Round Table Discussion – AOS & SCO-SOC 2021 Virtual Meeting
August 12, 2021

Title: Drone Applications for Ornithology

Organizers:

- Dr. David Bird
  Emeritus Professor of Wildlife Biology, McDill University and
  Founding/Consulting Editor, Journal of Unmanned Vehicle Systems
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- Rick Spaulding
  Sr. Wildlife Biologist, ManTech Advanced Systems International
  Chair, The Wildlife Society Drone Working Group
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Abstract:
In an era of rapid global change, ornithologists are relying on an ever-increasing suite of novel tools to answer questions and solve problems related to avian research, conservation, and management. Over the past 10 years, the use of unmanned aerial vehicles, or drones, has exploded in popularity in ecological studies in general, and in ornithology in particular. Drones have many advantages over traditional survey and research techniques, as they eliminate safety risks associated with fixed-wing and helicopter surveys, reduce cost and disturbance, increase accuracy, and allow the collection of high-resolution data over large and/or otherwise inaccessible areas. Some of the major areas of application of drones that have emerged in avian research and conservation include, but are not limited to: (1) population surveys, including breeding colonies and non-breeding aggregations and the use of different types of camera sensors (e.g. visible, thermal IR); (2) individual nest inspections, particularly for raptors; (3) radio-tracking surveys involving the use of radio telemetry sensors; (4) acoustic surveys, involving the use of song-recording sensors; (5) avian habitat research and monitoring involving high-resolution 2D and 3D mapping and multi- and hyperspectral imaging; and (6) bird dispersal, either for nuisance birds or to deter birds from hazards. This Round Table Discussion provides not just highlights of the use of drones in avian ecology, but also a forum for discussion among both experts and potential users of drones potentially resulting in future research collaborations between ornithologists in academic, government, and private sectors.

The Wildlife Society (TWS) Drone Working Group (WG)

https://wildlife.org/drone/

Presented by Rick Spaulding, Chair – TWS Drone WG
ManTech Advanced Systems International
Rick.Spaulding@mantech.com

- Formed in October 2019
- The Drone WG's Goals include, but are not limited to:
  1. Facilitate communication and the exchange of information among members of The Wildlife Society interested in the use of drones for wildlife research, management, and conservation.
  2. Enhance knowledge and technical capabilities of wildlife professionals in the safe, ethical, legal, and professional use of drones in wildlife management, research, and conservation.
  3. Increase public and local, state, and federal agency awareness and appreciation of drones as a component of wildlife research, management, and conservation.

- Currently 96 members representing academia, consultants, federal and state natural resource agencies, and citizen scientists.
- 84 members in the US
- 9 members in Canada
- 1 member in Australia
- 1 member in the UK
- 1 member in Argentina
- Membership in the TWS Drone WG is open to only to members of TWS. Membership dues vary (e.g., student, international, retired, etc.). See https://wildlife.org/join/ for details.
- Drone WG annual dues are $5.

- The Drone WG maintains a literature database covering the use of drones for wildlife research, conservation, and management.
- The database is updated regularly and sent out to members monthly.
- The literature database currently has 695 references listed in an Excel spreadsheet.
- The spreadsheet contains the following information for each reference, as applicable:
    - author, title, publication year, journal, keywords, drone and sensor type(s), study species and family, and study location.
- All references are available as pdfs upon request from a WG member.

- TWS Drone WG website:
  https://wildlife.org/drone/
- The WG sponsors and organizes a Drone Symposium at the annual TWS conference.
- Under the Annual Meeting tab on the Drone WG website, access:
  - the abstracts and presentations from the Drone Symposium held on Oct 1, 2020 during the virtual 2020 TWS Annual Meeting (14 presentations), and
  - the abstracts for 18 presentations to be given at the Drone Symposium during the virtual 2021 TWS Annual Meeting (Nov 1-5).

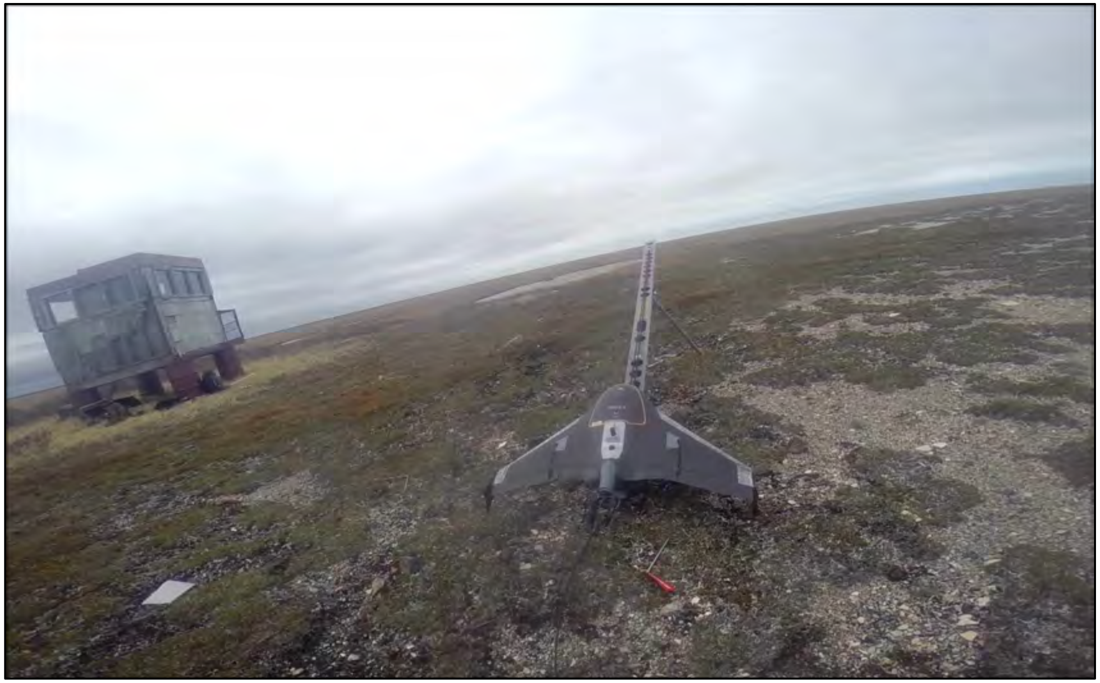
Breeding Waterfowl Responses to Drone Surveys

Susan Ellis-Felege

University of North Dakota

Drone Platform

- Drone: Trimble UX5
- Fixed-wing, survey grade aircraft
- Sony RGB camera mounted within body
- Launched with an elastic catapult
- Battery powered, ~30-45 min flight time



Barnas et al 2018: Ecology & Evolution

Drone Platform

- DJI Matrice 200
- Quadcopter
- VTOL

- Variety of sensors
    - XT2, X5S
- ~25 minutes

- “Lawn mower” flight pattern

Ryckman et al In Review: PLoS One

Nest Monitoring

Surveillance camera at nest

Example video

- Mini surveillance cameras, trail cameras
- Monitored snow geese, common eiders, and dabbling ducks
- Reviewed videos from prior to, during, and after flights
- Proportion of time spent in different behaviors
- Control birds

Results

Flight Day/ Not Flight Day

Top model for all behaviors was an interactive model of *Day x Group*

Behaviour	Akaike Weight	Intercept β ± SE	Drone Group x Day Before β ± SE	Drone Group x Flight Day β ± SE	Control Group x Flight Day β ± SE
Resting	0.721	1.3 ± 1.2	-2.9 ± 1.4	-4.1 ± 1.4	-1.2 ± 0.9
Nest Maintenance	0.798	-2.7 ± 0.4	-0.3 ± 0.5	0.9 ± 0.5	0.2 ± 0.5
Low Scan	0.651	-3.5 ± 0.9	2.2 ± 1.1	2.2 ± 1.1	0.6 ± 0.9
High Scan	0.683	-5.3 ± 1.4	0.9 ± 1.3	1.7 ± 1.3	1.2 ± 1.1
Head Cocking	0.854	-8.6 ± 0.8	0.1 ± 0.9	3.6 ± 0.9	2.0 ± 0.9
Off Nest	0.786	-6.0 ± 2.1	-1.4 ± 1.4	1.1 ± 1.4	1.5 ± 1.4

<u>**Take Home Points**</u>:

- In control geese, **sleeping decreased** on days with drone flights!
- For geese surveyed with drone, we observed **increases in "vigilance"** behaviors
  - E.g. High Scanning, Head Cocking, Off Nest
- In all cases where geese left the nest, they **covered their eggs** before leaving (good!)

Barnas et al 2018: Ecology & Evolution

Results

Flight Process (Pre, During, and Post)

No single best model for all behaviors, but *Group X Flight Period* was a “good” model overall

Behaviour	Akaike Weight	Intercept β ± SE	Drone Group x Pre Flight β ± SE	Drone Group x Drone Flight β ± SE	Drone Group x After Flight β ± SE
Resting	0.721	-0.6 ± 1.9	-1.7 ± 2.1	-4.1 ± 2.1	-3.2 ± 2.1
Nest Maintenance	0.798	-4.4 ± 0.9	0.1 ± 1.1	1.3 ± 1.1	2.7 ± 1.1
Low Scan	0.651	-5.0 ± 1.2	1.5 ± 1.3	2.2 ± 1.3	4.1 ± 1.3
High Scan	0.683	-5.9 ± 1.2	0.2 ± 1.2	1.4 ± 1.2	1.4 ± 1.2
Head Cocking	0.854	-8.9 ± 0.7	0.8 ± 0.9	3.7 ± 0.9	0.5 ± 0.9
Off Nest	0.786	-6.3 ± 1.6	-2.1 ± 1.6	-0.8 ±1.6	0.7 ± 1.6

Take Home Points:

- Lots of variability in overall responses, and amongst individuals
- **Increases in Head Cocking** behaviors while the drone was in the air, geese potentially aware of aircraft overhead?

Barnas et al 2018: Ecology & Evolution

Behavioral Responses of Common Eiders to Drone Surveys

Evaluate the use of a small UAV/drones for studying nesting common eiders

Ellis-Felege et al. *In Review*

Results

Is <u>nest attendance</u> different on the day before and day of a drone flight?

