



## AIMS for Wildlife: An Automated Interactive Monitoring System

**Michael Casazza**

Senior Research Wildlife Biologist, Emeritus  
Western Ecological Research Center, Dixon Field Station  
Dixon, California

## WESTERN ECOLOGICAL RESEARCH CENTER DIXON FIELD STATION

Specializing in wildlife conservation

- Tracking wildlife for +30 year
- Producing impactful research
- Collaborating with land and wildlife managers



## HISTORY OF ANIMAL TRACKING

Banding studies & visual surveys  
<2 locations/individual  
Early 1900s

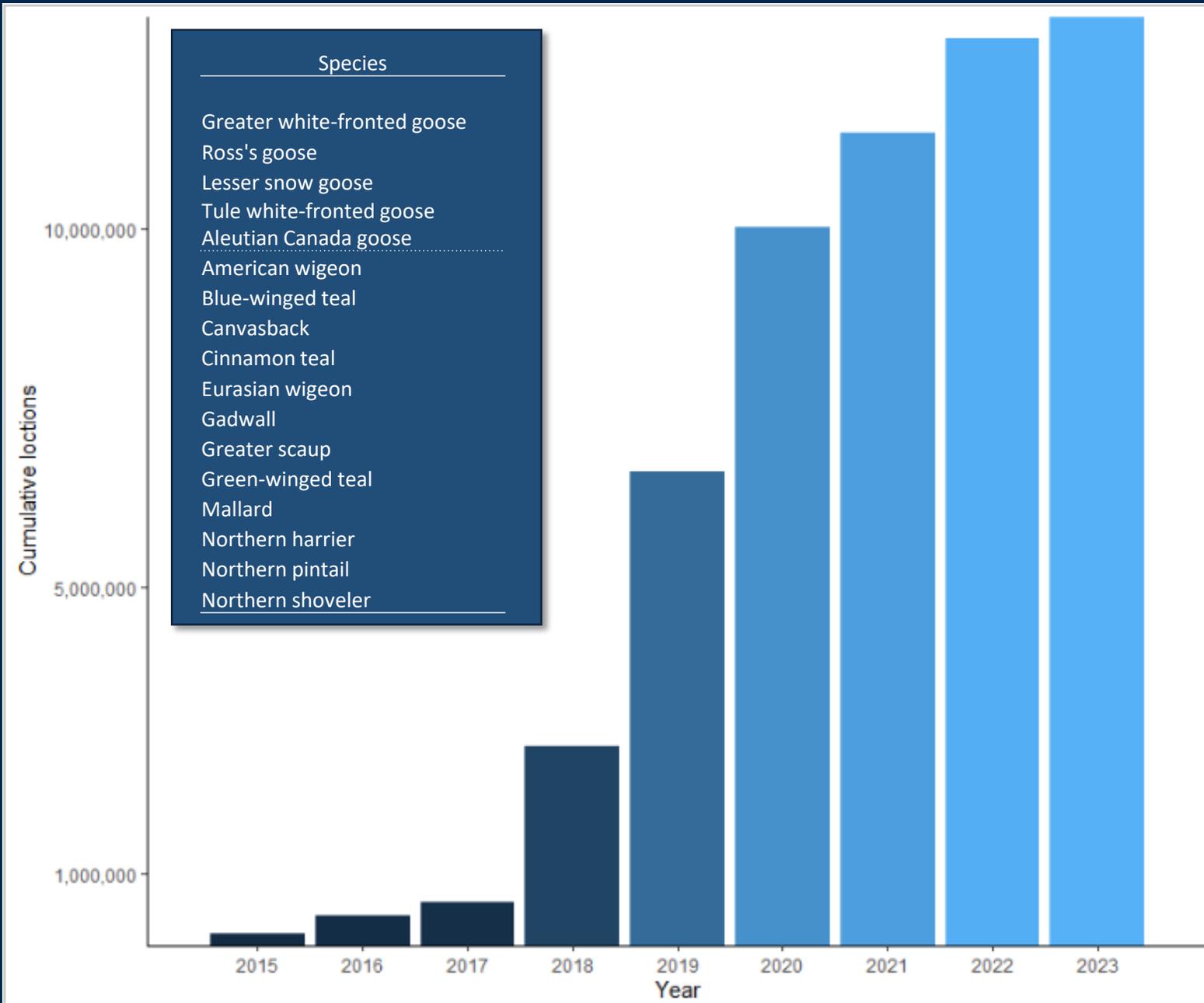
VHF telemetry  
~100 locations/individual  
1970s

Satellite telemetry  
~200 locations/individual  
2000s

GSM-GPS telemetry  
~5,000 locations/individual  
2010s



# BACKGROUND: WATERFOWL GPS 2015-2024



Our waterfowl data summary:

- 17 species and counting
- > 200,000 bird days
- > 16 million locations
- New species being added!



