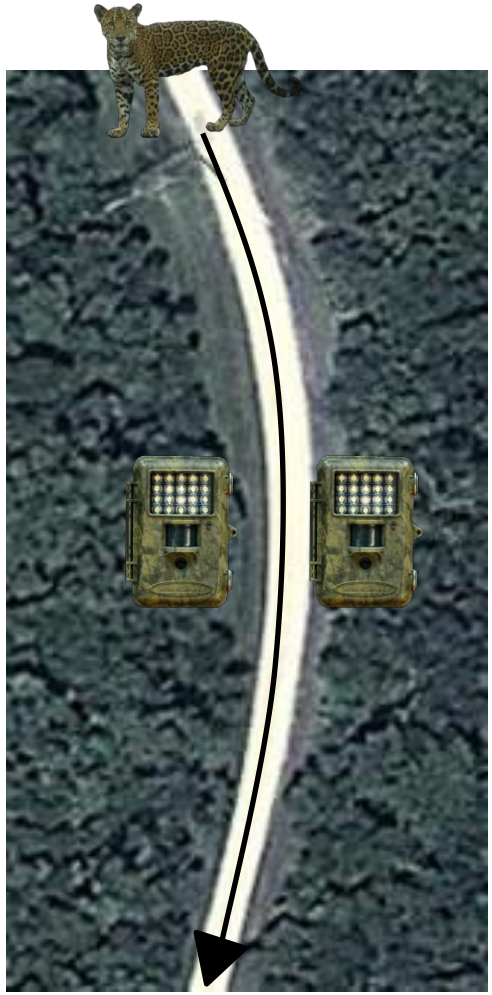
# Co-Existence Ecology of Large Predators in Belize

Brogan Holcombe, Chris Rowe, Dr. Marcella Kelly
Virginia Tech
The National Conferences of Undergraduate Research 2018
April 5, 2018

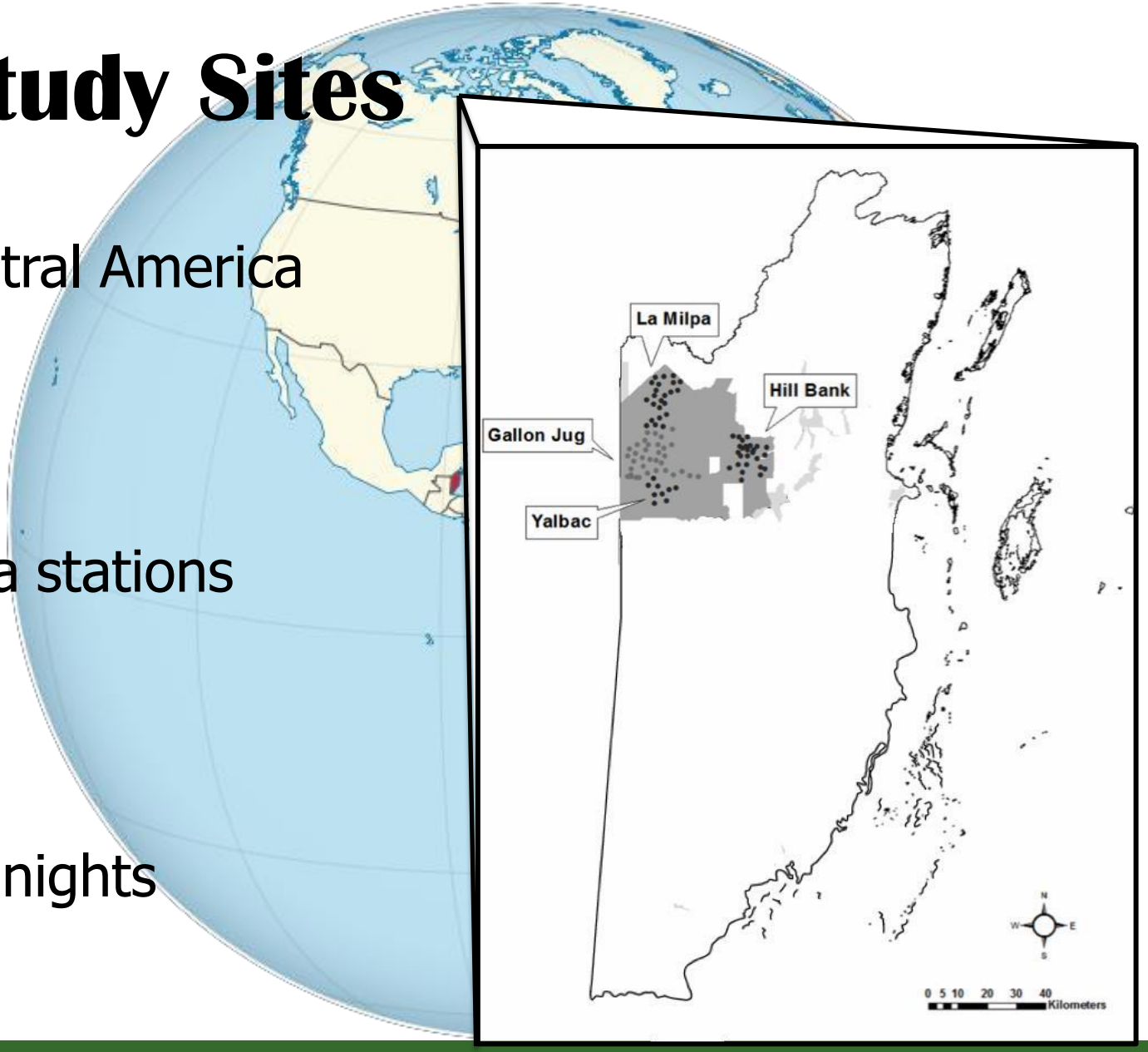
# The Jaguar Project

- Camera Stations
  - 2 remotely triggered trail camera along various trails
  - Taking pictures of elusive species in dense jungle terrain
- Regularly spaced stations across landscape
- Keeping track of them in Belize, Central America for conservation efforts



# 2016 Study Sites

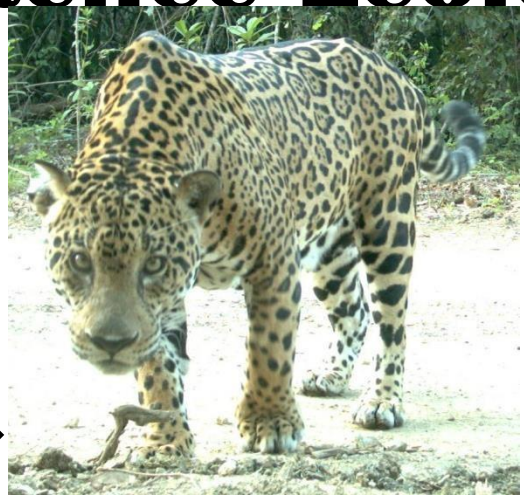
- Belize, Central America
- 112 camera stations
- 6,451 trap nights



# My work with the Jaguar Project

- Started out just doing basic photo data entry
- Became interested in co-existence ecology
- Received a grant for the field project for the summer 2017 survey

