1st International Conference on Drones and Unmanned Systems (DAUS 2025)

19-21 February 2025
Granada, Spain

Special Session:
Drone Applications for Wildlife Research, Management, and Conservation

(Part 2)

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DAUS 2025

<u>Special Session</u>: Drone Applications for Wildlife Research, Management, and Conservation

LIST OF PRESENTATIONS*

PART 1
Keynote Presentation: The Use of Drones in Wildlife Ecology: Future Challenges and Opportunities – **Rick Spaulding**
Considerations When Using Drones to Study Wildlife: Lessons Learned So Far – **Fred Tremblay** and Kyle Elliott

PART 2
A Short History of the Use of Drones to Study and Conserve Wildlife – **David Bird**

PART 3
Uncrewed Aerial Vehicles: Taking Cetacean Research to New Heights – **Gina Lonati**, John Durban, Don LeRoi, Michael Moore, and Kim Davies
Spectral-Based Classification of Invasive Wildlife Using Uncrewed Aerial Systems and Hyperspectral Imagery – **Daniel McCraine**, Sathishkumar Samiappan, Leon Kohler, Timo Sullivan, and David Will
Drone Data Management, Processing, and Analysis: Best Practices with Examples from California and Costa Rica – **Sean Hogan**
Monitoring Large Non-breeding Aggregations: Using Drones to Enhance Avian Research in Dense and Urban Environments – **Craig Gibson**
Designing Drones for Wildlife Radio Telemetry – **Michael Shafer**

*Presenters in bold

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A Short History of the Use of Drones to Study and Conserve Wildlife

David M. Bird
Emeritus Professor of Wildlife Biology, McGill University, Montreal, Quebec, Canada; david.bird@mcgill.ca

Summary: Uncrewed vehicle systems (UVS; aka drones) are rapidly gaining more and more acceptance as a bona fide technological tool for wildlife biologists and managers all over the world. Compared to using crewed light airplanes or helicopters, drones present a cheaper, greener, less intrusive, and much safer (the number one source of mortality for wildlife biologists is dying in a plane or helicopter crash!) option. In the last 15 years, the use of drones by wildlife biologists has come a long way. Whether flying a drone to census nest contents of raptorial birds and tree-nesting water birds; count ground-nesting birds like terns, waterfowl, or penguins; determine the age, sex, and health status of whales; map habitat for a threatened or endangered species; detect animals with infrared cameras or acoustic sensors; radio track the locations and movements of wildlife species; collect aerial insects; or disperse nuisance wildlife, a myriad of new applications are appearing in the pages of a growing number of scientific journals devoted solely to this technology every year. Fortunately, there is also a keen interest among wildlife biologists and managers to study the disturbance impact of drones upon wildlife to foster the responsible use of drones and to know their limitations. This presentation provides an historical review into the evolution of their use right up to recent achievements in wildlife research and management, including successes and failures.

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A Short History of the Use of Drones to Study and Conserve Wildlife

David M. Bird
McGill University, Quebec

1st International Conference on Drones and Unmanned Systems
Granada, Spain
February 21, 2025

McGill UNIVERSITY

Some Advantages of Drones for Wildlife Biologists

- Initially more expensive but now cheaper in long run, e.g. maintenance costs, operators
- Fly at lower altitudes, at night
- Better data, e.g. imagery, “draping” of images
- Less obtrusive to wildlife and more green overall
- Can carry many kinds of sensors
- Number One: safer for humans!

Job-related mortality of wildlife workers in the United States, 1937–2000

D. Blake Sasse

Abstract Wildlife biologists face a variety of job-related hazards that are unique to this profession, most of them involving the remote areas where work is performed and the unusual techniques used to study or manage wildlife. Information on biologists and others killed while conducting wildlife research or management was obtained from state and federal natural resources agencies, solicitations on wildlife-based internet discussion groups, and published obituaries. Ninety-one job-related deaths were documented from 1937 to 2000. Aviation accidents, drowning, car and truck accidents, and murder were the most common causes of death. Thirty-nine aviation accidents accounted for 66% of deaths, with aerodynamic stalls and power-line collisions being the most significant causes of accidents for which information was available. These safety threats should be taken into consideration during the design and planning of future research and management projects.

Key words aviation, history, mortality, safety, techniques

Early naturalists traveled through remote areas to study plants and animals and shared the risks that took the lives of settlers, soldiers, and others who made a living on the American frontier. The earliest American to die while in pursuit of scientific knowledge may have been John Lawson, surveyor general of the Carolinas and author of a book on the natural history of the region, who was burned to death by the Tuscarora Indian tribe in 1711. While encounters with hostile native Americans could occur, disease was a more dangerous threat to scientists and others in this period. Pioneer ornithologist Alexander Wilson died in 1813 after contracting dysentery while swimming a river to collect a bird; typhoid fever killed William Gambrel on an 1849 expedition through the Southwest (Evans 1993). Charles Linden died in 1888 as a result of long-term effects of exposure during an expedition to the Everglades (Anonymous 1888).

The methods used by early naturalists to obtain information and specimens were often dangerous. Francis J. Birtwell was strangled to death by a rope used as a safety line while collecting eggs from a bird nest, and John S. Cairns was killed by an accidental firearms discharge while on a trip in North Carolina (Anonymous 1895, Anonymous 1901). John K. Townsend and George F. Breninger died of arsenic poisoning acquired while preparing specimens for museum collections (Anonymous 1906, Evans 1993). Young naturalists such as Robert Shufeldt, age 15, and Worth H. Weller, age 18, often made significant contributions to science in these early years while facing the same dangers as their older peers. Shufeldt, who worked for the Natural History Museum of Marietta College, drowned while attempting to collect birds along the Ohio River in 1892 (Anonymous 1892, Hulbert 1892). Weller, author of several articles on herpetology, died after falling from a cliff while studying salamanders in North Carolina (Maslowski 1988).

Pioneering naturalists made many contributions to our knowledge of the flora and fauna of the

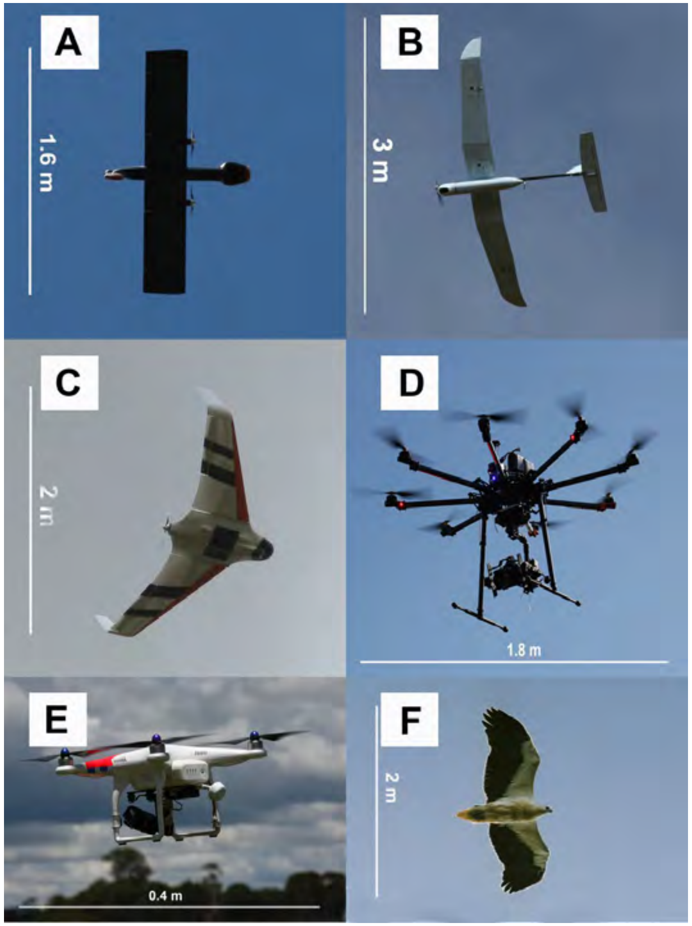
Author's address: Arkansas Game and Fish Commission, #2 Natural Resources Drive, Little Rock, AR 72205, USA; e-mail: dbsasse@agfc.state.ar.us.


Birds

Drones for bird study & conservation

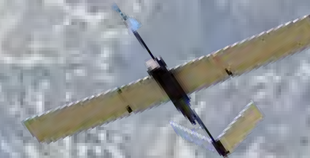
Main applications

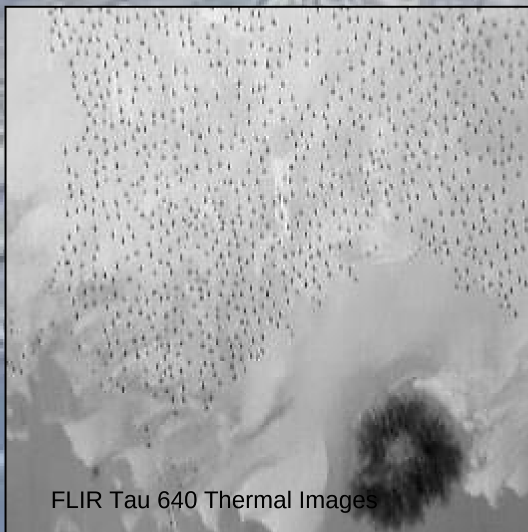
1. Photographic population surveys
   - Non-breeding
   - Breeding
2. Infrared cameras & bird detection
3. Nest inspections
4. Acoustic surveys
5. Habitat research & monitoring
6. Radiotracking
7. Dispersal of nuisance birds
8. Disturbance/stress effect



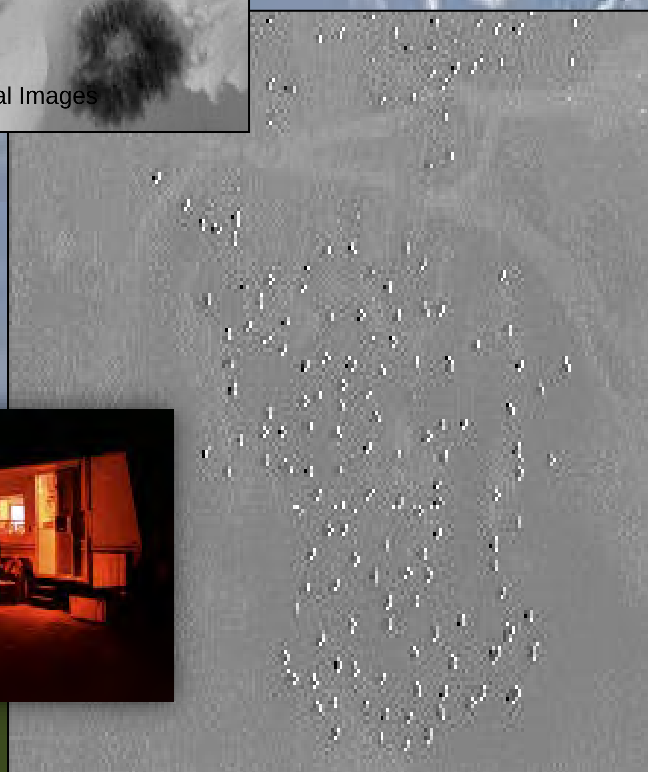
McEvoy et al. 2016

Sandhill Cranes – SW Colorado





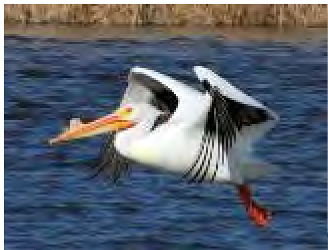
FLIR Tau 640 Thermal Images



Census of Ground-nesting Colonial Water Birds

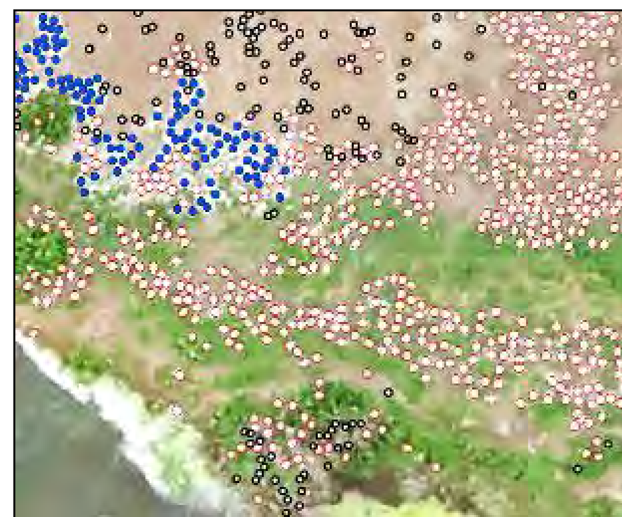
Chase Lake National Wildlife Refuge, ND June 11-12, 2014

Using UAS to aerial survey American White Pelicans, Double Crested Cormorants, gulls and other ground nesting water birds



Monitoring Habitat Change

Other applications included landscape change and power line surveys for bird strike detection.



