



**NOAA
FISHERIES**

Northeast
Fisheries Science
Center, Protected
Species Branch

A Comparison of Manned and Unmanned Aircrafts for Surveying Wildlife Populations: A Case Study of the Gray Seal Population on Muskeget Island

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With contributions from D.W. Johnston, J. Dale, E.
Newton, and S. Wood



UAS Applications for Pinniped Ecology and Assessment

- Trends in abundance
- Distributional changes
- Adverse impacts
- Metapopulation insights
- Morphometrics
- Molt stage
- Contact structure
- Mortality rates

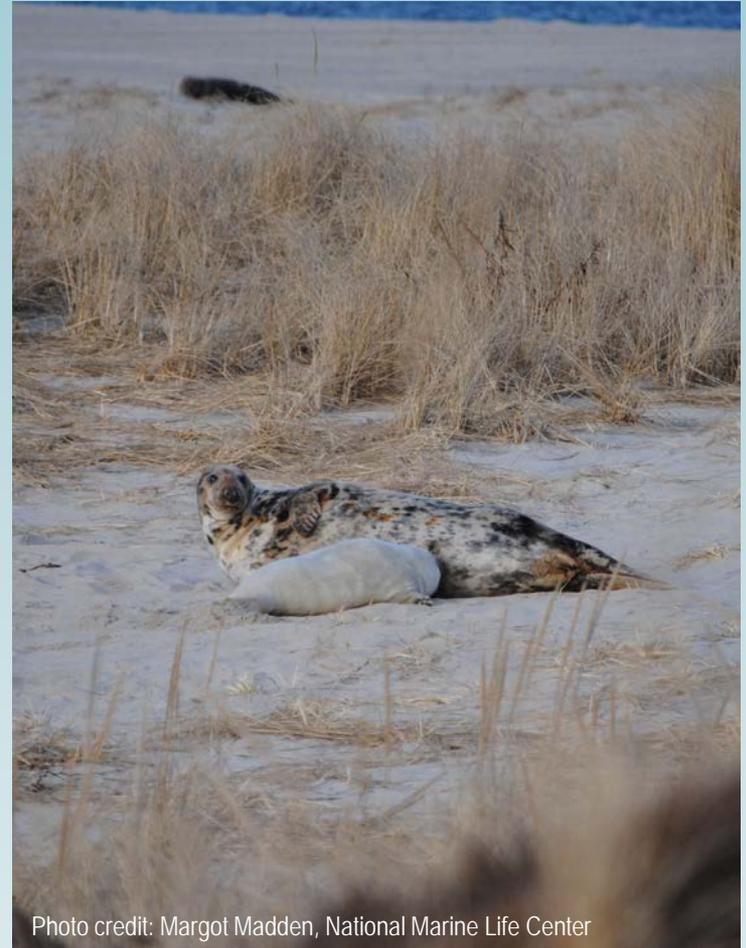


Photo credit: Margot Madden, National Marine Life Center

Drones for Wildlife Research – lots of Public Interest!

NATION & WORLD

Posted February 5 | Updated February 5

SECTIONS

Portland Press Herald

Scientists use drones to count seals in giant colony off Nantucket

The rising number of seals has generated complaints from charter fishing boat operators and some beachgoers, creating a need for new data.

BY PATRICK WHITTLE THE ASSOCIATED PRESS

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'Hexacopter' boon to seal pup count off Nantucket

Sunday

Posted Feb 7, 2016 at 2:00 AM

Updated Feb 7, 2016 at 7:00 AM



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Last month, National Oceanic and Atmospheric Administration researchers used the AP-22 Marine Hexacopter on Nantucket hoping it could help answer one of the region's frequently asked and daunting questions: How many seals call Cape and Islands their home.

