chickadee chips cessation	NA

Under all variables, there are no records of “stopped singing and chips” (0 times), so a chi-square test cannot be performed (shows NA).

Park	Black-capped Chickadee Singing Cessation times	Black-capped Chickadee Chips Cessation times
All Three Parks	0	3
Smith Bybee Park	0	0

Probabilities on all Birds

Oaks Park Conditional Probabilities			
Singing	Probability	Chipping	Probability
P(Singing Dogs)	31.46%	P(Chipping Dogs)	83.15%
P(Singing No Dogs)	47.50%	P(Chipping No Dogs)	93.68%
P(Singing Cessation Dogs)	12.36%	P(Chipping Cessation Dogs)	38.2%
P(Singing Cessation No Dogs)	7.19%	P(Chipping Cessation No Dogs)	6.25%
P(Singing Humans)	25.95%	P(Chipping Humans)	79.64%
P(Singing No Humans)	54.96%	P(Chipping No Humans)	98.33%
P(Singing Cessation Humans)	19.46%	P(Chipping Cessation Humans)	20.58%
P(Singing Cessation No Humans)	2.81%	P(Chipping Cessation No Humans)	3.16%

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P(Singing Cessation No Dogs)	6.32%	P(Chipping Cessation No Dogs)	12.47%
P(Singing Humans)	27.54%	P(Chipping Humans)	47.31%
P(Singing No Humans)	58.99%	P(Chipping No Humans)	69.84%
P(Singing Cessation Humans)	14.77%	P(Chipping Cessation Humans)	14.57%
P(Singing Cessation No Humans)	6.85%	P(Chipping Cessation No Humans)	13.70%

The probabilities were calculated from the combined 4 days at each park using all bird species.

Approximately 20% of the observations are unknown.
Probability given no humans equates to the probability given no one is around.

Smith Bybee Park Conditional Probabilities			
Singing	Probability	Chipping	Probability
P(Singing Dogs)	NA	P(Chipping Dogs)	NA
P(Singing No Dogs)	34.30%	P(Chipping No Dogs)	80.1%
P(Singing Cessation Dogs)	NA	P(Chipping Cessation Dogs)	NA
P(Singing Cessation No Dogs)	4.84%	P(Chipping Cessation No Dogs)	11.69%
P(Singing Humans)	12.08%	P(Chipping Humans)	93.96%
P(Singing No Humans)	36.67%	P(Chipping No Humans)	78.63%
P(Singing Cessation Humans)	9.4%	P(Chipping Cessation Humans)	7.38%
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Probabilities on all Birds

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P(Singing Cessation No Humans)	2.81%	P(Chipping Cessation No Humans)	3.16%

Singing 67% less likely with humans than without humans at Smith Bybee, and 53% less likely with humans than without humans at both Oaks and Sellwood Parks.

How is **singing** affected by humans and dogs?

Sellwood Park Conditional Probabilities			
Singing	Probability	Chipping	Probability
P(Singing Dogs)	32.49%	P(Chipping Dogs)	46.6%
P(Singing No Dogs)	54.46%	P(Chipping No Dogs)	68.05%
P(Singing Cessation Dogs)	18.39%	P(Chipping Cessation Dogs)	18.39%
P(Singing Cessation No Dogs)	6.32%	P(Chipping Cessation No Dogs)	12.47%
P(Singing Humans)	27.54%	P(Chipping Humans)	47.31%
P(Singing No Humans)	58.99%	P(Chipping No Humans)	69.84%
P(Singing Cessation Humans)	14.77%	P(Chipping Cessation Humans)	14.57%
P(Singing Cessation No Humans)	6.85%	P(Chipping Cessation No Humans)	13.70%

Smith Bybee Park Conditional Probabilities			
Singing	Probability	Chipping	Probability
P(Singing Dogs)	NA	P(Chipping Dogs)	NA
P(Singing No Dogs)	34.30%	P(Chipping No Dogs)	80.1%
P(Singing Cessation Dogs)	NA	P(Chipping Cessation Dogs)	NA
P(Singing Cessation No Dogs)	4.84%	P(Chipping Cessation No Dogs)	11.69%
P(Singing Humans)	12.08%	P(Chipping Humans)	93.96%
P(Singing No Humans)	36.67%	P(Chipping No Humans)	78.63%
P(Singing Cessation Humans)	9.4%	P(Chipping Cessation Humans)	7.38%
P(Singing Cessation No Humans)	4.36%	P(Chipping Cessation No Humans)	12.15%

Singing 33% less likely with dogs than without dogs at Oaks, and 40% less likely with dogs than without dogs in Sellwood.

Probabilities on all Birds

Oaks Park Conditional Probabilities			
Singing	Probability	Chipping	Probability
P(Singing Dogs)	31.46%	P(Chipping Dogs)	83.15%
P(Singing No Dogs)	47.50%	P(Chipping No Dogs)	93.68%
P(Singing Cessation Dogs)	12.36%	P(Chipping Cessation Dogs)	38.2%
P(Singing Cessation No Dogs)	7.19%	P(Chipping Cessation No Dogs)	6.25%
P(Singing Humans)	25.95%	P(Chipping Humans)	79.64%
P(Singing No Humans)	54.96%	P(Chipping No Humans)	98.33%
P(Singing Cessation Humans)	19.46%	P(Chipping Cessation Humans)	20.58%
P(Singing Cessation No Humans)	2.81%	P(Chipping Cessation No Humans)	3.16%

Chipping 32% less likely with humans than without humans in Sellwood, but only 19% less likely with humans than without humans in Oaks. In contrast, chipping 19.5% MORE LIKELY with humans than without humans in Smith Bybee.