USGS
science for a changing world

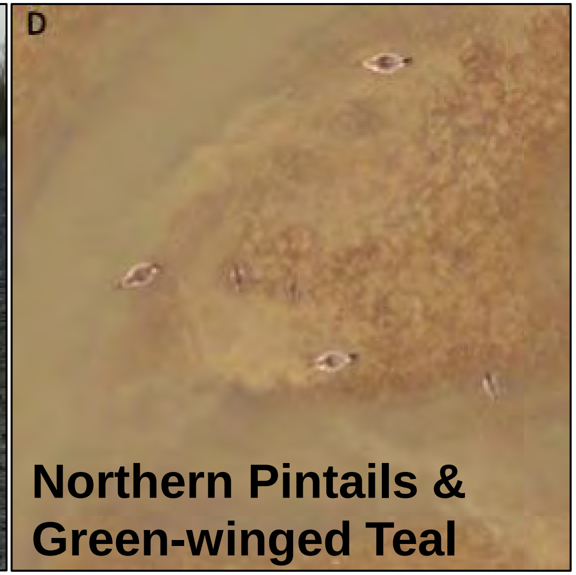
Non-breeding bird surveys

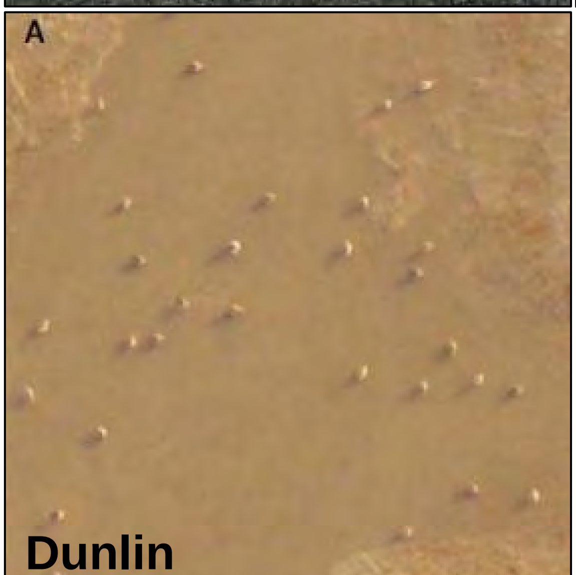
Chabot & Bird 2012

Non-breeding bird surveys

Chabot & Bird 2012

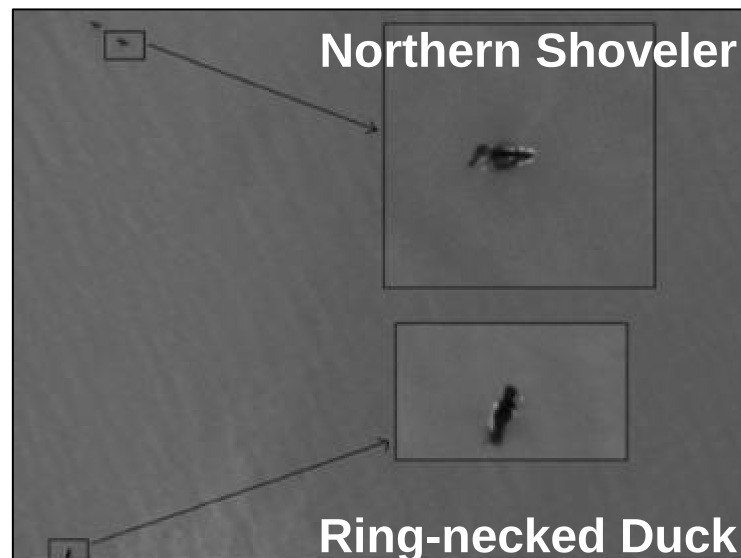
Non-breeding bird surveys





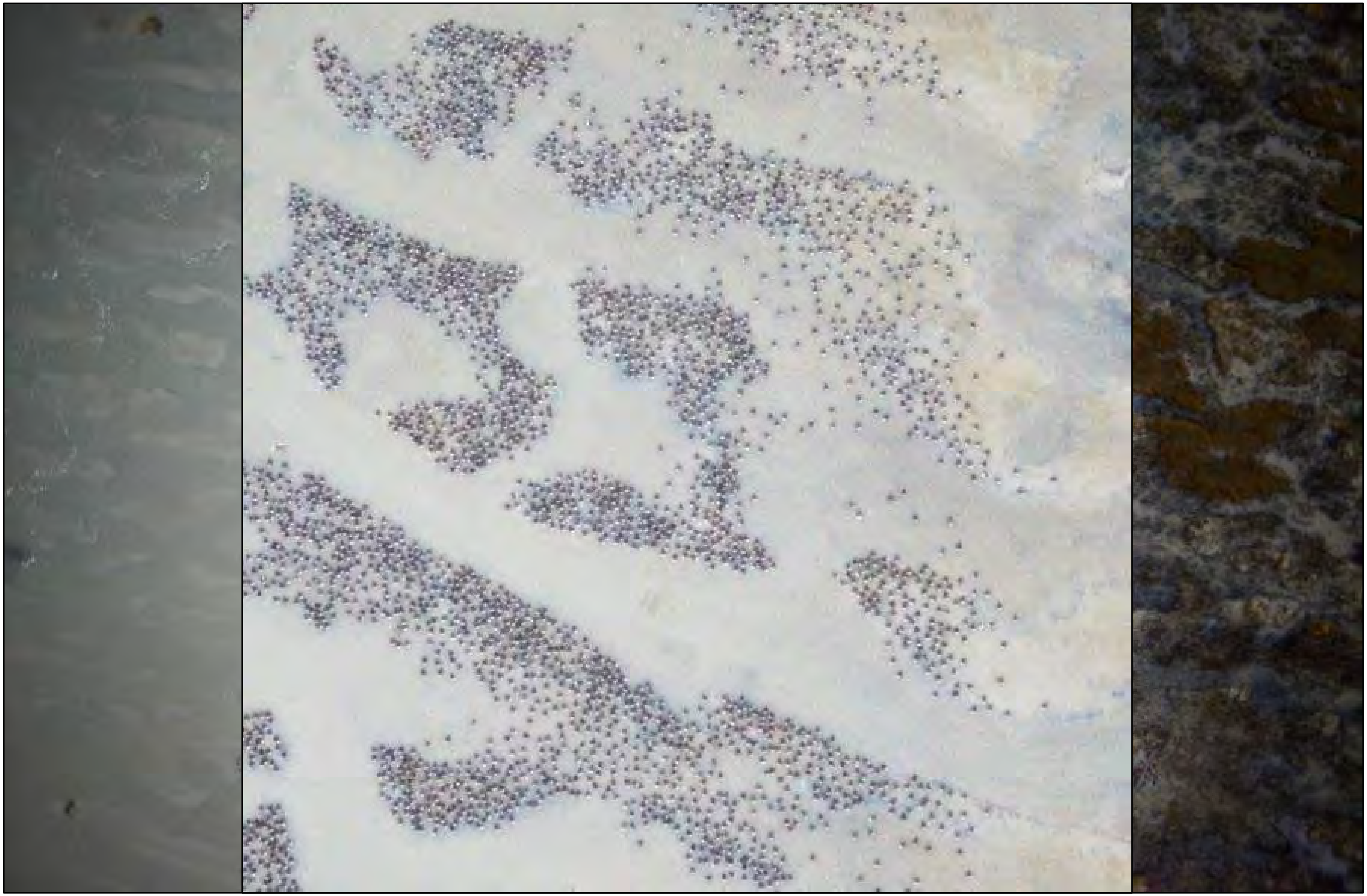
Drever et al. 2015

Wintering waterfowl & shorebirds



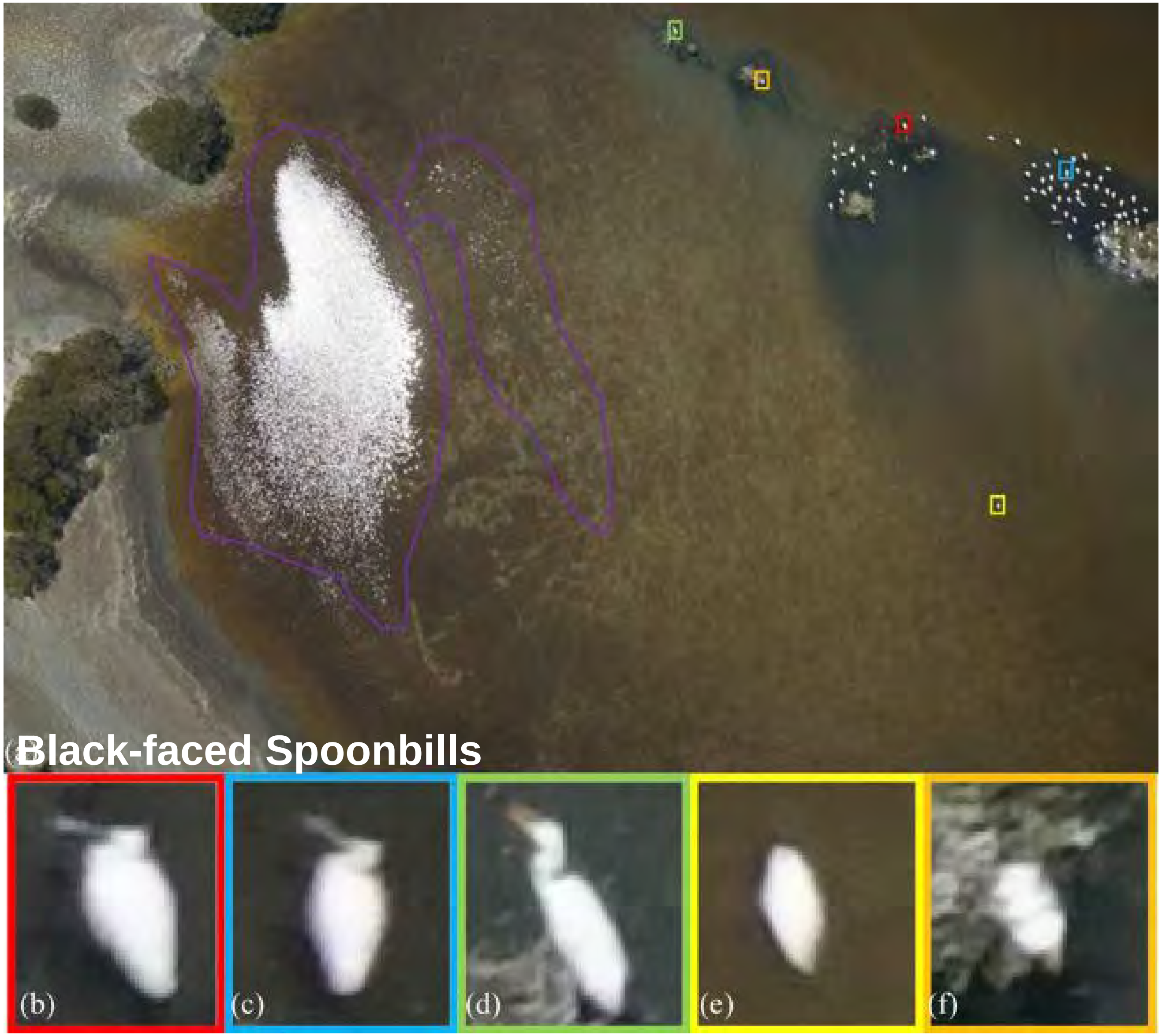
Dulava et al. 2015

Non-breeding bird surveys



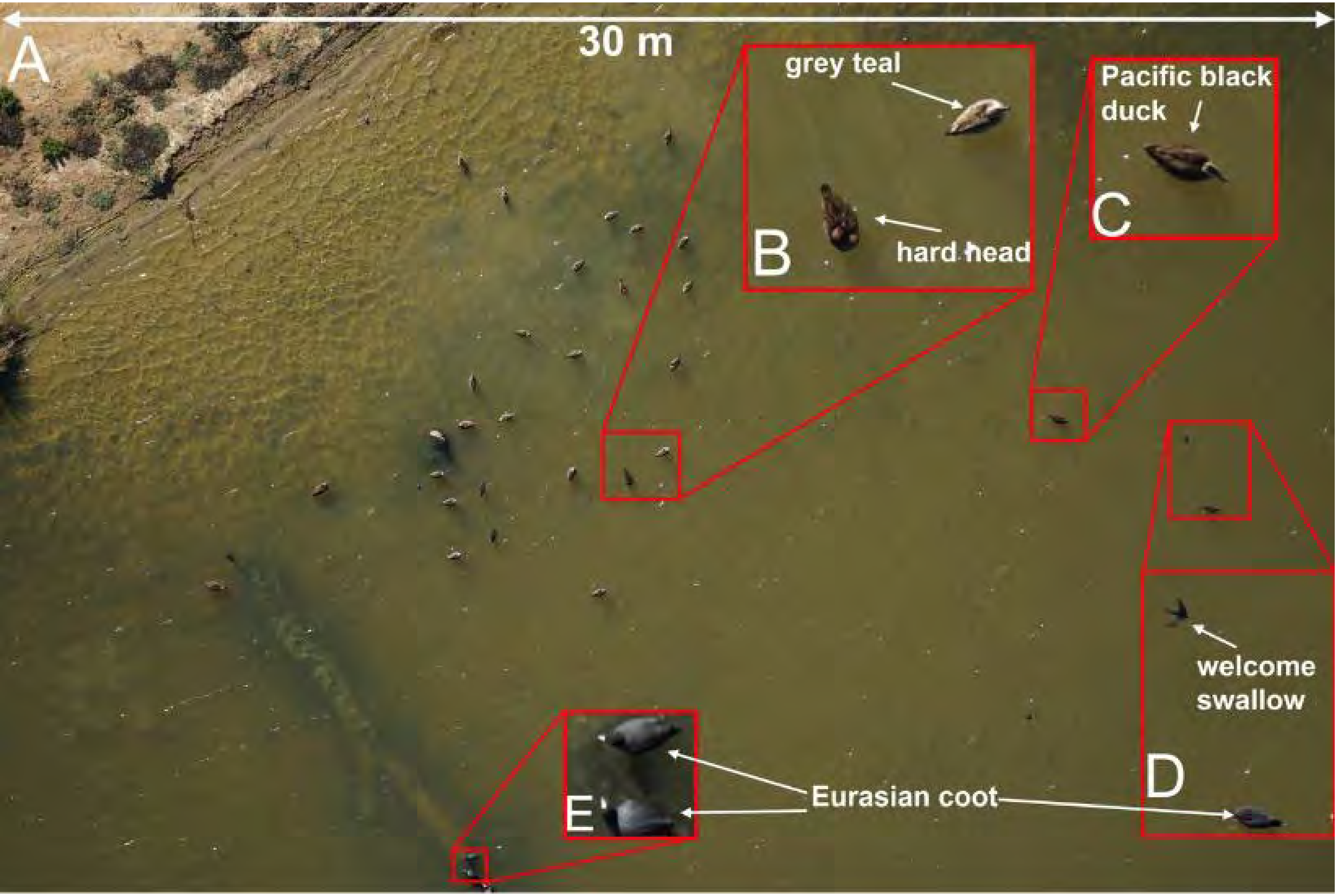
Drever et al. 2015

Non-breeding bird surveys



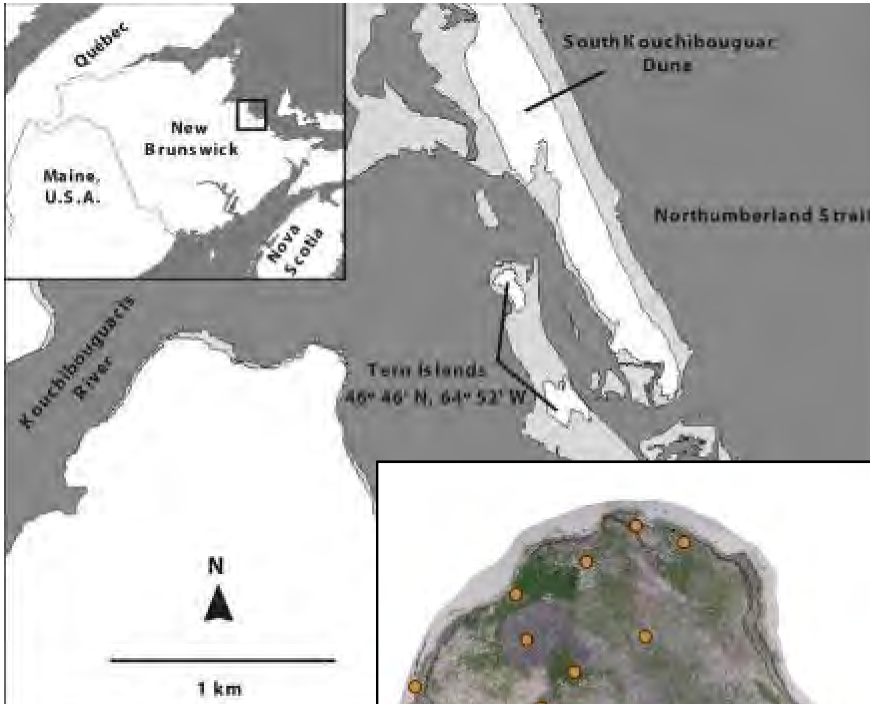
Liu et al. 2015

Non-breeding bird surveys



McEvoy et al. 2016

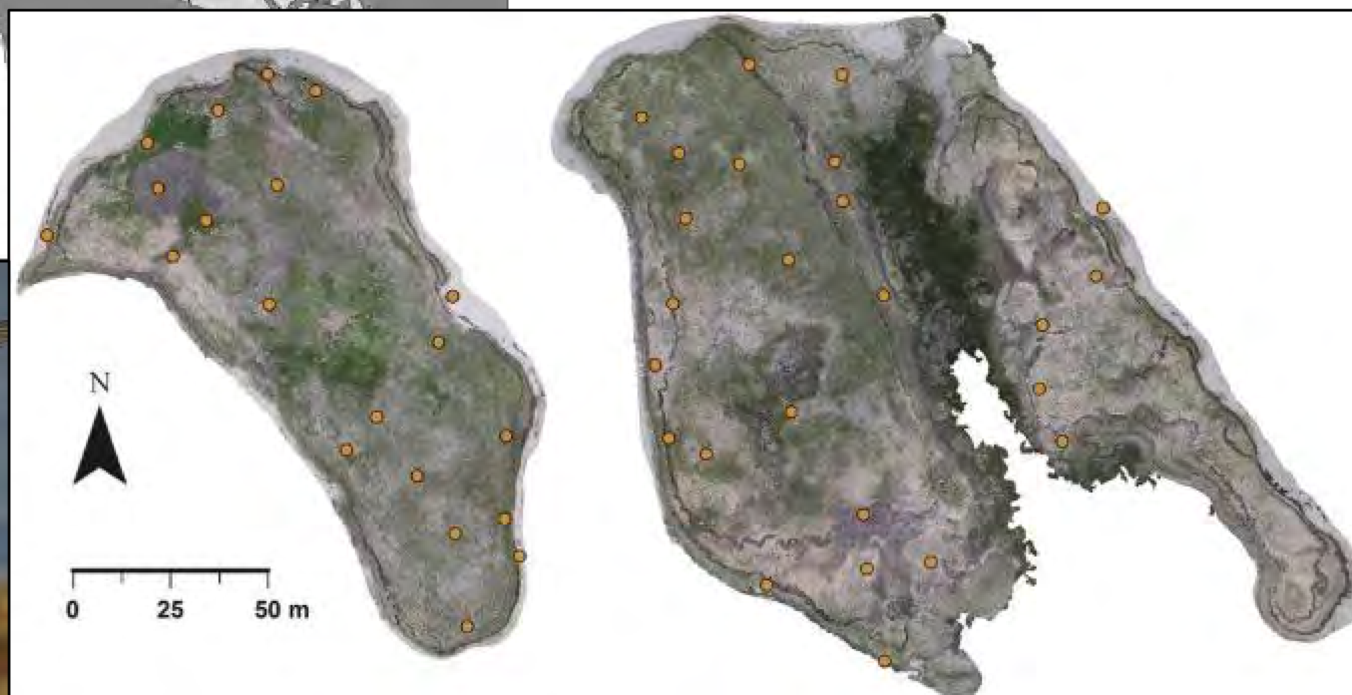
Breeding colony surveys



Common Tern colony of 6,000 nests

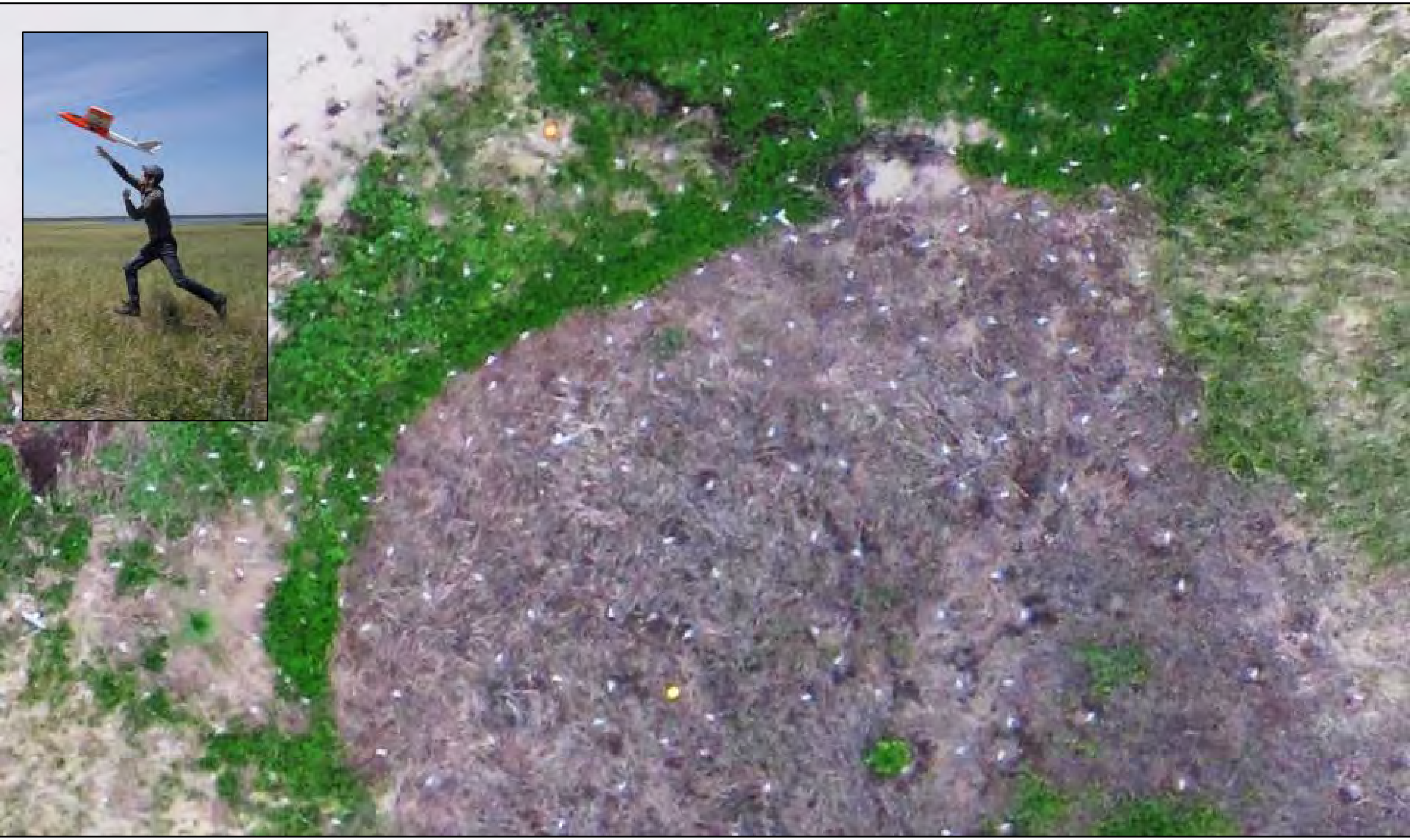
Kouchibouguac National Park, NB

Ground-aerial count comparison



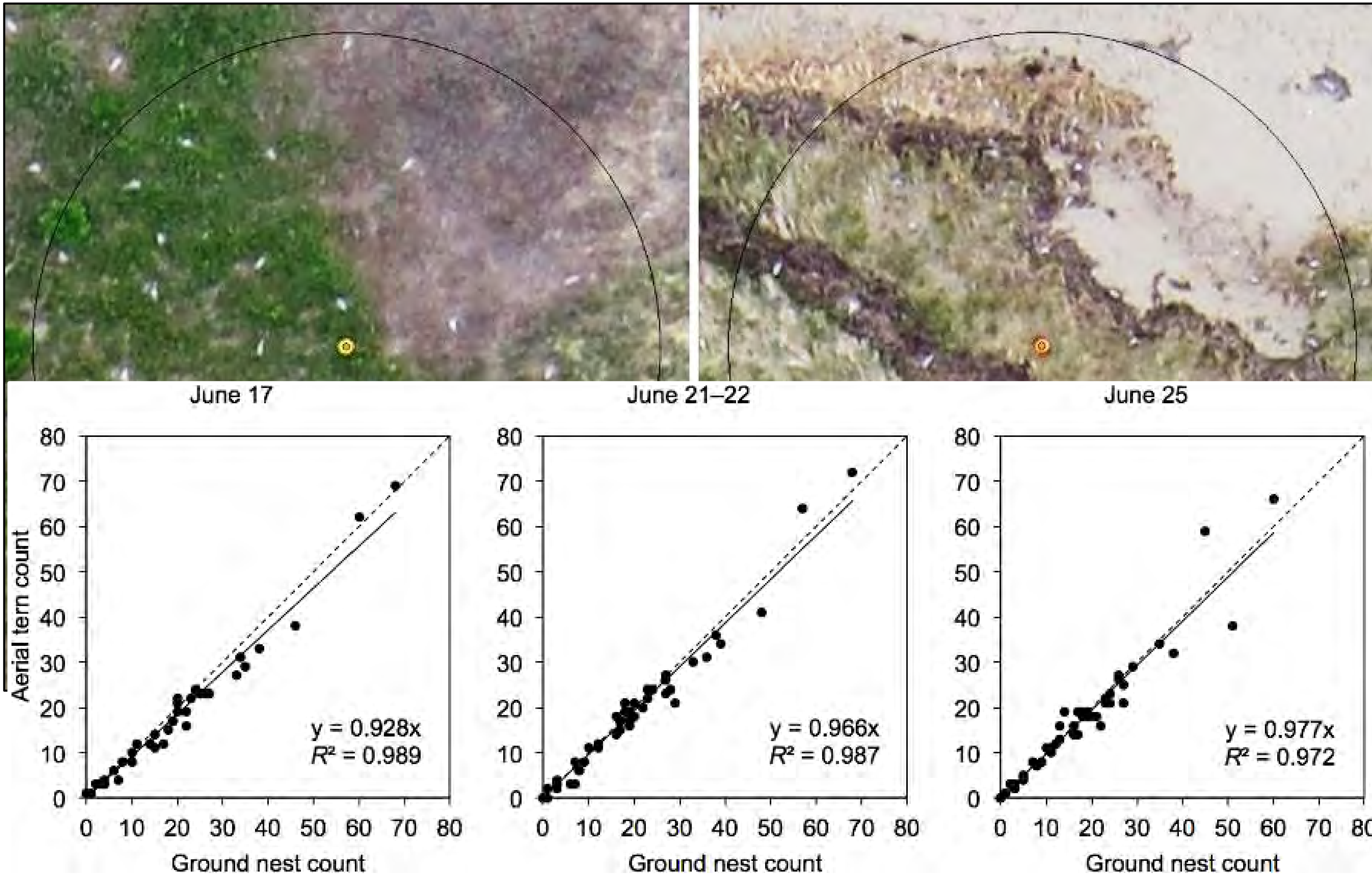
Chabot et al. 2015

Breeding colony surveys



Chabot et al. 2015

Breeding colony surveys



Chabot et al. 2015

Breeding colony surveys

Diaz-Delgado et al. 2017

Breeding colony surveys

Lesser Frigatebirds

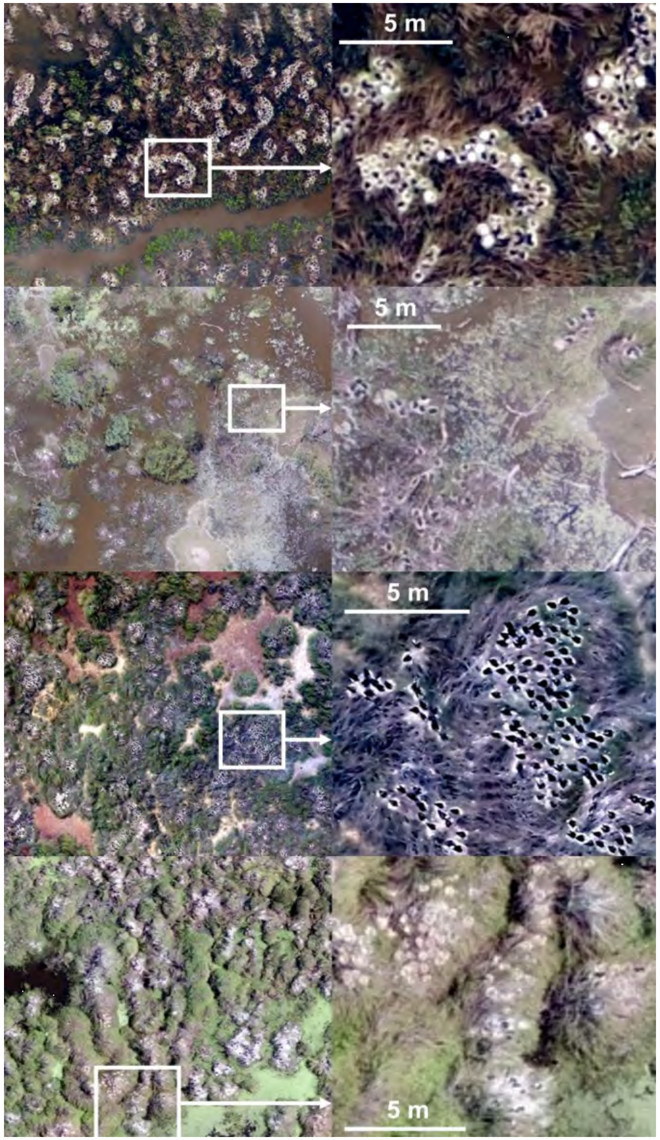
Crested Terns

Hodgson et al. 2016

Breeding colony surveys

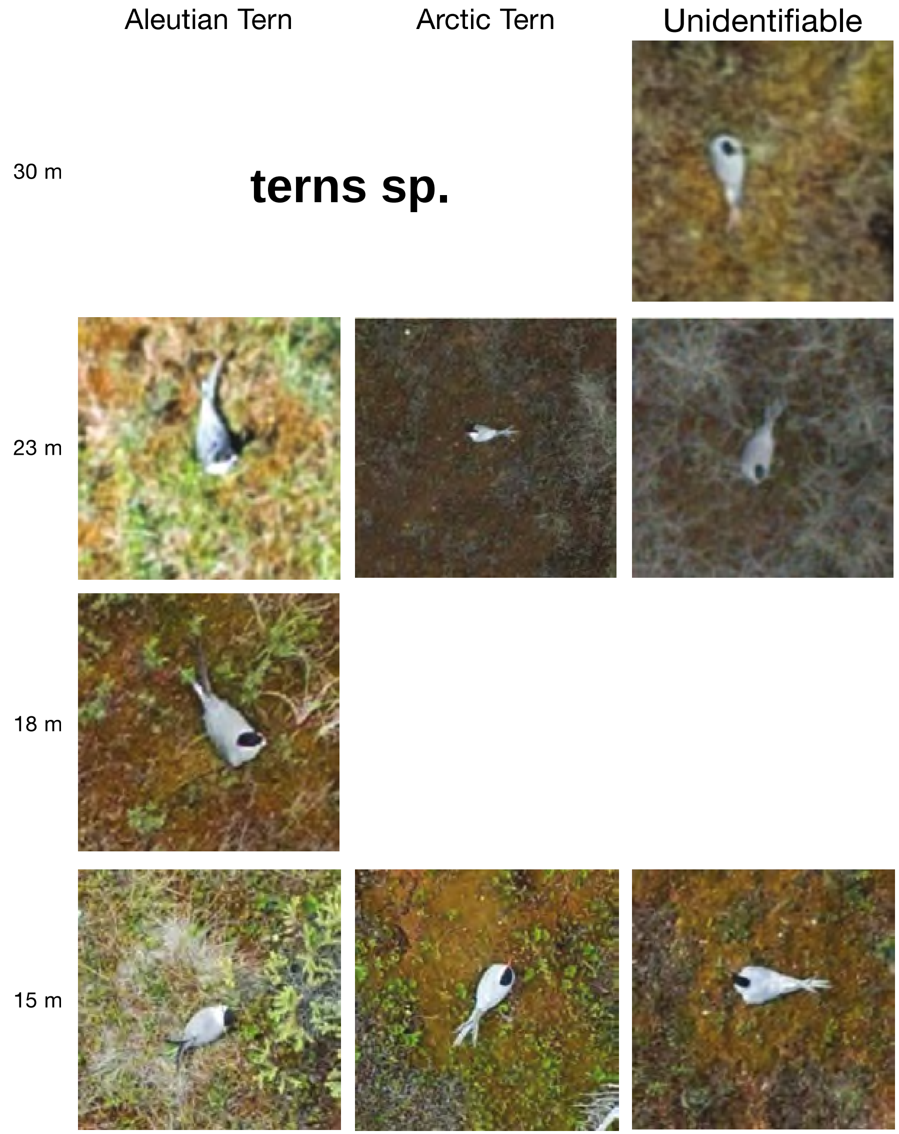
Afan et al. 2018