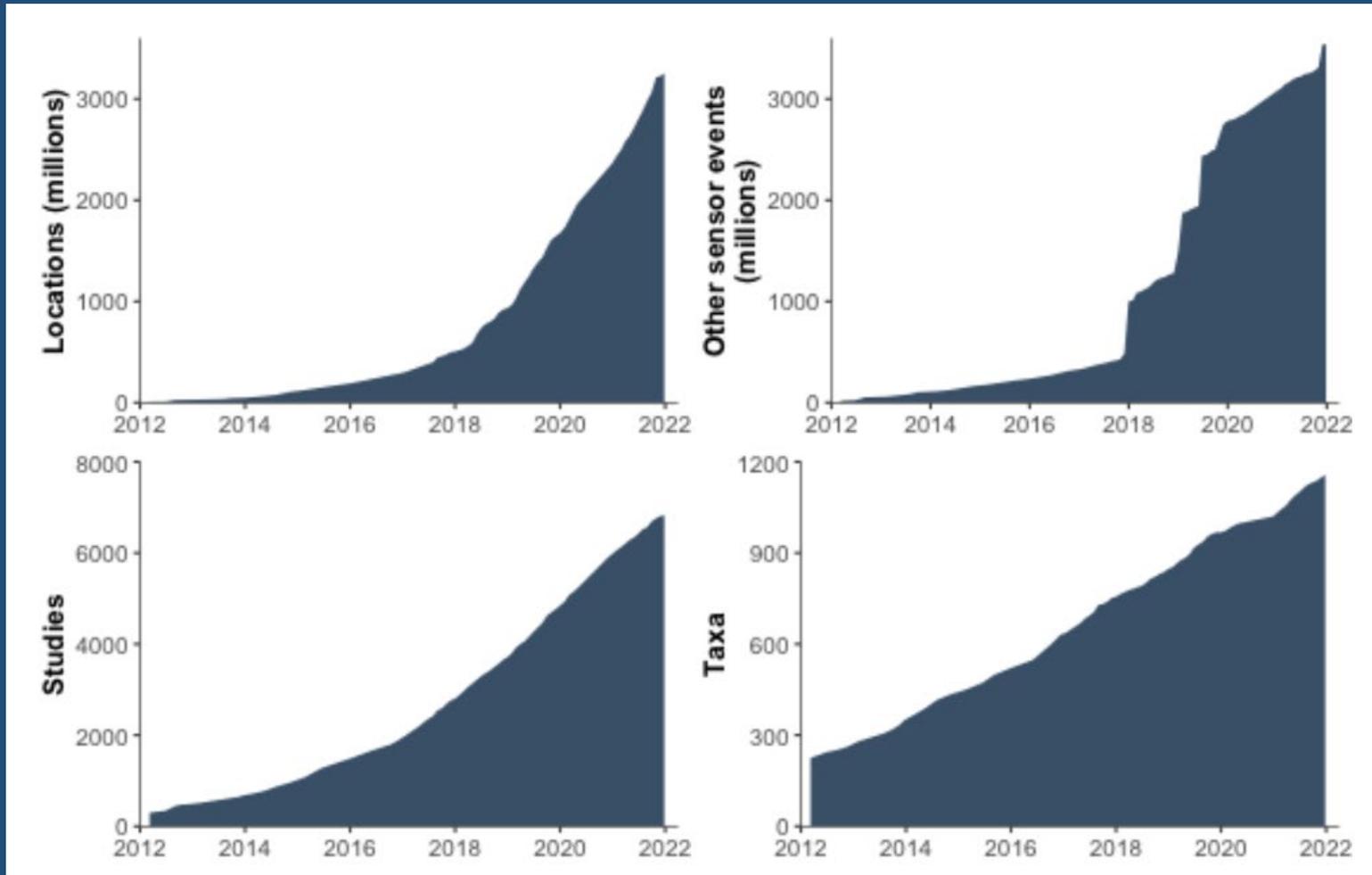
# BACKGROUND: WATERFOWL GPS 2015-2023



Michael Casarez, Research Wildlife Biologist  
U.S. Geological Survey, Western Ecological Research Center  
mike\_casarez@usgs.gov