Sellwood Park Conditional Probabilities			
Singing	Probability	Chipping	Probability
P(Singing Dogs)	32.49%	P(Chipping Dogs)	46.6%
P(Singing No Dogs)	54.46%	P(Chipping No Dogs)	68.05%
P(Singing Cessation Dogs)	18.39%	P(Chipping Cessation Dogs)	18.39%
P(Singing Cessation No Dogs)	6.32%	P(Chipping Cessation No Dogs)	12.47%
P(Singing Humans)	27.54%	P(Chipping Humans)	47.31%
P(Singing No Humans)	58.99%	P(Chipping No Humans)	69.84%
P(Singing Cessation Humans)	14.77%	P(Chipping Cessation Humans)	14.57%
P(Singing Cessation No Humans)	6.85%	P(Chipping Cessation No Humans)	13.70%

Chipping 32% less likely with dogs than without at Sellwood where it's Song Sparrows, but only 11% less likely at Oaks

where it is Chickadees.

Smith Bybee Park Conditional Probabilities			
Singing	Probability	Chipping	Probability
P(Singing Dogs)	NA	P(Chipping Dogs)	NA
P(Singing No Dogs)	34.30%	P(Chipping No Dogs)	80.1%
P(Singing Cessation Dogs)	NA	P(Chipping Cessation Dogs)	NA
P(Singing Cessation No Dogs)	4.84%	P(Chipping Cessation No Dogs)	11.69%
P(Singing Humans)	12.08%	P(Chipping Humans)	93.96%
P(Singing No Humans)	36.67%	P(Chipping No Humans)	78.63%
P(Singing Cessation Humans)	9.4%	P(Chipping Cessation Humans)	7.38%
P(Singing Cessation No Humans)	4.36%	P(Chipping Cessation No Humans)	12.15%

How is **chipping** affected by humans and dogs?

Probabilities on all Birds

Oaks Park Conditional Probabilities			
Singing	Probability	Chipping	Probability
P(Singing Dogs)	31.46%	P(Chipping Dogs)	83.15%
P(Singing No Dogs)	47.50%	P(Chipping No Dogs)	93.68%
P(Singing Cessation Dogs)	12.36%	P(Chipping Cessation Dogs)	38.2%
P(Singing Cessation No Dogs)	7.19%	P(Chipping Cessation No Dogs)	6.25%
P(Singing Humans)	25.95%	P(Chipping Humans)	79.64%
P(Singing No Humans)	54.96%	P(Chipping No Humans)	98.33%
P(Singing Cessation Humans)	19.46%	P(Chipping Cessation Humans)	20.58%
P(Singing Cessation No Humans)	2.81%	P(Chipping Cessation No Humans)	3.16%

Singing cessation almost 7 times more likely with humans present than without in Oaks park, but only 2 times more likely with humans than without in both Sellwood and Smith Bybee Parks.

Sellwood Park Conditional Probabilities			
Singing	Probability	Chipping	Probability
P(Singing Dogs)	32.49%	P(Chipping Dogs)	46.6%
P(Singing No Dogs)	54.46%	P(Chipping No Dogs)	68.05%
P(Singing Cessation Dogs)	18.39%	P(Chipping Cessation Dogs)	18.39%
P(Singing Cessation No Dogs)	6.32%	P(Chipping Cessation No Dogs)	12.47%
P(Singing Humans)	27.54%	P(Chipping Humans)	47.31%
P(Singing No Humans)	58.99%	P(Chipping No Humans)	69.84%
P(Singing Cessation Humans)	14.77%	P(Chipping Cessation Humans)	14.57%
P(Singing Cessation No Humans)	6.85%	P(Chipping Cessation No Humans)	13.70%

Singing cessation is nearly 2 times more likely with dogs than without dogs in Oaks and nearly 3 times more likely with dogs in Sellwood.

How is **singing cessation** affected by humans and dogs?

Smith Bybee Park Conditional Probabilities			
Singing	Probability	Chipping	Probability
P(Singing Dogs)	NA	P(Chipping Dogs)	NA
P(Singing No Dogs)	34.30%	P(Chipping No Dogs)	80.1%
P(Singing Cessation Dogs)	NA	P(Chipping Cessation Dogs)	NA
P(Singing Cessation No Dogs)	4.84%	P(Chipping Cessation No Dogs)	11.69%
P(Singing Humans)	12.08%	P(Chipping Humans)	93.96%
P(Singing No Humans)	36.67%	P(Chipping No Humans)	78.63%
P(Singing Cessation Humans)	9.4%	P(Chipping Cessation Humans)	7.38%
P(Singing Cessation No Humans)	4.36%	P(Chipping Cessation No Humans)	12.15%