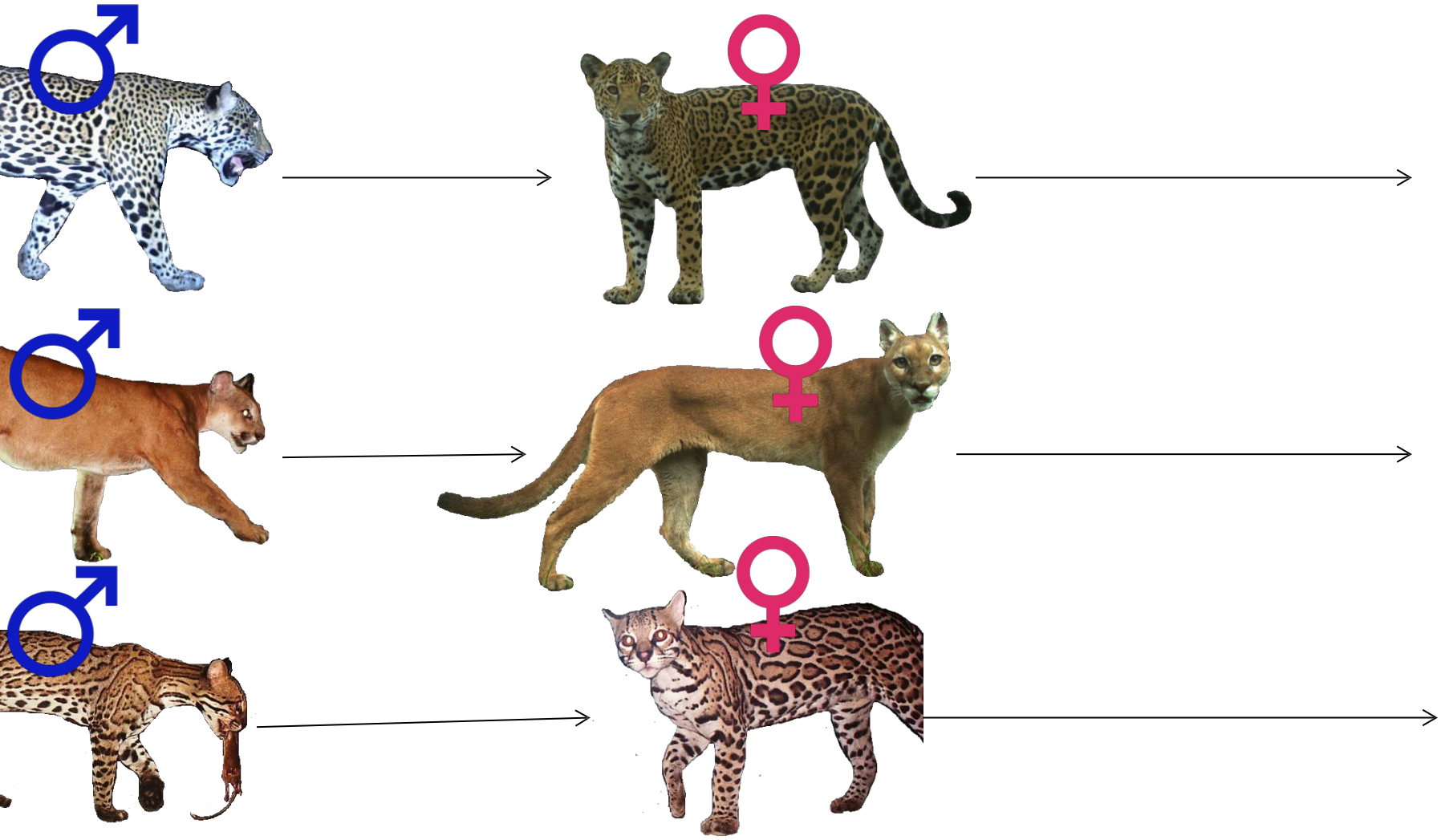
# Co-Existence Ecology



# Conservation Issues

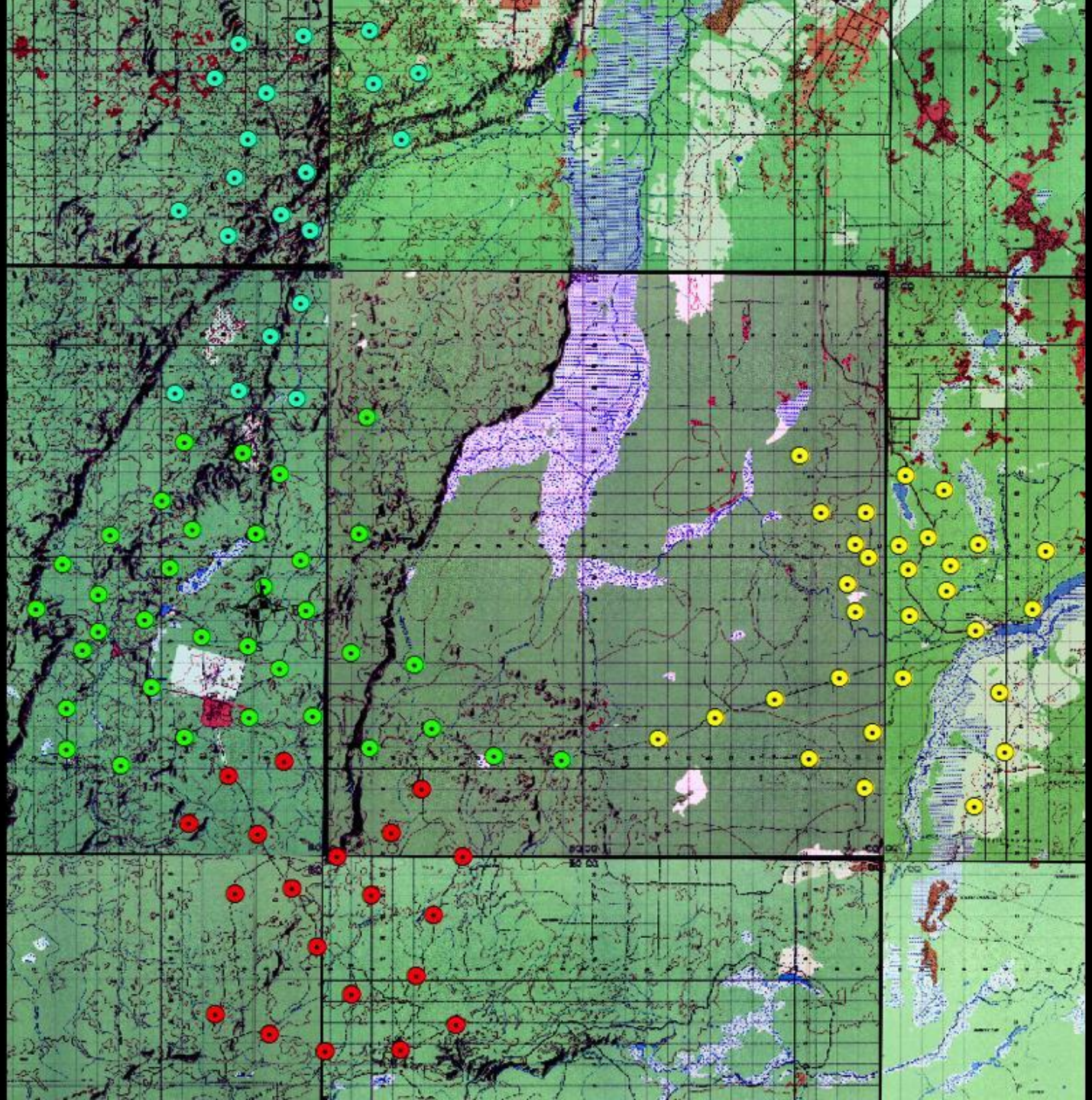
- Conservation efforts working to protect one species may impact other species
- Improving management efforts practices
- Different land uses effect species differently