Breeding colony surveys



Straw-necked Ibis

Lyons et al. 2019

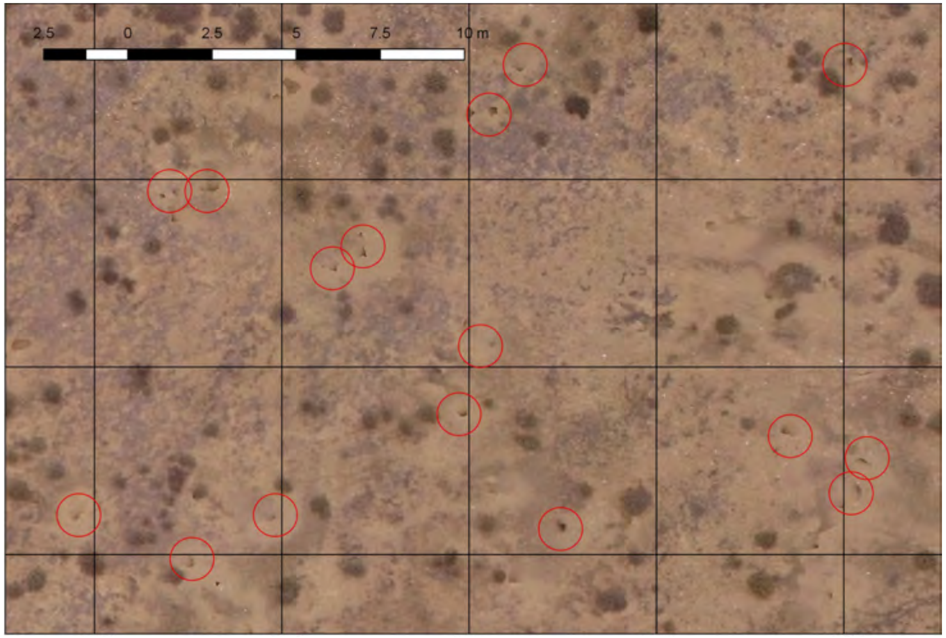


Magness et al. 2019

Breeding colony surveys

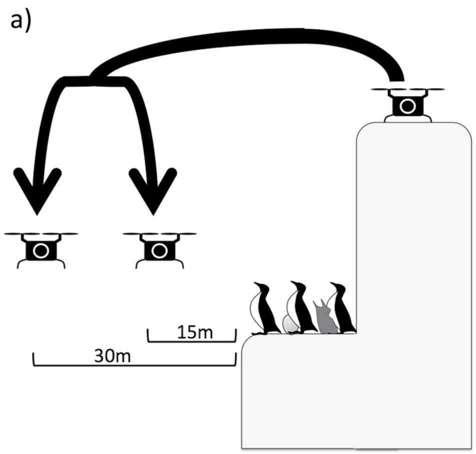
Burrow- and cliff-nesting species

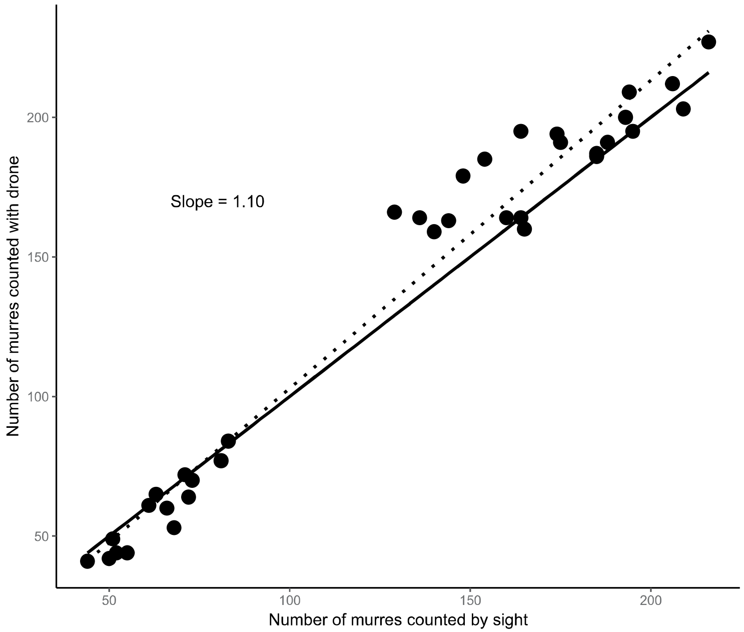
Black-vented Shearwater burrows



Albores-Barajas et al. 2018

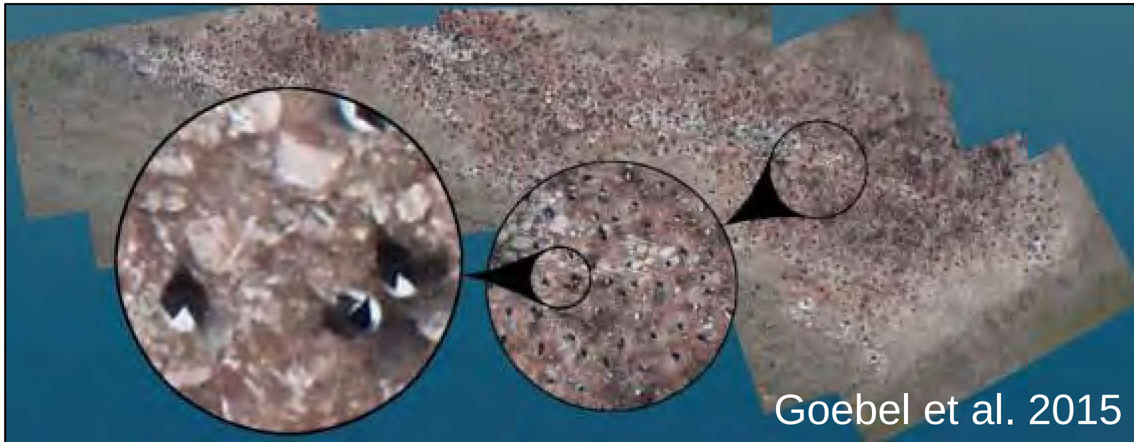
Thick-billed Murres





Brisson-Curadeau et al. 2017

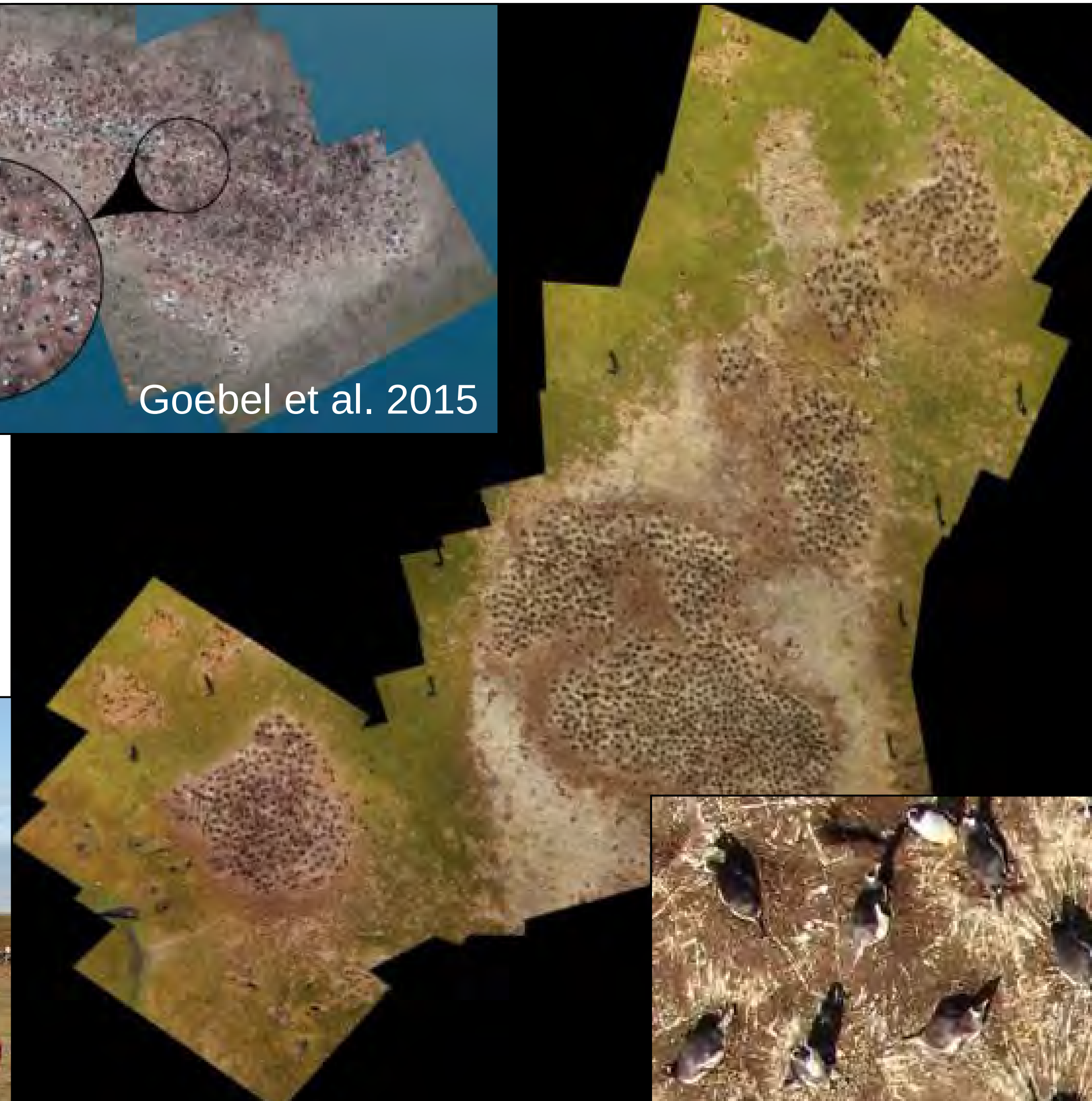
Breeding colony surveys



Goebel et al. 2015

Chinstrap Penguins

Gentoo Penguins



Ratcliffe et al. 2015

Drones 'effective method' for counting seabirds

5 March, 2021 News stories

Drones, or un-crewed aerial vehicles, are helping scientists to survey remote colonies of seabirds more rapidly and efficiently than ever before. The results, which show population change in three seabird species, are published this month (March 2021) in the journal *Polar Biology*.

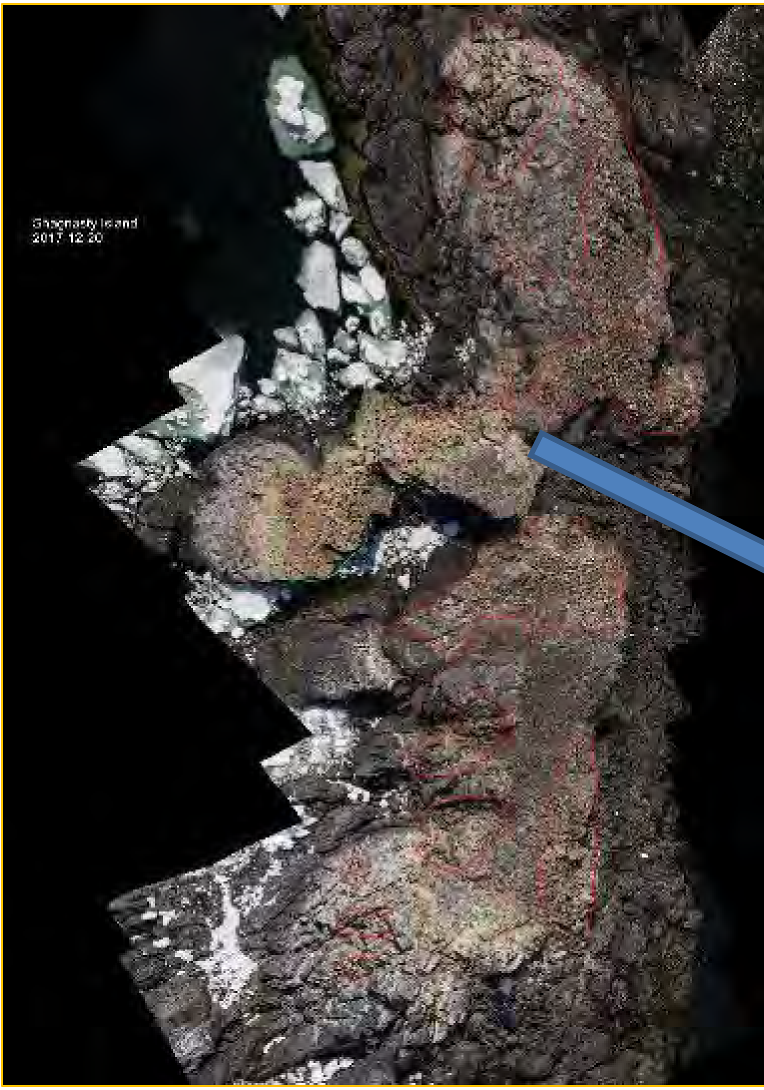
Scientists at British Antarctic Survey have been monitoring chinstrap penguins, gentoo penguins and shag colonies on sub-Antarctic Signy Island, in the South Orkneys, since 1978. Population counts have been carried out on the ground. This study shows close comparability between ground counts and drone surveys for all three birds.