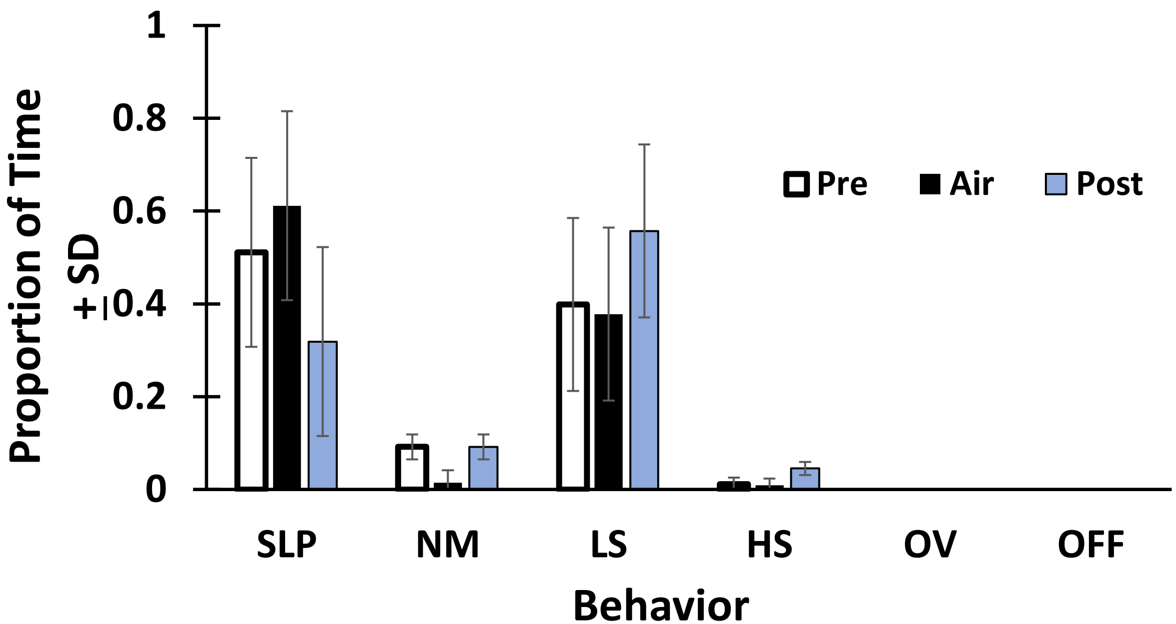
	Control Days Before Drone Surveys	Day of Drone Surveys
Birds with no recesses	11	11
Birds with at least one recess	11	11

<u>Take Home:</u>

- COEI had consistent # of recess events regardless of drones.
- Only 1 eider left the nest during a drone flight.
- Recess times were occurring primarily at night when less aerial predators.
- Recess duration was similar on days with (Avg: 28 mins) and without flights (Avg: 31 mins)

Results

How do COEI behave relative to <u>flight process</u>?



<u>Take Home:</u>

- COEI never left nest during flight process.
- COEI never exhibited overhead vigilance during flight process.
- Little response differences → slight increase in vigilance/activity

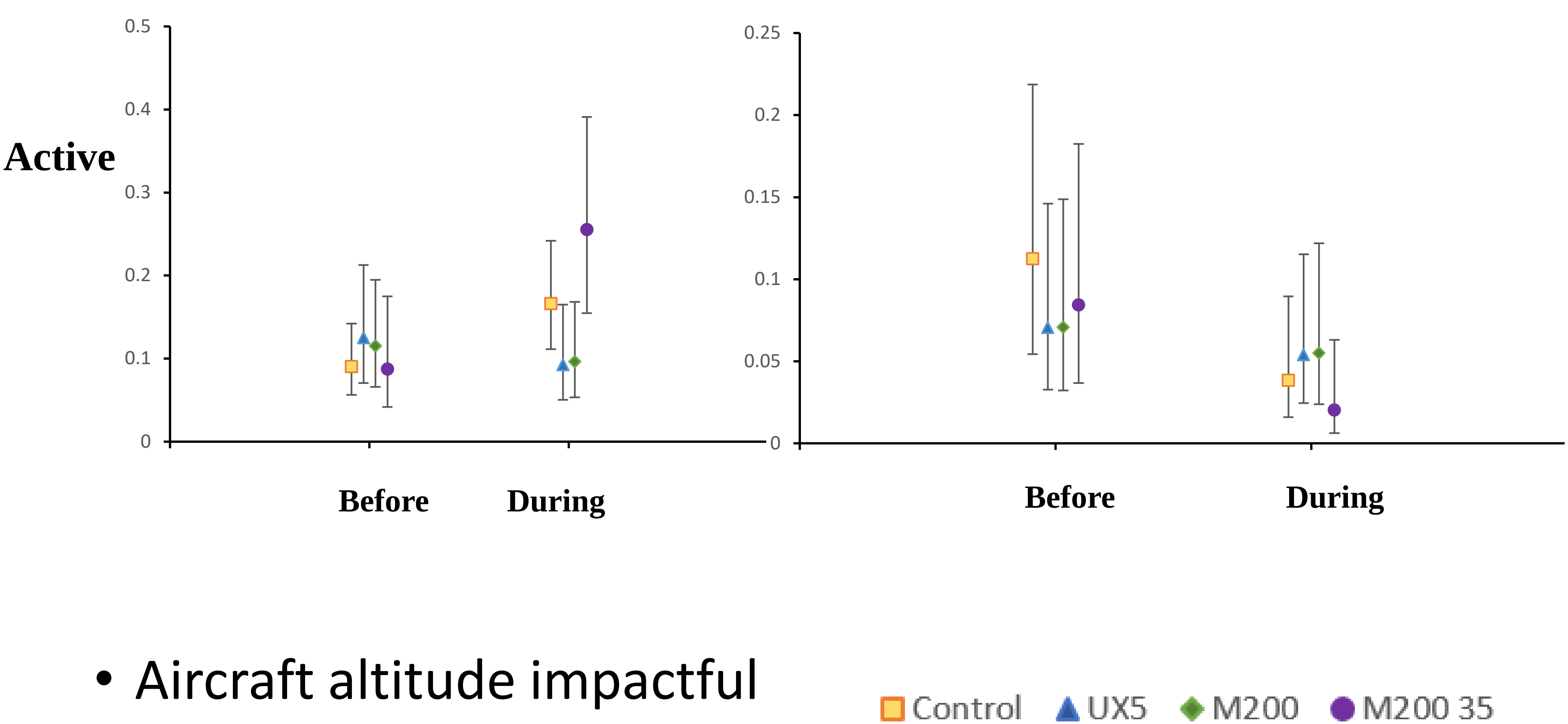
Ducks – Upland nesting species

BWTE & GADW

(a) no activity (none) (b) active (c) alert

Ryckman et al. In Prep

Dabbling Upland Nesting Ducks – North Dakota



- Aircraft altitude impactful
- Species react differently

General Conclusions – Wildlife Behavior

- **Animals are aware of flights.**
  - Geese (Barnas et al. 2018)
  - Dabbling ducks (Ryckman et al. in Prep)
  - But…
  - Eiders (Ellis-Felege et al. In Review) less responsive
  - Species reactions different (Mulera-Pazmany et al. 2017
- **Platform, launch distance important**
  - Geese depart nest before launch
  - Ducks on control wetlands respond (Ryckman et al. In Review)