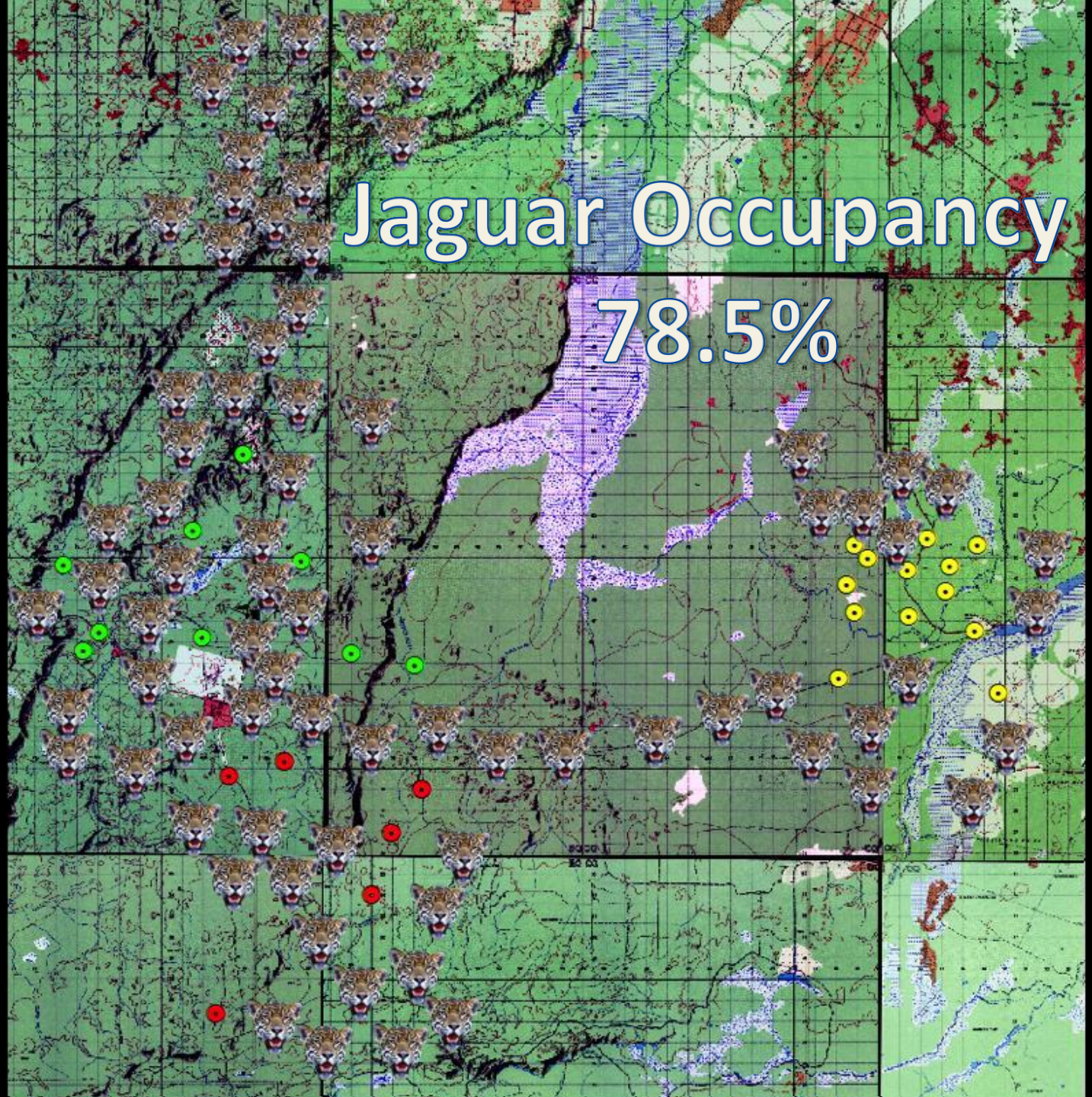
# Co-Existence Ecology Between Sexes

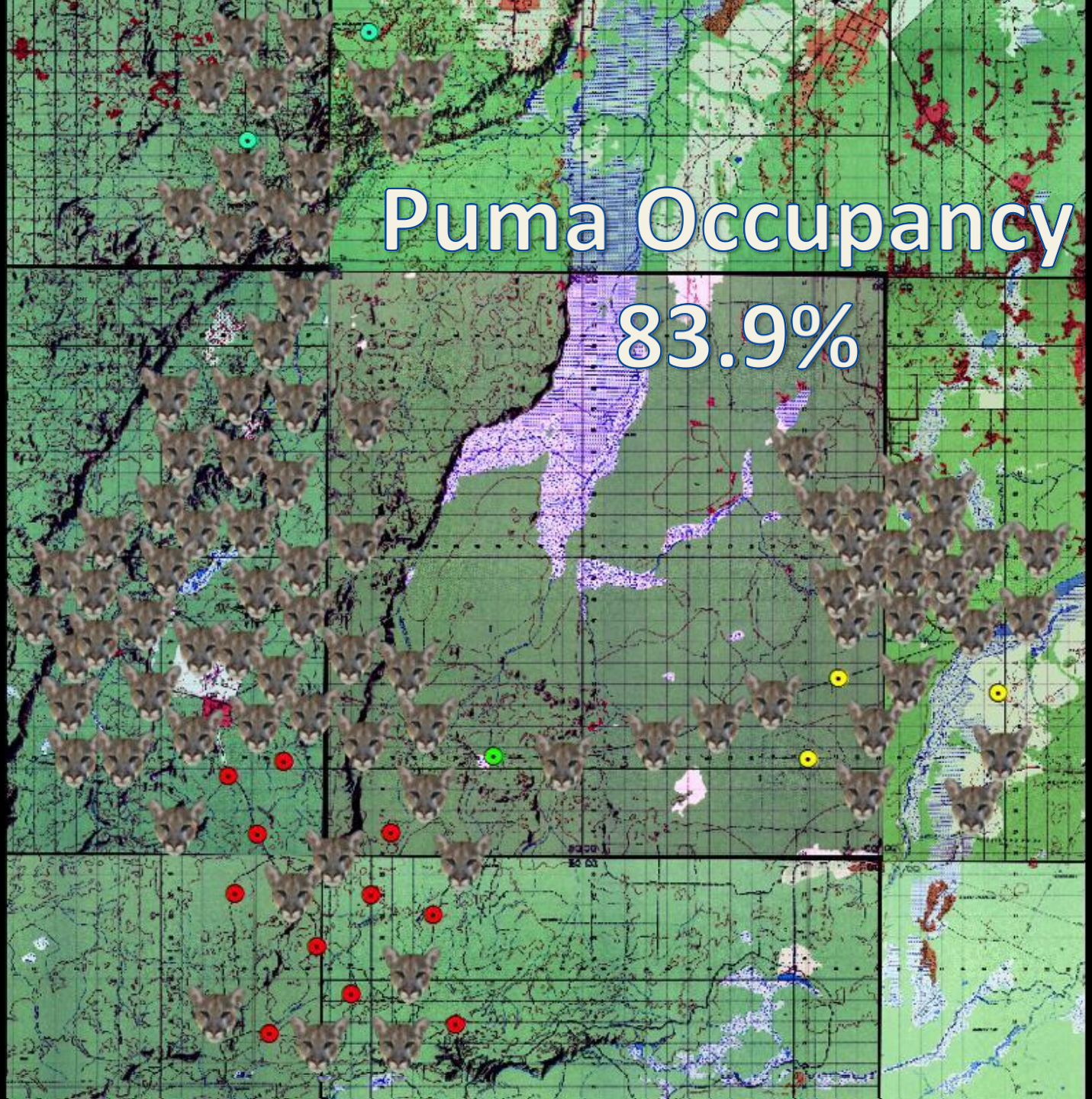


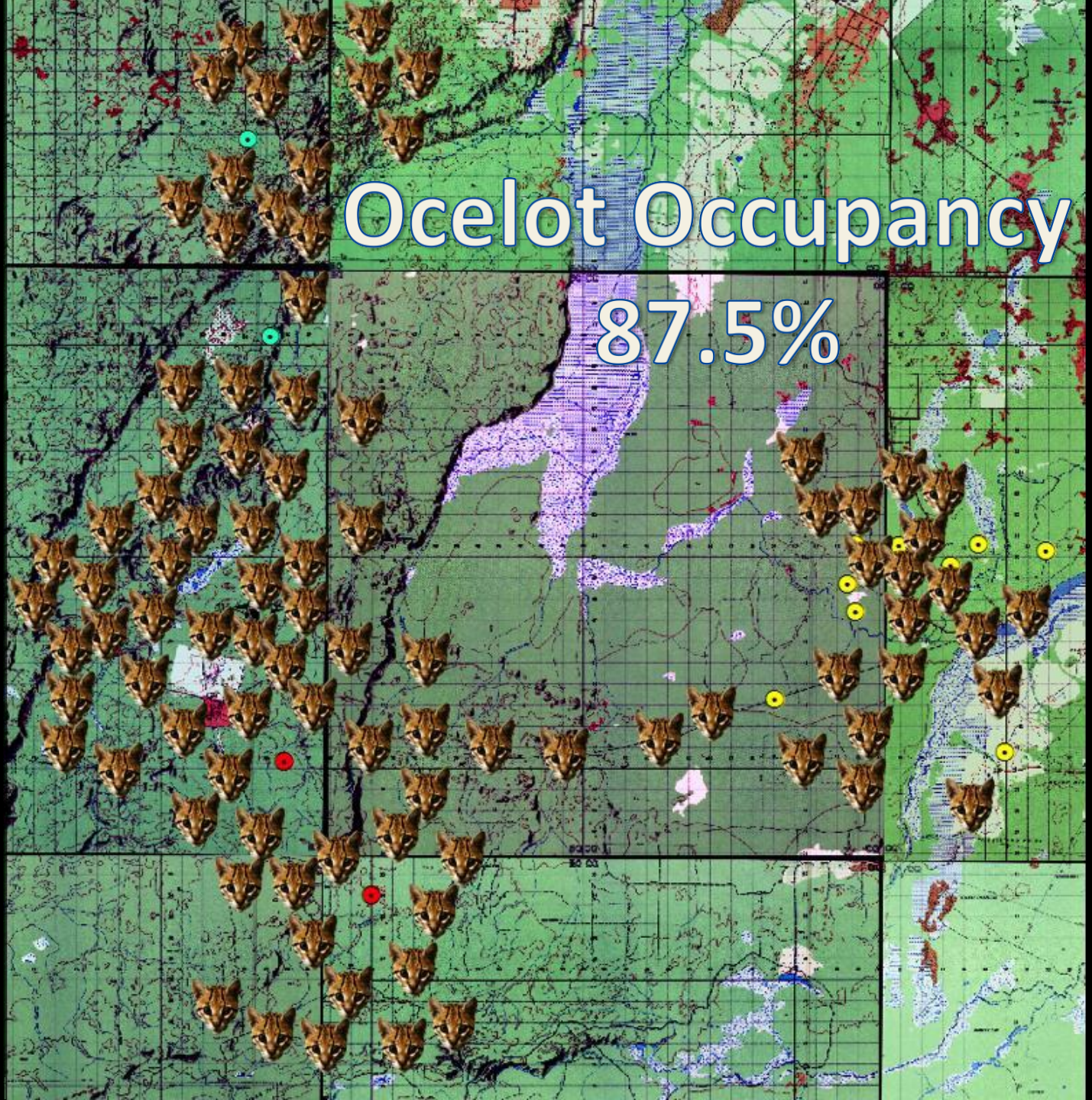
# Occupancy & Detection Modeling

- Occupancy
  - distribution across the landscape
- Detection
  - determining how many times they're detected by the cameras




Jaguar Occupancy
78.5%


Puma Occupancy
83.9%

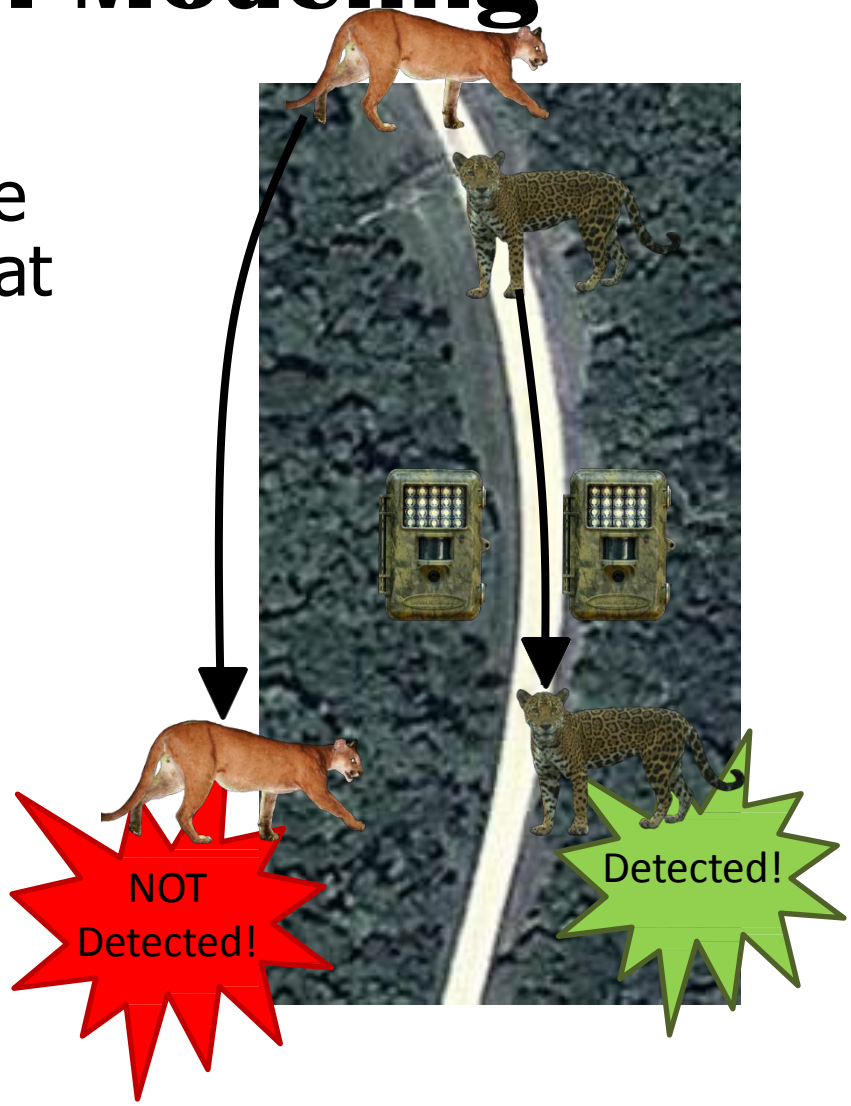

Ocelot Occupancy
87.5%

# Detection Modeling

- Elusive wild cats are hard to study
  - Remote noninvasive trail cameras help collect data
- A image is considered a single 'capture' event

