Advancements in APH-22 Technology with Applications to Protected Species

Kimberly Murray, Michael Jech,
Jennifer Johnson, Elizabeth Josephson

NOAA Fisheries, NEFSC

9 March 2017

UAS Can Help Meet NEFSC Goals

❖ To improve the quality, efficiency, and responsiveness of stock assessments

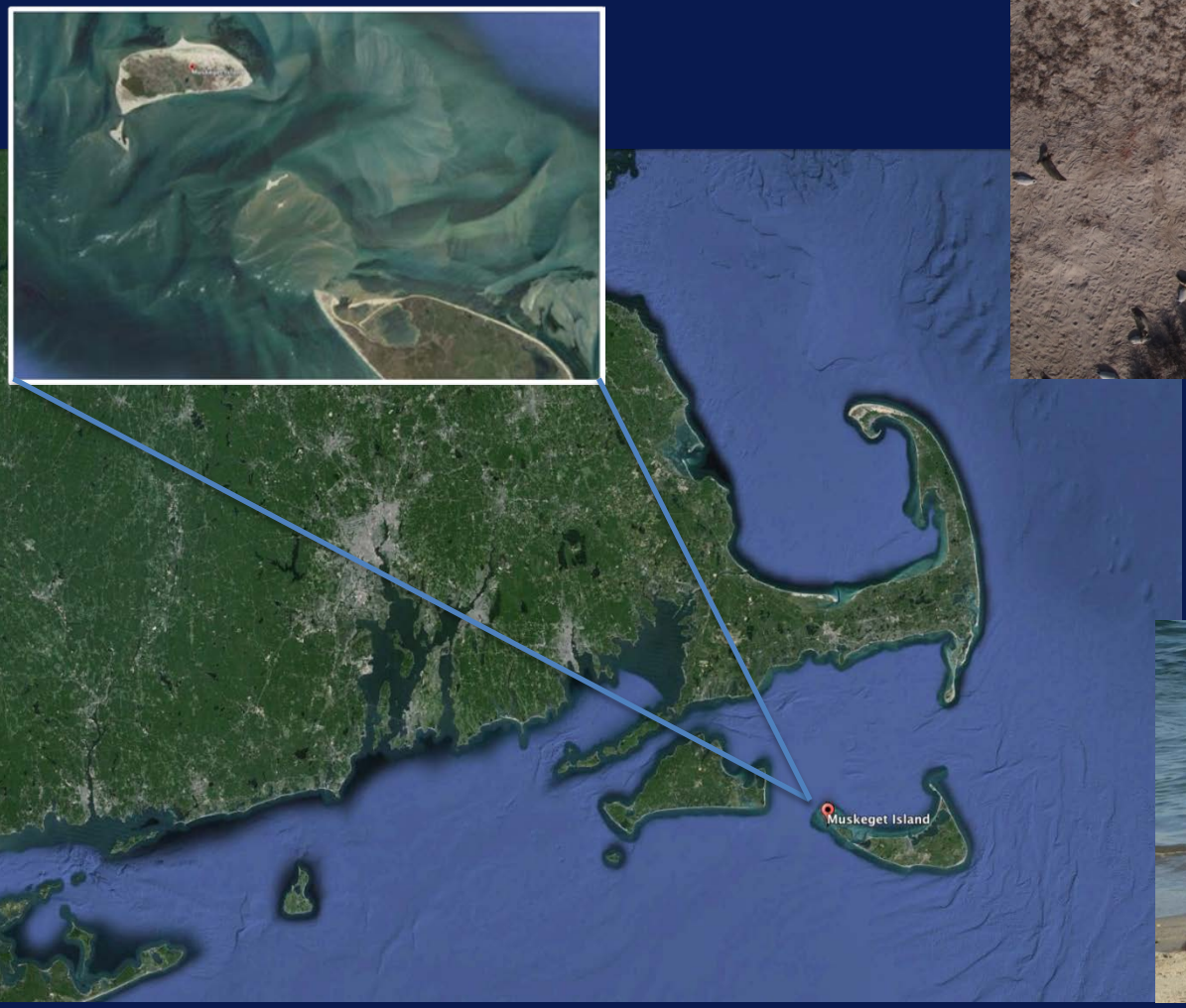
❖ To collect species abundance and distribution data to help identify emerging threats, and assess how they affect distribution, behavior, and species interactions