# BACKGROUND: WE AREN'T ALONE

## Data in Movebank

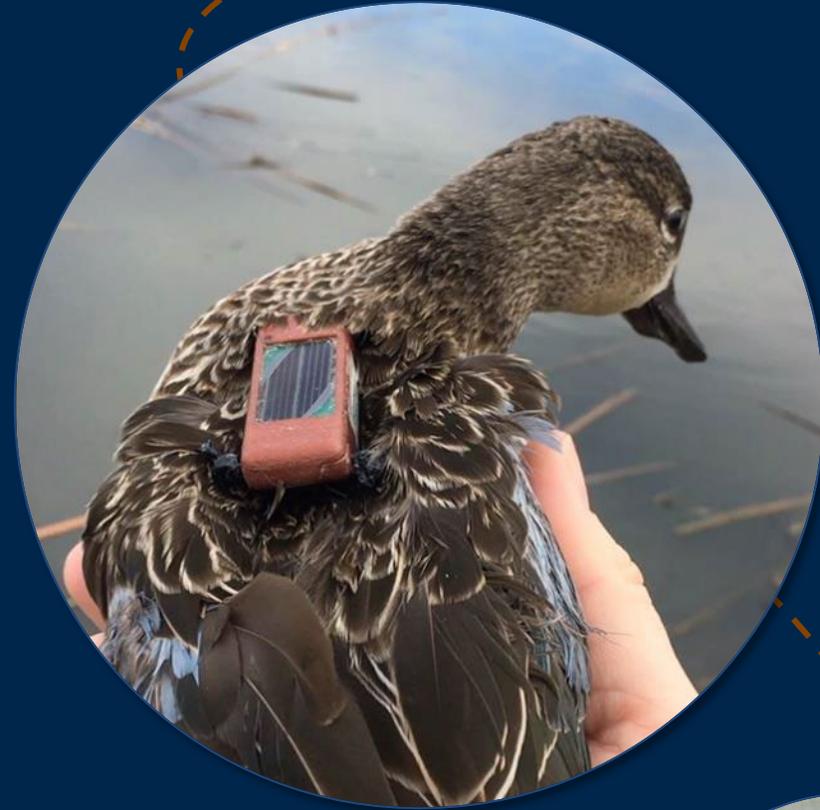


Source: Movebank.org



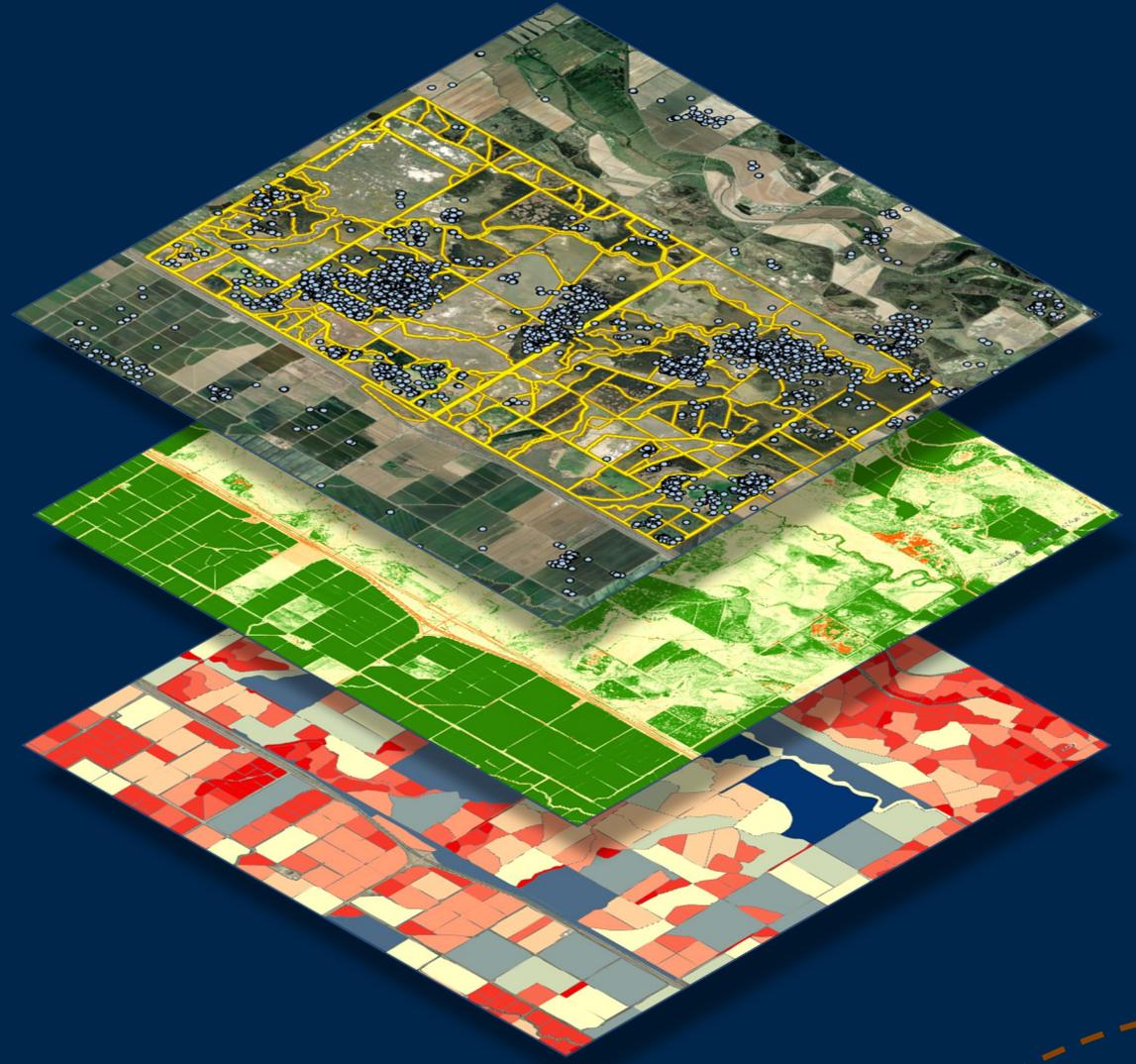
# TECHNOLOGICAL ADVANCES

- Precise locational data
- Transmitters smaller, less costly, more relocations, longer lasting
- Sensors: accelerometry, temperature, etc.
- Standardized outputs (Movebank), available in real time



# TOOLS TO HANDLE "BIG DATA"

- Satellite based remote sensing readily available
- Cloud Based solutions allow for data integration
- Machine learning/Artificial intelligence
- Time: from years to minutes



# CURRENT MONITORING PARADIGM



- Currently: “how many” or “what’s the trend”
- Documents species demise
- Not proactive
- Limits complexity of questions
- Lacks real-time actionable Information



# HOW CAN WE HELP?



How can we get this powerful data into the hands of managers and decision makers?



# OUR GOALS: BREAKING THE DATA FREE



Make GPS data  
easily accessible and  
operationally relevant



Make data available in  
real-time for faster  
decisions



Leverage existing data  
and products



Reduce need for  
specialized skills  
(GPS telemetry, GIS)



Communicate  
information in  
digestible format



Save managers and  
decision makers time





AIMS  
FOR  
WILDLIFE

AUTOMATED  
INTERACTIVE  
MONITORING  
SYSTEM



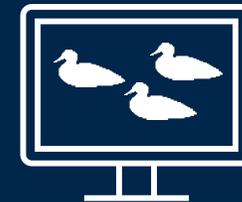
---

Collects real-time  
wildlife and  
environmental data



---

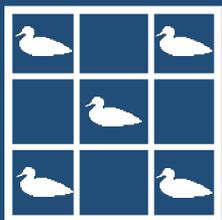
Aggregates,  
processes, and  
analyzes data