Identify and accurately map locations, size and shape of penguin colonies on Signy Island


ORIGINAL PAPER

Un-crewed aerial vehicle population survey of three sympatrically breeding seabird species at Signy Island, South Orkney Islands

Distinguish between species in mixed occupancy breeding sites



Chinstrap Penguins = green

South Georgia shags = red

Adjacent Adélie (left of green line) and Chinstrap Penguin nests

35 metre height

Image magnified

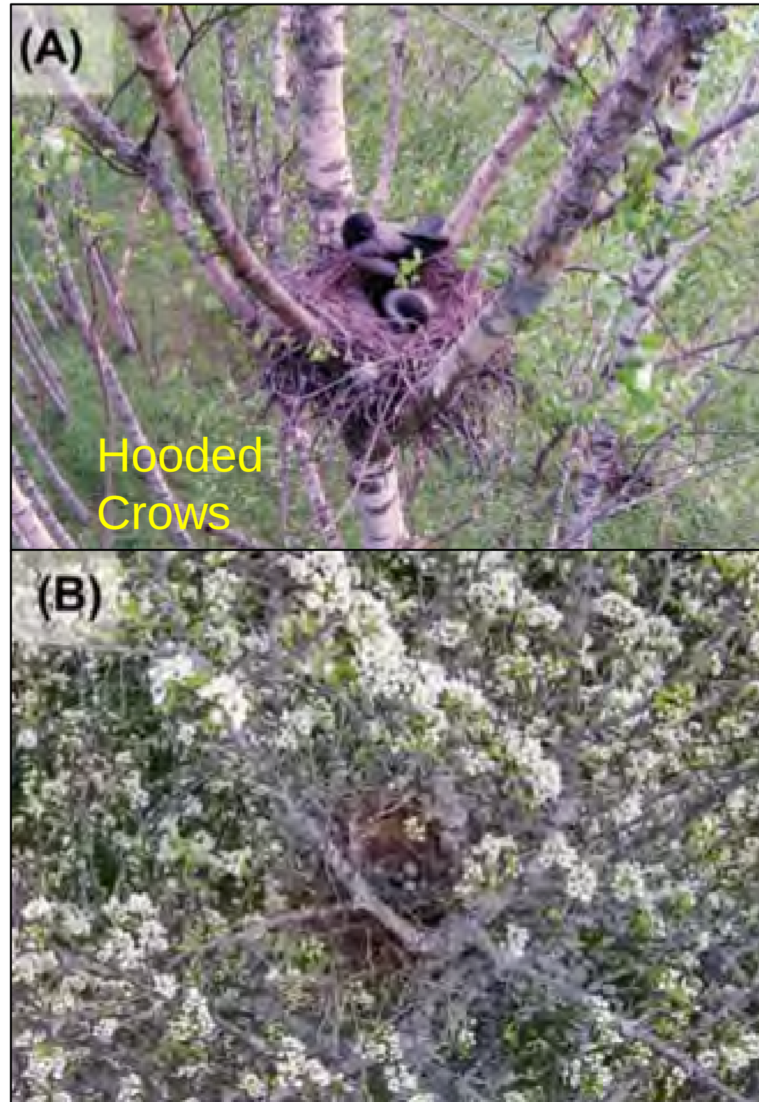
- Low altitude multi-rotor UAV surveys
- Sufficiently high-resolution images to allow accurate I.D. of similar species

British Antarctic Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Censusing Open Tree-Nesting Water Birds

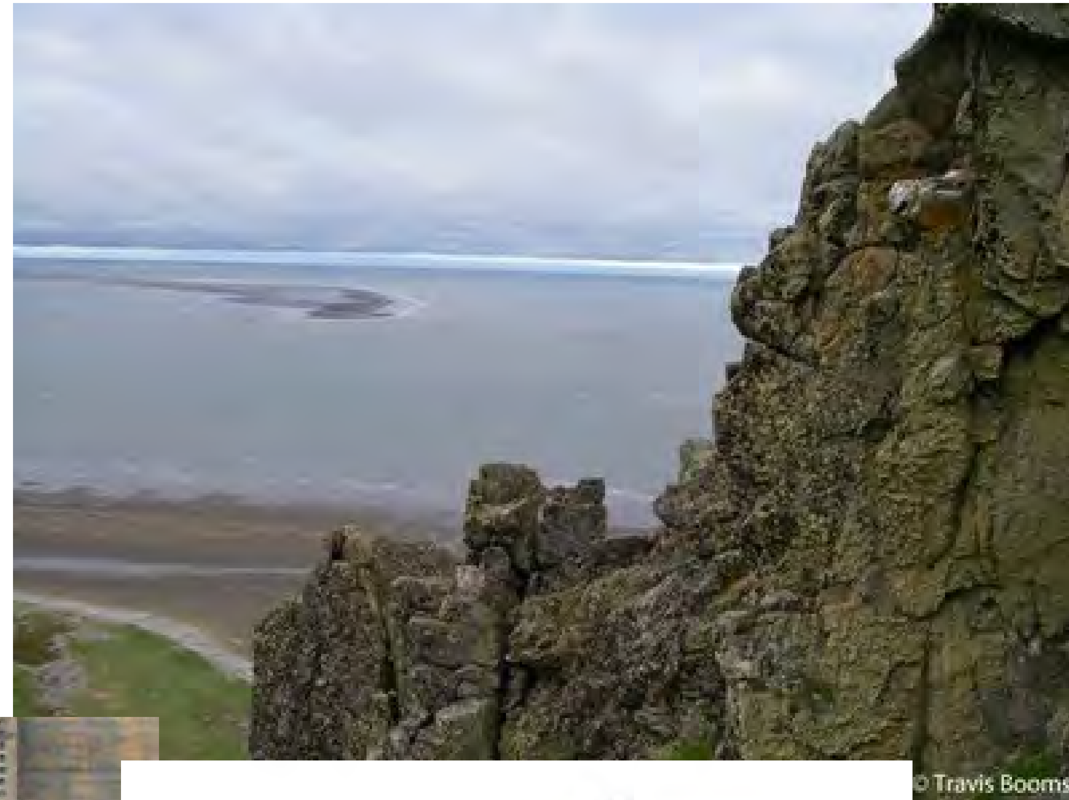
Drones for nest inspections

Mulero-Pazmany et al. 2014



Weissensteiner et al. 2015

Censusing Raptor Nests


© Travis Booms

Traditional Nest Census Techniques

Swainson's Hawk Nest, Kyle, SK, July 14, 2012

Drones Save Time, Effort and Money!

- A photo of an abandoned Golden Eagle nest taken by a rotary drone in Norway

- Took 2-3 minutes to check, and would have demanded mountaineers and heavy climbing 200 m up a steep cliff otherwise

Courtesy of Tomas Aarvak

Using a Drone to Acquire Images of Nest Contents and to Determine Nest Defense Responses of Four Raptor Species

James Junda (M.Sc. Student), David M. Bird (McGill Univ), Erick Greene (Univ of Montana)

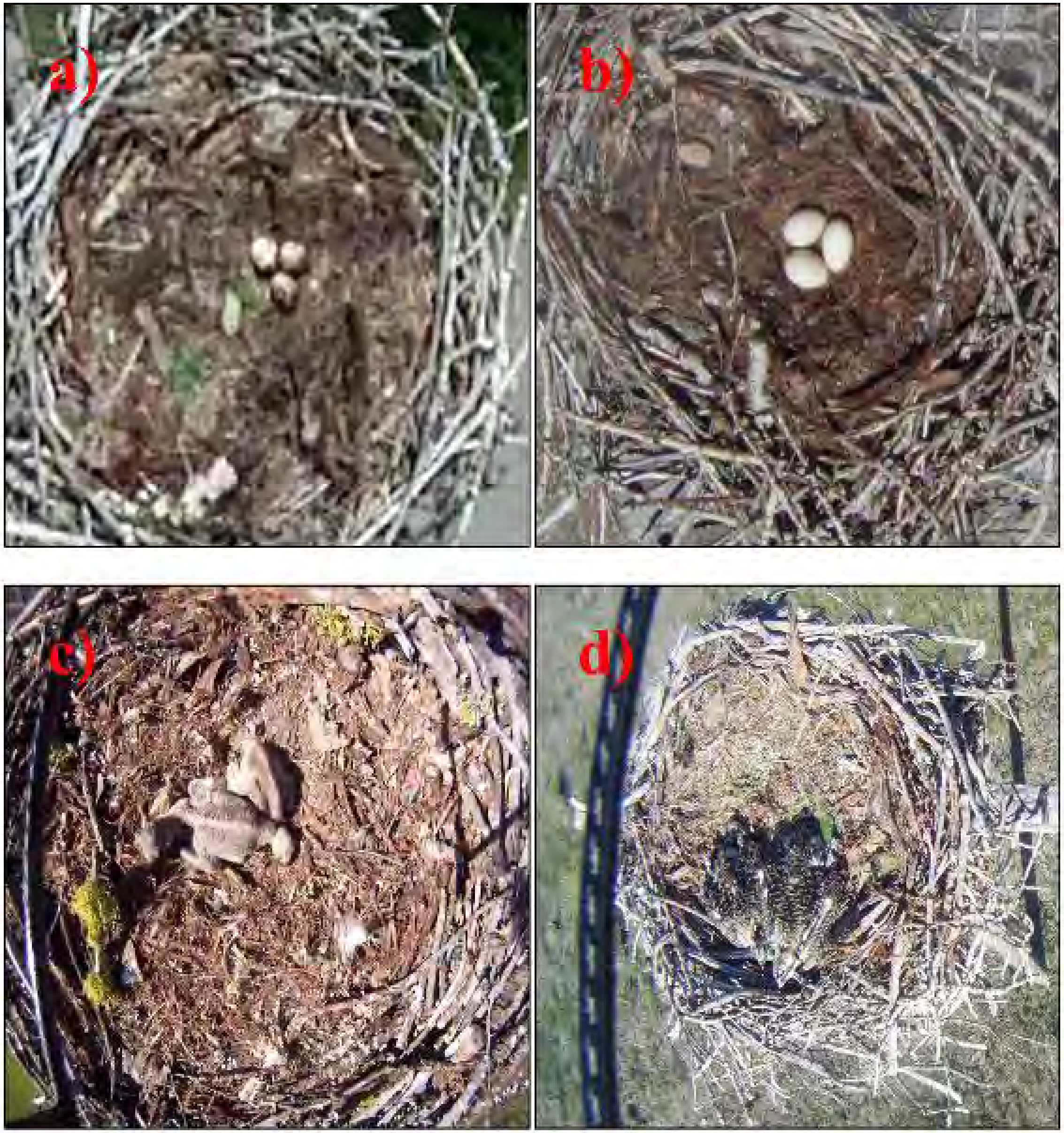
Ospreys, Hawks and Eagles

Success of Flights*

- **Osprey****:
  80/82
- **Red-tailed Hawk**:
  3/5
- **Bald Eagle**:
  7/8
- **Ferruginous Hawk**:
  10/11

*Could have been 100% success with revisits

**Two strikes by Osprey, both caused by human error



Osprey

a) Three Eggs

b) 3 Goose Eggs

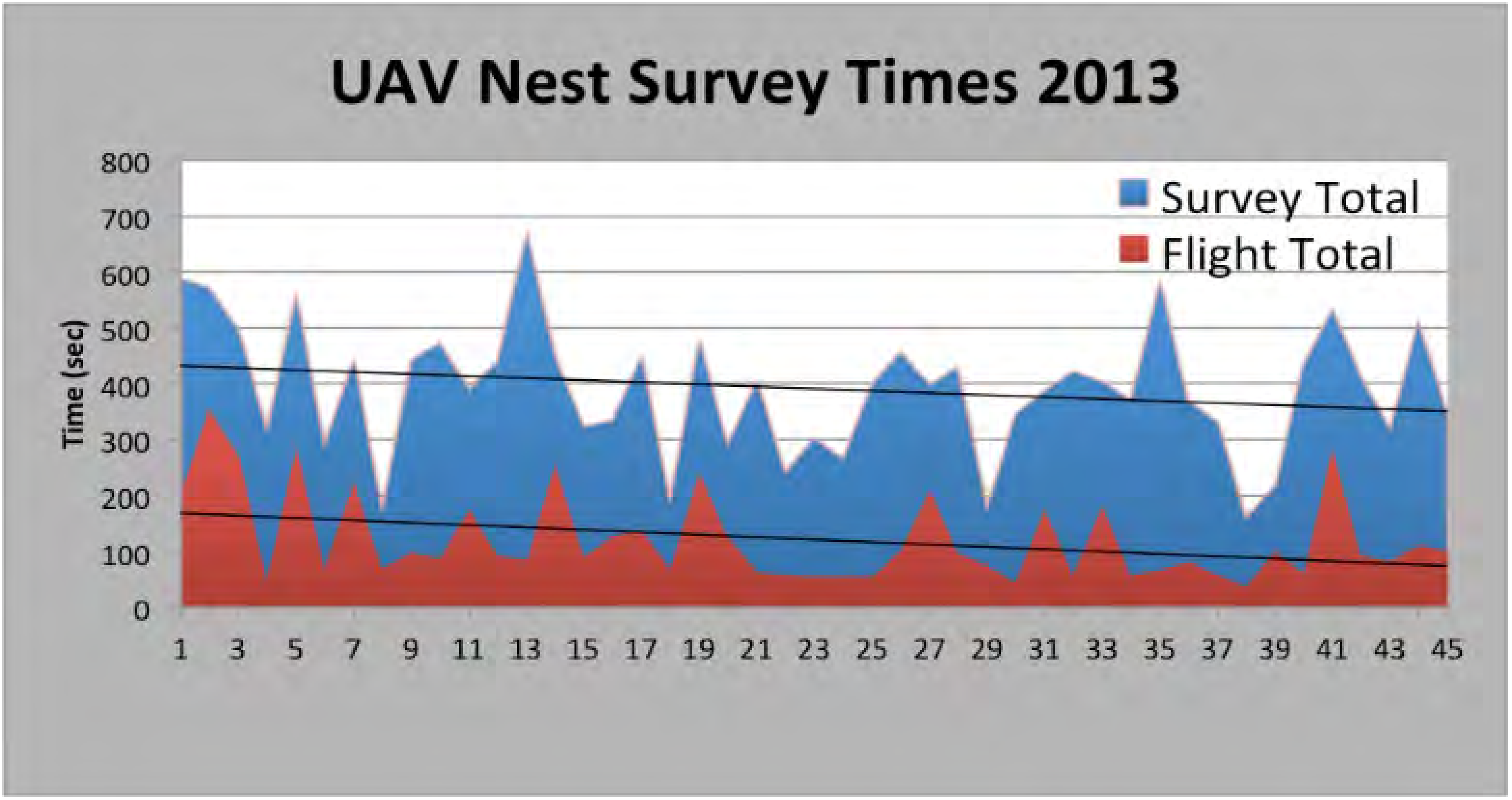
c) 2 Young Chicks

d) 2 Older Chicks

Nestlings

a) Ferruginous Hawk
b) Red-tailed Hawk
c) Osprey
d) Bald Eagle

Speed of Drone Surveys



- Nest approach to return of adult to nest = <u>avg. 6.5 minutes</u>
- Actual flight time of UAV = 3.0 minutes
- More efficient with experience over the season

NRC Research Press

ARTICLE

Proper flight technique for using a small rotary-winged drone aircraft to safely, quickly, and accurately survey raptor nests

James Junda, Erick Greene, and David M. Bird

Abstract: Small rotary-winged unmanned aerial vehicles or "drones" mounted with a small video camera were successful in surveying the nest contents of four species of raptor, including Osprey (*Pandion haliaetus*), Bald Eagle (*Haliaeetus leucocephalus*), Ferruginous Hawk (*Buteo regalis*), and Red-tailed Hawk (*B. jamaicensis*) in an accurate and safe manner when the proper flight technique was employed. A total of 110 surveys were completed in 2013 and 2014 with quality images of nest contents obtained in 106 or (96.4%) of flights. A successful and safe flight requires two personnel: the pilot who controls the aircraft and the spotter who monitors the behaviour of the adult birds defending the nest and keeps the pilot updated on all potentially dangerous interactions between aircraft and the birds. With the video camera recording, the aircraft is flown above the nest to a predetermined location that allows an unobscured camera shot of the nest. This technique can be readily adapted to a variety of habitat types and species. The accuracy of data obtained combined with the flexibility, low cost, and speed of this technique make it a useful technological alternative to the safety risks and obtrusiveness associated with traditional survey techniques.

Key words: nest defense behaviour, unmanned aerial vehicles (UAV), raptor, nest productivity,

DJI Mavic Pro

DJI Mini-Mavic

- more easily transportable in the field!
- Affordable enough to buy two or three
- great camera and gimbal
- 25 min flying time
- easy to fly
- “2” versions now available that are even better
- Mini-Mavic 2’s weight of 249 g minimizes paperwork

Bald Eagle chicks (2017 Dan Zazelenchuk, Saskatchewan (note the dead heron)

Prairie Falcon chicks, 2017, Saskatchewan (Dan Zazelenchuk)

Eugene Potapov’s Steller’s Sea-eagle nest study with drones

Finnish drone studies of Ospreys and White-tailed Sea Eagles by Tapio Osala

Note: **400 – 500 flights over three summers at osprey and white-tailed sea eagle nests with no serious attack attempts (avoid known aggressive ospreys)**

Note: 128 flights from 2016 to 2019 with no aggression toward the drone

Shane McPherson's drone study of Crowned Eagles in South Africa

CHACO EAGLE (*Buteogallus coronatus*) ECOLOGY AND CONSERVATION

CENTRO PARA EL ESTUDIO Y CONSERVACION DE LAS AVES RAPACES EN ARGENTINA

PROYECTO ÁGUILA DEL CHACO • CHACO EAGLE PROJECT •

Note: No known aggression toward the drone at the nests

Diego Gallego

PhD Student at CONICET

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@proyectoaguilachaco

Population trends & reproduction of Bald Eagles at Besnard Lake, Saskatchewan, Canada 1968-2020

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

Drone use

- 2016 – 2018 DJI Phantom 3 Pro
- 2019 -2020 DJI Mavic Pro & DJI FPV goggles
- ~ 400 nests checked to date; launched from a boat
- Average flight time (2020) = 3.6 minutes
- Minimal disturbance compared to climbing and manned aircraft!!

<u>Notes:</u>

- **need to know that nesting harriers are present**

- **Have not tried infrared cameras**

- **Flushing the bird reveals the nest location**

Using drones to find the ground nests of Western Marsh Harriers in Finland (Tapio Osala, unpubl., 2021)

And what about hole-nesting species??

Bird, Pace and Elliott, submitted, Journal of Raptor Research

Using a Drone With an Extended Camera Arm

- Camera entering nest box

- Small WiFi Camera


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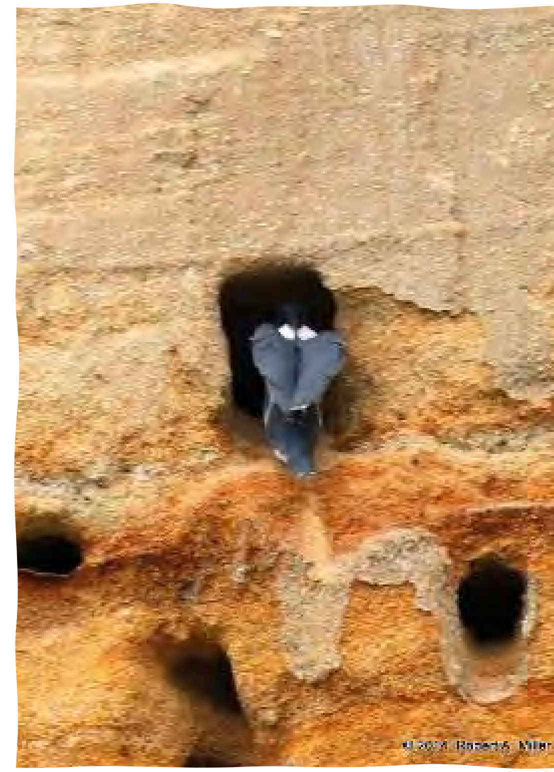
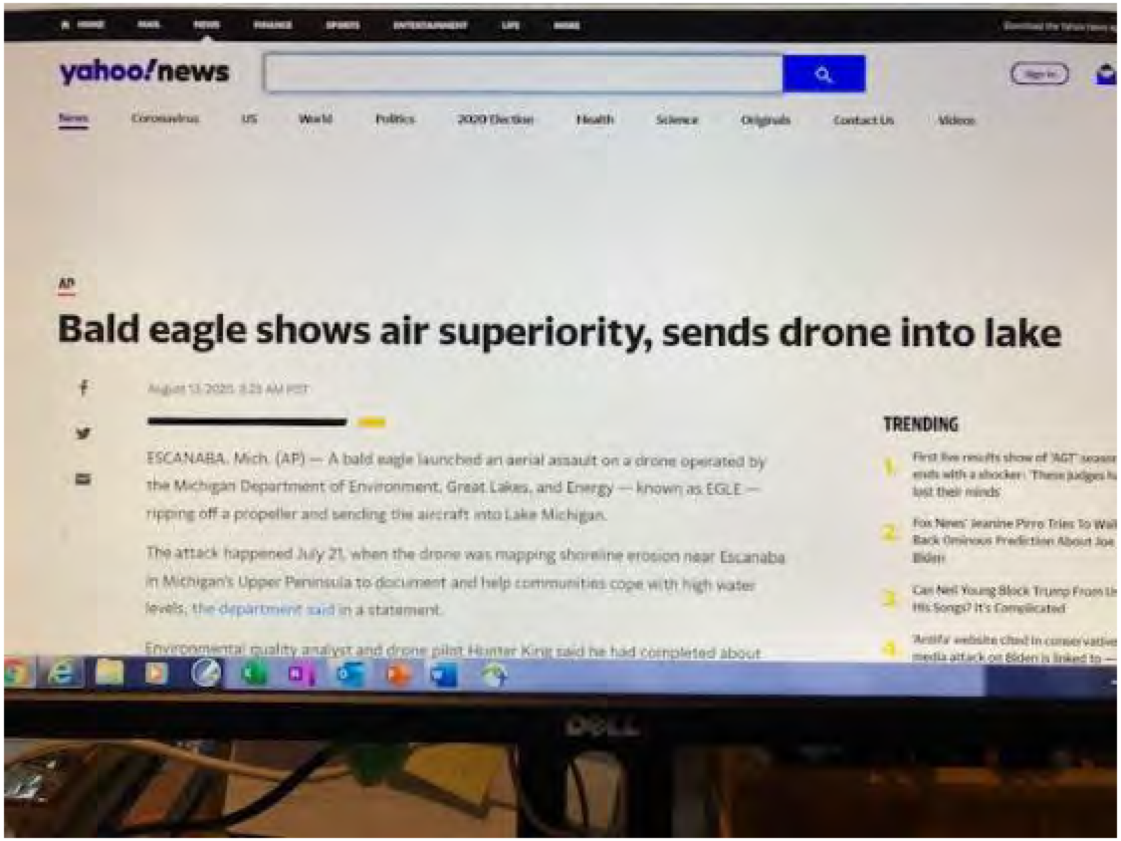
  

Not Only Kestrels!!