# Detection Modeling

- Statistical model used accounts for not be able to 'capture' all animals at the camera station
- Accounts for animals that may not be detected
- Allows more accurate results and modeling



# Program PRESENCE

- Statistical modeling software used for studying detection
- Data input on a week by week basis across 13 weeks
- Ran 16 models for all three interactions

# Modifications to Detection Model

## Normal Modeling

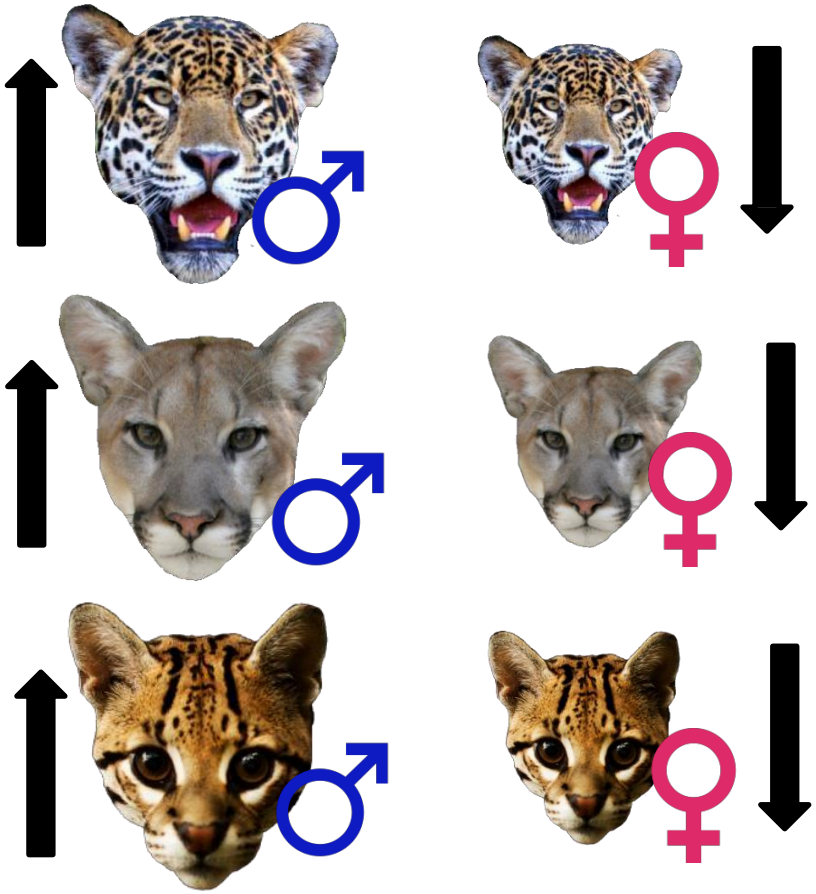
- Studying interactions between two different species in modeling program PRESENCE