Probabilities on all Birds

Oaks Park Conditional Probabilities			
Singing	Probability	Chipping	Probability
P(Singing Dogs)	31.46%	P(Chipping Dogs)	83.15%
P(Singing No Dogs)	47.50%	P(Chipping No Dogs)	93.68%
P(Singing Cessation Dogs)	12.36%	P(Chipping Cessation Dogs)	38.2%
P(Singing Cessation No Dogs)	7.19%	P(Chipping Cessation No Dogs)	6.25%
P(Singing Humans)	25.95%	P(Chipping Humans)	79.64%
P(Singing No Humans)	54.96%	P(Chipping No Humans)	98.33%
P(Singing Cessation Humans)	19.46%	P(Chipping Cessation Humans)	20.58%
P(Singing Cessation No Humans)	2.81%	P(Chipping Cessation No Humans)	3.16%

Chipping cessation 6.5 times more likely with humans present at Oaks Park. Conversely, chipping cessation 39.1% LESS LIKELY with humans present in Smith Bybee. Chipping cessation nearly equally likely with or without human presence in Sellwood.

Sellwood Park Conditional Probabilities			
Singing	Probability	Chipping	Probability
P(Singing Dogs)	32.49%	P(Chipping Dogs)	46.6%
P(Singing No Dogs)	54.46%	P(Chipping No Dogs)	68.05%
P(Singing Cessation Dogs)	18.39%	P(Chipping Cessation Dogs)	18.39%
P(Singing Cessation No Dogs)	6.32%	P(Chipping Cessation No Dogs)	12.47%
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P(Singing No Humans)	58.99%	P(Chipping No Humans)	69.84%
P(Singing Cessation Humans)	14.77%	P(Chipping Cessation Humans)	14.57%
P(Singing Cessation No Humans)	6.85%	P(Chipping Cessation No Humans)	13.70%

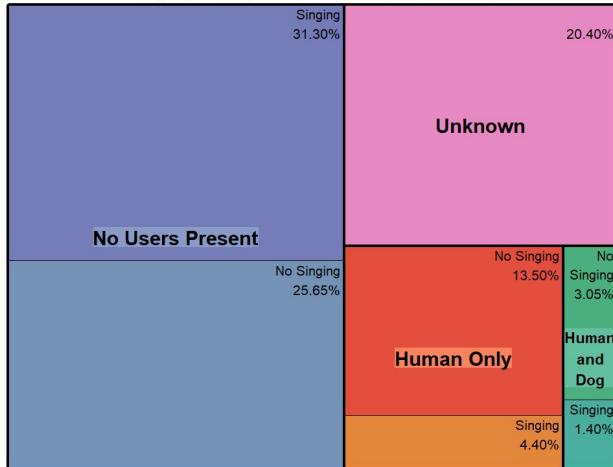
Chipping cessation 6 times MORE LIKELY with dogs than without dogs in Oaks, while only 1.5 times more likely in Sellwood.

How is **chipping cessation** affected by humans and dogs?

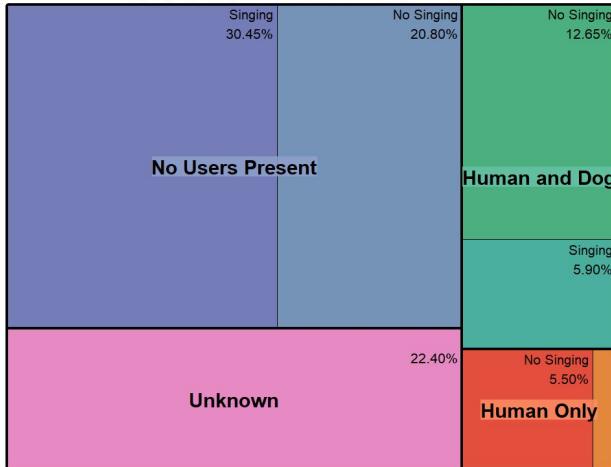
Smith Bybee Park Conditional Probabilities			
Singing	Probability	Chipping	Probability
P(Singing Dogs)	NA	P(Chipping Dogs)	NA
P(Singing No Dogs)	34.30%	P(Chipping No Dogs)	80.1%
P(Singing Cessation Dogs)	NA	P(Chipping Cessation Dogs)	NA
P(Singing Cessation No Dogs)	4.84%	P(Chipping Cessation No Dogs)	11.69%
P(Singing Humans)	12.08%	P(Chipping Humans)	93.96%
P(Singing No Humans)	36.67%	P(Chipping No Humans)	78.63%
P(Singing Cessation Humans)	9.4%	P(Chipping Cessation Humans)	7.38%
P(Singing Cessation No Humans)	4.36%	P(Chipping Cessation No Humans)	12.15%

Singing Probability on all Birds

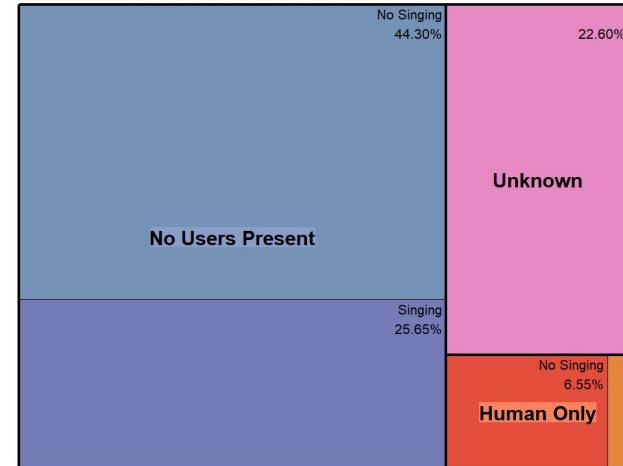
Singing Activity in Oaks Park by User Group