Aggressive Raptors!

A peregrine attacking a rotary drone in the Altay Mountains, Russia/Mongolian border (Eugene Potapov)



August 13, 2020

War Between Drones and Wedge-tailed Eagles in Australia!!!

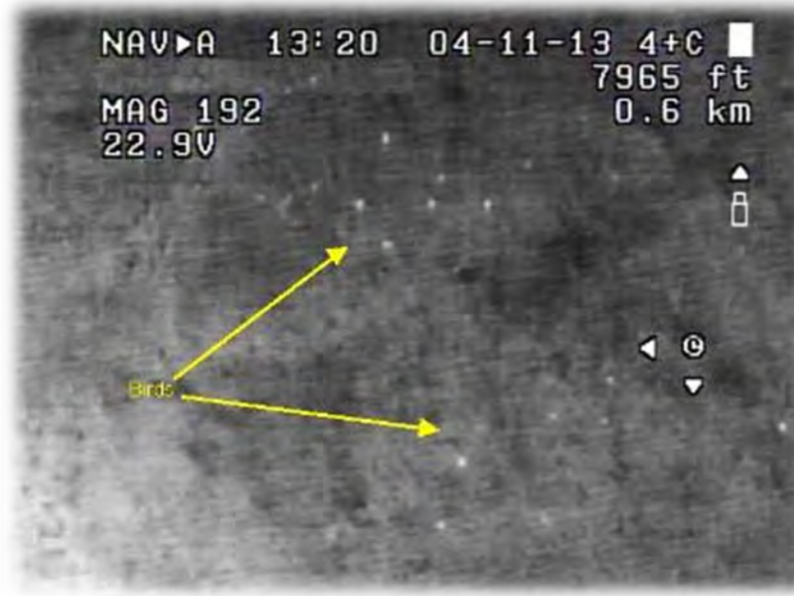

Gulls 1……Drones 0

Drones and IR cameras for bird detection

What about thermal-infrared cameras…

Affixing a FLIR camera to a Mavic; must weigh less than 200 g

Detection of Sage Grouse by Drones with Infrared Cameras



USGS
science for a changing world

Using IR Cameras to Detect Songbird Nests

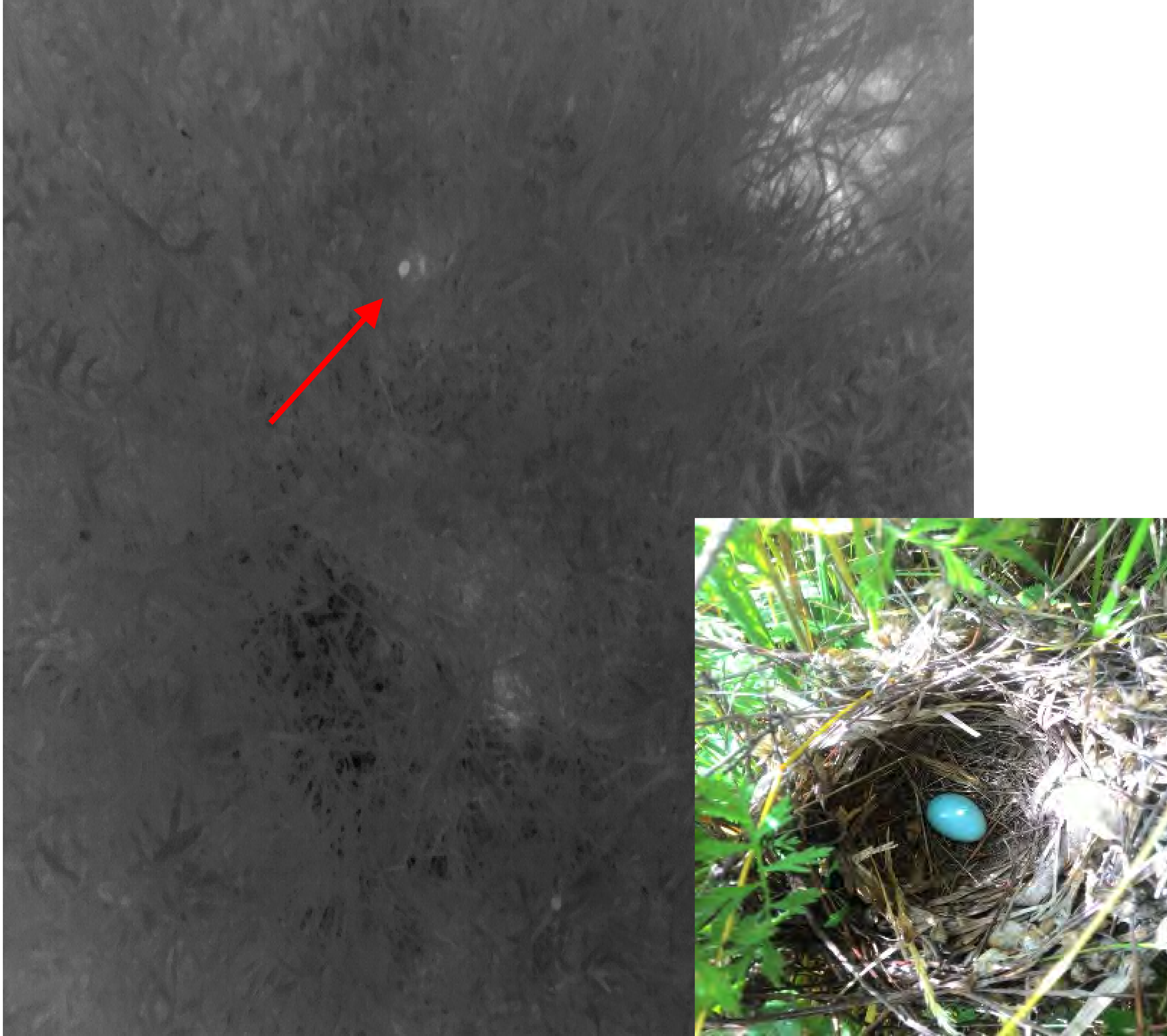

Seek
thermal
XR

Using drones to study nesting songbirds

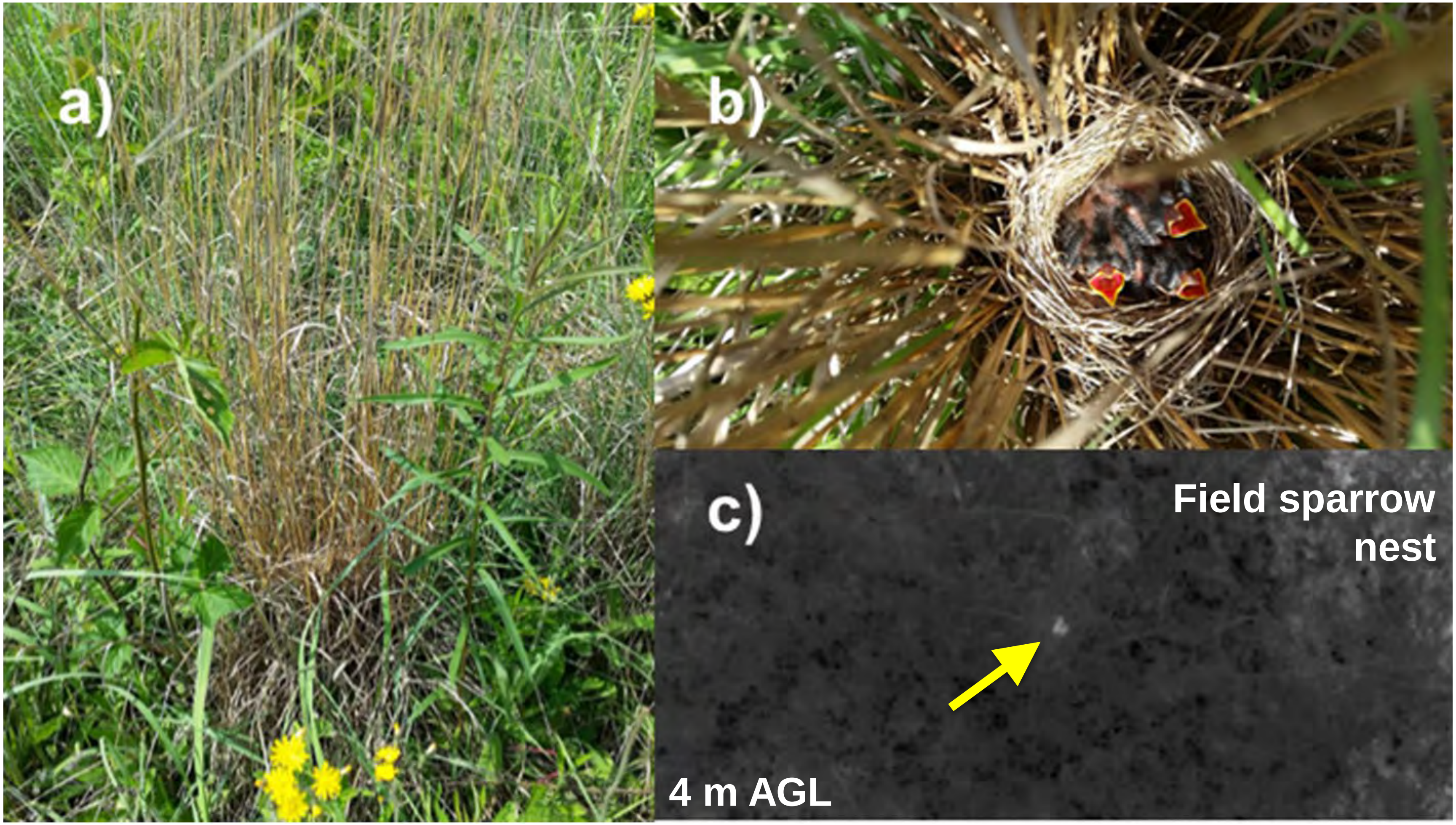
Dr. Darren Proppe

Chace Scholten, Kristin Strydhorst, Alex Kamphuis, Kaitlyn Vredevoogd, Conner Shea, Olivia Lamberg, Jenna Atma, Bradley Scholten, Abigail Olen

Calvin University

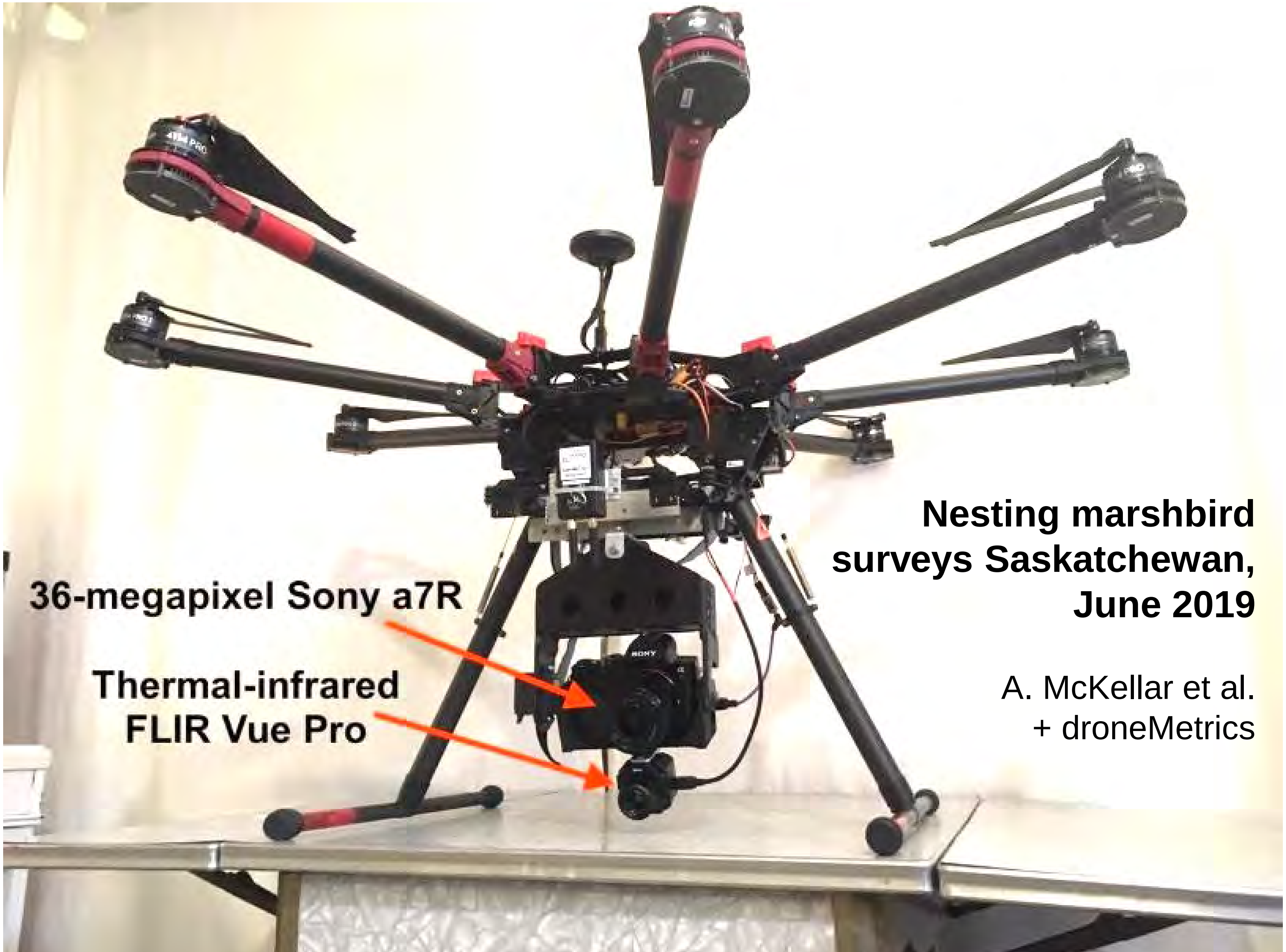


Drones and IR cameras for bird detection



Scholten et al. 2019

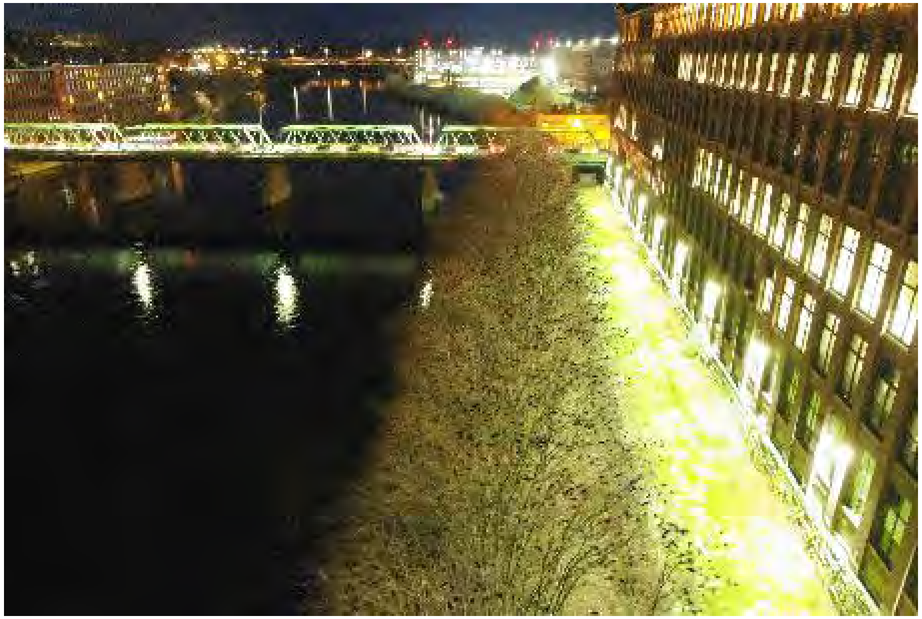
Drones and IR cameras for bird detection



Drones and IR cameras for bird detection

A. McKellar et al. + droneMetrics 2019

The Crow Patrol: Craig Gibson and Will Bick, Lawrence, MA

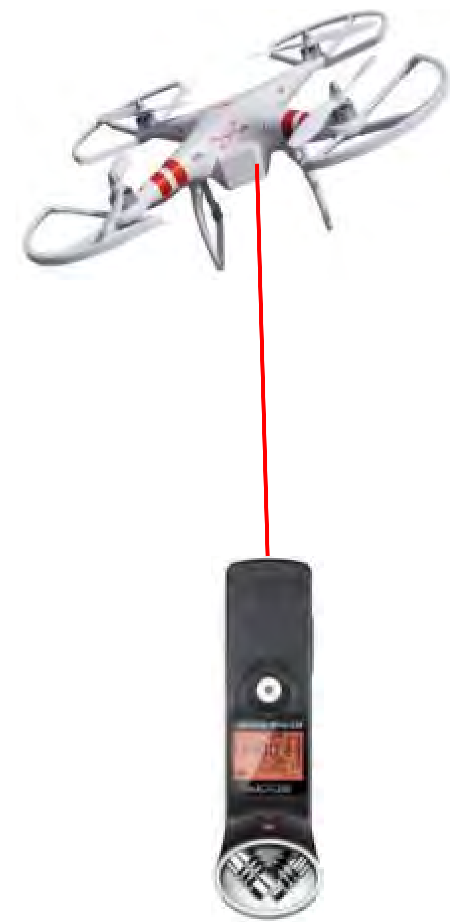


DJI Mavic 3 Thermal Drone: a Game-Changer

Using "Audio" Drones to Census Songbird Populations

The feasibility of using drones equipped with sound recorders to count songbirds

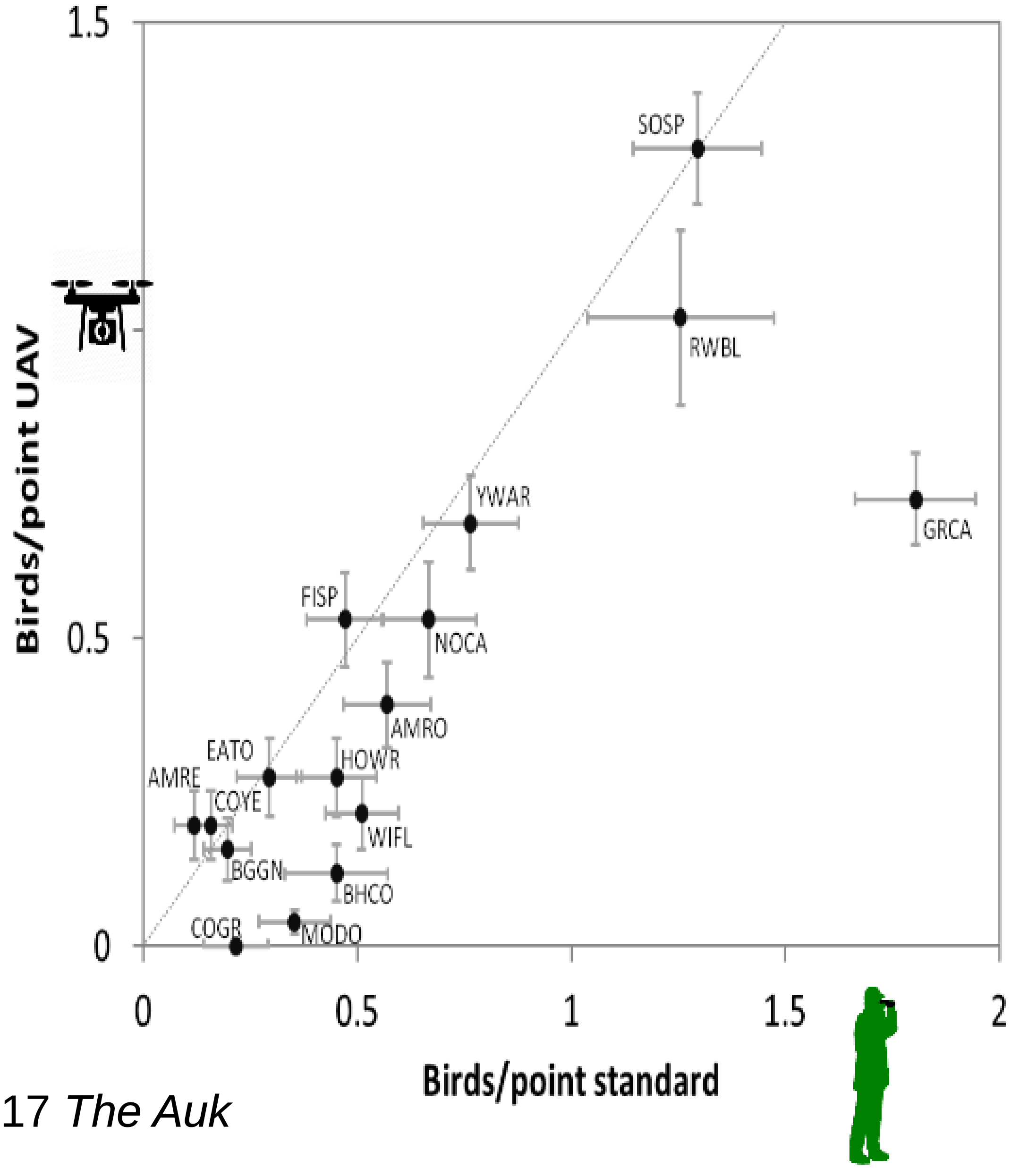
Andy Wilson and undergrads at Gettysburg College



Drones allow low-cost access to inaccessible or dangerous terrain

They successfully attached a pocket digital recorder to a DJI Phantom II quadcopter, to record bird song remotely

How do UAV counts compare to “standard” counts?