## Modified Modeling

- Studying interactions within the same species
  - Sexes used as two separate species in PRESENCE

# Objective

To determine how detection is influenced by sex within a species



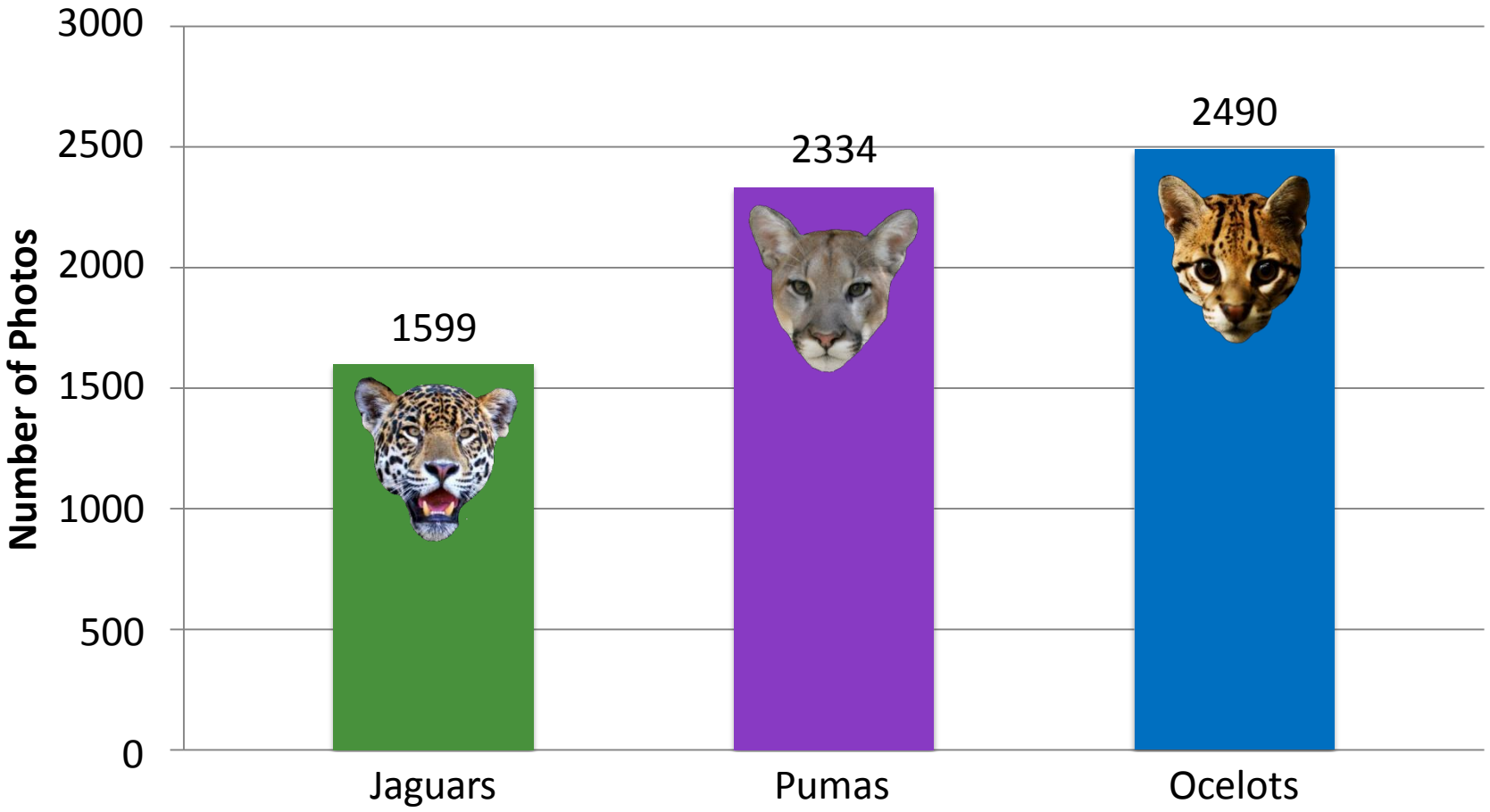
**Predictions**:

1.We expect the males across all species to have higher detection when females are present to find mates

2.We expect females across all species to have lower detection at stations where males are present because of infanticide