---

Produces automated  
visualizations, summaries,  
and alerts in a web interface

Data Sources



Stratified GPS

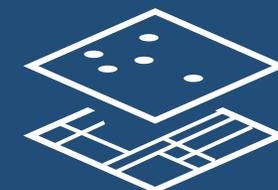


Targeted GPS



Crowdsourced Data

- MOTUS
- eBird
- Movebank



Environmental Data

Data Processing



QA/QC



Analysis



Cloud Storage

Products



Custom Reports



Web Apps



Wildlife Alerts



Long Term Dataset

Data  
Sources



Stratified GPS



Targeted GPS



- MOTUS
- eBird
- Movebank

Crowdsourced Data



Environmental Data

Data  
Processing



QA/QC



Analysis



Cloud Storage

Products



Custom Reports



Web Apps



Wildlife Alerts



Long Term Dataset

Data Sources



Stratified GPS



Targeted GPS



Crowdsourced Data

- MOTUS
- eBird
- Movebank



Environmental Data

Data Processing



QA/QC



Analysis



Cloud Storage

Products



Custom Reports



Web Apps

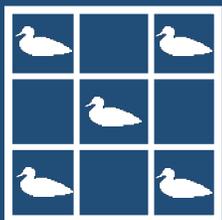


Wildlife Alerts



Long Term Dataset

Data Sources



Stratified GPS

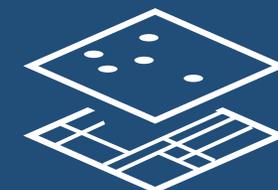


Targeted GPS



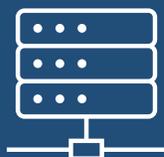
- MOTUS
- eBird
- Movebank

Crowdsourced Data



Environmental Data

Data Processing



QA/QC



Analysis



Cloud Storage

Products



Custom Reports



Web Apps



Wildlife Alerts



Long Term Dataset

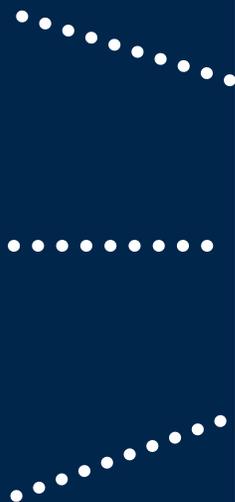
## USER INPUTS



Dates



Area of  
interest



Wildlife Manager/  
Decision Maker