By Doug Fraser

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CAPE COD TIMES

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AIR U.S. EXCLUSIVE

UAS Used to Study Gray Seal Pup Populations

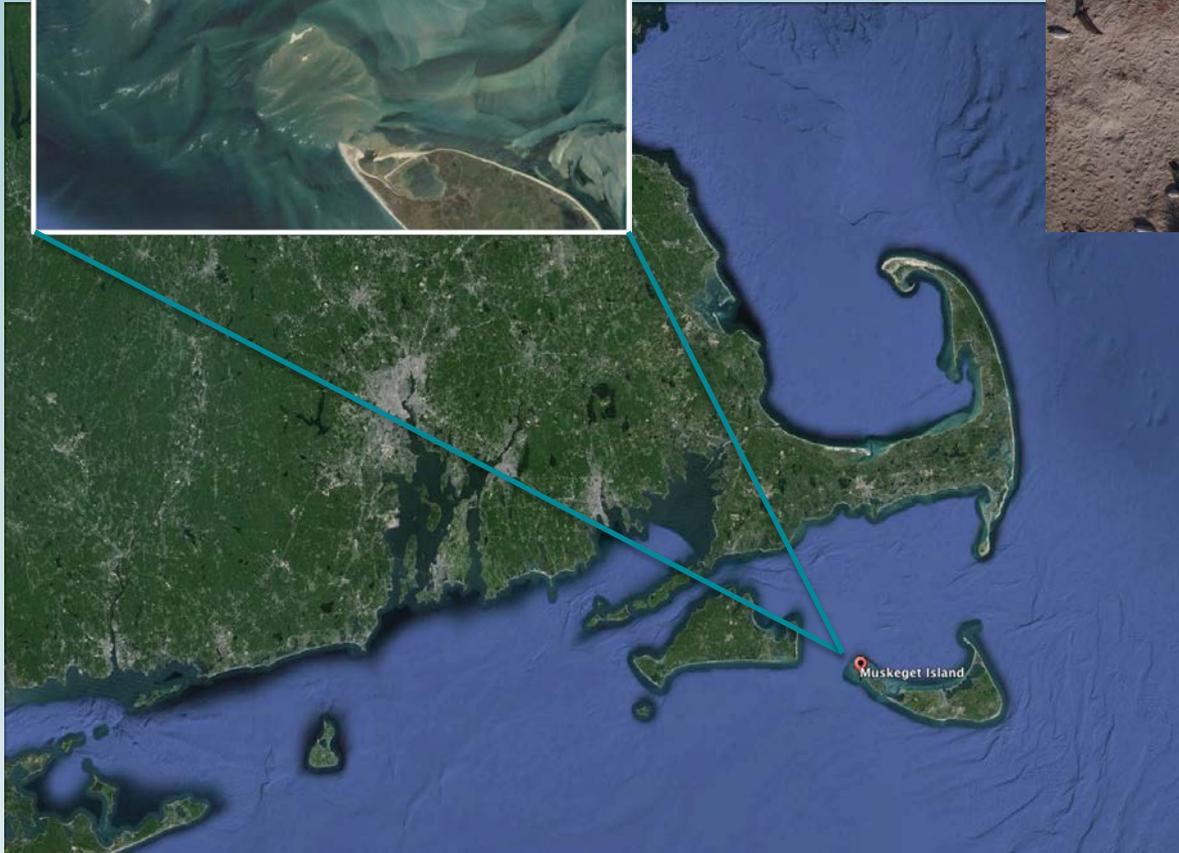
BY RENEE KNIGHT

Gray Seal (*Halichoerus grypus*)



- Total size of Western North Atlantic stock unknown
- Over 500,000 animals in Canada, spillover to US
- U.S. population appears to be increasing
- Pupping and year-round residency in U.S.

Muskeget Island Pup Survey, 2016



Manned/Unmanned Platform Comparisons

sensefly eBee

- Canon s110 RGB camera
- sensefly thermomap infrared camera
- Flights flown at 60m altitude
- 2.3cm ground sampling distance (RGB); 7cm GSD(IR)



Manned/Unmanned Platform Comparisons

de Havilland Twin Otter

- Belly-mount camera system
- 3 Canon Mark III 5D, Zeiss 85mm lenses
- Flights flown at 229m
- ~1cm ground sampling distance



Manned/Unmanned Platform Comparisons

APH-22

- Olympus E-PM2 camera
- Flights flown at 30-100m experimental
- 0.5 – 1.4cm ground sampling distance