# 2016 Data Set

Average number of trap nights per station across all study sites= 64.2 nights

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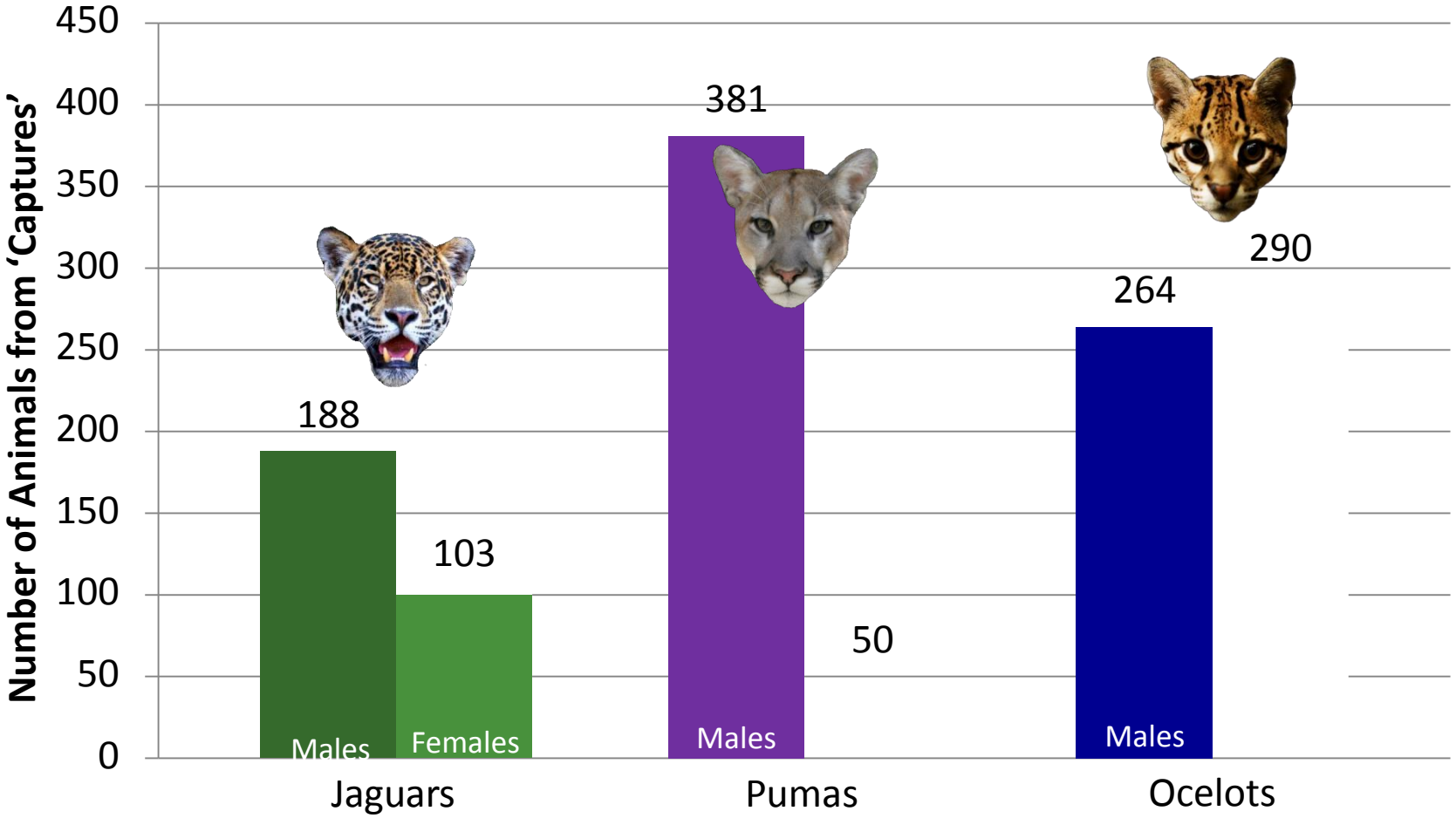
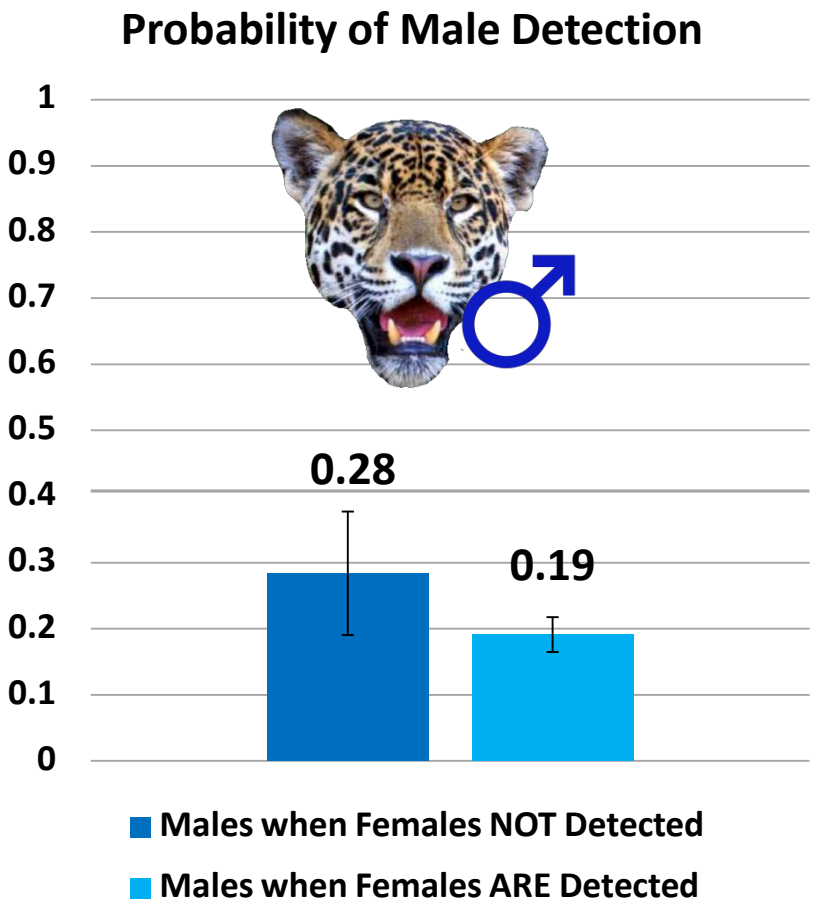
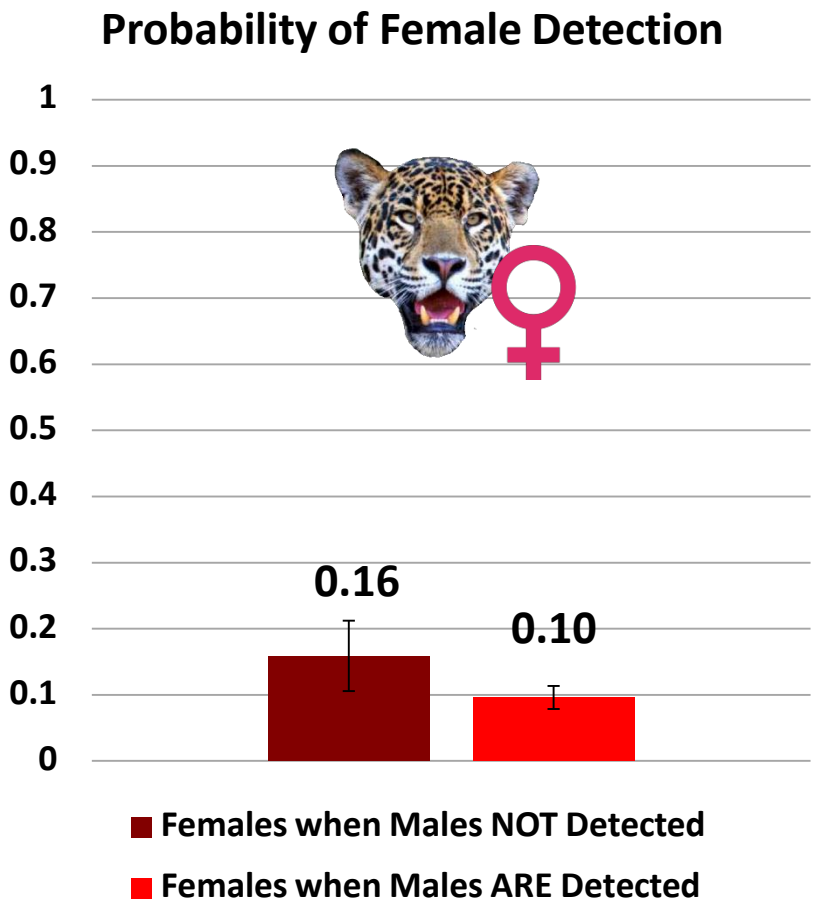
# Number Individuals of 'Captures' for All Four Study Sites