- **Lack of behavior ≠ no physiological response**
  - Seabirds

Using thermal imaging drones to detect burrow nesting seabirds

Lindsay Young

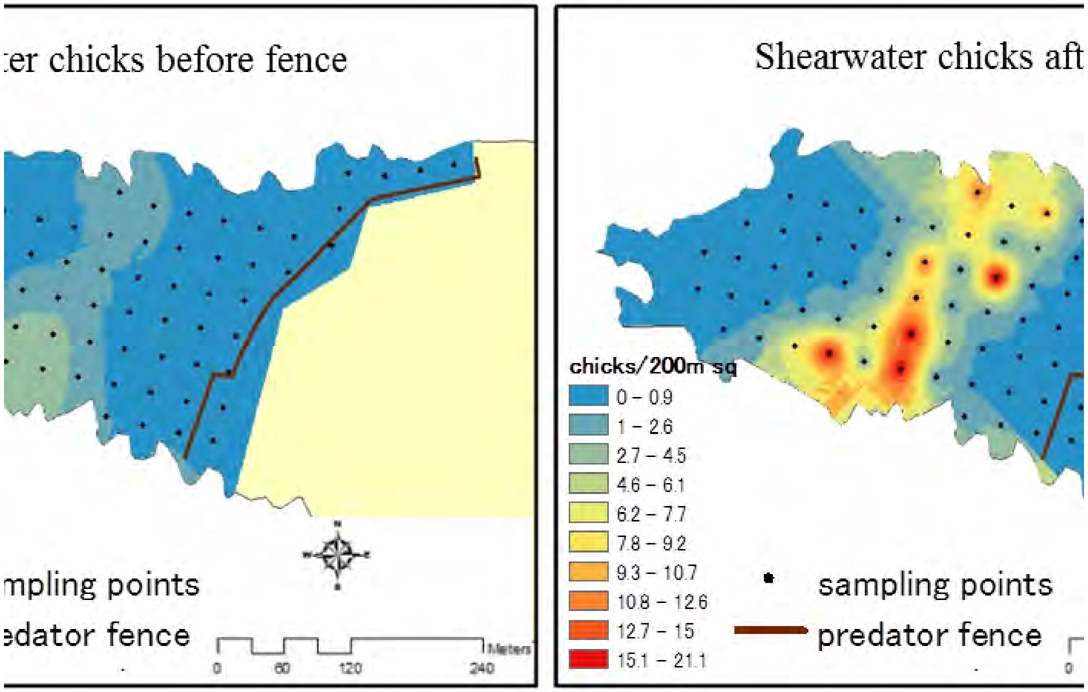
Executive Director

Pacific Rim Conservation

www.pacificrimconservation.org

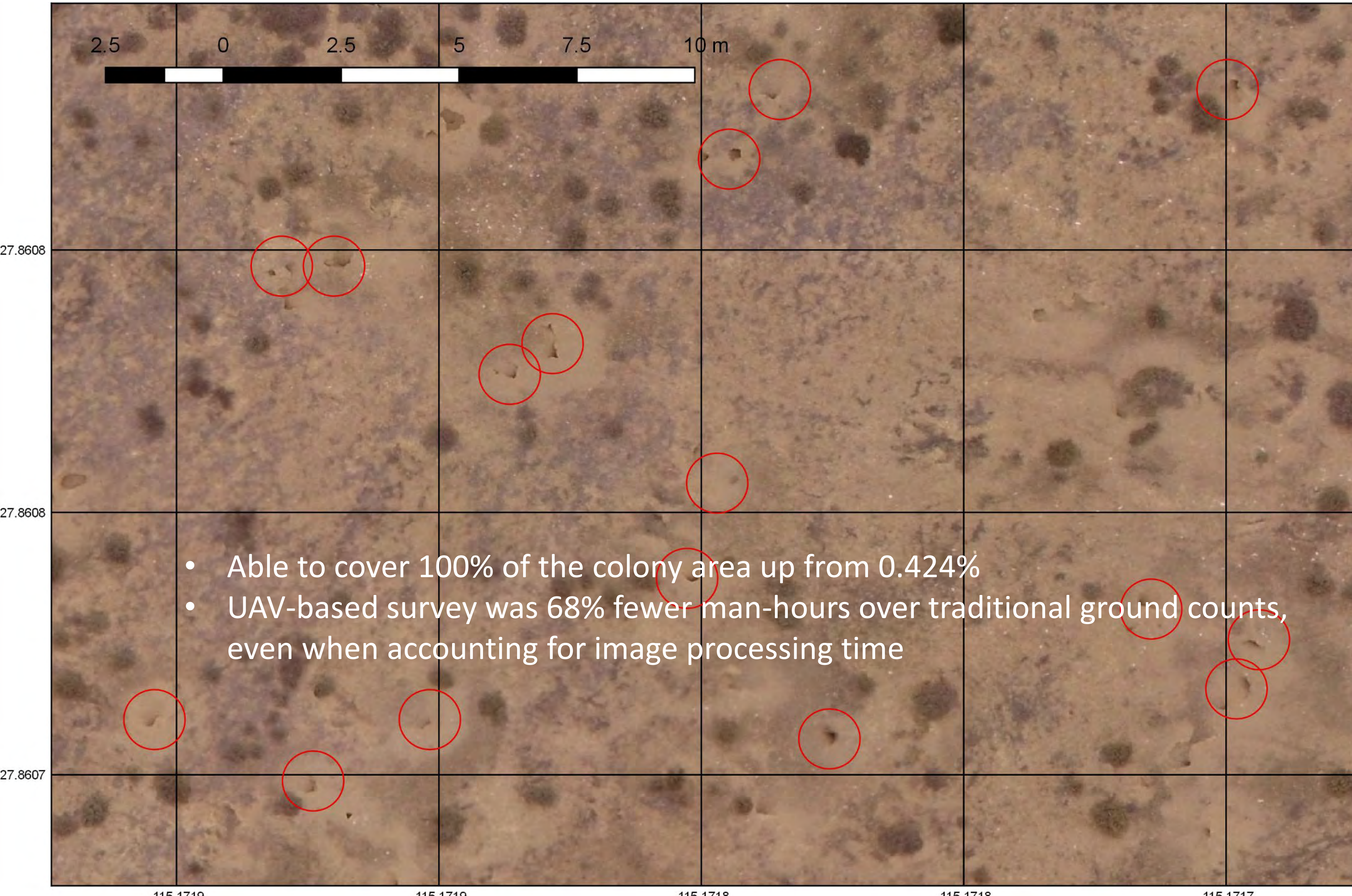
What makes burrow nesters difficult?

- Nocturnal
- Underground
- In very rugged areas



Current Methods:

- measure colony area and then extrapolate burrow densities from a sample of plot(s) within the colony



- Able to cover 100% of the colony area up from 0.424%
- UAV-based survey was 68% fewer man-hours over traditional ground counts, even when accounting for image processing time

Albores-Barajas et al. 2018. A new use of technology to solve an old problem: Estimating the population size of a burrow nesting seabird. PLoS One

Drone models

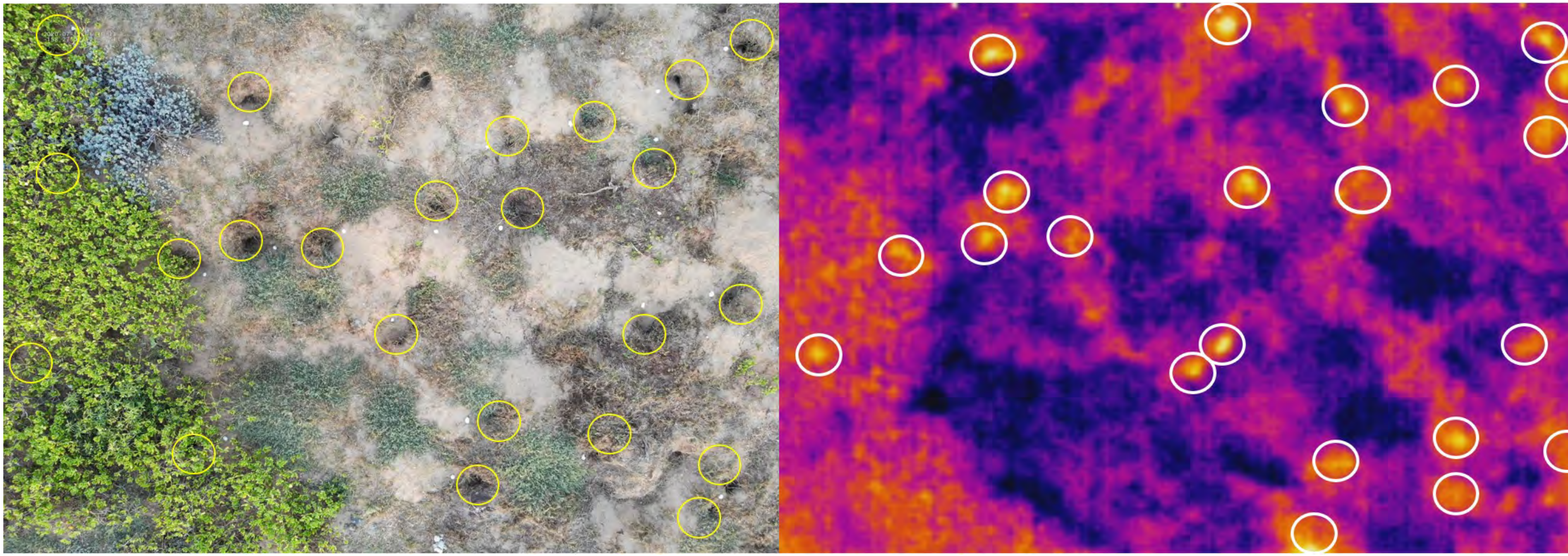
- Mavic 2 Enterprise Dual quadcopter drone- visual and thermal (flir) camera
- Good starter drone (~$3300)
- Portable and easy to fly
- Cannot take radiometric jpegs
- Low resolution thermal camera

- DJI matrice M200v2 with Zenmuse XT camera
- Expensive ($~19,000) and not as portable
- Takes radiometric jpegs
- Much higher resolution thermal camera

Methods

- Flew 30 min prior to sunrise for max temperature difference b/w birds and ground
- Variables tested:
  - Camera resolution between drone models
  - % overlap of photos (min 70% up to 90%)
  - Flight height (8-20m)
  - # pixels per target (5-30 pixels/bird)

Results



- Collected 1,000+ confirmed burrow points in 2,000 +images
- Verified thermal images with marked ground control points (i.e. flagged burrows)
- Can detect island heat signature of birds in burrows
- Heat is detected at burrow mouth and not above bird
- Birds on the surface emit less of a heat signal than burrows.
- Currently developing AI model to auto detect burrows

Benefits

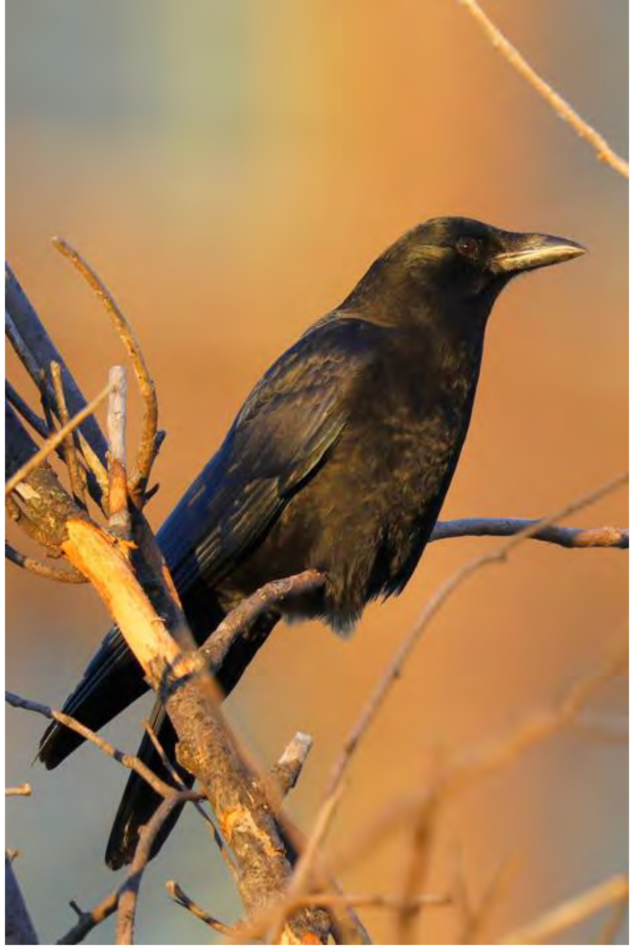
- Safer than helicopters for montane surveys
- Potentially more accurate than manual
- Can reach areas people cannot
- Can locate colonies and conduct surveys without disturbing habitat
- Requires less manpower than manual surveys

Limitations

- DOI policy- no drones with any Chinese components
- Airspace restrictions
- For burrow nesters, does not give total # of burrows but rather occupied burrows
- Data intensive
- Disturbance to some species
- Currently not able to distinguish between species (in the future?)