## OUTPUTS



Custom Reports



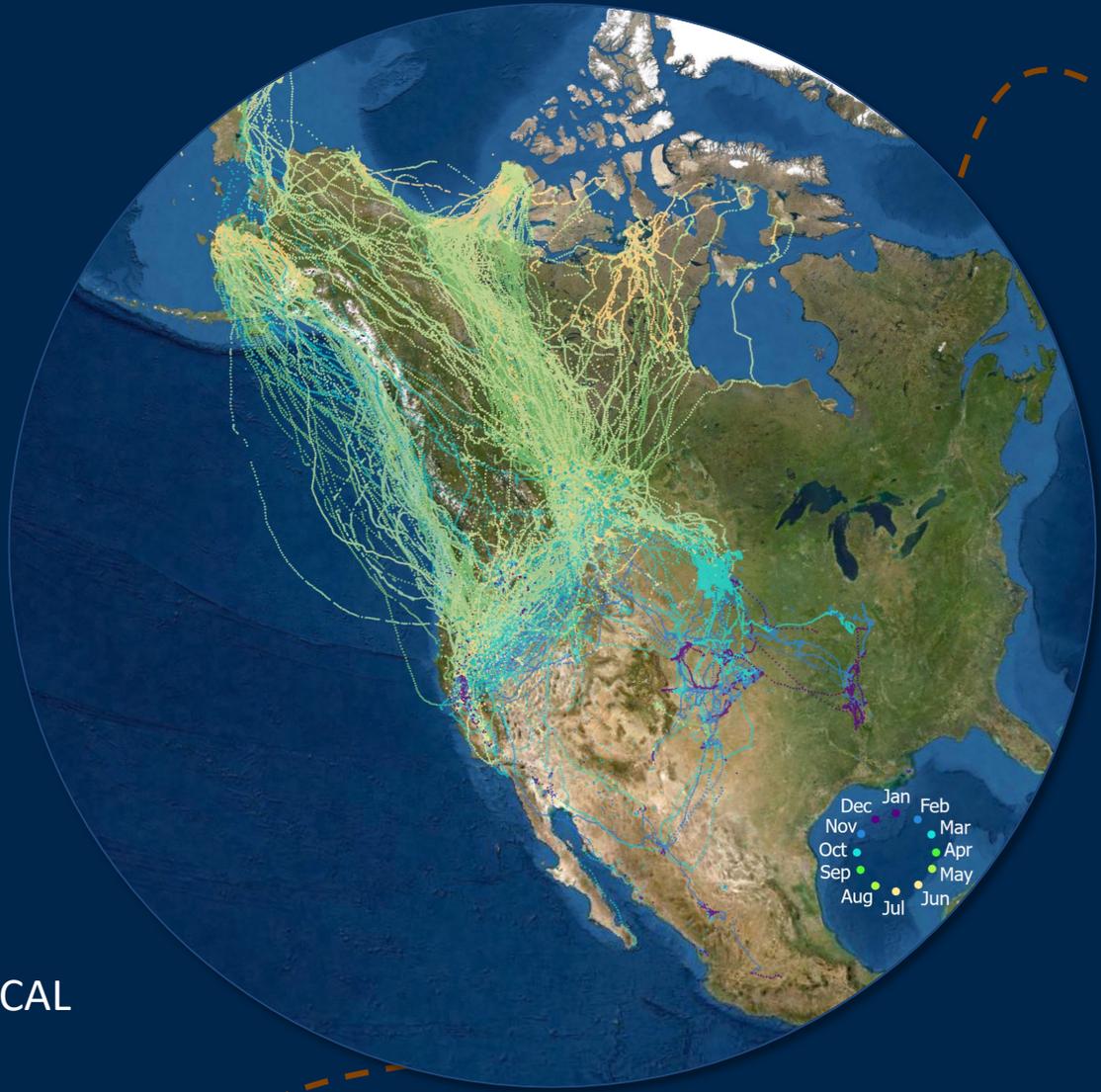
Web Apps



Wildlife Alerts

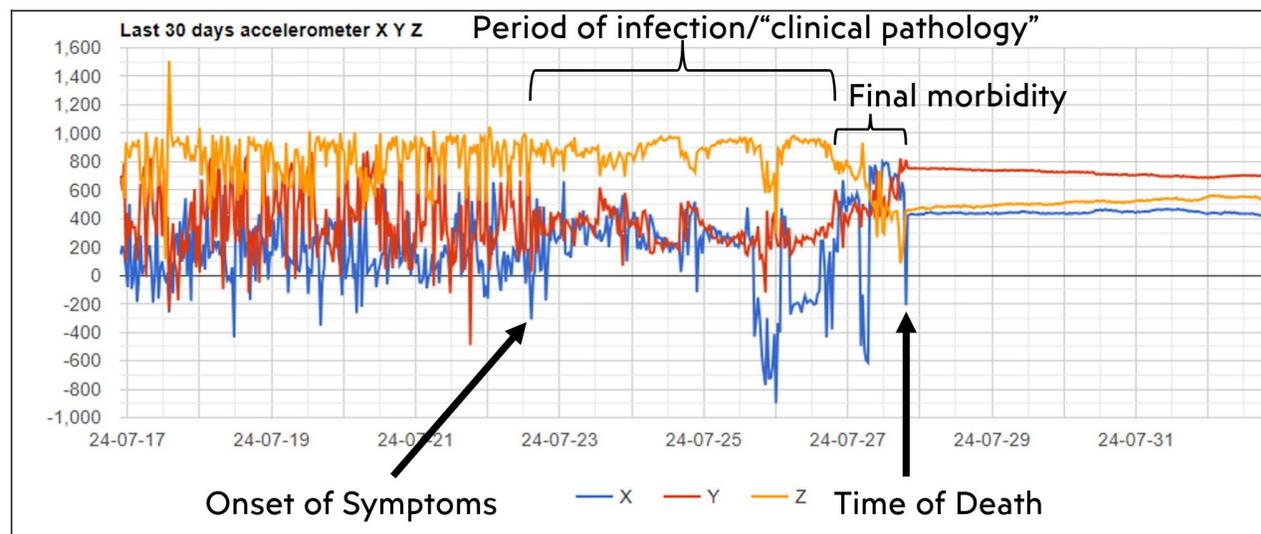


Long Term  
Dataset



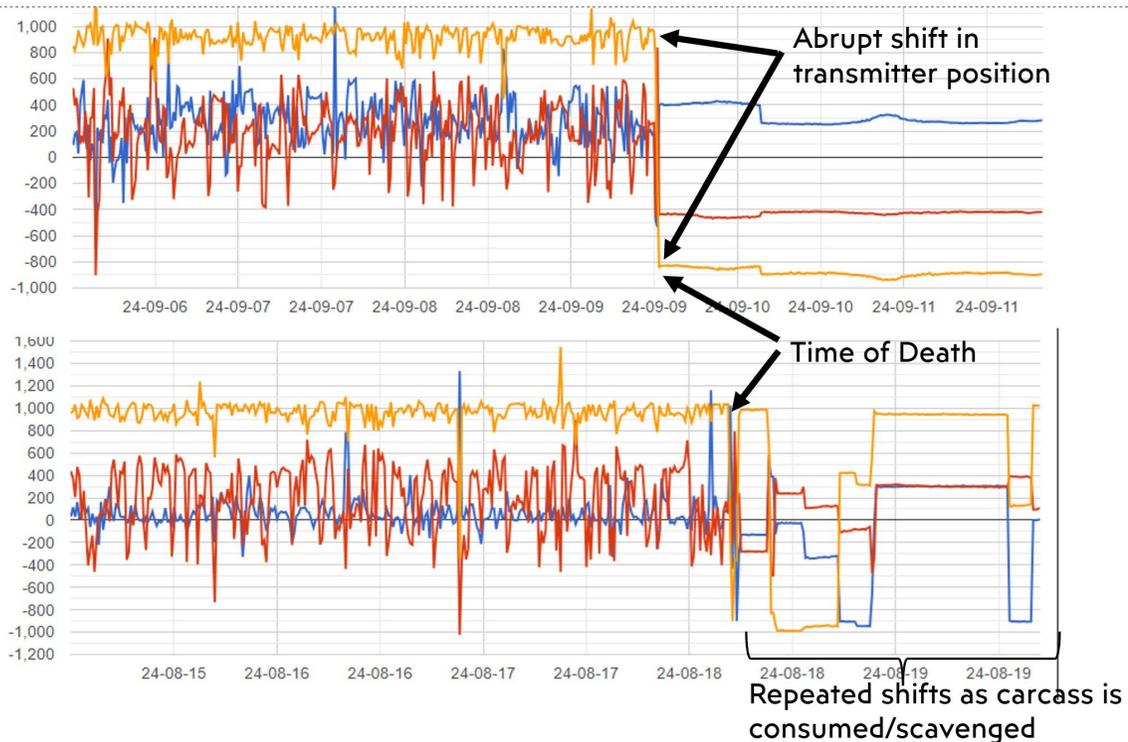
# AIMS: Wildlife Alerts- Mortality Report

## DISEASE



# AIMS: Wildlife Alerts- Mortality Report

## PREDATION



# AIMS: Wildlife Alerts- Mortality Report

- Email sent to wildlife area managers
- Coordinates for mortality are included with google maps link
- Basic description included (species, unit or distance to nearest refuge, etc.)



# AIMS: REFUGE REPORT

Updated daily for California  
State Wildlife Areas and  
National Wildlife Refuges

## Monthly Refuge Updates

1 Introduction

2 Putting *Gray Lodge* into context

3 *Gray Lodge*

4 Report information

5 Contact Information

Automated  
Wildlife  
Report



AIMS  
FOR  
WILDLIFE

## Automated Wildlife Report for *Gray Lodge*:

*November 1, 2023 to November 30, 2023* (PROVISIONAL DATA)

This information is preliminary and is subject to revision. It is being provided to meet the need for timely best science. The information is provided on the condition that neither the U.S. Geological Survey nor the U.S. Government may be held liable for any damages resulting from the authorized or unauthorized use of the information.

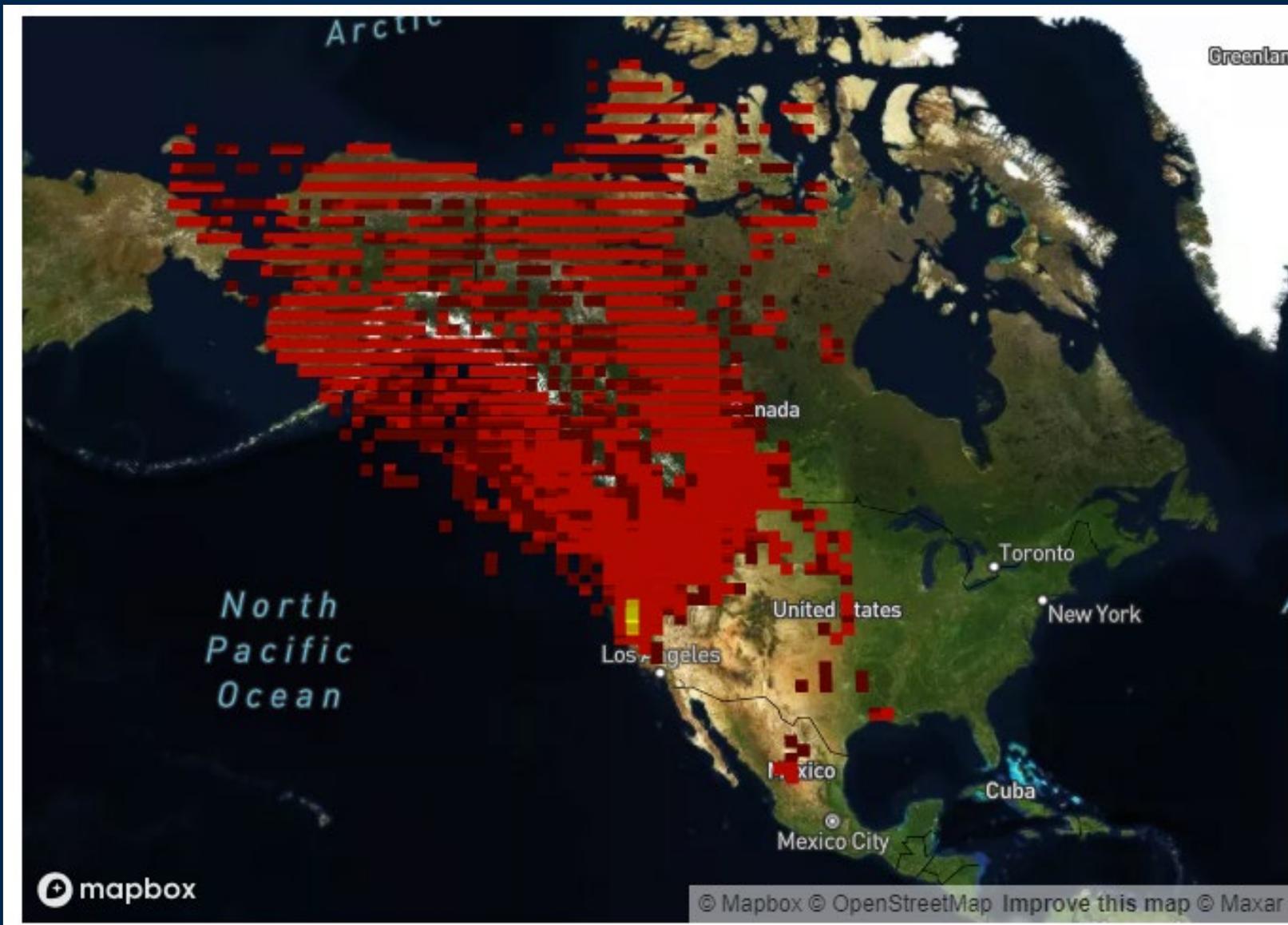
### 1 Introduction

[How to use this report](#)