AOU species codes

Wilson et al. 2017 *The Auk*

Drones for habitat monitoring

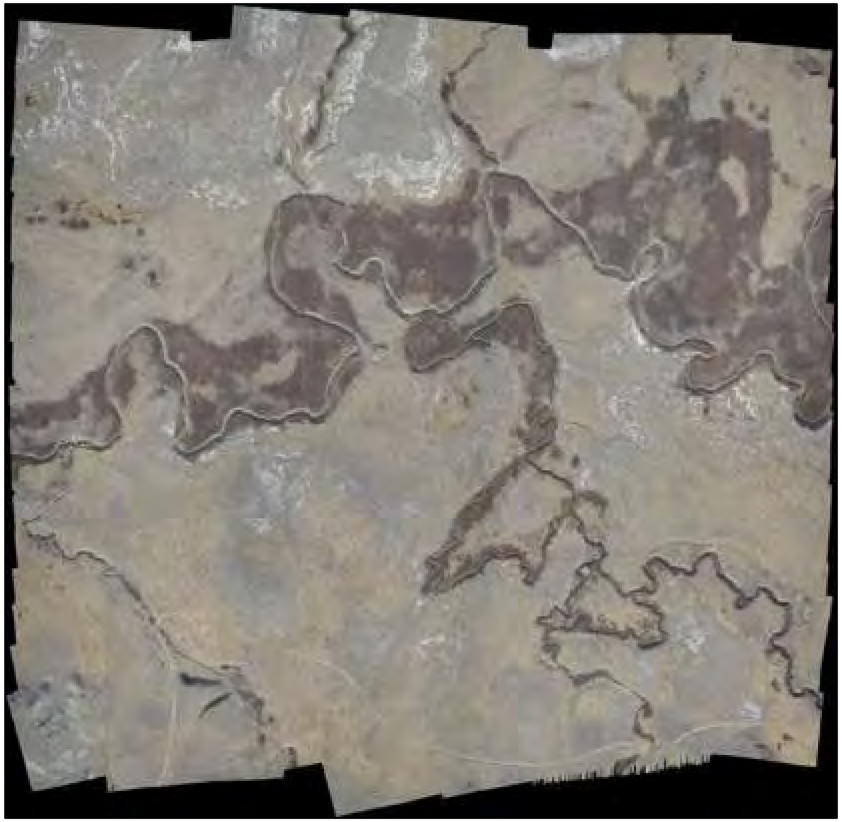
- Managed Wetland (Baie-du-Febvre, QC)
- Designated critical breeding habitat
- Assessed habitat preferences to guide development of management plan

Chabot & Bird 2013
Chabot et al. 2014

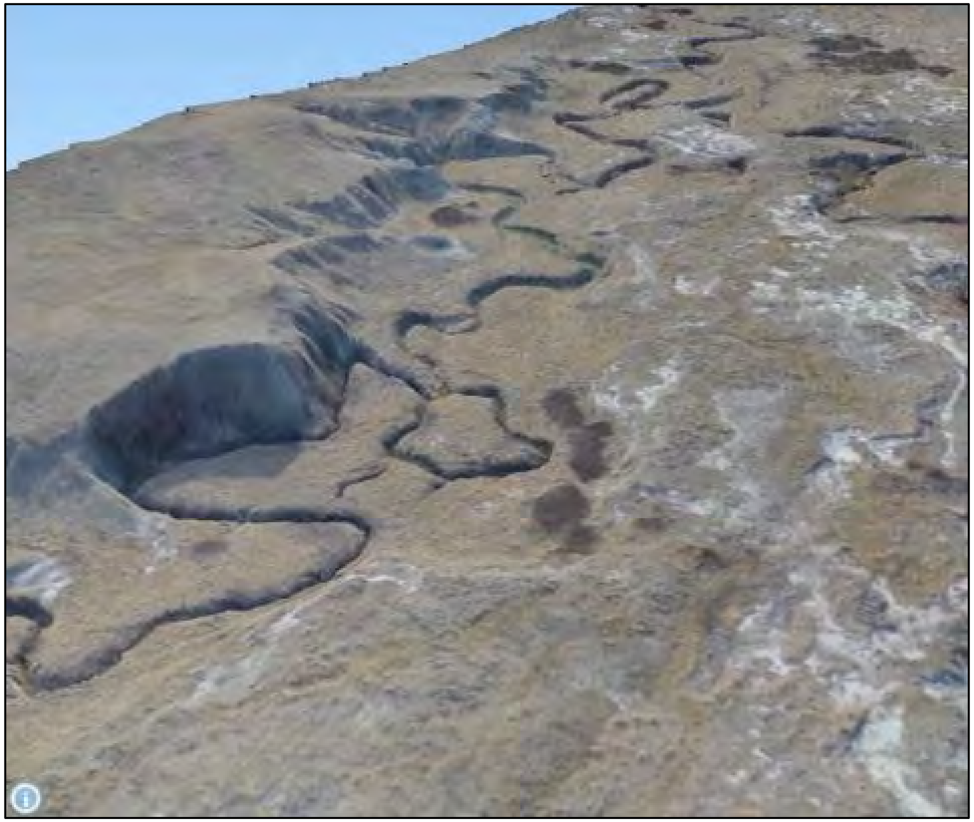
Drones for habitat monitoring

Endangered sage grouse habitat (Grasslands National Park, SK)
Assess sagebrush availability & distribution
Mapped 24 km^2 in 3 days at 4 cm/pixel

Orthomosaic (49 photos, 1 km^2)



3D topographical model



Bloom et al. + ING Robotic Aviation 2014

Quadcopter Drone Photography as a Means of Characterizing Habitat for American Kestrels

Matthew Kamm

Reed Research Group

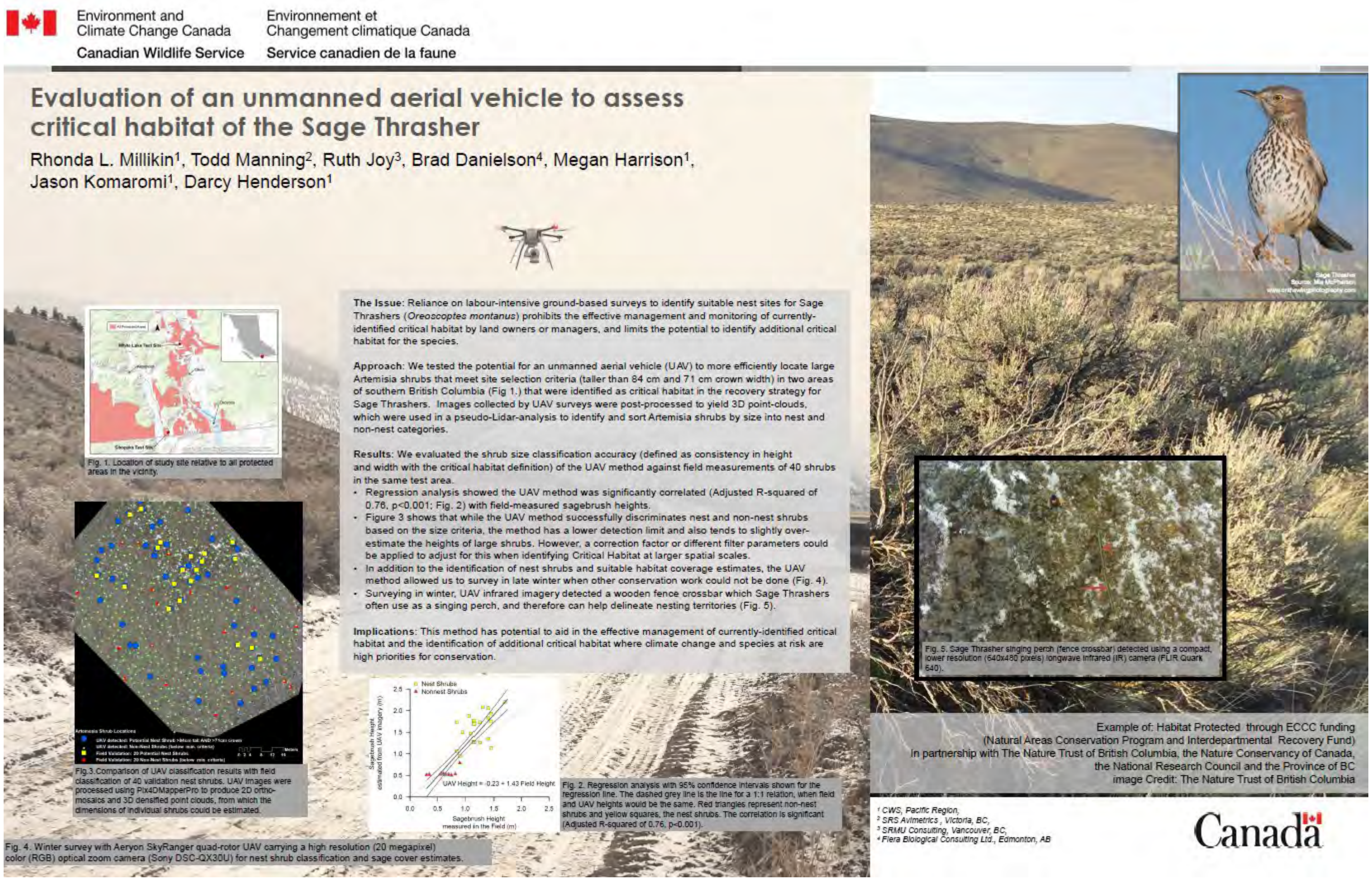
Department of Biology

Tufts University

@KestrelKapers

Mapping Critical Habitat for Sage Thrashers Using Unmanned Aerial Vehicles to Enhance Monitoring and Management

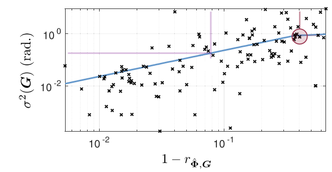
Brad Danielson, Rhonda Millikin et al. (2017)

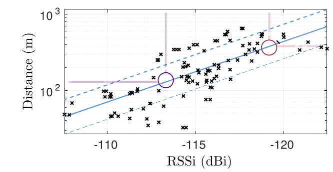


Poster courtesy of Rhonda Millikin

Drones for radiotracking

Drones for radiotracking birds

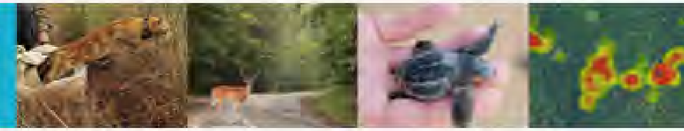




Wildlife Drones

Drones for radiotracking birds

WILDLIFE RESEARCH



Ecology, management and conservation in natural and modified habitats

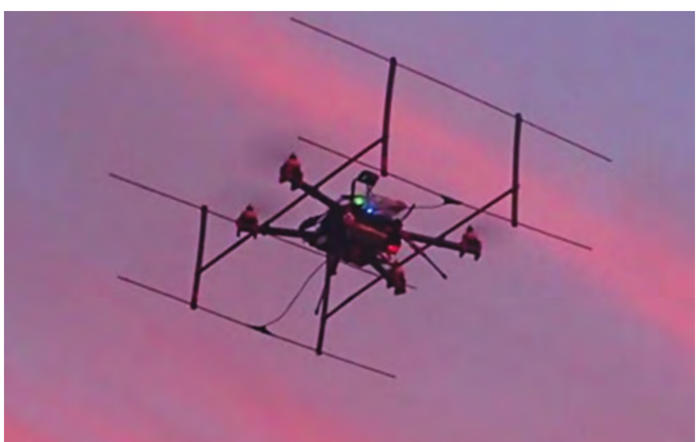
Aerial VHF tracking of wildlife using an unmanned aerial vehicle (UAV): comparing efficiency of yellow-eyed penguin (*Megadyptes antipodes*) nest location methods

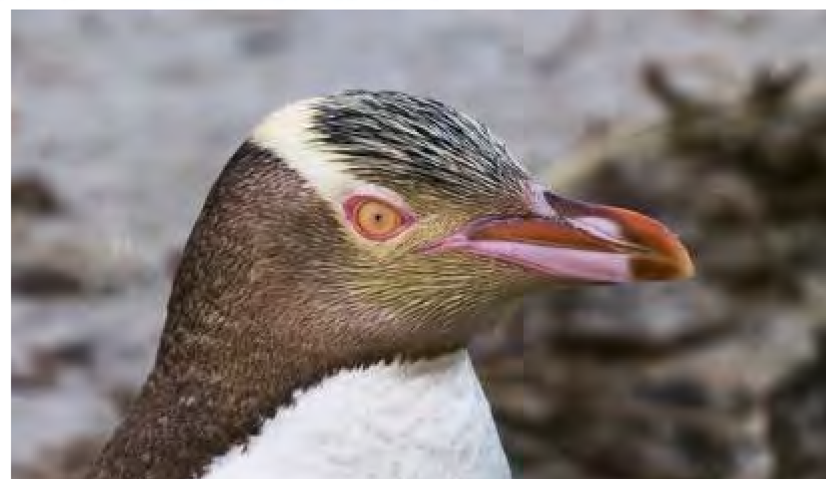
Chris G. Muller [A B D], B. Louise Chilvers [A], Zane Barker [C], Kelvin P. Barnsdale [C], Phil F. Battley [B], Rebecca K. French [B], Josh McCullough [C] and Fred Samandari [C]

+ Author Affiliations

Wildlife Research 46(2) 145-153 https://doi.org/10.1071/WR17147

Submitted: 20 October 2017 Accepted: 26 November 2018 Published: 12 February 2019





Omni-Directional Antenna!!

Micro Tags

MOTUS towers to pick up signals from nanotags placed on Bicknell's thrushes and Swainsons' thrushes

drones MDPI

Article

Estimating bird tag location errors from a VHF receiver mounted on a drone

André Desrochers[1]*, Junior A. Tremblay[2], Yves Aubry[3], Dominique Chabot[4], Paul Pace[5], and David M. Bird[6]

[1] Département des sciences du bois et de la forêt, Université Laval, 2405 rue de la Terrasse, Québec, Qc, G1V 0A6 Canada 1; andre.desrochers@sbf.ulaval.ca

[2] Environment and Climate Change Canada, Science and Technology, 801-1550 avenue d'Estimauville, Québec, QC G1J 0C3, Canada; junior.tremblay@canada.ca

[3] Environment and Climate Change Canada, Canadian Wildlife Service, 801-1550 avenue d'Estimauville, Québec, QC G1J 0C3, Canada; yves.aubry@canada.ca

[4] droneMetrics, 7 Tauvette Street, Ottawa, ON, K1B 3A1, Canada

[5] Defense Research and Development Canada, 3701 Carling Avenue, Ottawa, ON K1A 0Z4, Canada

[6] Avian Science and Conservation Centre of McGill University, c/o 10980 Dunne Road, North Saanich, BC V8L 5J1, Canada.

* Correspondence: e-mail andre.desrochers@sbf.ulaval.ca; Tel.: +1-418-656-2131

Received: date; Accepted: date; Published: date

Using Off-the-Shelf Drones to Track Birds

Affixing a receiver and antenna to pick up VHF signals

No more static interference from the drone engine!!

Designing Drones for Wildlife Radio Telemetry

Dr. Michael Shafer

Associate Prof. Mechanical Engineering

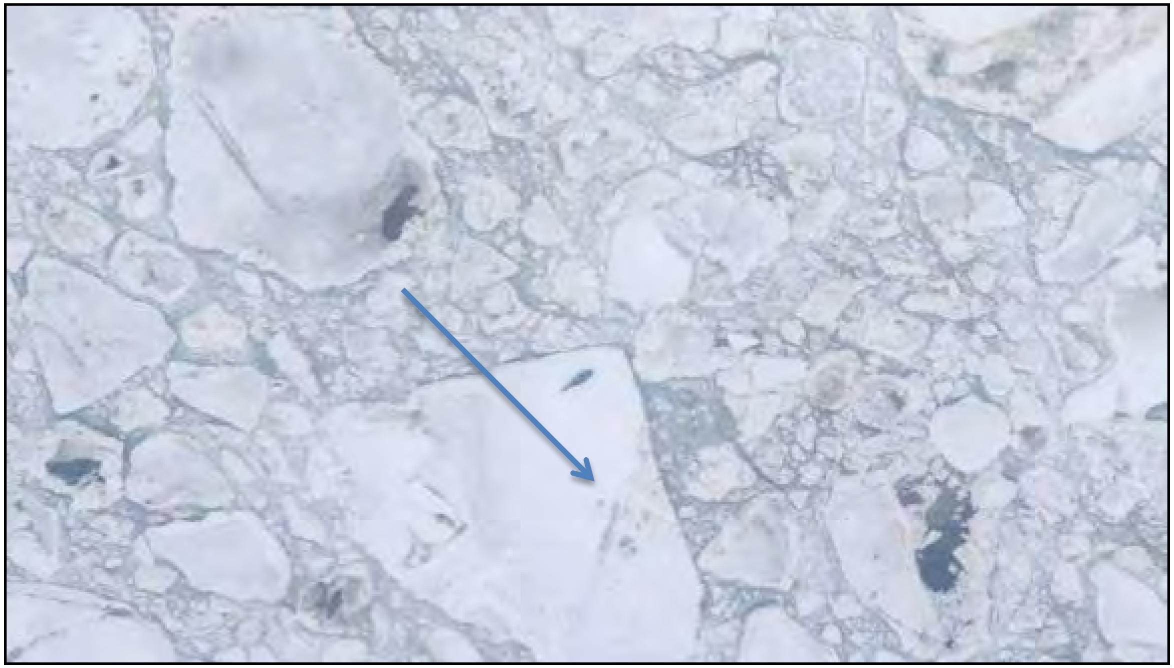
Northern Arizona University


Mammals

Dawn of drone ecology: low-cost autonomous aerial vehicles for conservation

<u>Lian Pin Koh</u> and Serge A. Wich

- Seek to improve wildlife stock assessments mainly in marine mammals and more often in cold environments
- Robyn Angliss and Wayne Perryman



Bill Koski, LGL Ltd
King City, ON

Marine mammal detection

John Durban, NOAA, La Jolla, CA and the
Vancouver Aquarium

Unmanned Aerial Vehicles for surveying humpback whales:

a direct comparison between land-based and UAV sightings

Amanda Hodgson, Natalie Kelly and David Peel

Murdoch University
CETACEAN RESEARCH UNIT

Extensive Core Microbiome in Drone-Captured Whale Blow Supports a Framework for Health Monitoring

Amy Apprill,a Carolyn A. Miller, Michael J. Moore, John W. Durban, Holly Fearnbach, Lance G. Barrett-Lennard

Department of Marine Chemistry and Geochemistry, Woods Hole Oceanographic I nstitution, Woods Hole

First use of BVLOS for a terrestrial civil application in Canada (military airspace)

Goose Bay, Labrador

September 2013

Canada's first BVLOS Flight in Civil Airspace: Moose Aerial Inventory

ING Robotics, Ottawa

Unmanned Systems Canada Conference
November 1-3, 2016

Scott Finucan and **Joe Eder**

Aviation Forest Fire & Emergency Services
Ministry of Natural Resources & Forestry

- detected two moose and two sets of tracks
- use of infrared camera not successful

Elk Population Surveys

Carrizo Plain, California

Raven UAS individual images from the Sony ActionCam (2mp) from 150 ft. AGL

Examining polar bear foraging behaviour in a large common eider seaduck colony

Patrick M. Jagielski[1], Cody J. Dey[1], H. Grant Gilchrist[2], Evan S. Richardson[3], Christina A.D. Semeniuk[1]

1. Great Lakes Institute for Environmental Research, University of Windsor, Windsor, Canada
2. Science and Technology Branch, Environment and Climate Change Canada, Ottawa, Canada
3. Science and Technology Branch, Environment and Climate Change Canada, Winnipeg, Canada

GLIER

University of Windsor

SEMENIUK RESEARCH LAB
Predictive Ecology

Environment and Climate Change Canada

Australia Gears Up for the Great Koala Count, Using Drones, Droppings and Dogs

By Yan Zhuang, New York Times, Dec. 10, 2020

WWF Australia drones to drop seeds for koala gum trees

October 19, 2020 By Reuters Staff

Censusing Prairie Dog Colonies

Elizabeth K. Peterson, Ph.D.