Acknowledgements

- NFWF, Marisla and Atherton Foundations for funding
- DLNW/DoFAW for training and logistical support
- Questions: lindsay@pacificrimconservation.org

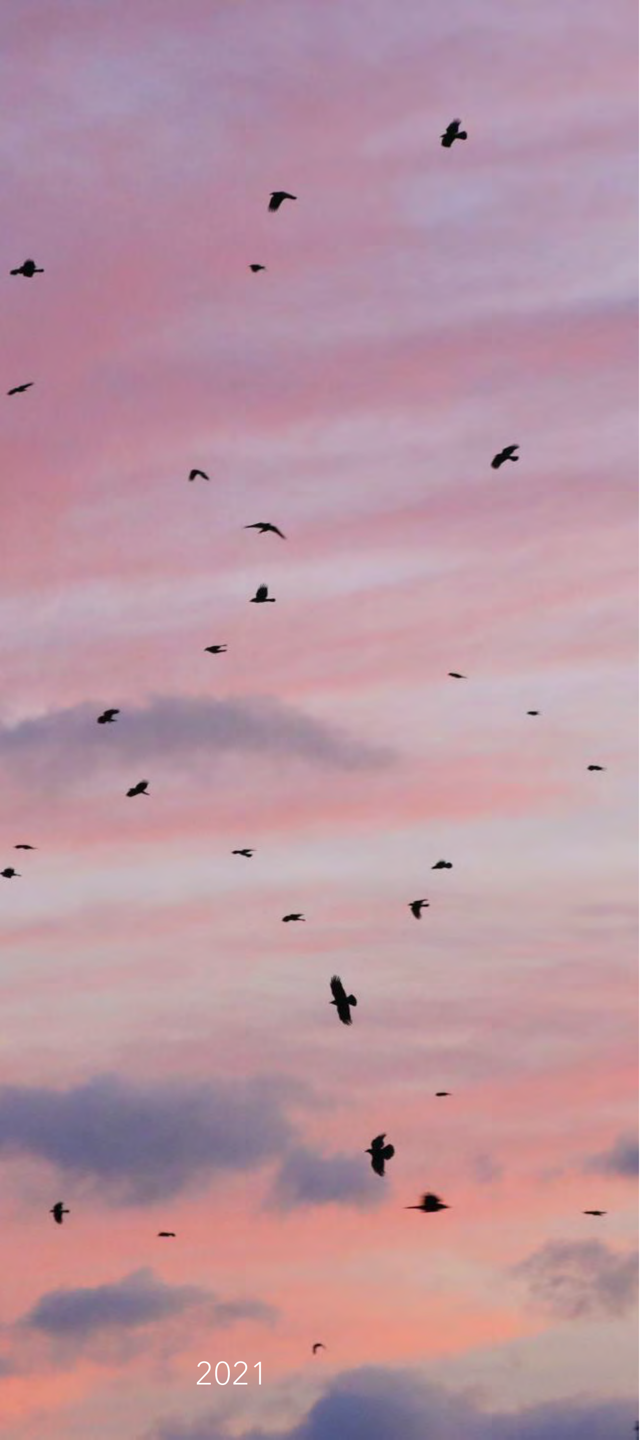



UAVS AT A LARGE WINTER CROW ROOST

Craig Gibson and Will Bicks

AOS & SCO-SOC 2021 Joint Meeting

THE WINTER CROW ROOST AT LAWRENCE, MA



WHAT ARE WE TRYING TO ACCOMPLISH?

Improve the ability of researchers and citizen scientists to perform bird census research.

- Develop an externally verifiable, data-driven counting methodology
- Utilize new technologies including Unoccupied Aerial Vehicles (UAVs)
- Contribute our methods and results to research projects (Christmas Bird Count)

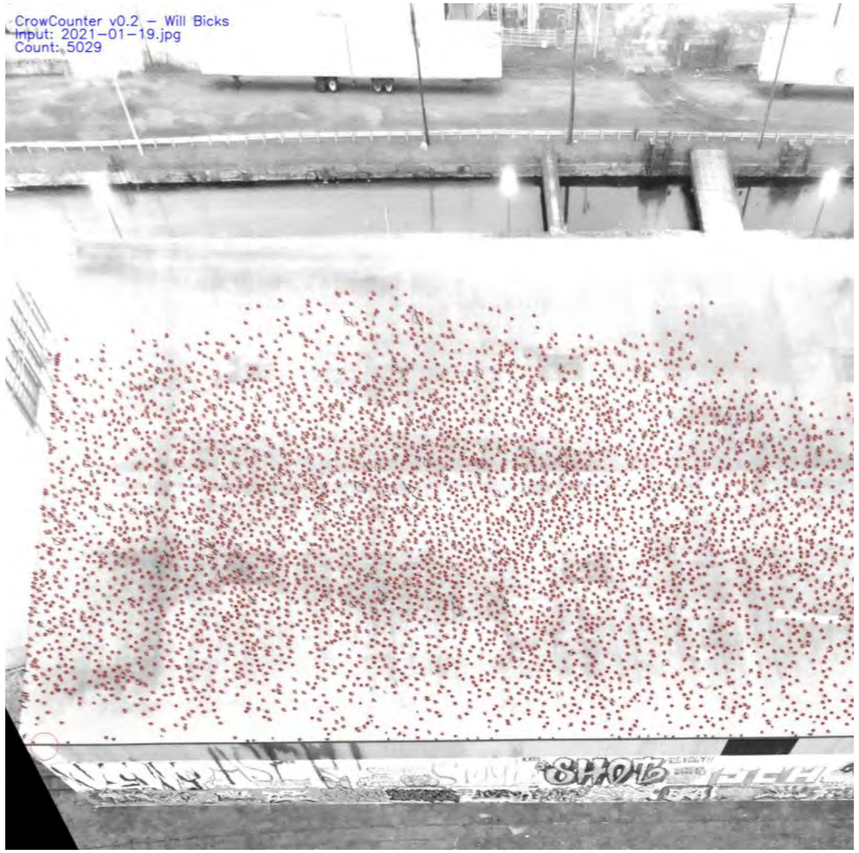
Develop counting methods that outperform existing techniques, which can struggle with:

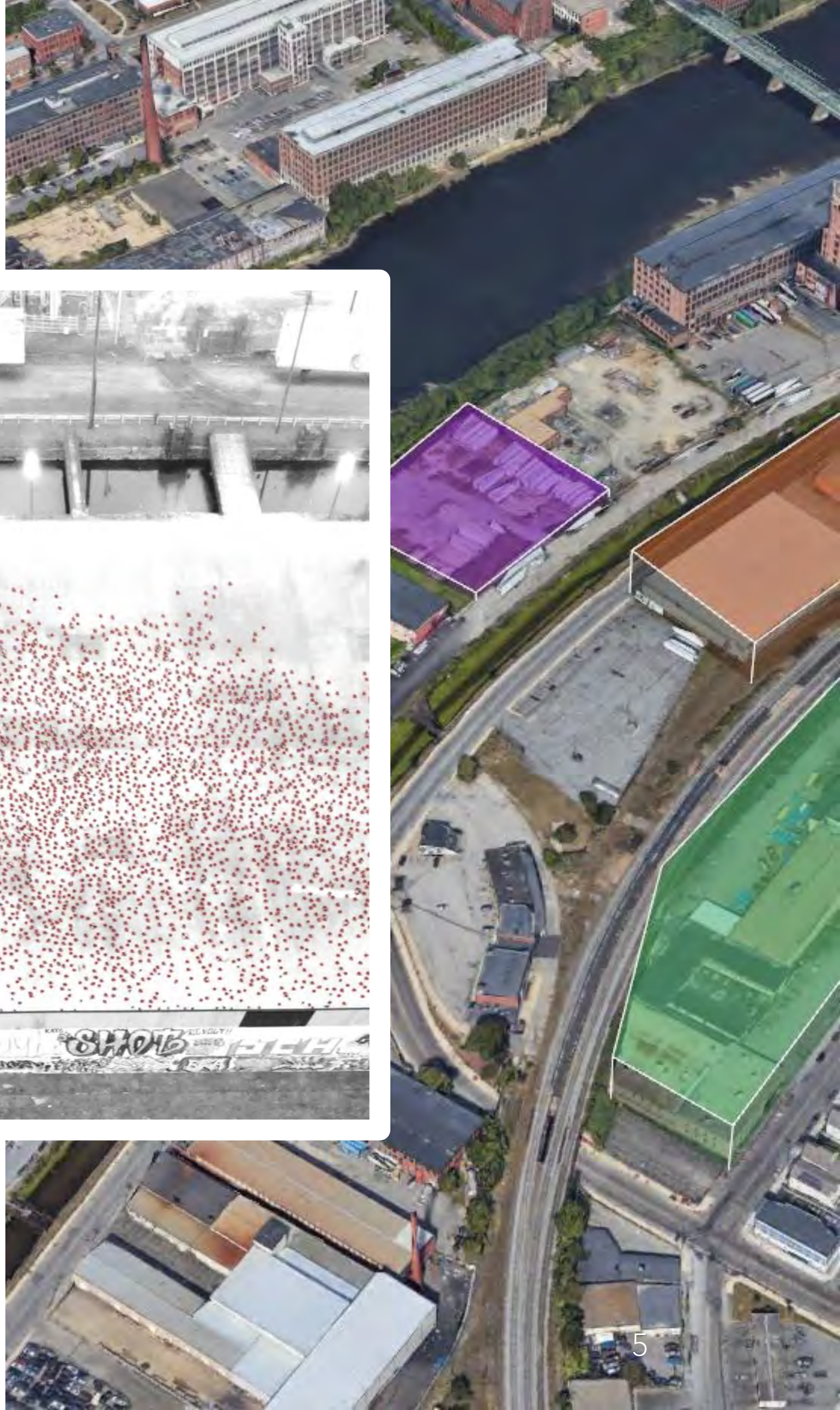
- Massive numbers of individuals (>10,000)
- Birds arriving in swirling, confusing waves
- Counting at night