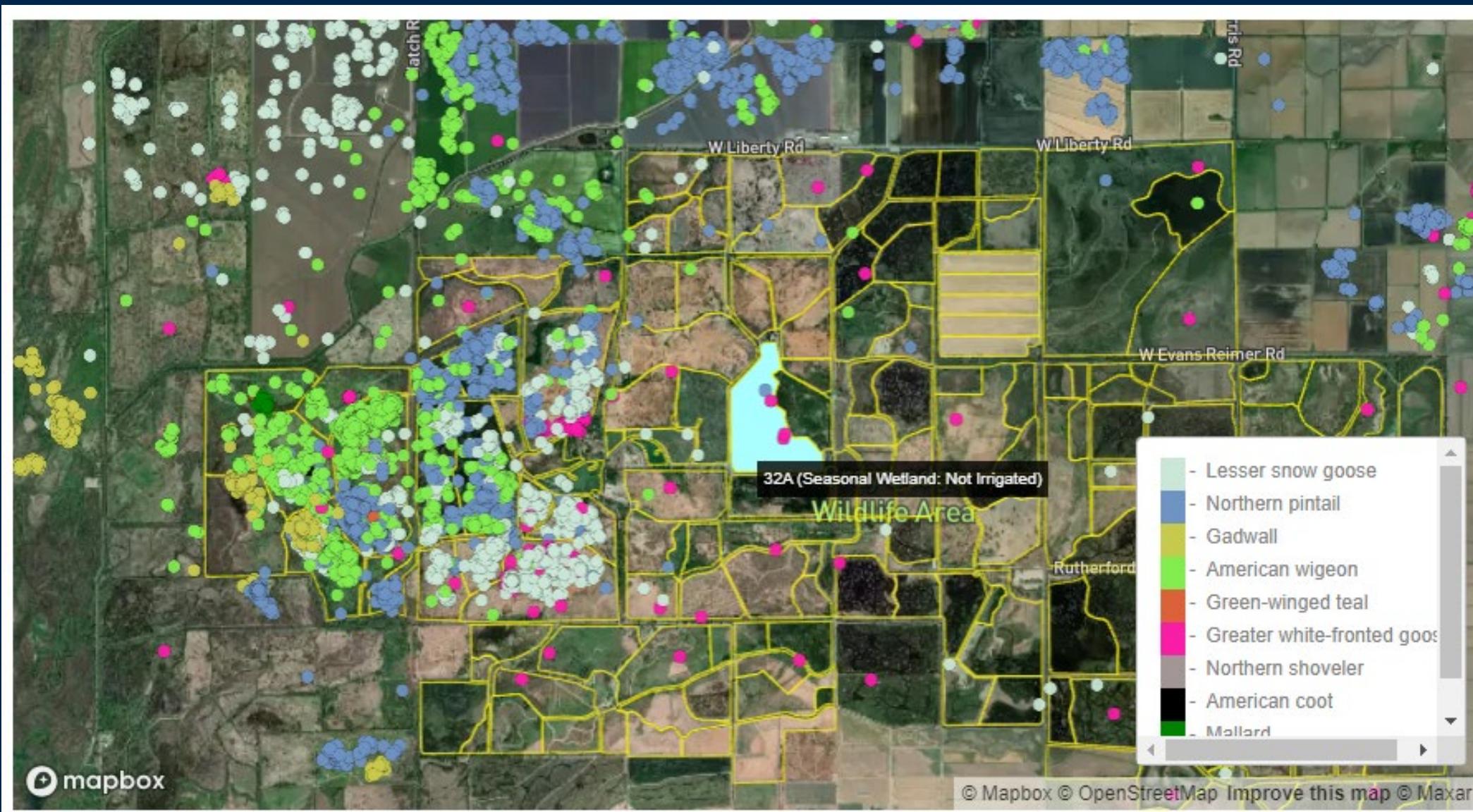
[Background](#)

Each report is interactive. The table columns can be sorted, and rows can be filtered. The maps can be navigated with your mouse, and you may utilize your mouse wheel to zoom in and out and hover the cursor over features to get more insights.