Approaches to Wildlife Surveys

- Traditional Twin Otter surveys are expensive, infrequent

- UAS surveys less expensive, more frequent, multi-purpose

Gray Seals in the U.S. Northwest Atlantic



Muskeget Gray Seal Pup Counts 2001 – 2016 (single day counts)

Advancing UAS to Meet NEFSC Goals

2016

- Seals surveyed on Muskeget Island with a NOAA Twin Otter, fixed-wing eBee, and rotary-wing APH-22
- eBee counts comparable to those from a Twin Otter
- APH-22 imagery superior
- APH-22 was best tool for surveying seal characteristics

2017

- Continue UAS research on Muskeget Island thanks to NOAA UAS Program Office grant
- Goal is to use the APH-22 for surveying AND characterizing the population
- Test enhanced platform and flight modes

APH-22 (aerialimagingsolutions.com)

- Vertical take-off and landing (VTOL) UAS
- 4.5 lbs, 32” wingspan
- Powered by 4-cell Lithium Polymer battery
- Sensors:
  - E-PM2 Olympus camera in gimbal
  - Laser Altimeter (SF11/C)
  - Infra-red camera (FLIR Tau 324)

Technology Readiness Level (TRL) Advancement

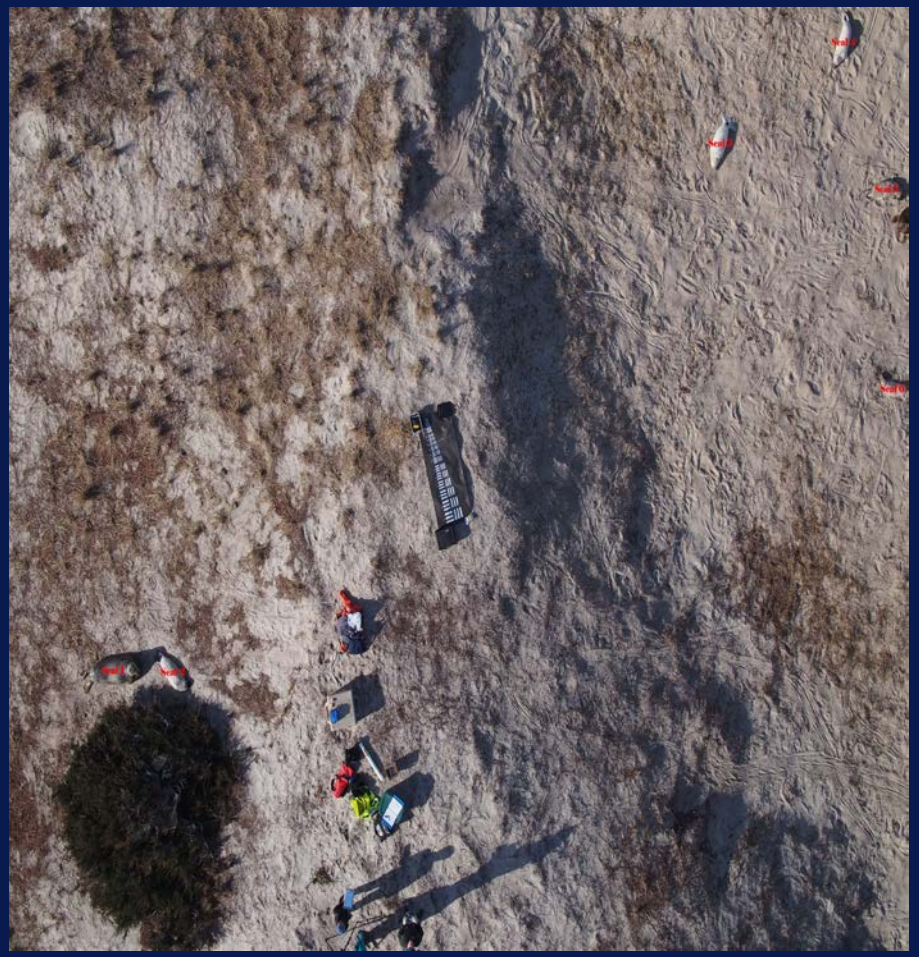
APH-22 System Configuration	Current TRL	Performance Metric	Anticipated TRL if Metric Achieved
Platform and standard camera/video with gimbal and laser altimeter	7	Obtain accurate and precise (within 5%) measurements of seal lengths	8
	7	Identify molt stage (via color, pelage) of animal >=80% of time	8
	7	Ability to acquire video (y/n)	8
	7	Ability to launch and recover from a vessel	8
	7	Ability to fly enhanced platform in waypoint mode	8