OUR STRATEGIES FOR IMPROVING CENSUS COUNTS

PRELIMINARY DATA FROM STAGING LOCATIONS

- Before entering the roost, crows assemble in multiple identified staging locations
- Utilize a DJI Mavic UAV with low noise propellers to image from above
- Process those images using automatic counting techniques developed with OpenCV and ImageJ
- Use data to develop estimates of total roost populations



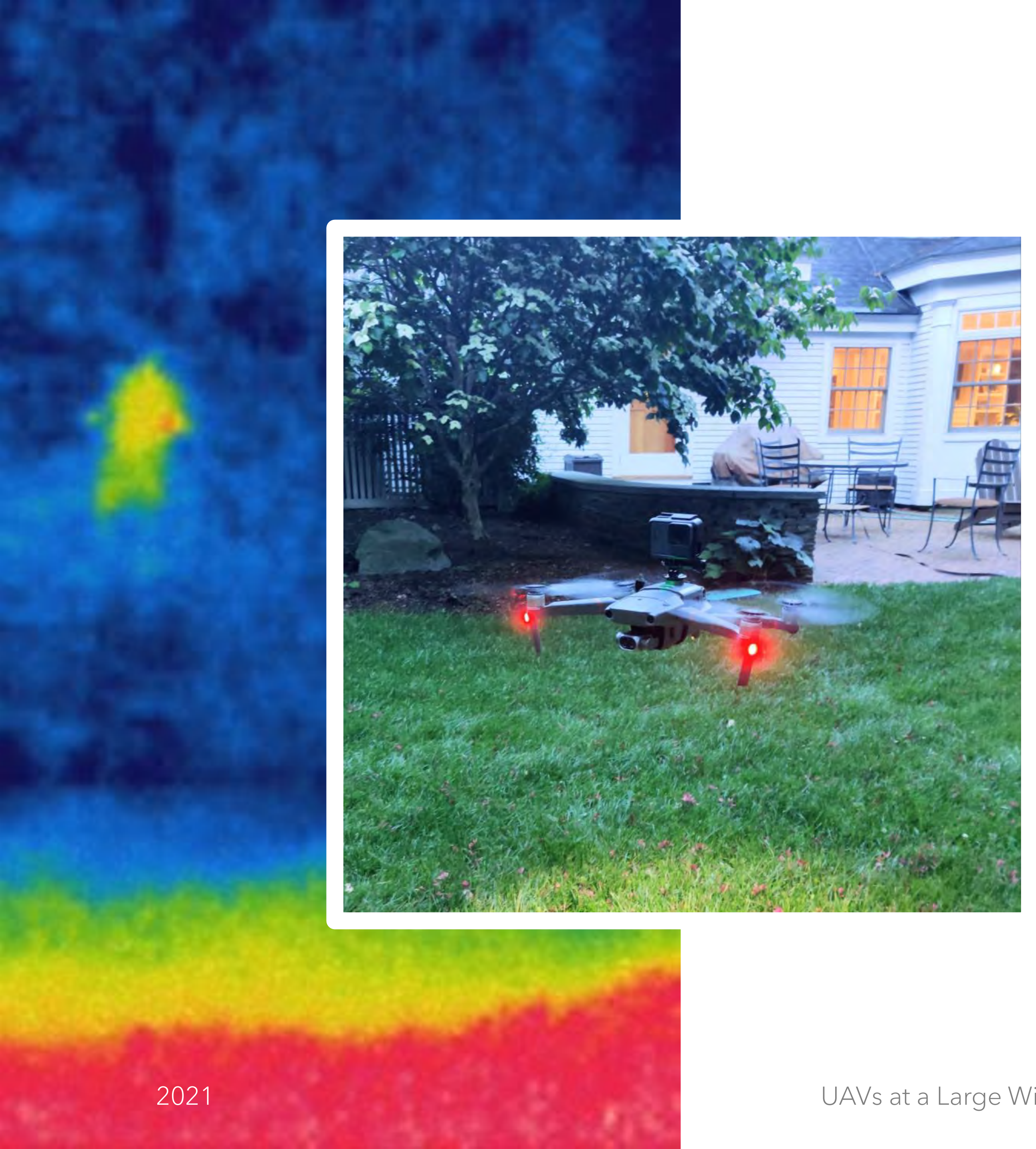


INFRARED ROOST IMAGING AFTER DARK

- Using long exposure and IR imaging from the ground to capture high resolution images of the birds in roost up to 90 mins after sunset
- Images broken down into sub regions and groups to allow for manual counting and tallying
- Excellent accuracy, some challenges with overlap

TAKING TO THE SKY FOR OVERHEAD ROOST IMAGES

- Almost completely eliminates issues of overlap
- Performs better with images than video
- Assisted by ambient artificial illumination
- Video shows minimal intrusiveness



UNFRUITFUL EXPERIMENTS

- Far infrared cameras (heat-based)
  - i.e. FLIR systems
  - Do not offer sufficient resolution for counting purposes
- Attaching unstabilized near infrared cameras to existing drone platforms
  - Require long exposures
  - Are too blurry due to constant drone movement

WHAT WE ARE WORKING ON NEXT

- Getting closer to the roost and capturing better images using night vision drones
- Evaluating phantom 4 pro v2 to be modified for infrared imaging and additional onboard IR illuminators
- Minimizing overlap issue previously faced in roost focused imaging
- Allow increasing accuracy for in roost counting

THANK YOU

Craig Gibson

Winter Crow Roost
cbgibson@wintercrowroost.com

Will Bicks

Crater Line Technologies
Undergrad Student, Rochester Institute of Technology

Additional Resources:

- Winter Crow Roost Blog
  www.wintercrowroost.com
- Crow Tools
  (Interactive counting exercises – coming soon)
  www.crow.tools

Drones as a Tool for Managing Birds in Conflict with Agriculture

Page E. Klug (page.e.klug@usda.gov)

USDA APHIS Wildlife Services, National Wildlife Research Center
North Dakota State University, Department of Biological Sciences, Fargo, ND

12 August 2021 - AOS & SCO-SOC 2021 Virtual Meeting (Roundtable Discussion)

Human-bird Conflict Scenarios in Agriculture - Drones

Price & Hall. 2012. Biol. Engineering Transactions 5:61-70
Burr et al. 2019. Human–Wildlife Interactions 13:16
Rhoades et al. 2019. Wildlife Damage Management Conf.

Wandrie et al. Crop Protection 117:15-19
Egan et al. Condor 122:1-15

Dayoub et al. 2020. Advanced Intelligent Systems & Informatics Conf.

Wan Mohamed et al. 2020. Materials Science & Engineering Conf.
Pla et al. 2019. Drones 3: 45.

Wang et al. 2019. Crop Protection 120:163-170
Wang et al. 2020. Crop Protection 137:105260
Bhusal et al. 2018. Intern. Conference Precision Ag.
Goel et al. 2017. ASABE Annual International Mtg.

Cattail breeding & roosting habitat & sunflower = stable blackbird populations

~547,341 acres of cattails in a 36,760 mi^2 area of the Prairie Pothole Region

+

~720,000 acres of sunflower in North Dakota

=

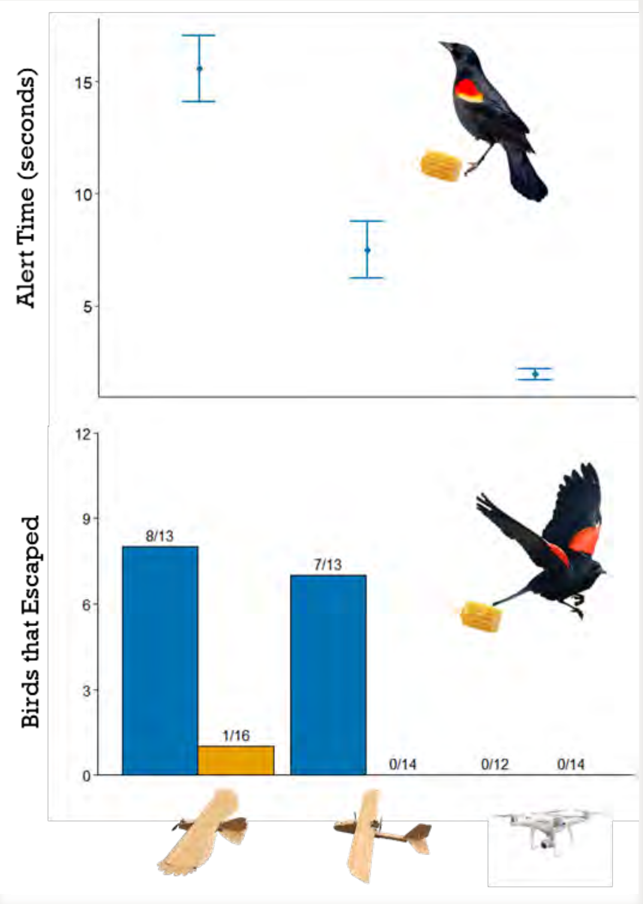
single roost >1 million blackbirds

Sunflower Damage in Prairie Pothole Region
>$3.5 million annually
Sunflower Damage in North Dakota
>$10.7 million annually
(regionally 2%, locally >20%)

Drone Platform

1. **<u>Drone platform (shape, size, color)</u>**
   <u>Tool integration (drones combined with other tools)</u>
   <u>Flight (speed, angle of approach altitude)</u>

Natural history (antipredator behavior, sensory ecology)
Season (breeding, molt, migration)
Natural predators (species, behavior)
Landscape (type/amount of refugia habitat, terrain)
Labor-intensity (time to abandonment, latency to return)
Habituation (tolerance and sensitization)
Markers of success (field abandonment, reduced birds, yield, farmer tool adoption)