## Monthly Refuge Updates



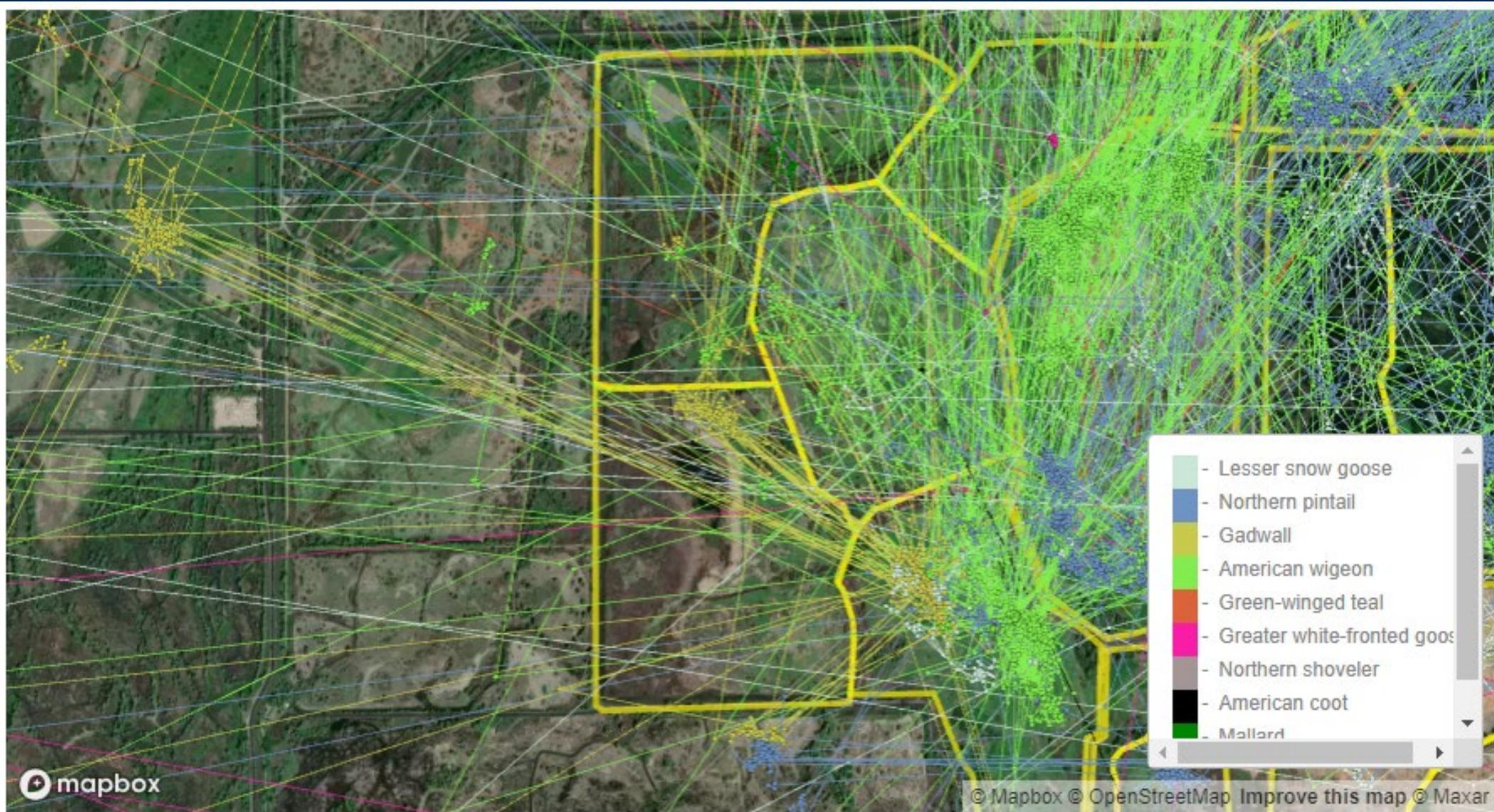
## Monthly Refuge Updates



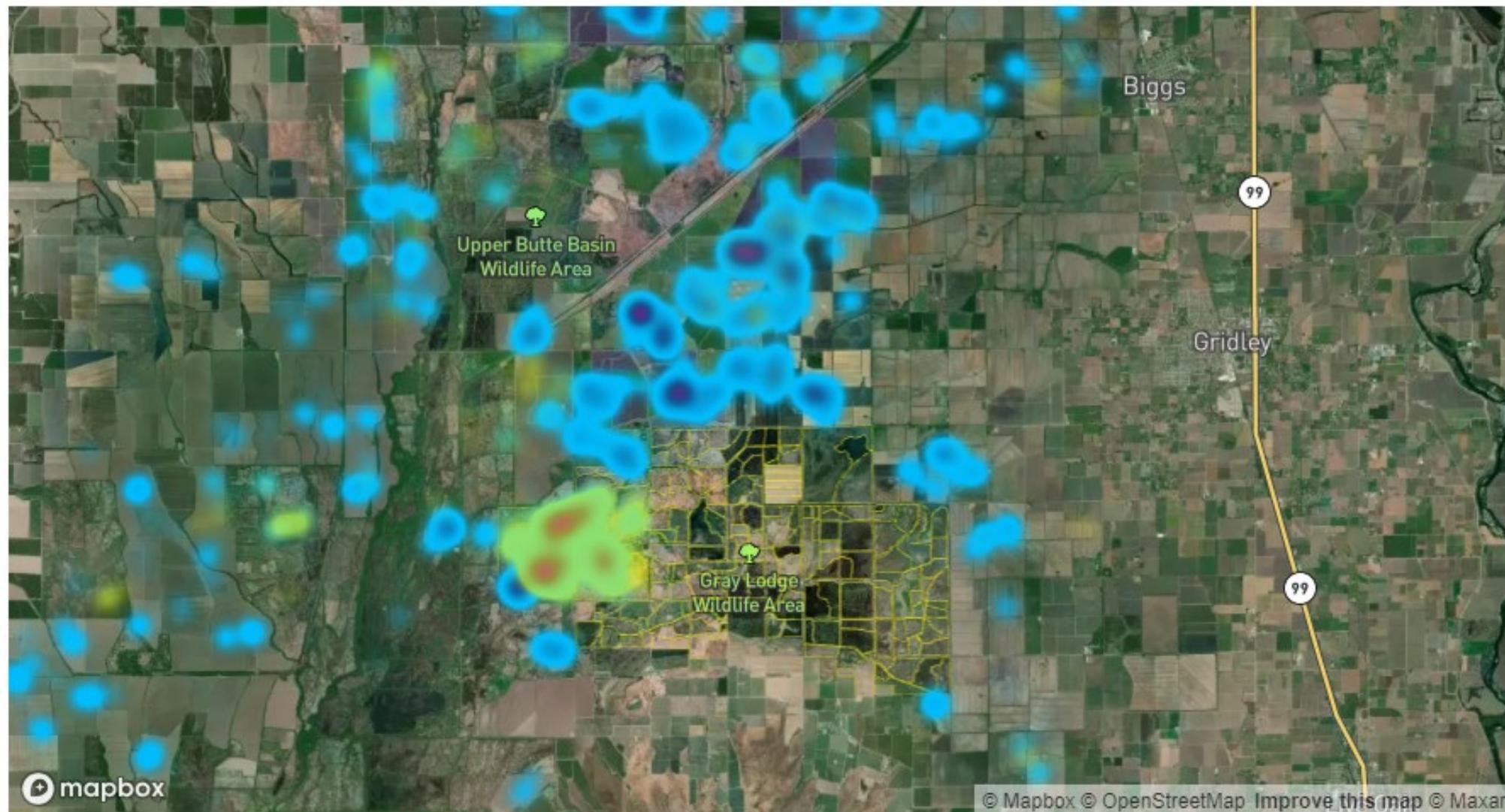
## Monthly Refuge Updates



## Monthly Refuge Updates



## Monthly Refuge Updates



## Monthly Refuge Updates

### 3.2 Habitat use at *Gray Lodge*

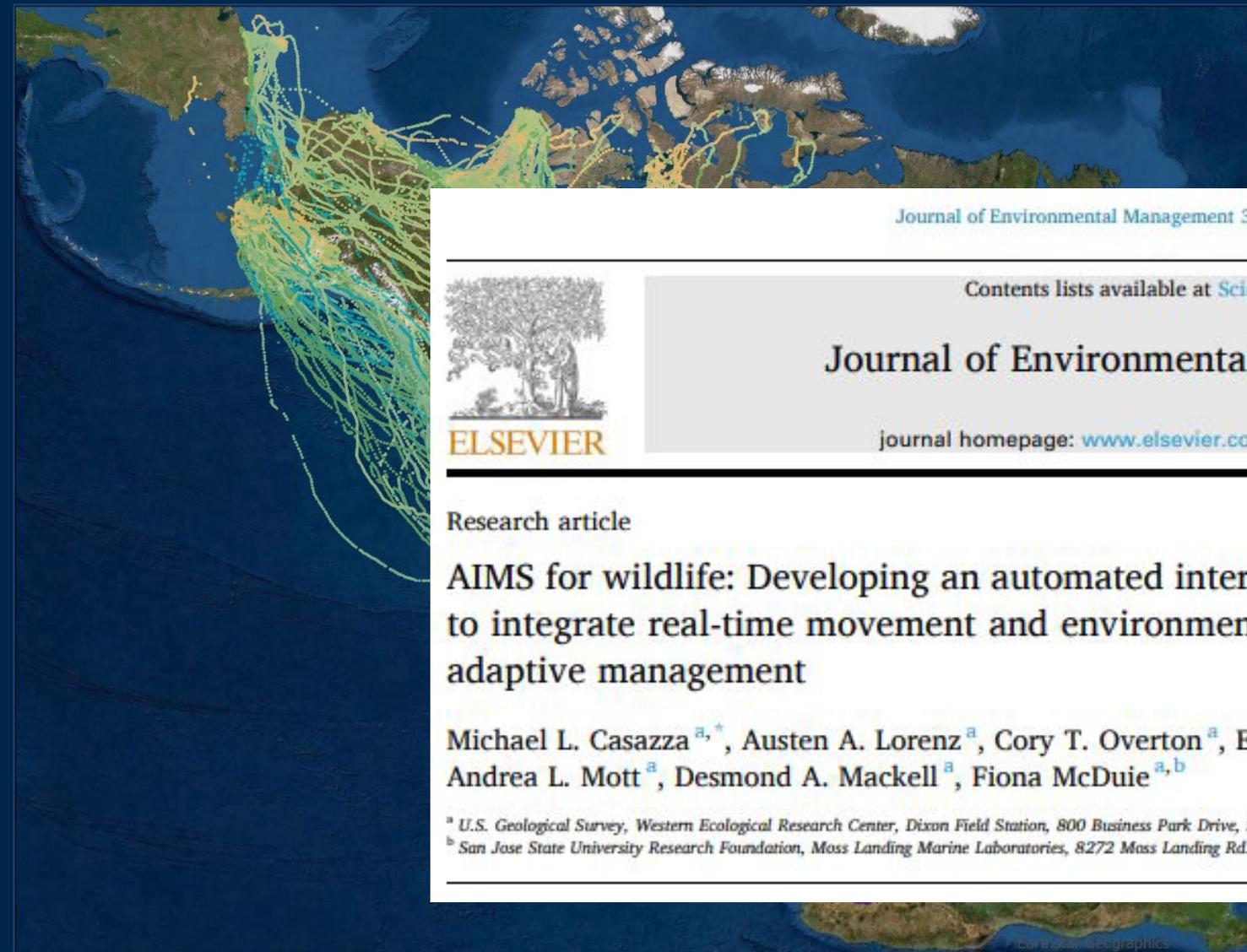
The table summarizes the use of management units by percentage of use and by bird locations per acre. It can be filtered and sorted to see the top use of each management class.

Day and night Day Night

Unit	Number of species	Individuals	Locations	Locations per acre	Percent of use	Management
▼ 7	6	29	3805	25.5	35.8%	Irrigated Seasonal Wetland: Smartweed/Watergrass
Species		Individuals	↓ Locations	Locations per acre	Percent of use	
American wigeon		11	2895	19.4	27.3%	
Northern pintail		6	800	5.4	7.5%	
Lesser snow goose		9	96	0.6	0.9%	
Green-winged teal		1	9	0.1	0.1%	
Northern shoveler		1	4	0.0	0.0%	
Gadwall		1	1	0.0	0.0%	
▶ 5	5	18	2291	26.3	21.6%	Seasonal Wetland: Not Irrigated
▶ 11B	3	18	1189	11.5	11.2%	Irrigated Seasonal Wetland: Smartweed/Watergrass
▶ 10A	3	6	858	40.9	8.1%	Irrigated Seasonal Wetland: Smartweed/Watergrass
▶ 18	4	13	425	3.0	4.0%	Irrigated Seasonal