Singing Activity in Sellwood Park by User Group



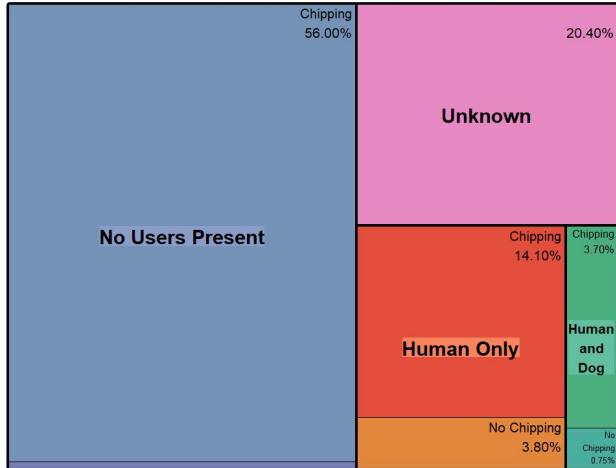
Singing Activity in Smith Bybee Park by User Group



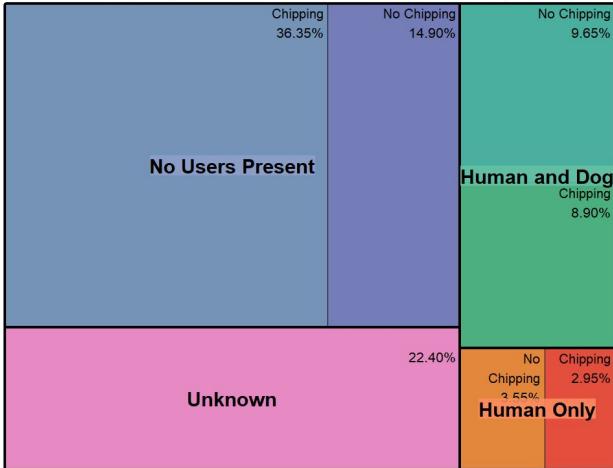
Within a random minute at each park, these are the probabilities of **singing** activity and user presence that can be expected.

Chipping Probability on all Birds

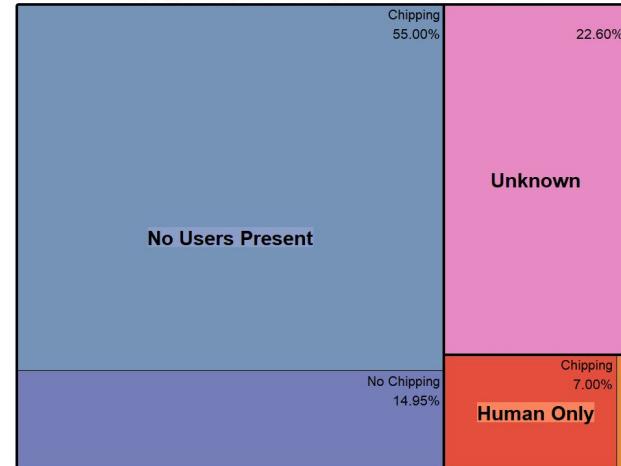
Chipping Activity in Oaks Park by User Group



Chipping Activity in Sellwood Park by User Group



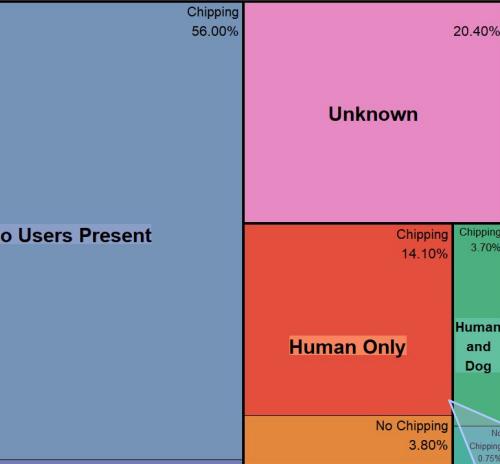
Chipping Activity in Smith Bybee Park by User Group



Within a random minute at each park, these are the probabilities of **chipping** activity and user presence that can be expected.

Chipping Probability on all Birds

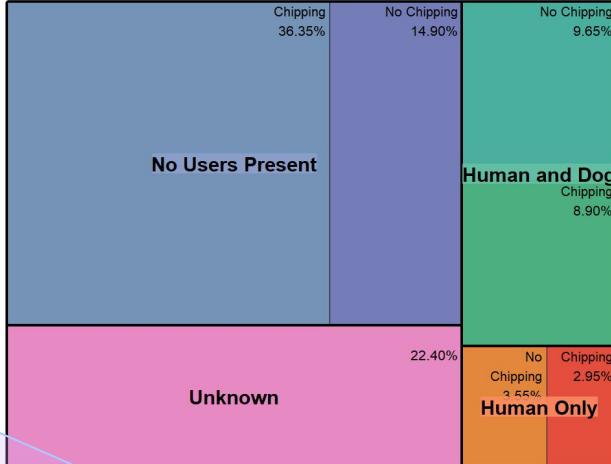
Chipping Activity in Oaks Park by User Group



More of a chance of witnessing chipping with humans only, than with both humans and dogs in Oaks.