Bird Species & Ecologies

Drone platform (shape, size, color)
Tool integration (drones combined with other tools)
Flight (speed, angle of approach altitude)

2. <u>Natural history (antipredator behavior, sensory ecology)</u>
<u>Season (breeding, molt, migration)</u>
<u>Natural predators (species, behavior)</u>

Landscape (type/amount of refugia habitat, terrain)
Labor-intensity (time to abandonment, latency to return)
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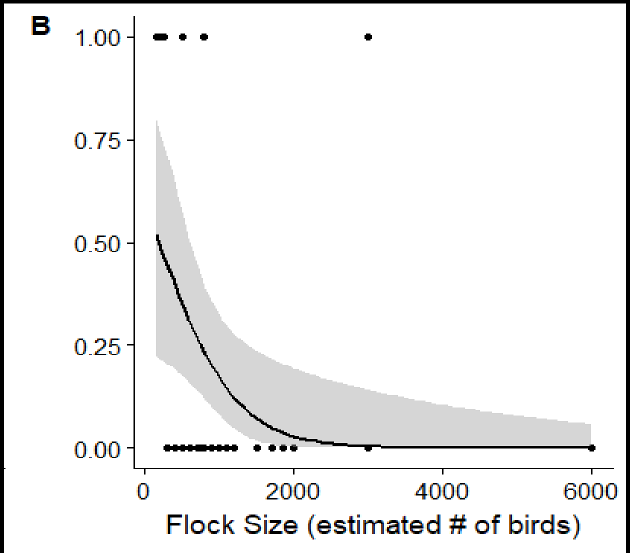
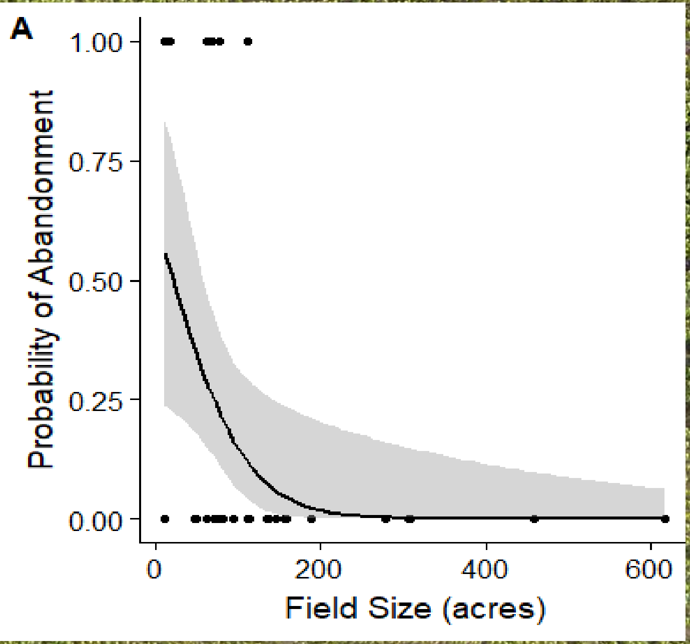


Agroecosystem Landscape

Drone platform (shape, size, color)
Tool integration (drones combined with other tools)
Flight (speed, angle of approach altitude)
Natural history (antipredator behavior, sensory ecology)
Season (breeding, molt, migration)
Natural predators (species, behavior)

3. <u>Landscape (type/amount of refugia habitat, terrain)</u>

Labor-intensity (time to abandonment, latency to return)
Habituation (tolerance and sensitization)
Markers of success (field abandonment, reduced birds, yield, farmer tool adoption)

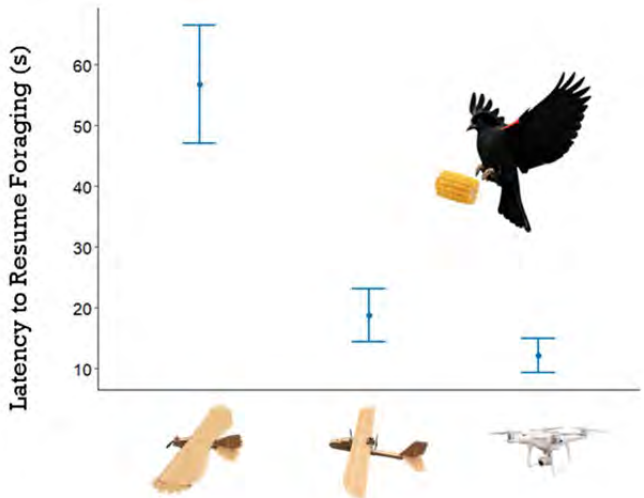


How long does it take? How long does it last?

Drone platform (shape, size, color)
Tool integration (drones combined with other tools)
Flight (speed, angle of approach altitude)
Natural history (antipredator behavior, sensory ecology)
Season (breeding, molt, migration)
Natural predators (species, behavior)
Landscape (type/amount of refugia habitat, terrain)

4. **<u>Labor-intensity (time to abandon, latency to return)</u>**
   <u>Habituation (tolerance and sensitization)</u>

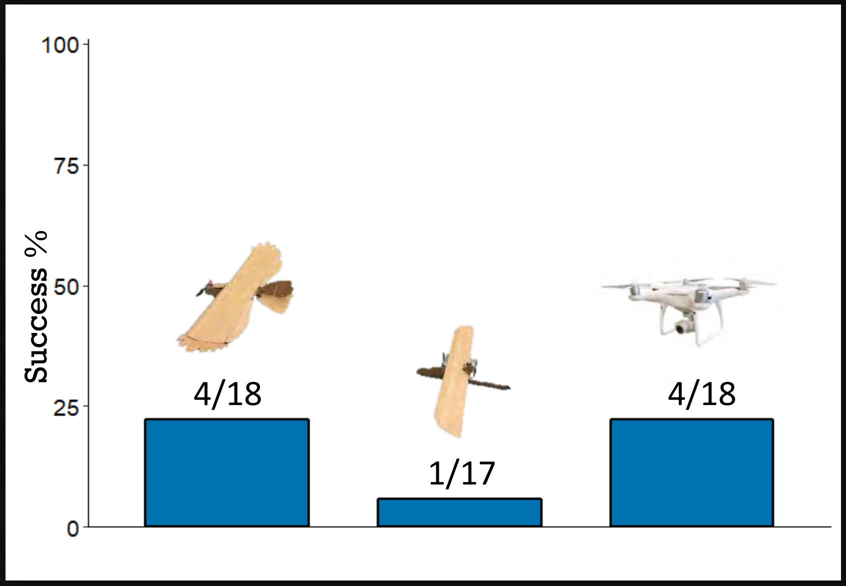
Markers of success (field abandonment, reduced birds, yield, farmer tool adoption)



Cost-benefit Analyses

Drone platform (shape, size, color)
Tool integration (drones with other tools)
Flight (speed, angle of approach altitude)
Natural history (antipredator behavior, sensory ecology)
Season (breeding, molt, migration)
Natural predators (species, behavior)
Landscape (type/amount of refugia habitat, terrain)
Labor-intensity (time to abandonment, latency to return)
Habituation (tolerance and sensitization)

5. <u>Markers of success (field abandonment, reduced birds, yield, farmer tool adoption)</u>



Systematic map effort of using small Unmanned Aircraft Systems (UAS) to monitor birds

Jared A. Elmore, *Kristine O. Evans, Sathishkumar Samiappan, Meilun Zhou, Morgan B. Pfeiffer, Bradley F. Blackwell, Raymond B. Iglay*

MISSISSIPPI STATE UNIVERSITY

Wildlife Services
USDA NWRC
National Wildlife Research Center

UAS

- Increasingly used in a wide variety of assessments
- Rapidly developing technology
- Limited scientific investigations, development of approaches, or knowledge of operating guidelines
- Lack of standardization among selection, user guidelines, and use

Systematic maps

- Aim to answer broad questions by collating, describing, and cataloging evidence
- Would help set a foundation for supporting UAS applications in animal monitoring

Systematic Map Protocol | Open Access | Published: 30 June 2021

Evidence on the effectiveness of small unmanned aircraft systems (sUAS) as a survey tool for North American terrestrial, vertebrate animals: a systematic map protocol

Jared A. Elmore, Michael F. Curran, Kristine O. Evans, Sathishkumar Samiappan, Meilun Zhou, Morgan B. Pfeiffer, Bradley F. Blackwell & Raymond B. Iglay

Environmental Evidence **10**, Article number: 15 (2021) | Cite this article

- Consolidate evidence of UAS to monitor animals in terrestrial environments
- What evidence exists on the effectiveness of UAS as a survey tool for terrestrial, vertebrate animals?