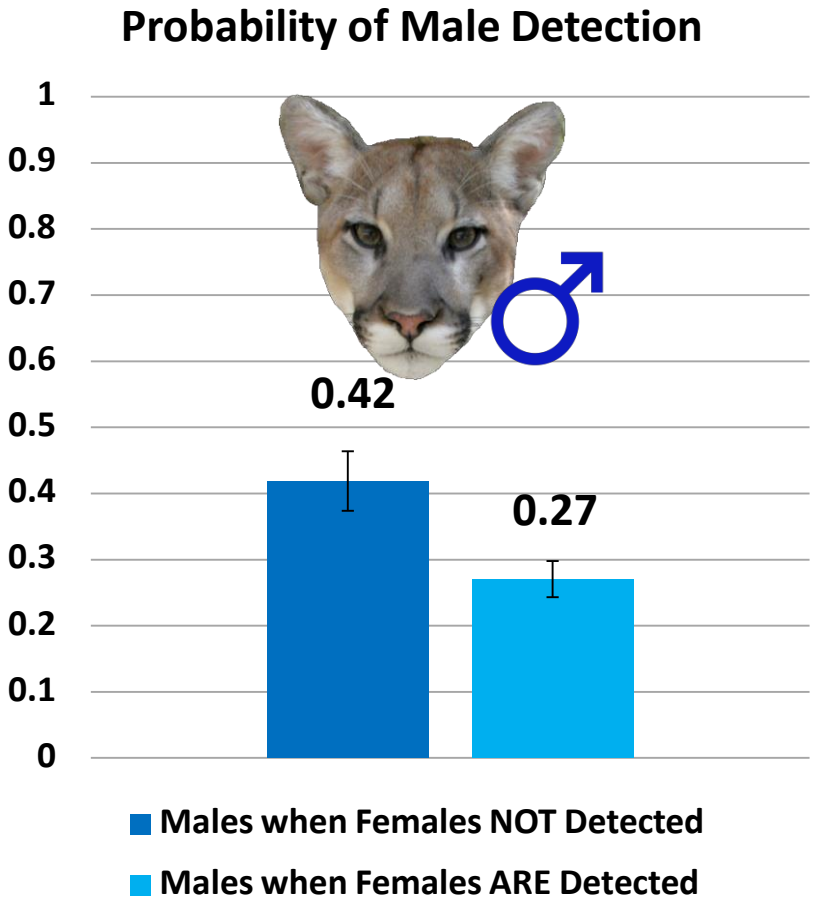


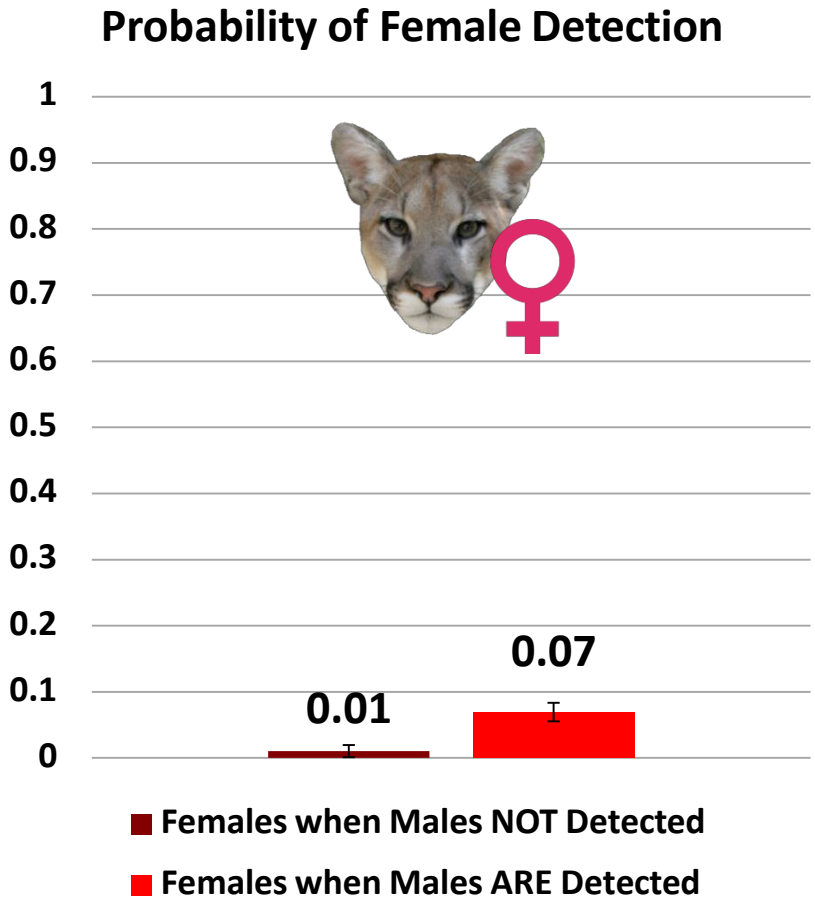
# Jaguar Male & Female Detection



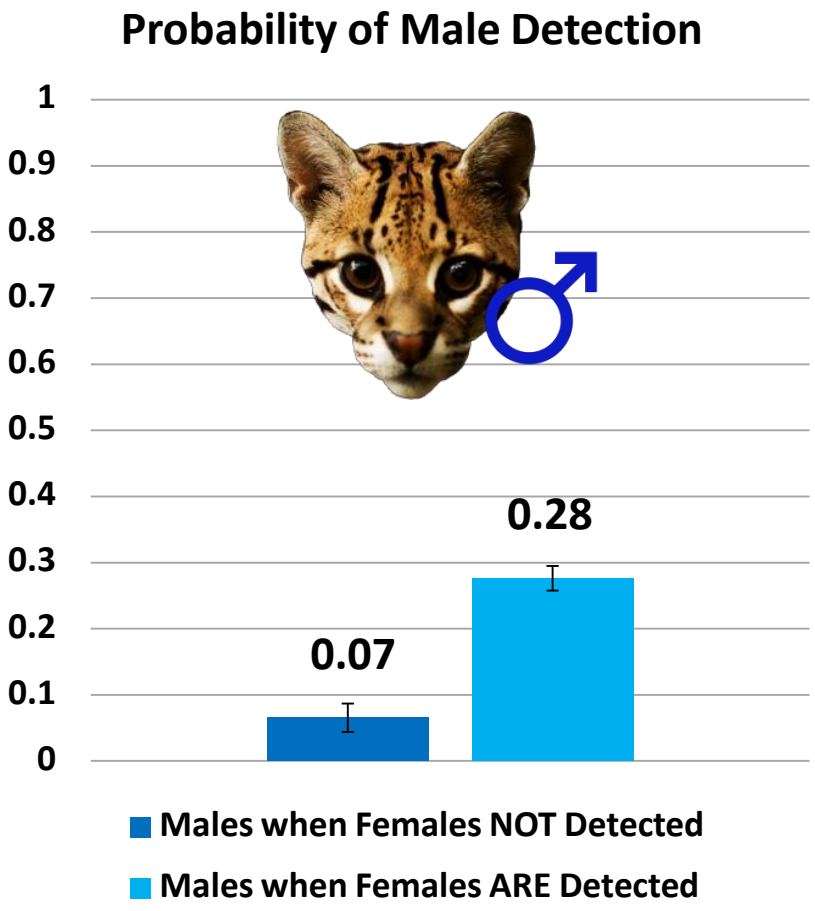



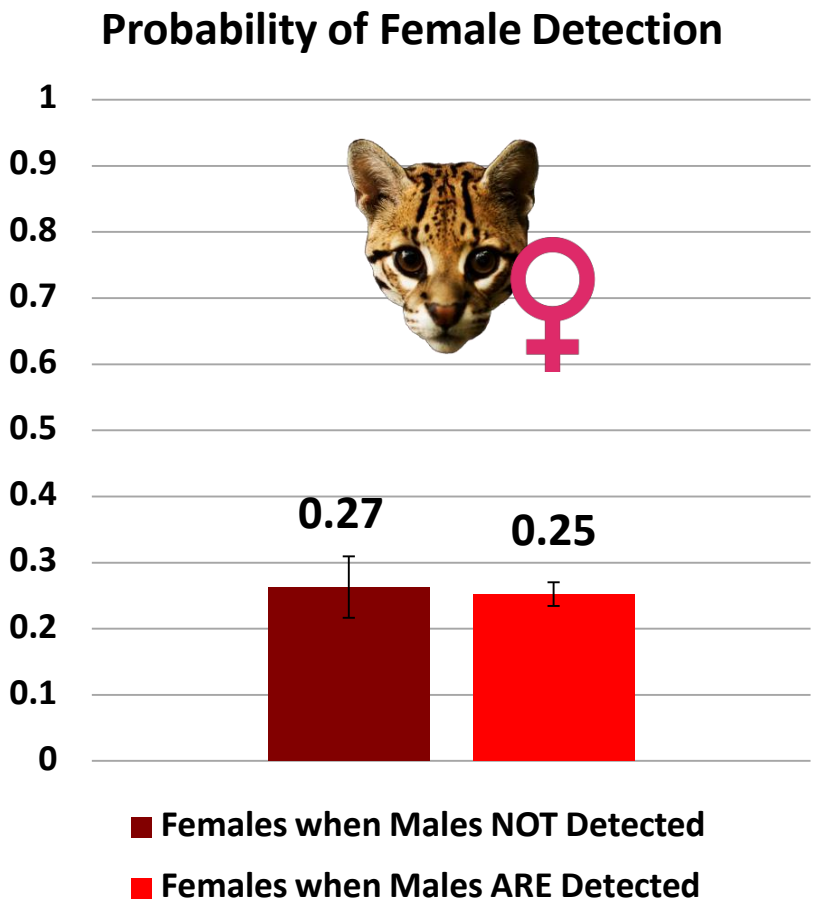
# Puma Male & Female Detection



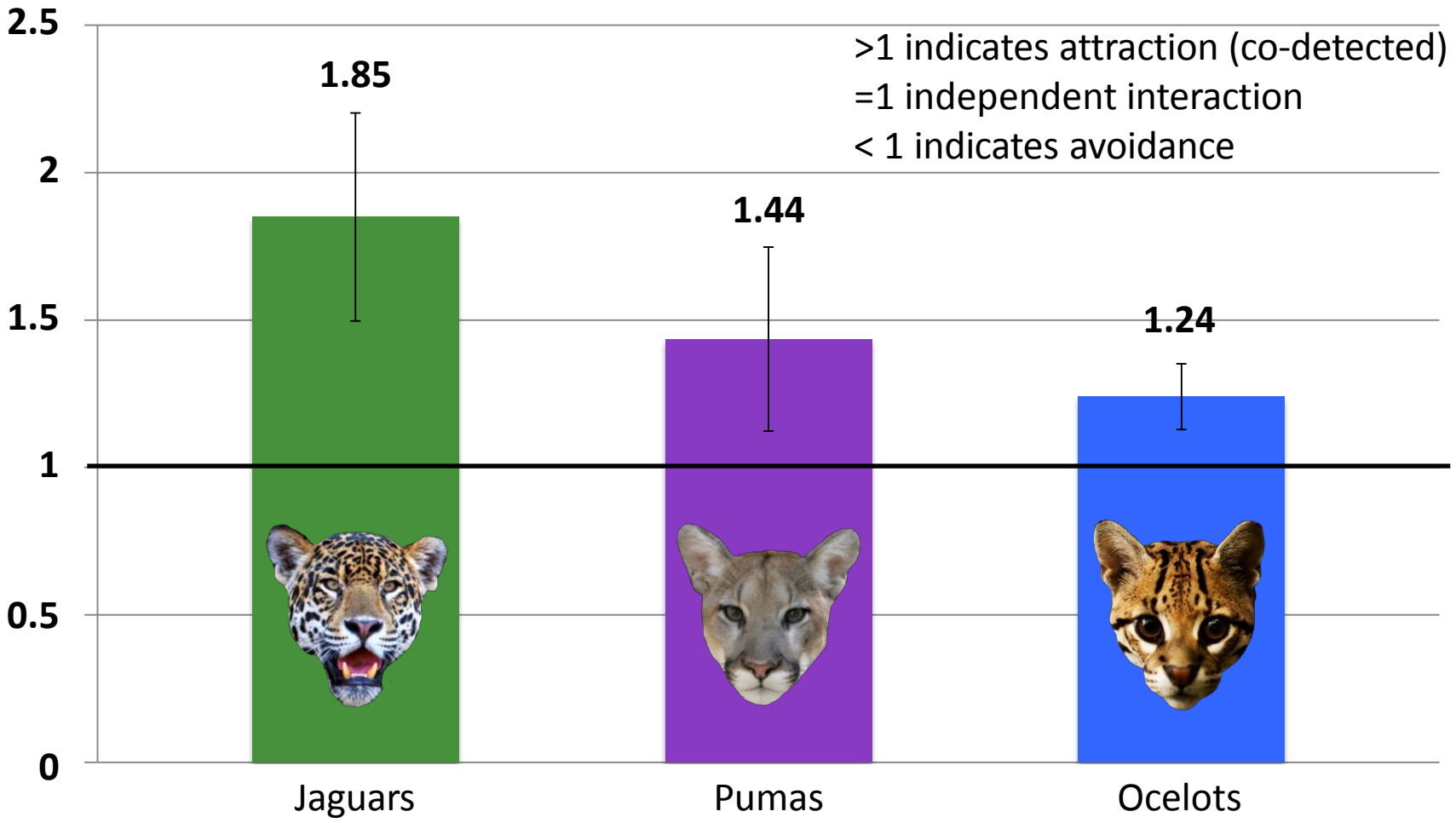



# Ocelot Male & Female Detection



# Delta Interaction Values



# Possible Causes of High Occupancy (Wide Distribution)

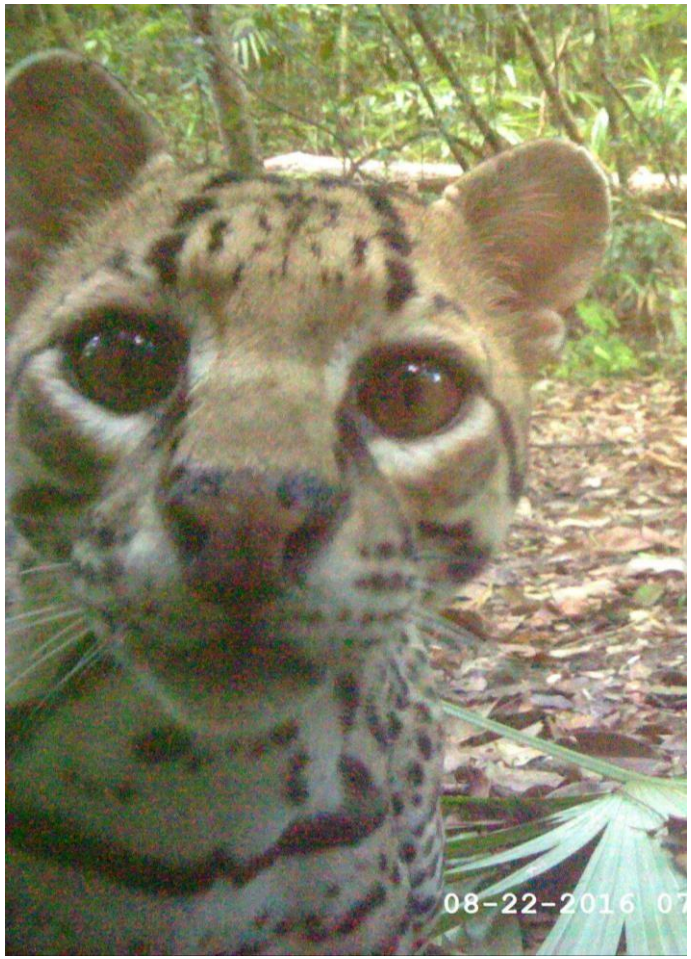
- Plentiful resources
- Lack of competition
- Very dense habitat
- Effective conservation efforts for all species

# Detection Summary

- Jaguars – sexes had higher detection when other sex absent
- Pumas – opposite of what was expected
- Ocelots – expected results
- Delta values indicated co-detection
  - No evidence of strong avoidance between sexes

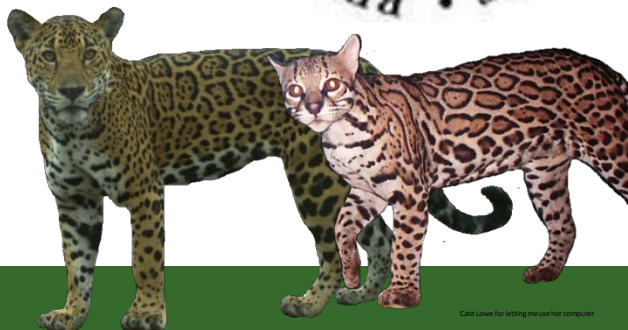
# Further Directions

- Examine past years of data collected to
  - Increase sample size
  - Include other factors
    - Human presence
    - Prey presence
- Analyze on a day by day basis instead of a week by week basis
  - More fine scale analysis



# Acknowledgement


- All the undergraduate students volunteering in Dr. Kelly's lab doing data entry and in the field collecting the raw photo data, this work would not be possible without their hard work
- Programme for Belize for their assistance & permission to work on their land
- Gallon Jug Estate for their assistance & permission to work on their land
- Yalbac Ranch and Cattle Corporation Limited (YRCC) for their assistance and permission to work on their land
- Virginia Tech's Department of Fish & Wildlife Conservation (FIW) & Virginia Tech's Department of Animal & Poultry Science (APSC)
- Virginia Tech's College of Natural Resources (CNRE) & Virginia Tech's College of Agriculture & Life Sciences (CALS)
- University of Belize for connecting interns with this project
- Forest Department of Belize for permission to conduct this work

Cate Lowe for letting me use her computer

# Questions?

**Brogan Holcombe – brogy23@vt.edu**

**See NCUR 2018 Proceedings for more info on this research**

# References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