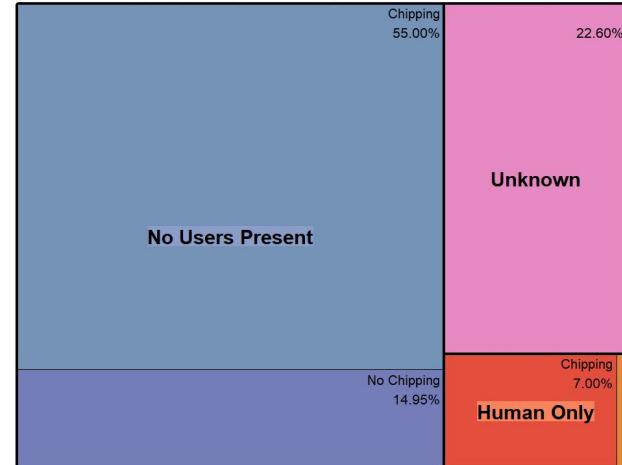
Within a random minute at each park, these are the probabilities of **chipping** activity and user presence that can be expected.

Chipping Activity in Sellwood Park by User Group



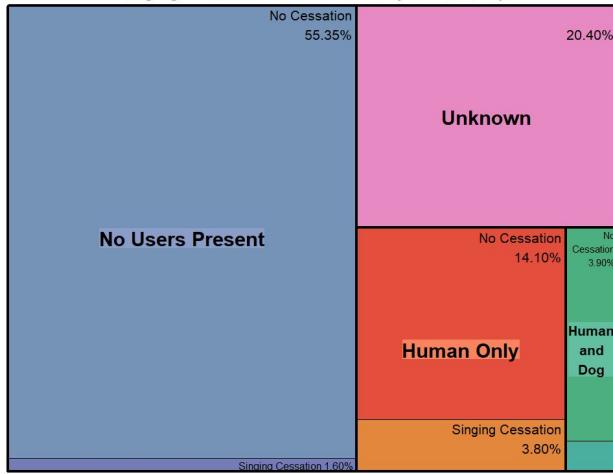
More of a chance of witnessing chipping with humans, than no chipping with humans in Smith Bybee.

Chipping Activity in Smith Bybee Park by User Group

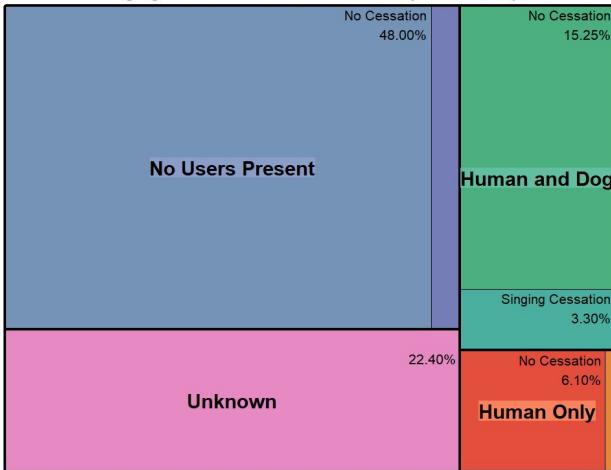


Singing Cessation Probability on all Birds

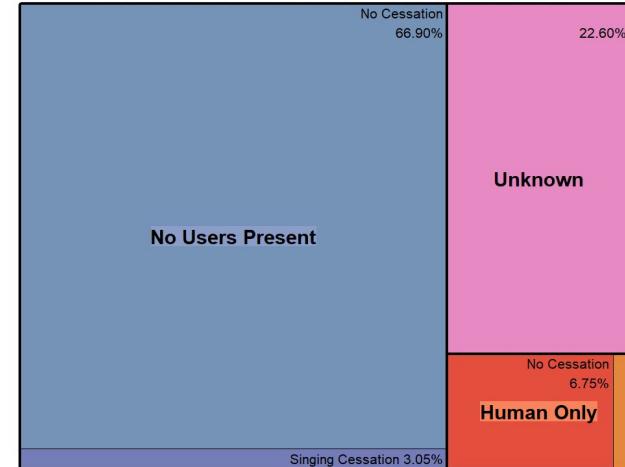
Singing Cessation in Oaks Park by User Group



Singing Cessation in Sellwood Park by User Group



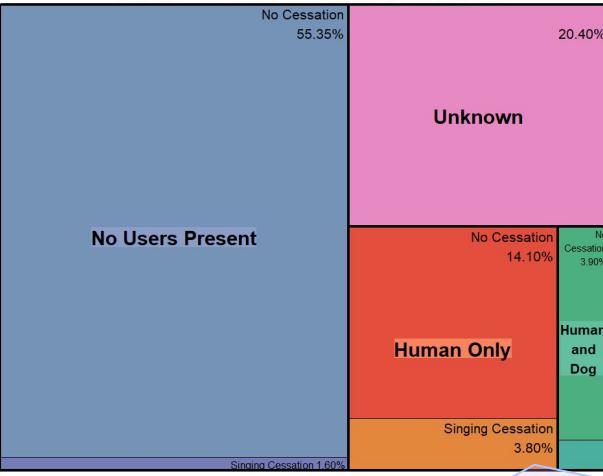
Singing Cessation in Smith Bybee Park by User Group



Within a random minute at each park, these are the probabilities of **singing cessation** and user presence that can be expected.