Google Scholar

ProQuest Dissertations & Theses Global

Methods

Clarivate Web of Science™

Scopus

EBSCO Wildlife & Ecology Studies Worldwide

- Searching for articles
- Article screening
- Data coding
- Mapping and presentation

Metadata specifics

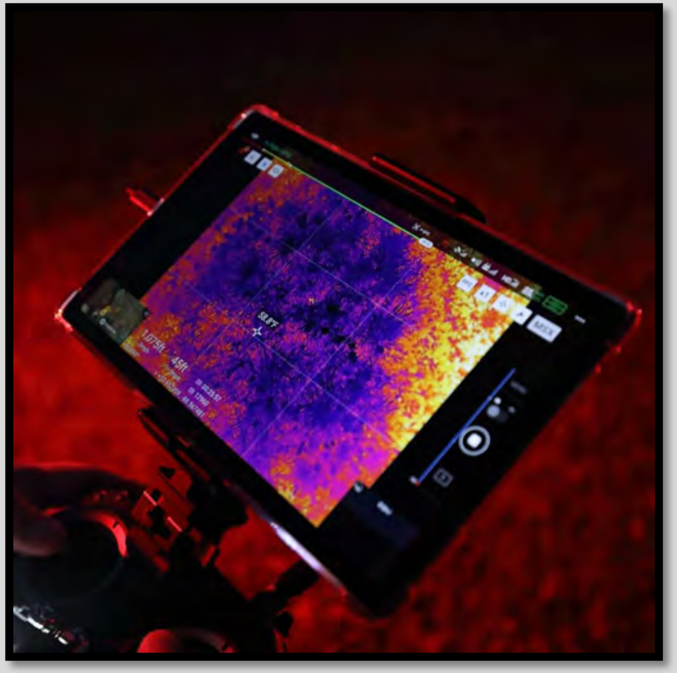
StudyID	Years of study	Drone manufacturer
Authors	Country of study	Drone model
Title	State/province of study	Control type
Year of publication	Location latitude in decimal degrees	Gimbal
Month of publication	Location longitude in decimal degrees	Mission planning software
Day of publication	Multiple locations	Above Ground Level (AGL)
Publication type	Multiple methodologies	Flight Speed
Publication venue/journal	Land cover type	Flight pattern
Issue number	Subject family EN	Flight duration
Volume number	Subject species EN	Flight time of day
Pages	Subject species Latin	Ground control points
Peer-reviewed	Animal groups	Ground truth
URL with DOI	Purpose of the study	Sensor manufacturer
Assigned reviewer	Bias estimated	Sensor model
Language	Bias estimation methods	Field calibration
If bias was considered, what factors affected it	Comparison to other methods	Calibration type
Is raw data available	Description of other method used	Ground sample distance
Constraints	Statistical analysis	Image analysis
	Type of statistical analysis	Image preprocessing

Results

- Number of articles at each stage
  - Title/Abstract: 3465
  - Full Text: 384
- Number of articles we've reviewed at full text
  - Total: 48
  - Include: 18

2020-10-20: UAS Wildlife Monitoring Systematic Map

3,465 unique entries



Results

1. What UAS models and sensors are most used?

Drone_Manufacturer	Drone_Model	Use_Frequency
3DR	Solo	5
DJI	Phantom 3 Pro	3
DJI	Phantom 4 Advanced	2
DJI	Mavic Pro	2
CropCam	CropCam	2
DJI	Matrice 100	1
3DR	Iris	1
Bluebird Aero Systems	Spylite	1
Custom	DJI X468 Traveller	1
3DR	Arducopter	1
DJI	Inspire 1	1
Skywalker	1680 v2	1
DJI	Phantom 2	1
DJI	Phantom 2 Vision	1
Multiplex	Twin Star II	1
Custom	Wang et al. 2020	1

Sensor_Manufacturer	Sensor_Model	Use_Frequency
DJI	Phantom 3 Pro	3
Ricoh	GR II	2
Panasonic	Lumix FT-1	2
DJI	Phantom 4 Advanced	2
DJI	Mavic Pro	2
Sony	NEX5	1
Sony	ILCE-5100	1
Sony	Cyber-shot RX100 III	1
Pentax	Optio A20	1
GoPro	Hero4	1
GoPro	Hero2	1
DJI	Zenmuse XT	1
DJI	Phantom 2 Vision	1
DJI	Zenmuse X5	1
CONTROP Precision Technologies Ltd	CONTROP Mstamp	1

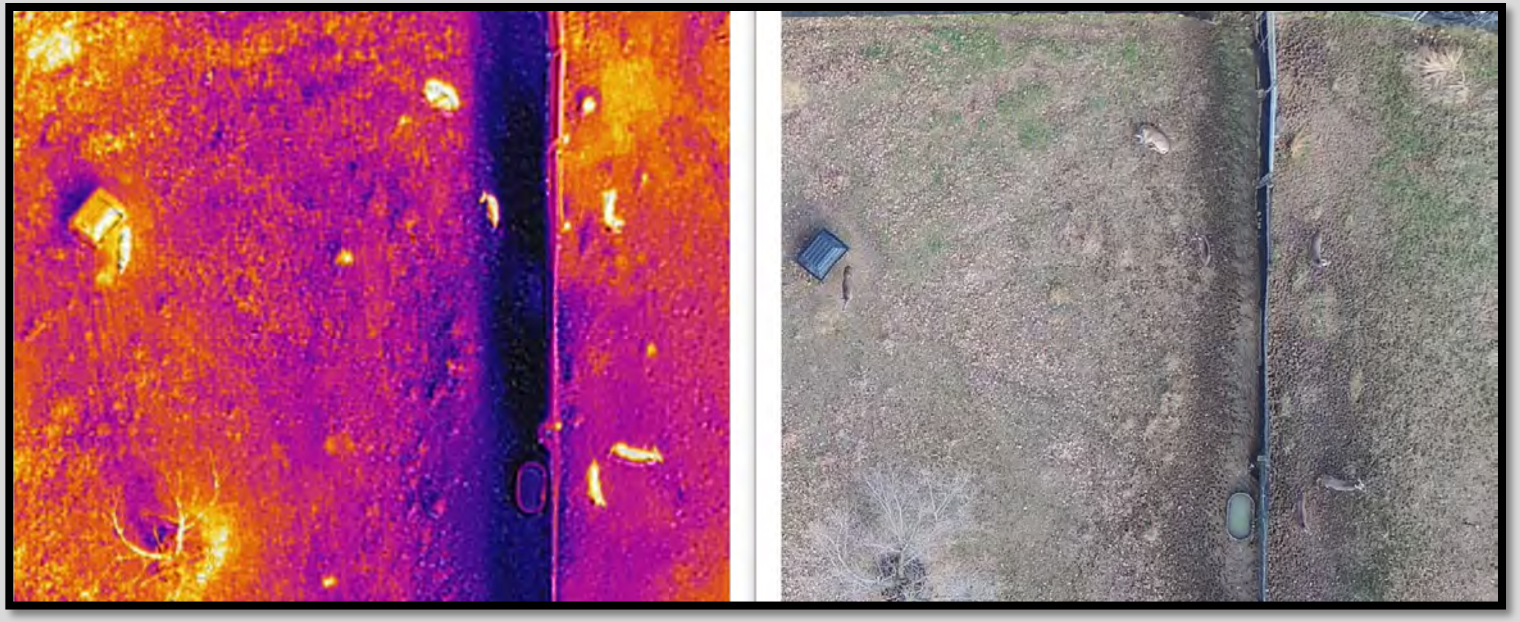
Results

1. Do applications differ among geographic ranges, land cover types, species, survey models, or survey environments?

Country_of_Study	Use_Frequency		Animal_Scientific_Name	Common_Name	Use_Frequency
United States of America	5		Threskiornis spinicollis	Straw-necked Ibis	2
Australia	5		Larus ridibundus	Black-headed Gull	2
Taiwan	3		Ardea brachyrhyncha	Yellow-billed Egret	1
Italy	3		Gelochelidon nilotica	Common Gull-billed	1
Spain	2		Egretta rufescens	Reddish Egret	1
Russia	2		Egretta caerulea	Little Blue Heron	1
United Kingdom	1		Diomedea dabbenena	Tristan Albatross	1
Sweden	1		Corvus corone	Carrion Crow	1
Finland	1		Aechmophorus	Western Grebe	1
China	1		Branta canadensis	Canada Goose	1
Canada	1		Ardea alba	Great White Egret	1
Botswana	1		Anser caerulescens	Snow Goose	1
Antarctica	1		Anastomus lamelligerus	African Openbill	1
			Anas platyrhynchos	Mallard	1
			Anas crecca	Common Teal	1
			Bucephala clangula	Common Goldeneye	1
			Haliaeetus pelagicus	Steller's Sea-eagle	1
			Tringa totanus	Common Redshank	1
			Leptoptilos crumenifer	Marabou	1
			Leucocarbo atriceps	Imperial Shag	1
			Mycteria ibis	Yellow-billed Stork	1
			Onychoprion aleuticus	Aleutian Tern	1
			Pelecanus rufescens	Pink-backed Pelican	1
			Platalea minor	Black-faced Spoonbill	1
			Rynchops niger	Black Skimmer	1
			Spizella pusilla	Field Sparrow	1
			Sterna paradisaea	Arctic Tern	1
			Thalasseus bergii	Greater Crested Tern	1
			Threskiornis aethiopicus	African Sacred Ibis	1
			Threskiornis moluccus	Australian Ibis	1
			Haematopus ostralegus	Eurasian Oystercatcher	1

Conclusion

- Consolidation of evidence on the effectiveness of UAS as a survey tool for terrestrial, vertebrate animals
- We will be able to make suggestions on how to standardize selection, guidelines, and use
- Combined with other ongoing efforts, we hope this helps inform UAS use for monitoring animals



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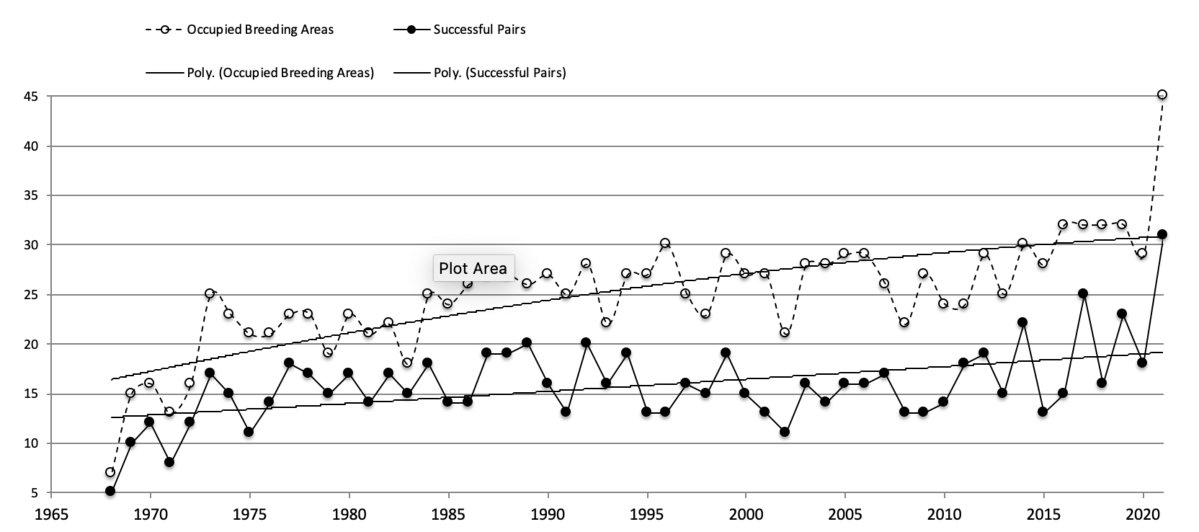
CONVENTIONAL VS. **DRONE**-ASSISTED NEST CHECKS OF **BALD EAGLES**