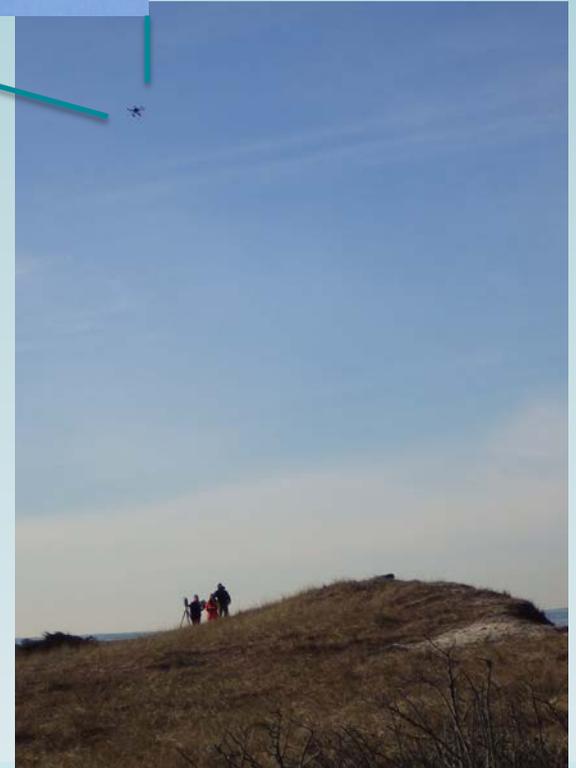


Image Evaluation

APH-22



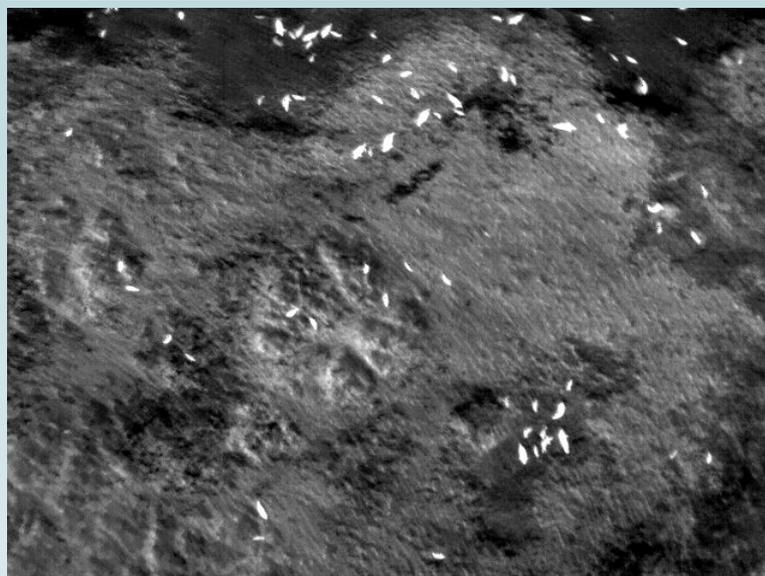
eBee –
RGB



Twin
Otter



eBee –
IR



Imaging Processing



eBee

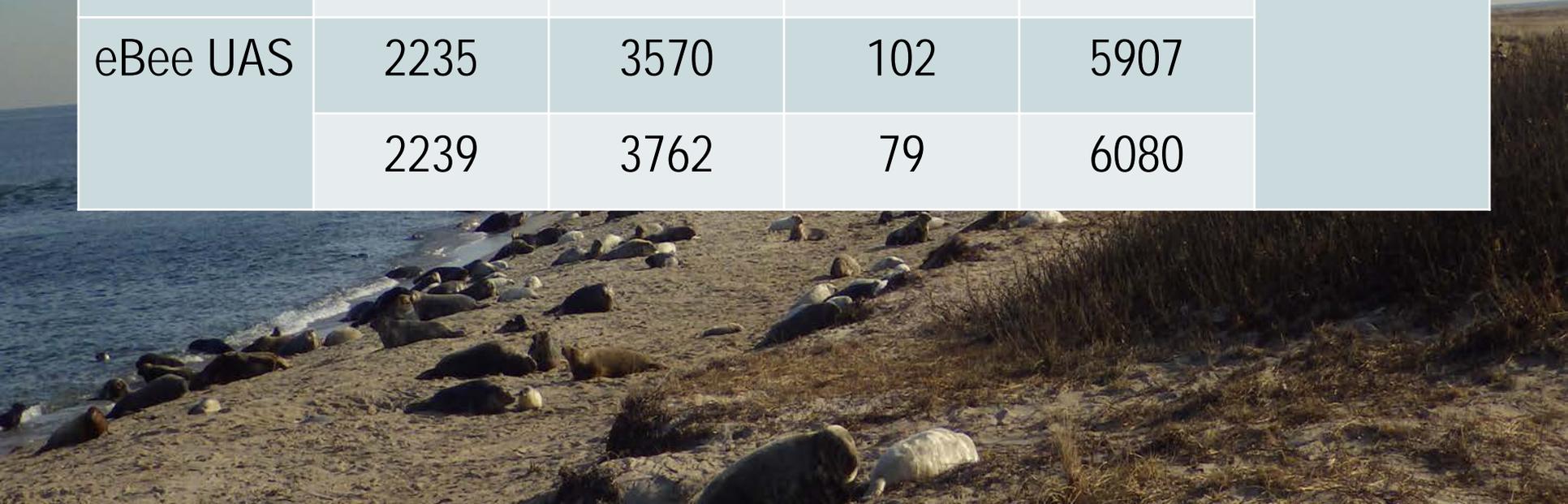
- Pix4D Mapper Pro  Orthomosaics
- Orthomosaic gridded in sections and counted via iTag