Postdoctoral Researcher

Communities to Build Active STEM Engagement

Colorado State University-Pueblo

Drone type impacts detection rate of bats during acoustic surveys

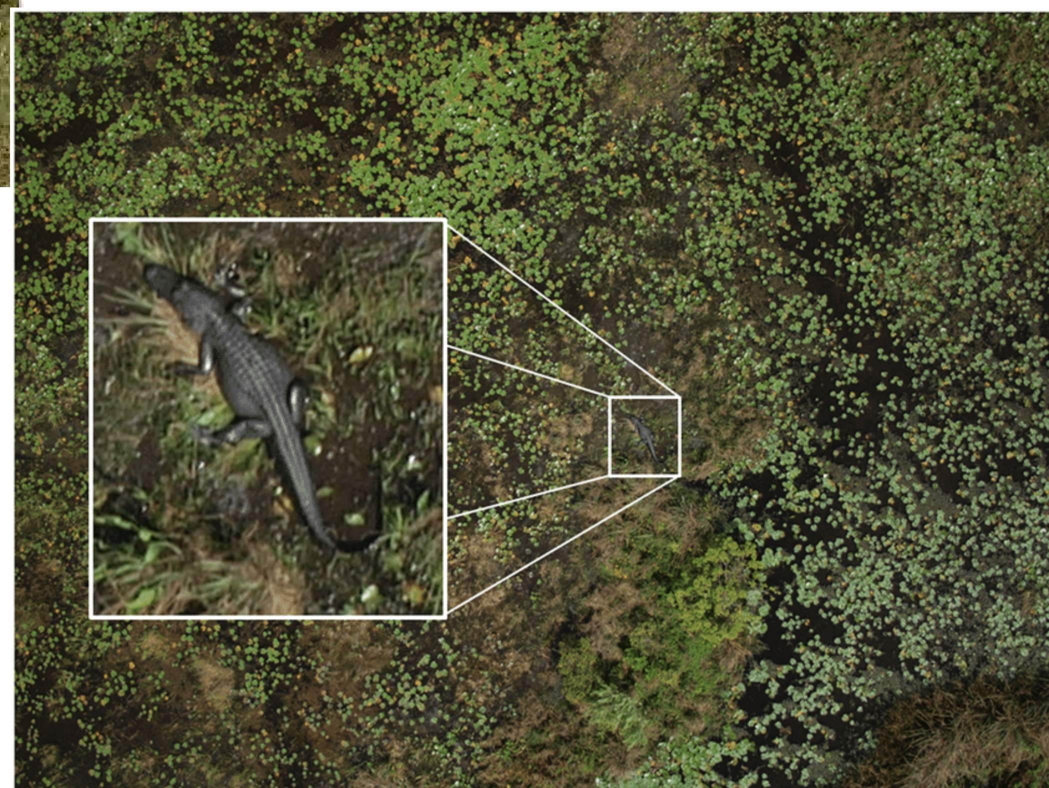
Kayla Nicole Kuhlmann, Amélie Fontaine, Émile Brisson-Curadeau,
David M. Bird, Kyle H. Elliott

McGill University


Herptiles

University of Florida pioneered the use of UAVs for wildlife surveys, including alligators in the Everglades

Designed the first floating fixed-wing UAV



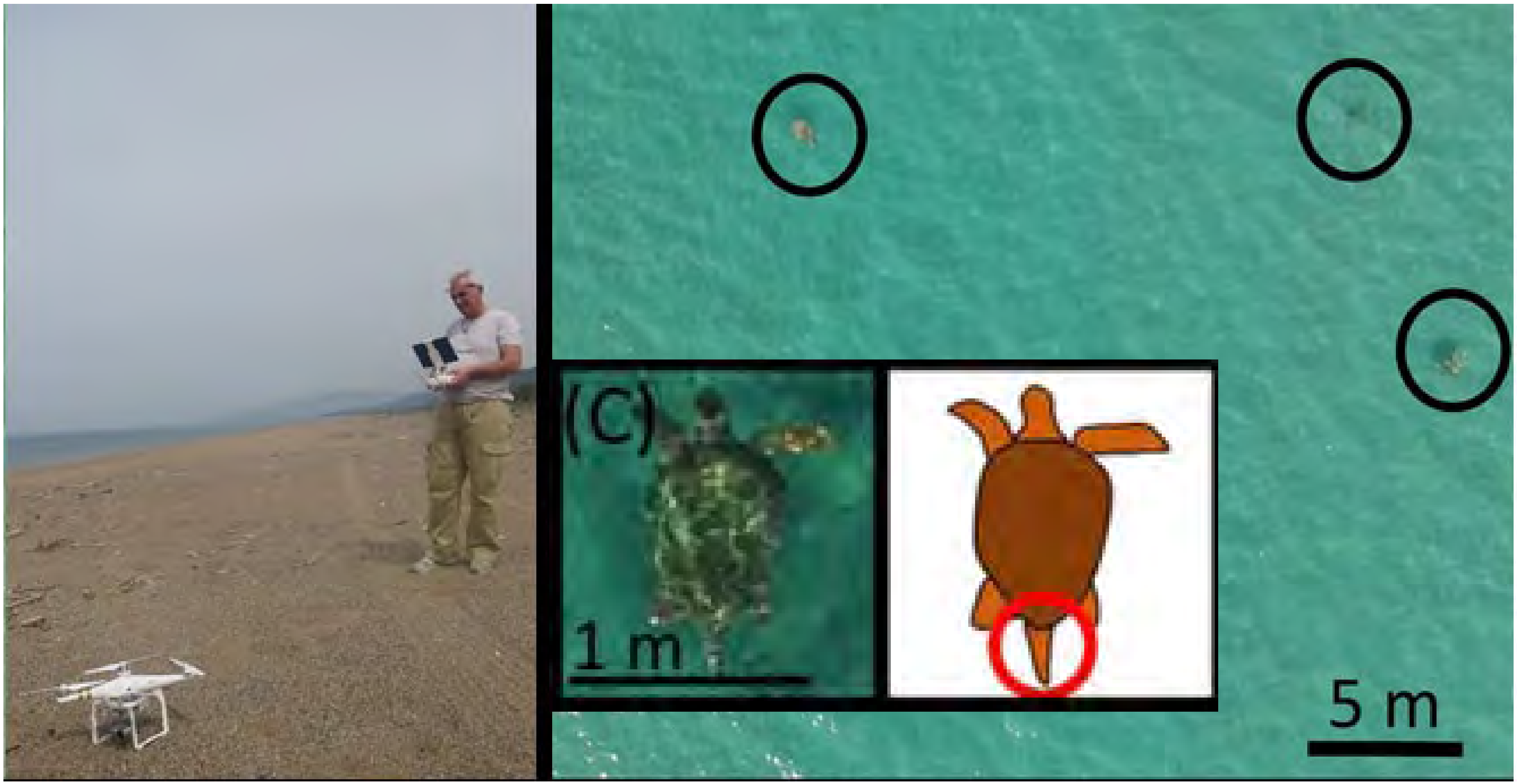
The Use of an Unmanned Aerial Vehicle to Locate Alligator Nests

Ruth M. Elsey, Phillip L. Trosclair

Southeastern Naturalist, March 2016 15(1):76-82

https://doi.org/10.1656/058.015.0106

Gail Schofield et al. Deakin University, Australia
***Functional Ecology* July 24, 2017**



40 pairs of loggerheads detected by boat surveys….320 by drone surveys!


Invertebrates

Application of Pesticides

Controlling Insects

Capturing Flying Insects

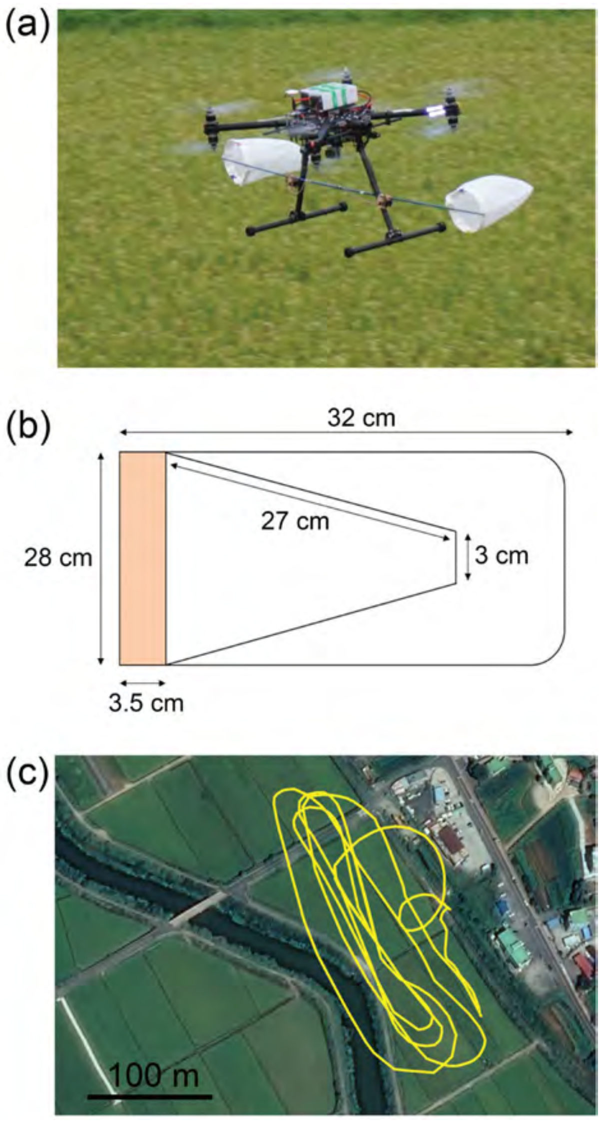
David Bird, Paul Pace and Kyle Elliott
McGill University

Potential of Unmanned Aerial Sampling for Monitoring Insect Populations in Rice Fields

Hong Geun Kim, Jong-Seok Park, and Doo-Hyung Lee

Florida Entomologist 101(2) : 330-334

https://doi.org/10.1653/024.101.0229



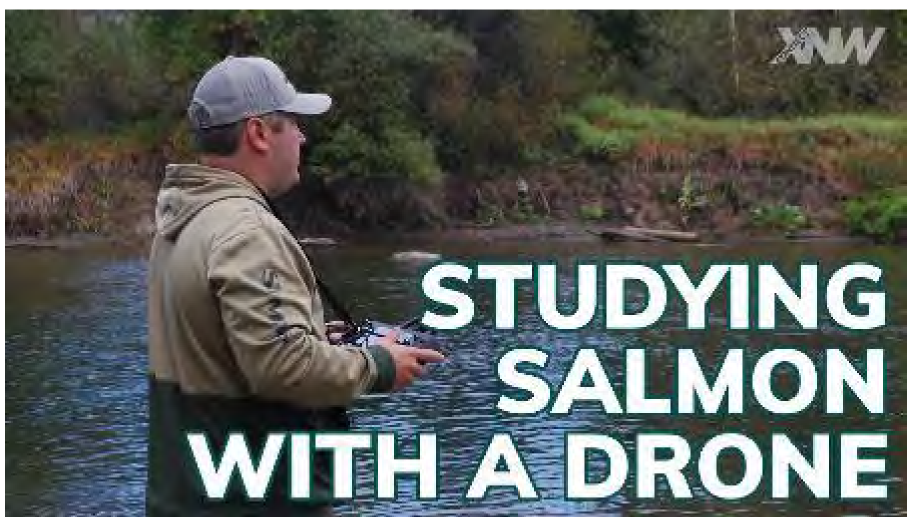

Fish

WDFW USING DRONES TO COUNT SPAWNING SALMON NESTS AND COLLECT DATA ON HABITAT RESTORATION

AUGUST 27, 2020

- Washington Department of Fish and Wildlife and Washington State University partnering to use drone technology to advance conservation efforts for summer chinook salmon in three areas of the Upper Wenatchee River watershed.

- High resolution photos and video taken by the drone will help to identify spawning locations and habitat characteristics.



Controlling Nuisance Wildlife







Scare Tactics Commonly Used





GOOSEBUSTERS

Evaluation of two unmanned aircraft systems as tools for protecting crops from blackbird damage

Lucas J. Wandrie, Page E. Klug, and Mark E. Clark

North Dakota State University, Department of Biological Sciences, Fargo, ND

United States Department of Agriculture, Fargo, ND

Highlights:

Low altitude approaches by rotary-wing UAS elicit avoidance responses in blackbirds

High altitude approaches with fixed-wing UAS do not appear to disturb blackbirds

UAS may provide an effective means for protecting food crops from blackbird damage

https://doi.org/10.1016/j.cropro.2018.11.008

Photo courtesy of Wikipedia Commons

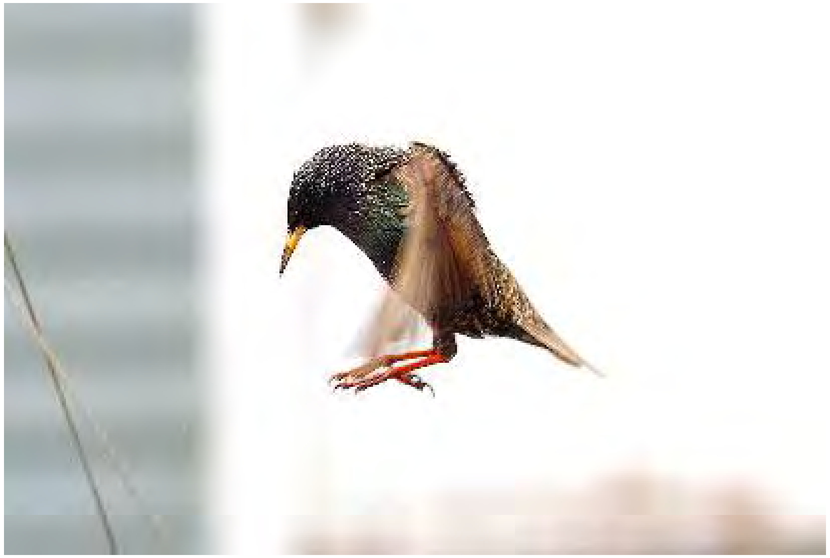


Photo courtesy of Mitch Girard

Photo collage: European Starling by simonglinn via Birdshare; murmuration photo by ad551 via Creative Commons. From AllAboutBirds

Could not find any starlings in the vineyards; went to a feedlot

Pigeons and blackbirds left immediately

Former back in 1 minute; latter in 10 minutes

Had to ‘babysit’ the drone

Photo courtesy of BirdControlGroup

- Shooting pellets that sting
- Emitting high-pitched sounds, alarm calls, raptor calls
- Firing laser beams????

Autonomous systems still require “babysitting” due to BVLOS concerns by the aviation authorities

Development of a bird damage management system for agriculture using UAVs incorporated with bird psychology

Authors:
Zihao Wang
Darren Fahey
Andrew Lucas
Andrea S. Griffin
Gregory Charmitoff
KC Wong

THE UNIVERSITY OF SYDNEY

Solving Habituation Issue with Bird Psychology

Solving the habituation issue using anti-predatory training research

Birds do not recognise the UAV.

Birds recognise risk by observing other birds and their calls.

Birds learn that the UAV is a risk by using stimuli.

Distress call triggers anti-predatory behaviour

Taxidermy bird signals the UAV can kill, which also reinforces learning about predator

Could drones disguised as birds of prey be used to scare birds?

Josh Spires - Aug. 12th 2020 8:25 am ET @drone_nr

The Robird®

The Technology

Manufacturer: AERIUM Analytics
Model: Female Peregrine Falcon
Propulsion: Flapping-Wing
Take Off Weight: 800 grams
Maximum Flight Time: 12 minutes
Maximum Air Speed: 20 m/s or 38 kts

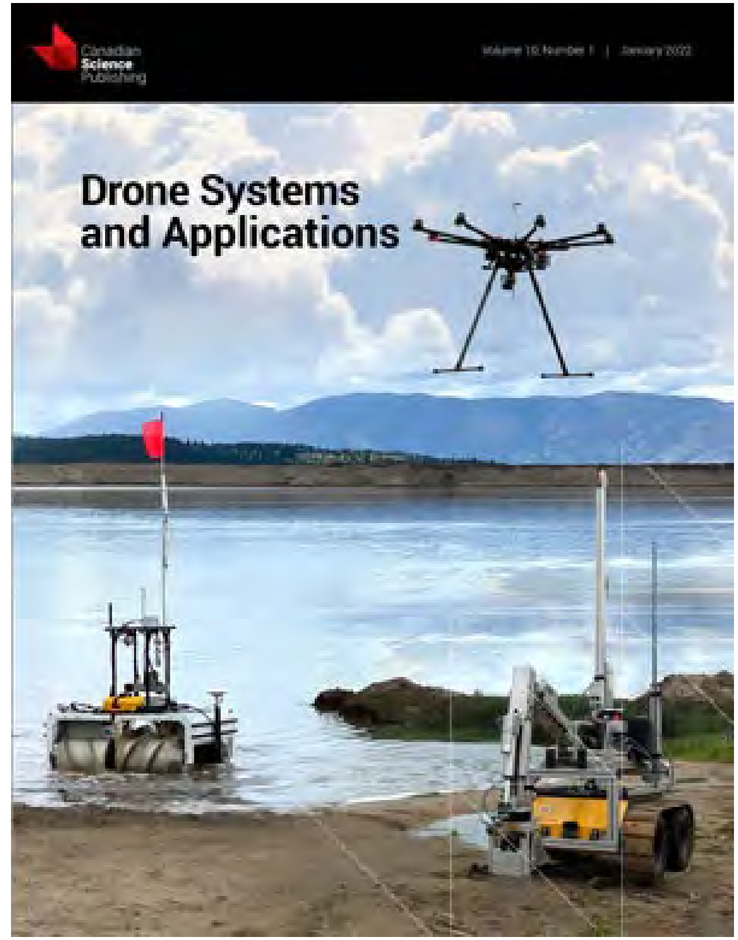
Applications

Mining: Deter birds from landing on tailing ponds
Airports: Preventing airplane bird strikes
Energy: Enabling pipeline construction

Robird is utilized with supporting tools such as pyrotechnics and bird calls

The RoFalcon

- Formerly the ***Journal of Unmanned Vehicle Systems***
- **Produced by Canada's leading not-for-profit publisher, Canadian Science Publishing**



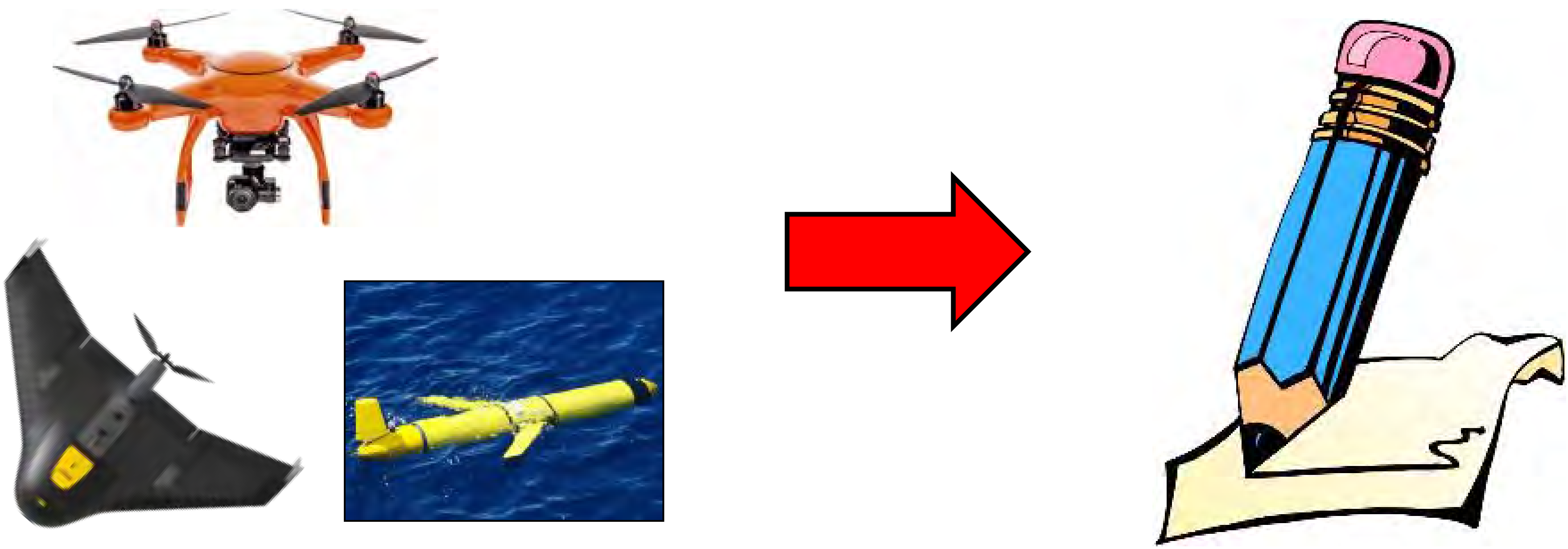
- ***Editor-in-Chief:***
  - ***Dominique Chabot,***
  - ***droneMetrics, Canada***

Visit the journal homepage:
www.cdnsciencepub.com/dsa

A Standardized Protocol for Reporting Methods When Using Drones for Wildlife Research

Andrew Barnas, Dominique Chabot, Amanda Hodgson, David Johnston, David Bird, Susan Ellis-Felege

Journal of Unmanned Vehicle Systems (Now Drone Systems and Applications)



Drone/UAS Database for Wildlife Research, Management, and Conservation

Compiled by the TWS Drone Working Group

Chair: BJ Quinton
Senior Biologist
Environmental Science Associates
4200 West Cypress Street, Suite 450
Tampa, FL 33607
BQuinton@esassoc.com

Thank you!!