Singing Cessation Probability on all Birds

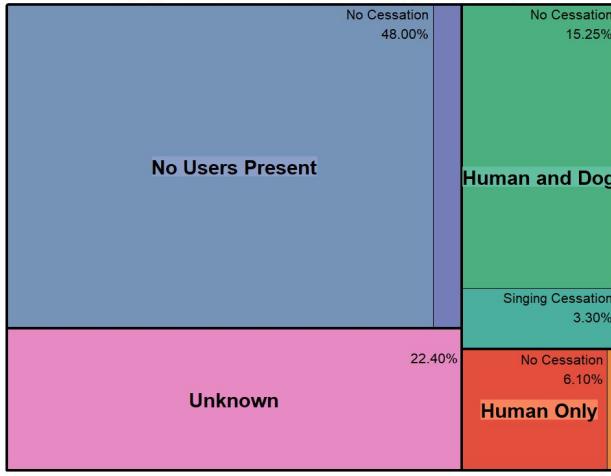
Singing Cessation in Oaks Park by User Group



Higher probability of witnessing humans causing singing cessation in Oaks.

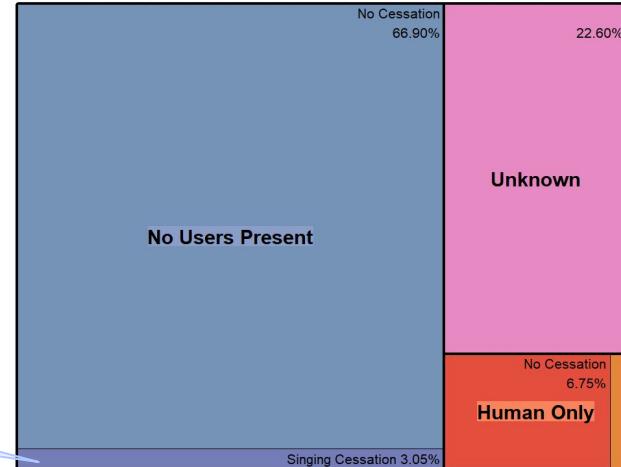
Within a random minute at each park, these are the probabilities of **singing cessation** and user presence that can be expected.

Singing Cessation in Sellwood Park by User Group



Higher probability of witnessing humans and dogs causing singing cessation in Sellwood.

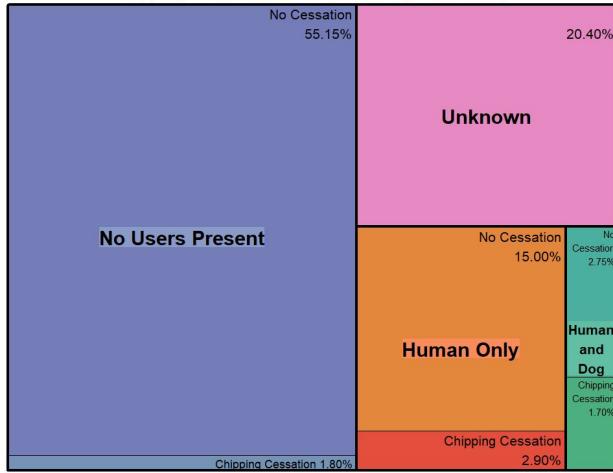
Singing Cessation in Smith Bybee Park by User Group



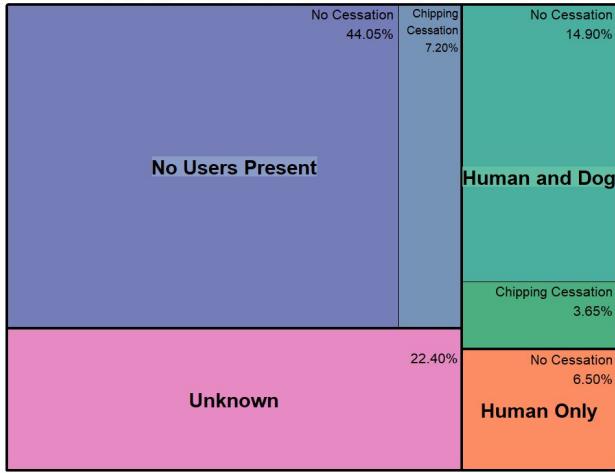
Higher probability of witnessing no users causing singing cessation in Smith Bybee.