# BENEFITS OF AUTOMATED WILDLIFE MONITORING

- Data stream applicable at multiple scales across time and space



Journal of Environmental Management 345 (2023) 118636

Contents lists available at [ScienceDirect](#)



**Journal of Environmental Management**

journal homepage: [www.elsevier.com/locate/jenvman](http://www.elsevier.com/locate/jenvman)



Research article

**AIMS for wildlife: Developing an automated interactive monitoring system to integrate real-time movement and environmental data for true adaptive management**

Michael L. Casazza<sup>a,\*</sup>, Austen A. Lorenz<sup>a</sup>, Cory T. Overton<sup>a</sup>, Elliott L. Matchett<sup>a</sup>, Andrea L. Mott<sup>a</sup>, Desmond A. Mackell<sup>a</sup>, Fiona McDuie<sup>a,b</sup>

<sup>a</sup> U.S. Geological Survey, Western Ecological Research Center, Dixon Field Station, 800 Business Park Drive, Suite D Dixon, CA, USA  
<sup>b</sup> San Jose State University Research Foundation, Moss Landing Marine Laboratories, 8272 Moss Landing Rd. Moss Landing, CA, USA



zed  
ewable  
ilability,  
nd



Living up to our motto



Thank You!

Contact:  
Michael Casazza  
[mike\\_casazza@usgs.gov](mailto:mike_casazza@usgs.gov)