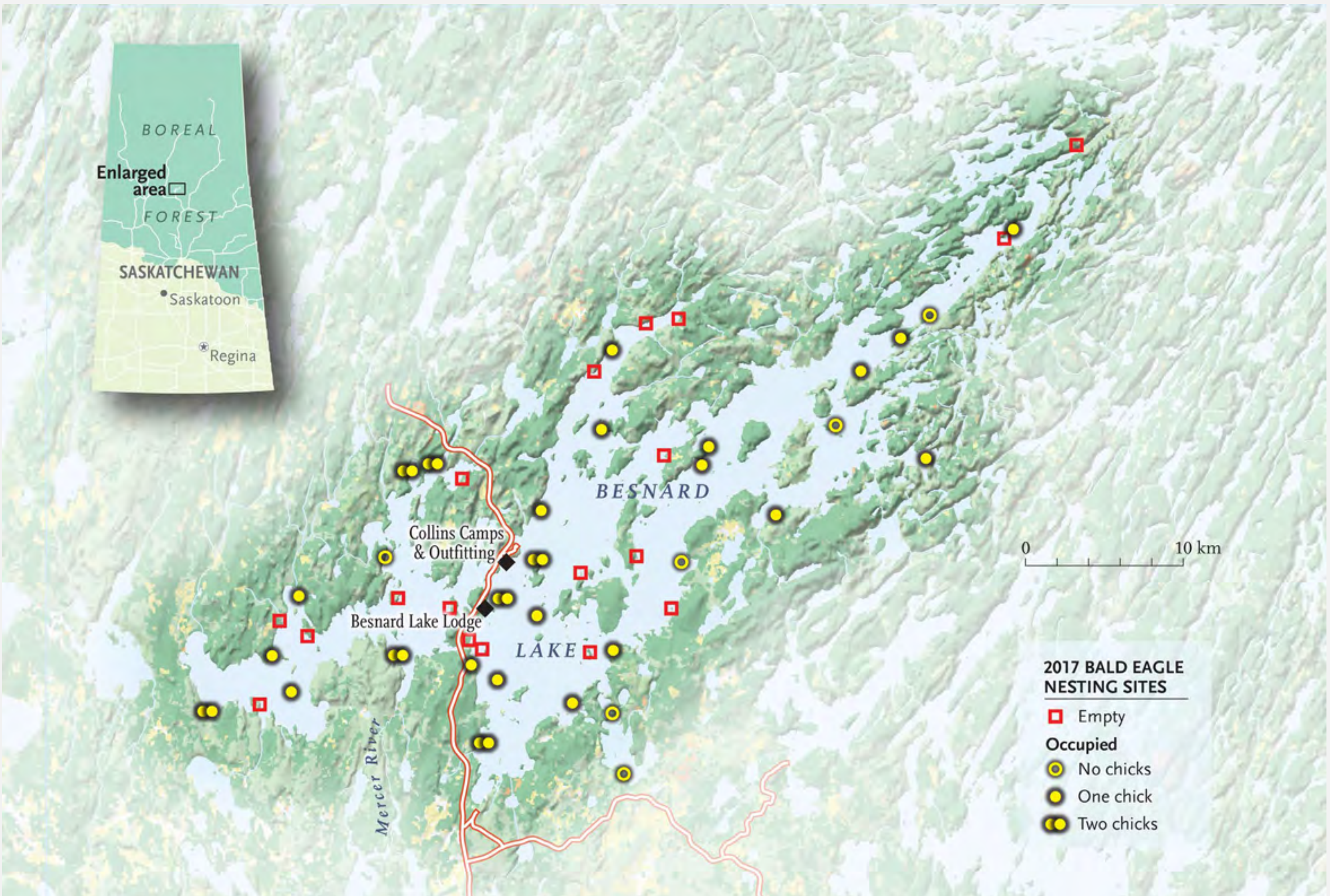
Elston Dzus, Jon Gerrard, Connie Dzus &
P. Naomi Gerrard

OBJECTIVE

- Evaluate effectiveness and effects of drones for conducting nest checks

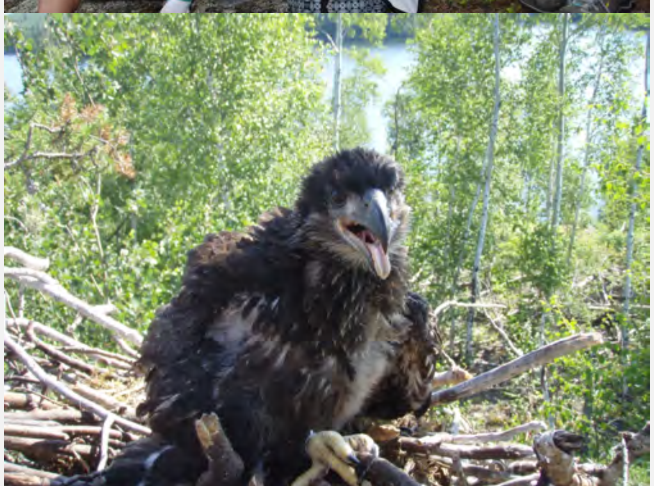


STUDY AREA


BOREAL
Enlarged area
FOREST
SASKATCHEWAN
Saskatoon
Regina
Collins Camps & Outfitting
Besnard Lake Lodge
BESNARD
LAKE
Mercer River
0
10 km
2017 BALD EAGLE NESTING SITES
Empty
Occupied
No chicks
One chick
Two chicks

CONVENTIONAL (BOAT-BASED) VS. DRONE-ASSIST

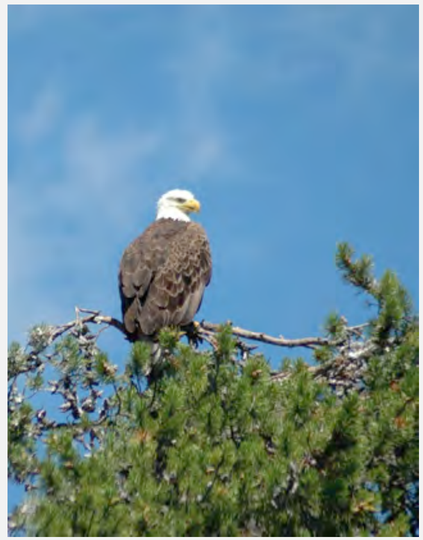
TEAM BOAT



- Accuracy
- Effort
- Disturbance

TEAM DRONE

CONVENTIONAL NEST CHECKS



Average Visit Time (2020): 17:29 min

DRONE NEST CHECKS

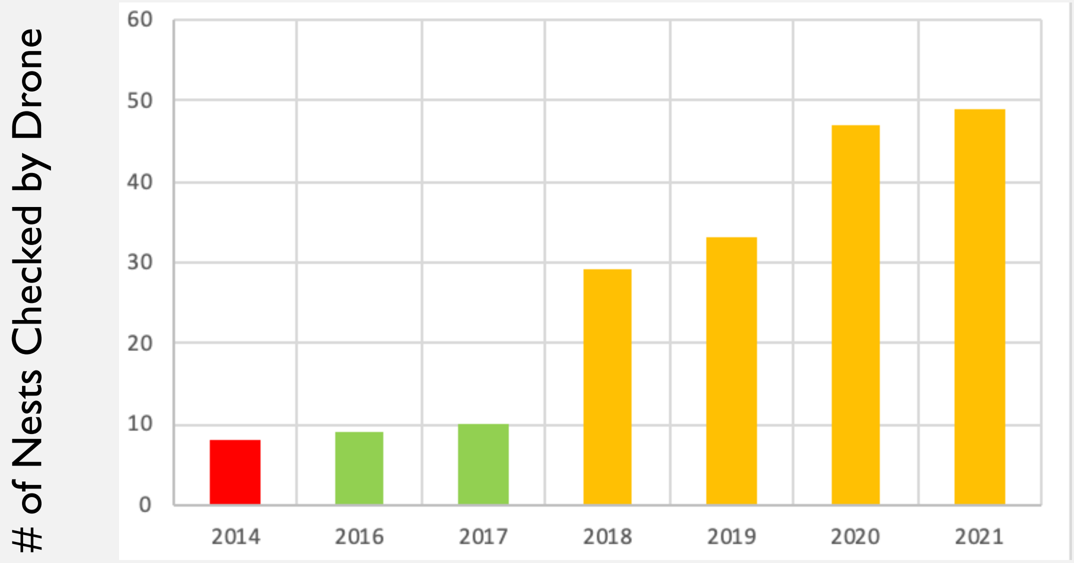
- Federal UAV license / banding permit
- Provincial research permit (UAV noted)
- FPV goggles …Co-pilot watches for adults

Average Visit Time (2020): 8:32 min
Average Flight Time (2020): 3:35 min

DRONE USE

- 2014 - J. Junda; Draganflyer X-4
- 2016 & 2017 - E. Dzus; 2018 DJI Phantom 3 Pro
- 2018 -2021 - E. Dzus; DJI Mavic Pro & DJI FPV goggles

- 177 nests checked by Dzus to date



VIEW FROM A DRONE

No Young

VIEW FROM A DRONE

One Young

VIEW FROM A DRONE

Two Young

ACCURACY
SUCCESSFUL NESTS

	TEAM BOAT	TEAM DRONE
2020	17	18*
2021	28	31

* Found new 2-chick nest on last day of study

ACCURACY
OF YOUNG

	TEAM BOAT	TEAM DRONE
2020	19	21*
2021	39	48

* Found new 2-chick nest on last day of study

SUMMARY

- Drones are highly effective for checking nests
- Significant savings of time
- Minimal disturbance
- Safe …. & Fun

QUESTIONS