A special thanks to Paul Pace, Erick Greene, Dan Zazelenchuk, Junior Tremblay, Andre Desrochers, Tom Franklin, Kyle Elliott, David Fifield, Emile Brisson-Curadeau, Tom Franklin, and especially to my former graduate students, i.e. Dominique Chabot, James Junda and Charla Patterson……

Partners & Sponsors:

McGill

The University of Montana

MicroPilot®

draganfly innovations inc

International Osprey Foundation

Kenneth M Molson Foundation

Animal Welfare Institute

Fédération canadienne de la faune / Canadian Wildlife Federation

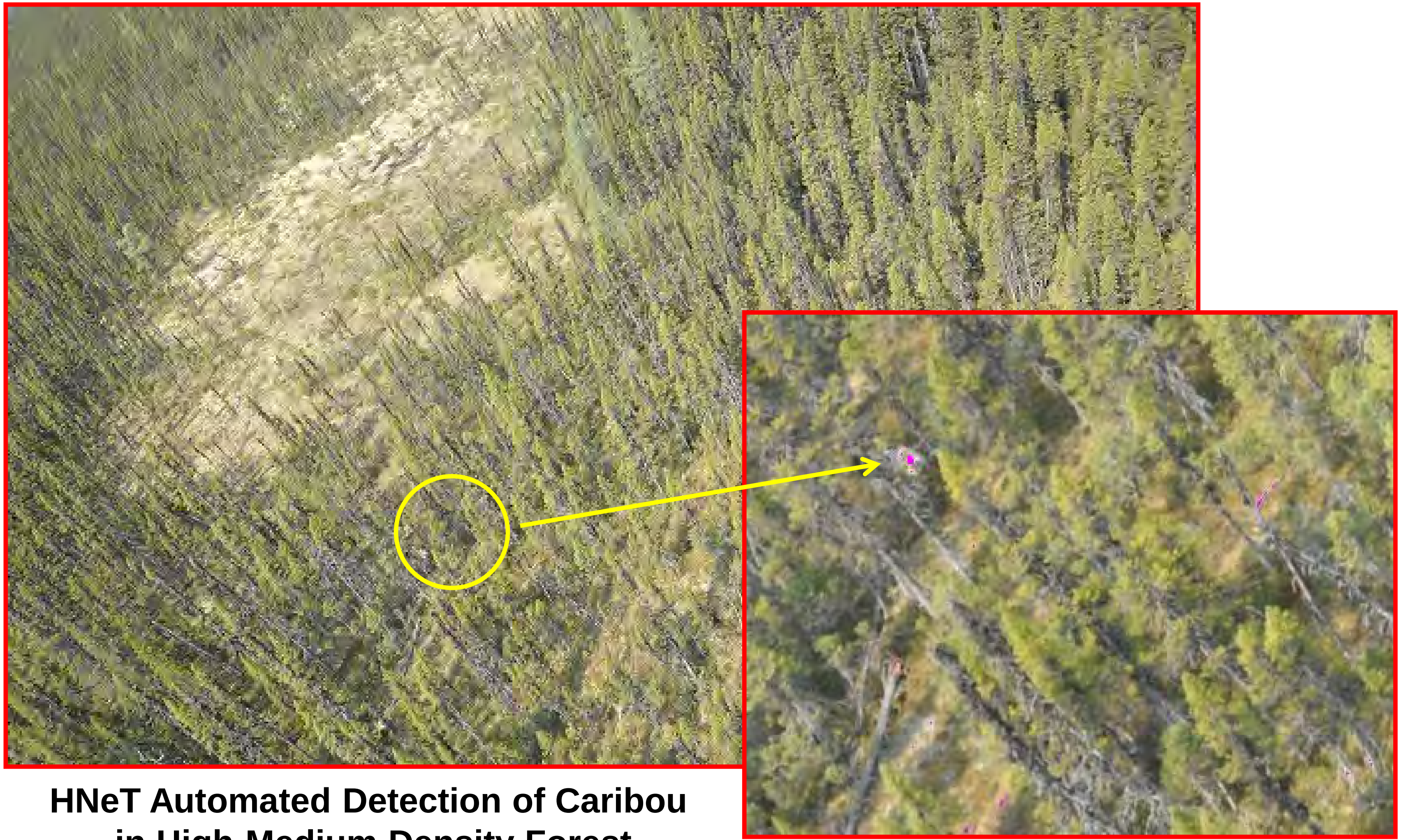
Canadian Wildlife Service / Service canadien de la faune

IEMR

Bird Protection Quebec / Protection des oiseaux du Québec

david.bird@mcgill.ca

Detectability/Imagery



HNeT Automated Detection of Caribou in High-Medium Density Forest

Issues, cont'd…

- Detectability depends on multiple factors related to both UAV and animals themselves
- Some animals visible in photographic imagery, others difficult to perceive or concealed, even with thermal imagery
- A really 'big' problem: data overload: 1000s of images to wade through!!!

Fake duck test by Jarrod Hodgson of the University of Adelaide shows drones and a machine learning system (AI) significantly more accurate than those made by humans on the ground….

-- *New Scientist*, July 24 2017

Fears over protected wildlife disturbed by drones

By Kevin Keane

BBC Scotland's environment correspondent

Published
31 August 2018

Police and wildlife experts are becoming "increasingly concerned" at the number of cases of protected wildlife being disturbed by drones.

Drones are being flown dangerously close to breeding birds and animals at sites in Scotland.

Seals have reportedly been chased into the sea at protected haul-out sites, which risks their pups being crushed.

Concerns are also being raised about nesting birds becoming panicked and plummeting off cliffs into the sea.

Controlling ``Nuisance`` Drone Operators

Unintentional disturbance by non-wildlife professional users

One drone-flying tourist banned from Kakadu National Park in South Africa for life!!

Eagles trained to take down drones

The BBC has been given access to the airbase where Dutch police are training eagles to take down unauthorised drones.

08 Mar Europe Share

It Takes a Drone to Catch a Drone!

Current Biology
Report

Bears Show a Physiological but Limited Behavioral Response to Unmanned Aerial Vehicles

Mark A. Ditmer,[1,*] John B. Vincent,[2] Leland K. Werden,[3] Jessie C. Tanner,[3] Timothy G. Laske,[4,5] Paul A. Iaizzo,[5] David L. Garshelis,[6] and John R. Fieberg[1]
[1]Department of Fisheries, Wildlife & Conservation Biology, University of Minnesota, St. Paul, MN 55108, USA
[2]Plant Biological Sciences Graduate Program, University of Minnesota, St. Paul, MN 55108, USA
[3]Department of Ecology, Evolution, and Behavior, University of Minnesota, St. Paul, MN 55108, USA
[4]Atrial Fibrillation Solutions, Medtronic plc, Mounds View, MN 55112, USA
[5]Department of Surgery, University of Minnesota, Minneapolis, MN 55455, USA
[6]Minnesota Department of Natural Resources, Grand Rapids, MN 55744, USA
*Correspondence: mark.ditmer@gmail.com
http://dx.doi.org/10.1016/j.cub.2015.07.024

SUMMARY

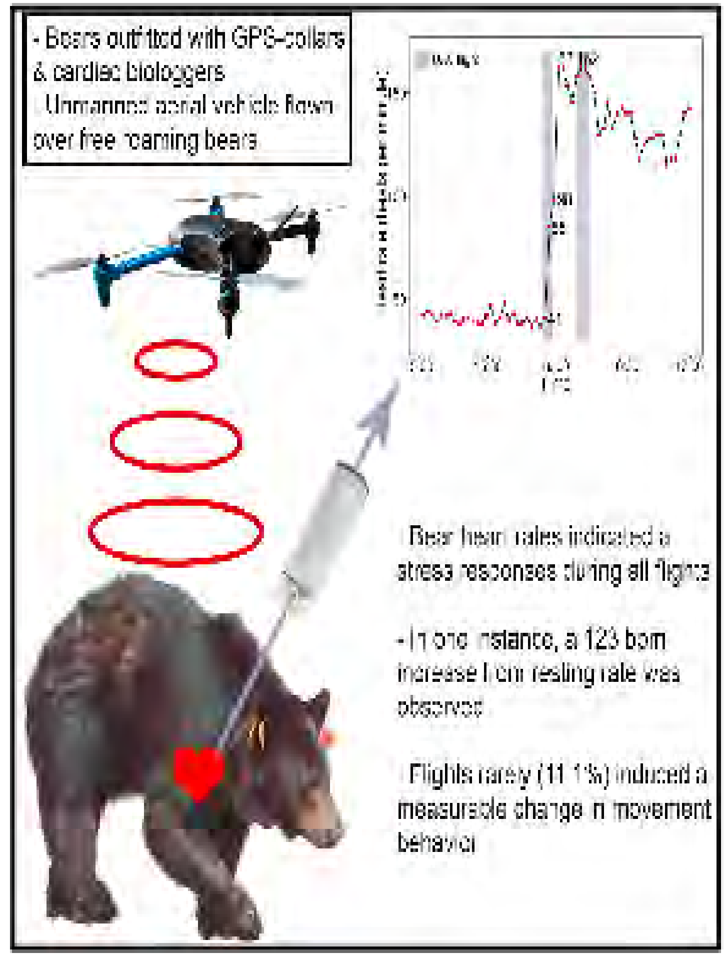
Unmanned aerial vehicles (UAVs) have the potential to revolutionize the way research is conducted in many scientific fields [1, 2]. UAVs can access remote or difficult terrain [3], collect large amounts of data for lower cost than traditional aerial methods, and facilitate observations of species that are wary of human presence [4]. Currently, despite large regulatory hurdles [5], UAVs are being deployed by researchers and conservationists to monitor threats to biodiversity [6], collect frequent aerial imagery [7–9], estimate population abundance [4, 10], and deter poaching [11]. Studies have examined the behavioral responses of wildlife to aircraft [12–20] (including UAVs [21]), but with the widespread increase in UAV flights, it is critical to understand whether UAVs act as stressors to wildlife and to quantify that impact. Biologger technology allows for the remote monitoring of stress responses in free-roaming individuals [22], and when linked to locational information, it can be used to determine events [19, 23, 24] or components of an animal's environment [25] that elicit a physiological response not apparent based on behavior alone. We assessed effects of UAV flights on movements and heart rate responses of free-roaming American black bears. We observed consistently strong physiological responses but infrequent behavioral changes. All bears, including an individual denned for hibernation, responded to UAV flights with elevated heart rates, rising as much as 123 beats per minute above the pre-flight baseline. It is important to consider the additional stress on wildlife from UAV flights when developing regulations and best scientific practices.

RESULTS

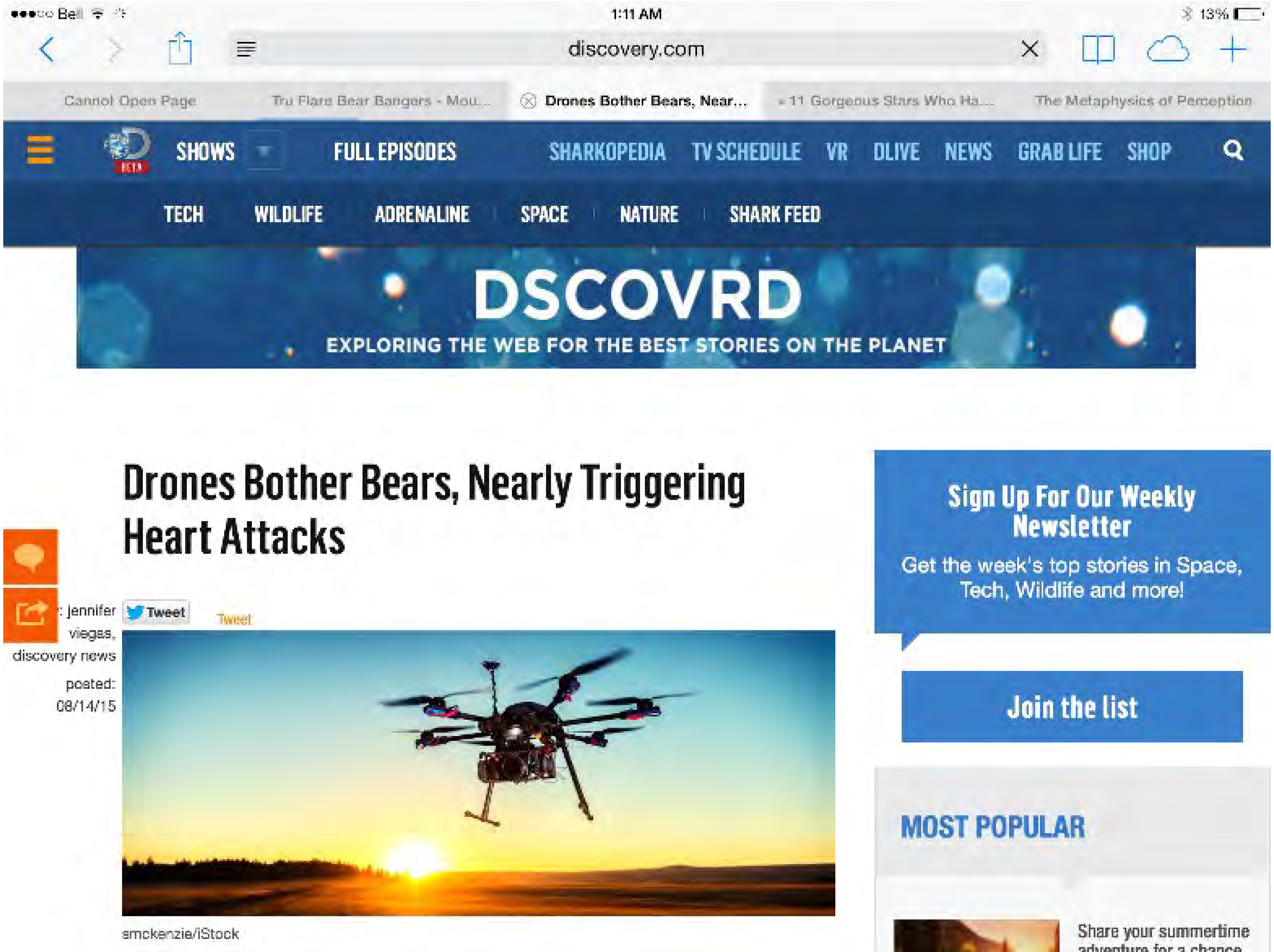
We investigated the influence of unmanned aerial vehicle (UAV) flights on the behavior and physiology of free-roaming American black bears (*Ursus americanus*) in northwestern Minnesota by capturing their location and movement with Iridium satellite GPS collars and heart rate (HR) in beats per minute (bpm) using cardiac biologgers developed for human use (Medtronic, Reveal XT Model 9529). Both GPS collars and biologgers recorded values at 2-min intervals, so it was possible to discern how individual bears responded, at fine temporal and spatial scales, to short-duration UAV flights. We flew a small quadcopter UAV (3D Robotics) using a fully autonomous mission plan that loitered and circled approximately 20 m over the location of the bear (pre-programmed just before takeoff) during the course of a 5-min flight. We hypothesized that bears would respond to the UAV in one of four ways: (1) no discernable behavioral or physiological response, (2) behavioral response only (i.e., increased movement rates and/or moving away from the area of the UAV), (3) no behavioral response, but a physiological response (measurable increase in HR), and (4) both a behavioral response and physiological response.

We conducted 18 UAV flights above or near four bears from September 21, 2014 to October 12, 2014. For 17 of these flights, we were able to collect associated HR and location data (Figure 1; Movie S1). Nine flights were conducted over two adult female bears with cubs (eight over one and one over the other), three flights were conducted over a 1-year-old male bear, and six flights were conducted over an adult female bear that entered a den for winter hibernation 2 days prior to the first UAV flight. Flight times averaged 5 min 3 s (SE = 16.7 s). Absolute altitude (height above ground) was influenced by vegetation and averaged 21.0 m per flight (SE = 1.45) including takeoff and landing. The minimum distance between the UAV and the target bear averaged 43 m (SE = 5.67). On average, the UAV was launched 215 m (range: 184–245) from the targeted location of the bear.

Bears responded to UAV flights with elevated HRs in all 17 flights with corresponding HR data (Figure S1). We calculated the "maximum HR anomaly" for bears by comparing the observed differences between maximum bear HRs and predicted values during UAV flights (see Figure 2A for brief description or Experimental Procedures for full description). The maximum HR anomalies associated with UAV flight times were significantly higher than the maximum HR anomalies during days without flights (Figure 2B). Maximum HR anomalies were the largest for the female with cubs, followed by the hibernating adult female, and finally the young male (Figure 2C). The



Headlines We Do Not Need!



Approaching birds with drones: first experiments and ethical guidelines

Elisabeth Vas, Amélie Lescroël,
Olivier Duriez, Guillaume Boguszewski
and David Grémillet

Animal Behaviour
February 1 2015

https://doi.org/10.1098/rsbl.2014.0754

SCIENTIFIC REPORTS

Seabird species vary in behavioural response to drone census

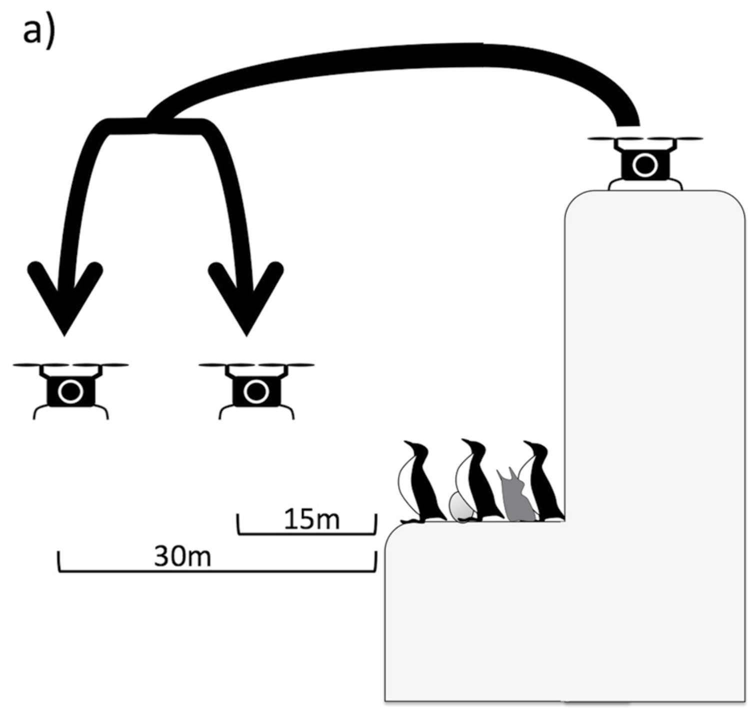
2017

Émile Brisson-Curadeau, David Bird, Chantelle Burke, David A. Fifield, Paul Pace, Richard B. Sherley & Kyle H. Elliott

Rotary-wing drone

Counts depending on the time of day

Less variability with drones



RESEARCH ARTICLE

Unmanned aircraft systems as a new source of disturbance for wildlife: A systematic review

Margarita Mulero-Pázmány, Susanne Jenni-Eiermann, Nicolas Strebel, Thomas Sattler, Juan José Negro, Zulima Tablado

Published: June 21, 2017 • https://doi.org/10.1371/journal.pone.0178448

Abstract

The use of small Unmanned Aircraft Systems (UAS; also known as "drones") for professional and personal-leisure use is increasing enormously. UAS operate at low altitudes (<500 m) and in any terrain, thus they are susceptible to interact with local fauna, generating a new type of anthropogenic disturbance that has not been systematically evaluated. To address this gap, we performed a review of the existent literature about animals' responses to UAS flights and