Chipping Cessation Probability on all Birds

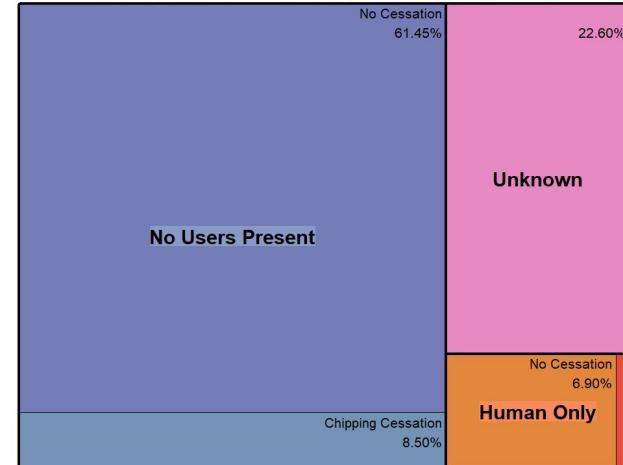
Chipping Cessation in Oaks Park by User Group



Chipping Cessation in Sellwood Park by User Group



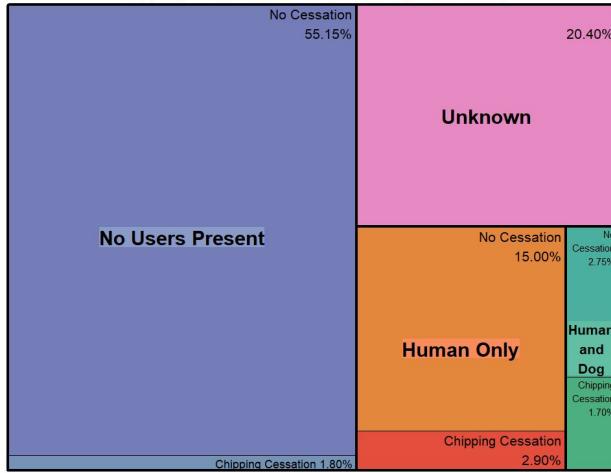
Chipping Cessation in Smith Bybee Park by User Group



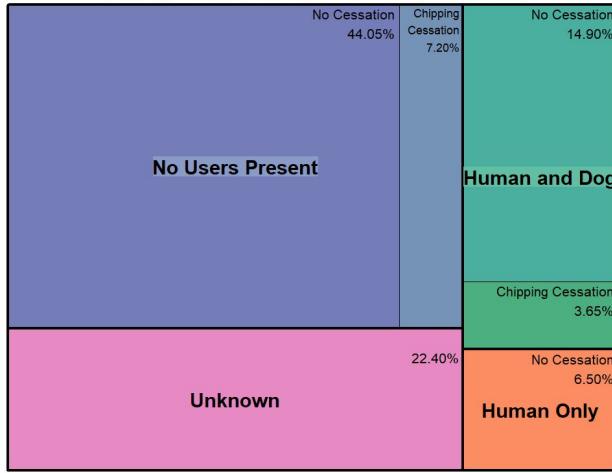
Within a random minute at each park, these are the probabilities of **chipping cessation** and user presence that can be expected.