Twin Otter

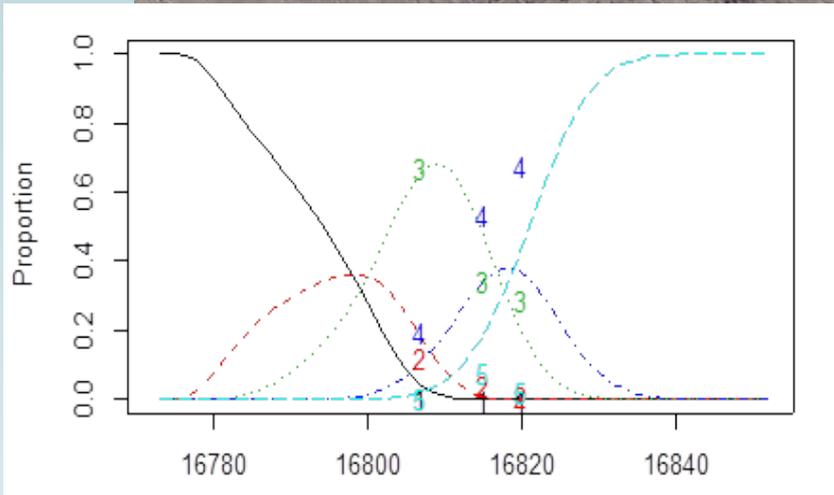
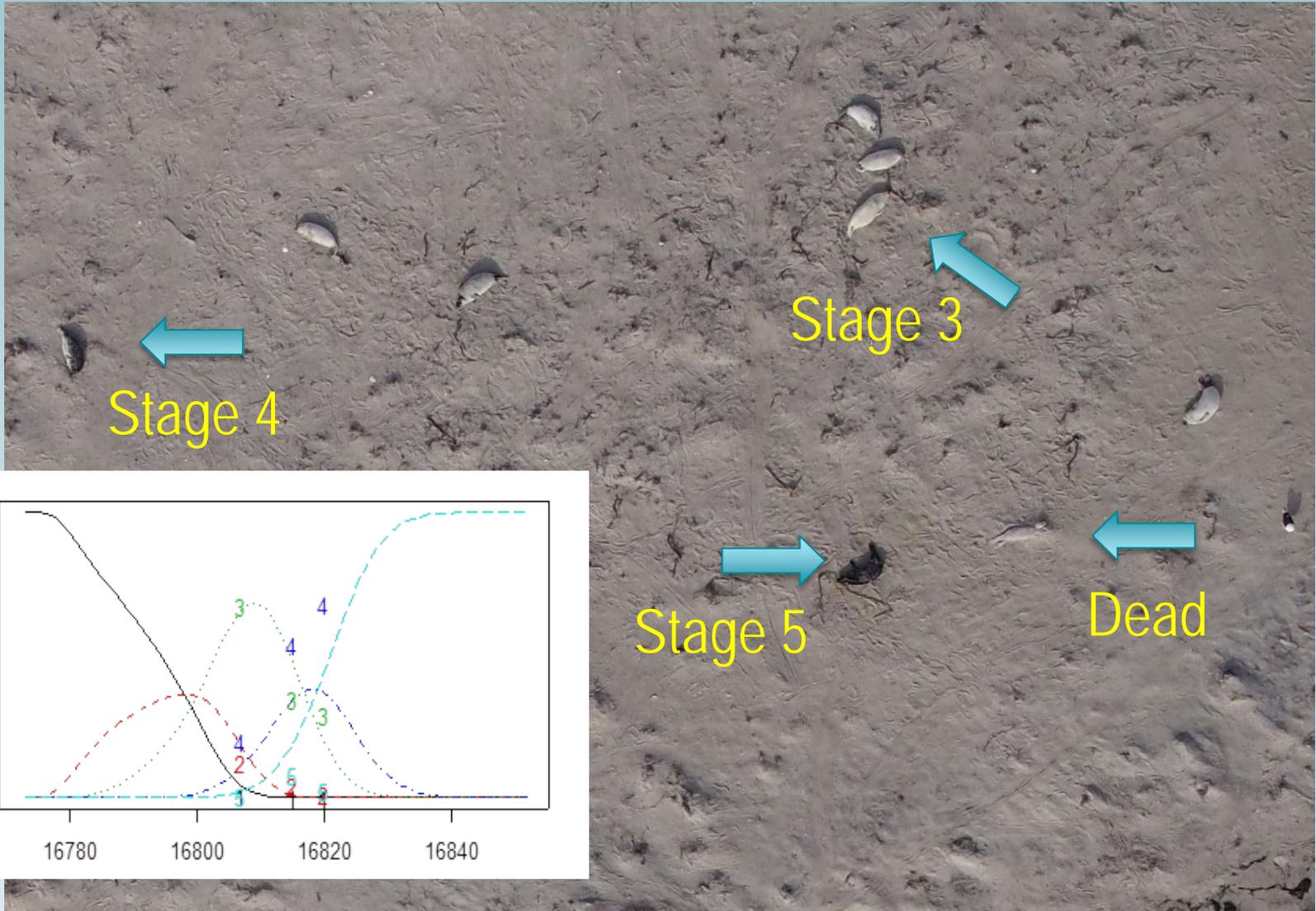
- Images stitched with Microsoft ICE  Composites
- Counted in Adobe Photoshop