Chipping Cessation Probability on all Birds

Chipping Cessation in Oaks Park by User Group

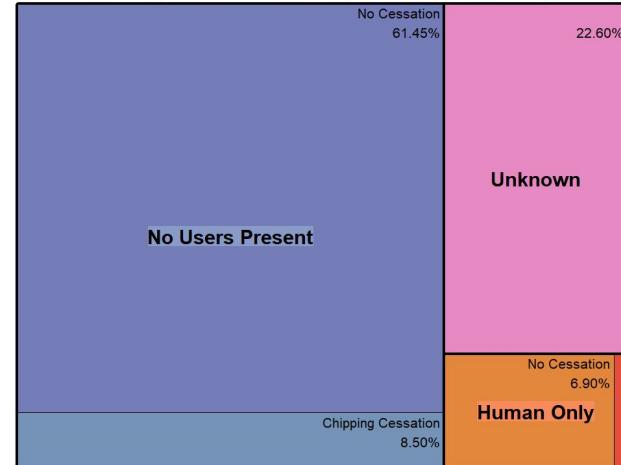


Chipping Cessation in Sellwood Park by User Group



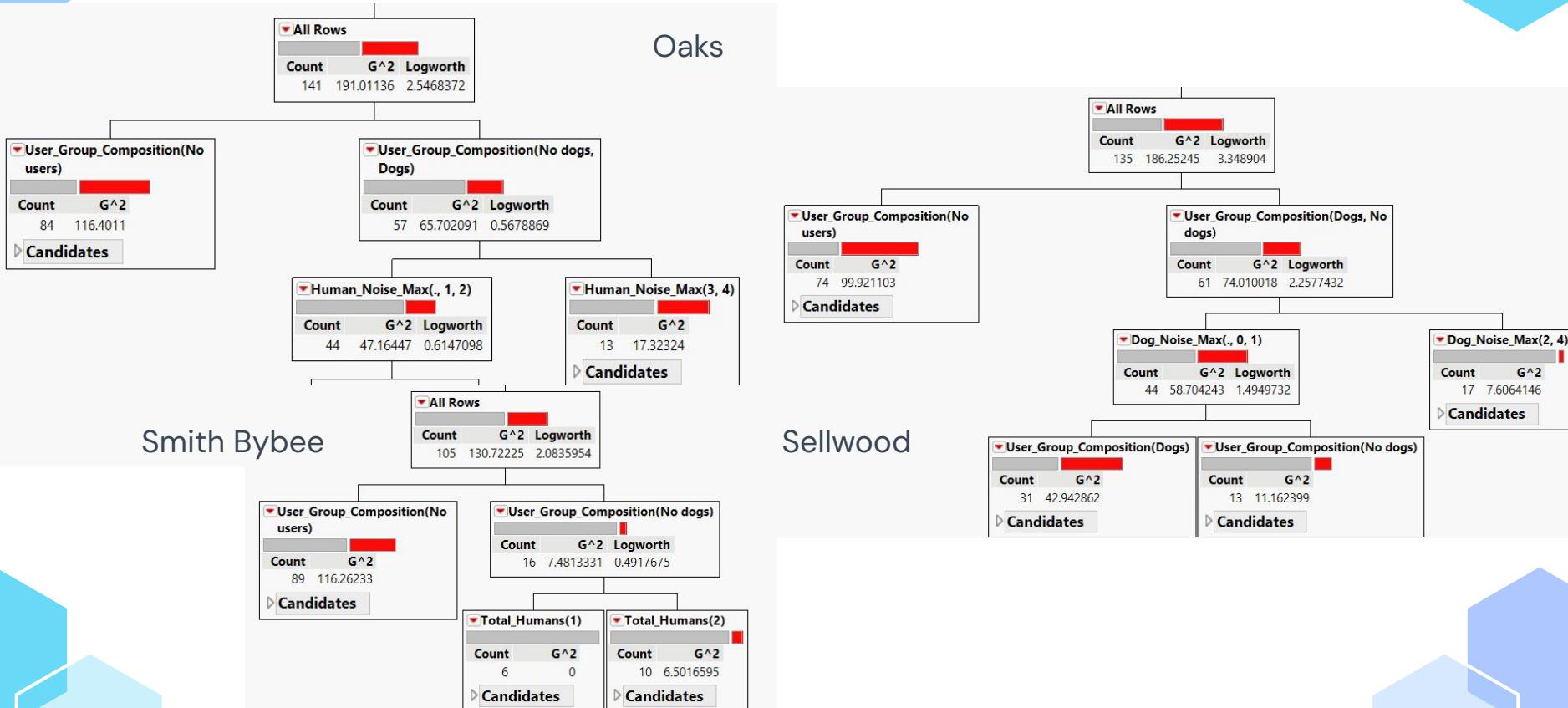
No instance of chipping cessation caused by humans only in Sellwood.

Chipping Cessation in Smith Bybee Park by User Group



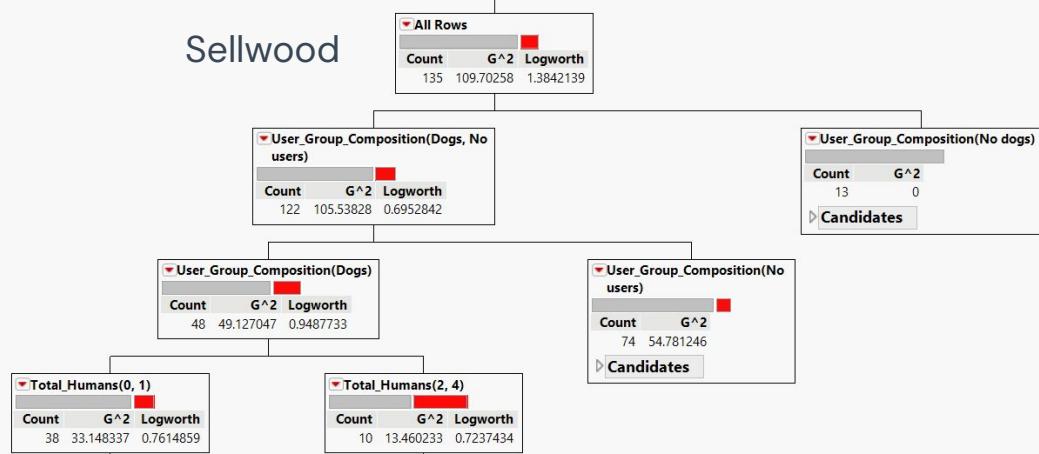
Within a random minute at each park, these are the probabilities of **chipping cessation** and user presence that can be expected.

Singing Activity by Park

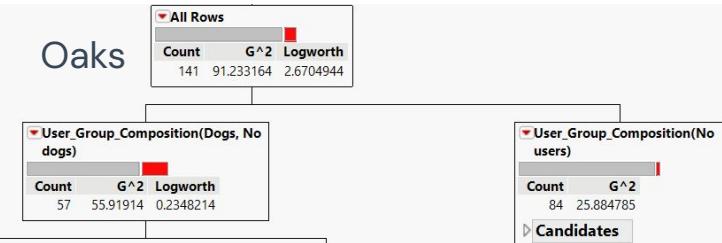


Chips and Call Cessation by Park

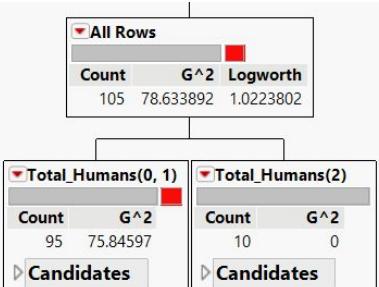
Sellwood



Oaks



Smith Bybee



Singing Cessation by Park