Seal Counts

Platform	Adults	Pups	Dead	Total	% Mean Diff (Total)
Twin Otter	2342	3788	47	6117	0.02%
	2160	3821	67	6048	
eBee UAS	2235	3570	102	5907	
	2239	3762	79	6080	



Identifying Pup Molt Stage



Quantifying Entanglements



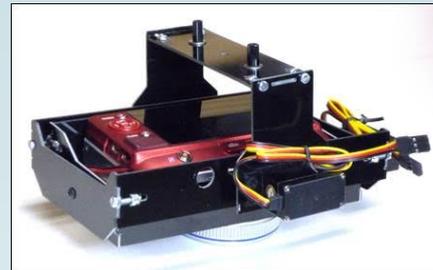
- Increases information about level of human-caused serious injury for stock assessments
- Increases surveillance for on-the-ground disentanglement response

2017 Research Plans



- To field test advancements to the APH-22 for surveying gray seal density and population characteristics:

- Camera gimbal
- Laser altimeter (SF11/C)
- Infra-red camera (FLIR Tau 324)



Thank you!

NOAA UAS
Office and
AOC:

Robbie Hood, Phil Kenul, Michael Marino,
Matthew Nardi



eMotion 2

Google Satellite

WARNING START MISSION RESUME MISSION GO TO START WPT GO TO HOME WPT GO LAND HOLD POSITION LAND NOW Click 3x ABORT LANDING

EB-01-000

41.3412297°N 70.2992737°W 0 m/AMSL (-30 m/WGS84)

Drone status
Idle
Ready to take off

Autonomy
Battery voltage: 99% (12.6 V) Time in flight: 10:10
Home distance: 2 m (---) Estimated wind: 0.0 m/s
Link quality: 100 %

Flight data
Ground speed: 0.0 m/s
Altitude: -2.0 m/AMSL, -32.3 m/WGS84
Ground sensor height: 0.0 m
Position: N 41.3361193°, W 70.2965584°

Instruments
AIRSPD m/s: 0.0
ALTITUDE m/ATO: 1.0

Identification
Name: Simulator (EB-01-000)
Drone Flight Log: 1

Camera information
Camera type: S110 RGB
Camera state: Standby

Simulator
Wind: 1.2 m/s 128°