Measurements of Seal Lengths

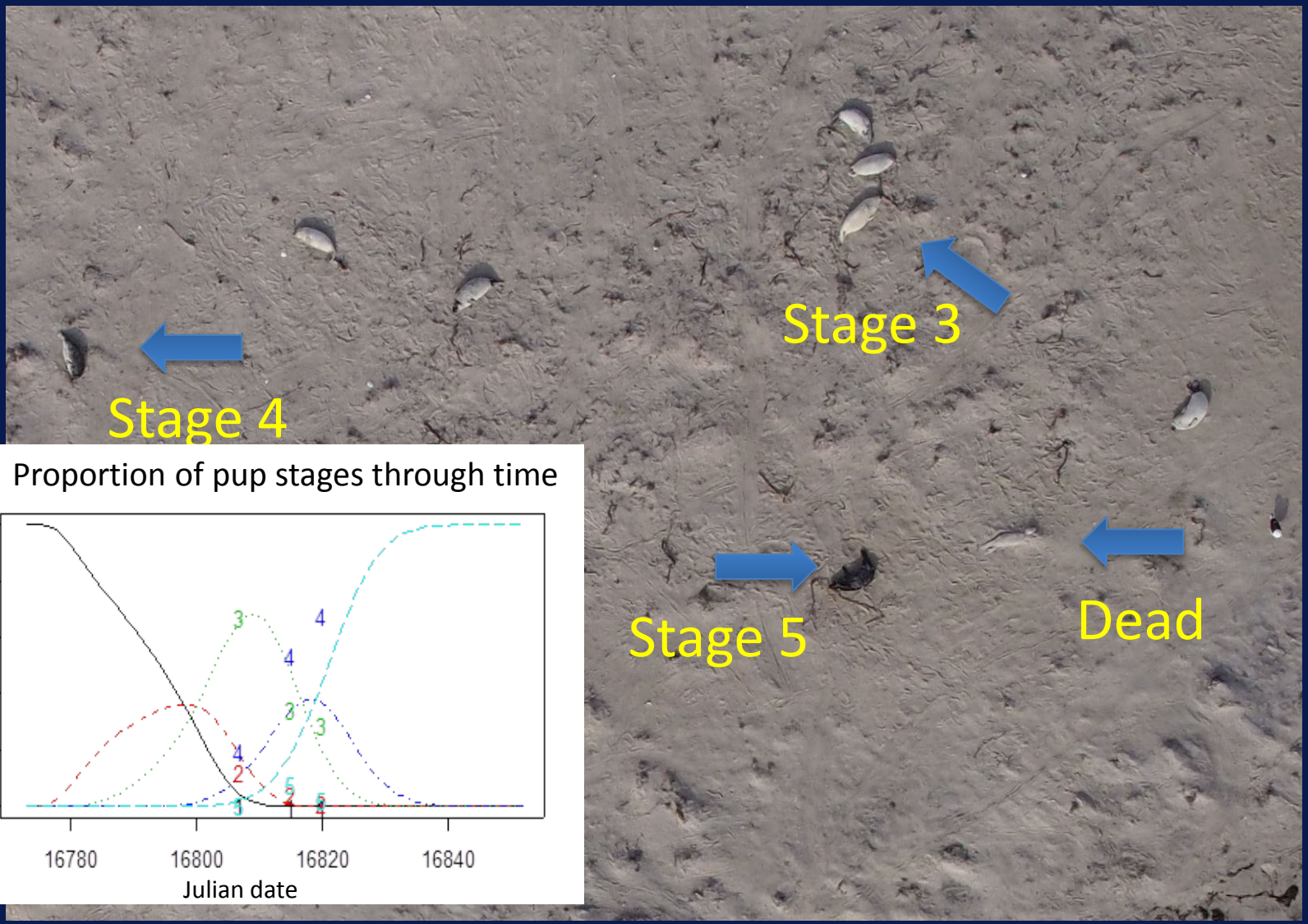
Chart #	Calc size*	Act size	% error
7	0.185	0.190	2.6
8	0.167	0.169	1.2
9	0.145	0.150	3.3
10	0.130	0.134	3.0

* Altitude measured via barometric pressure

Seal	Calc size* (m)
1	1.28
2	0.90
3	0.85
4	0.88



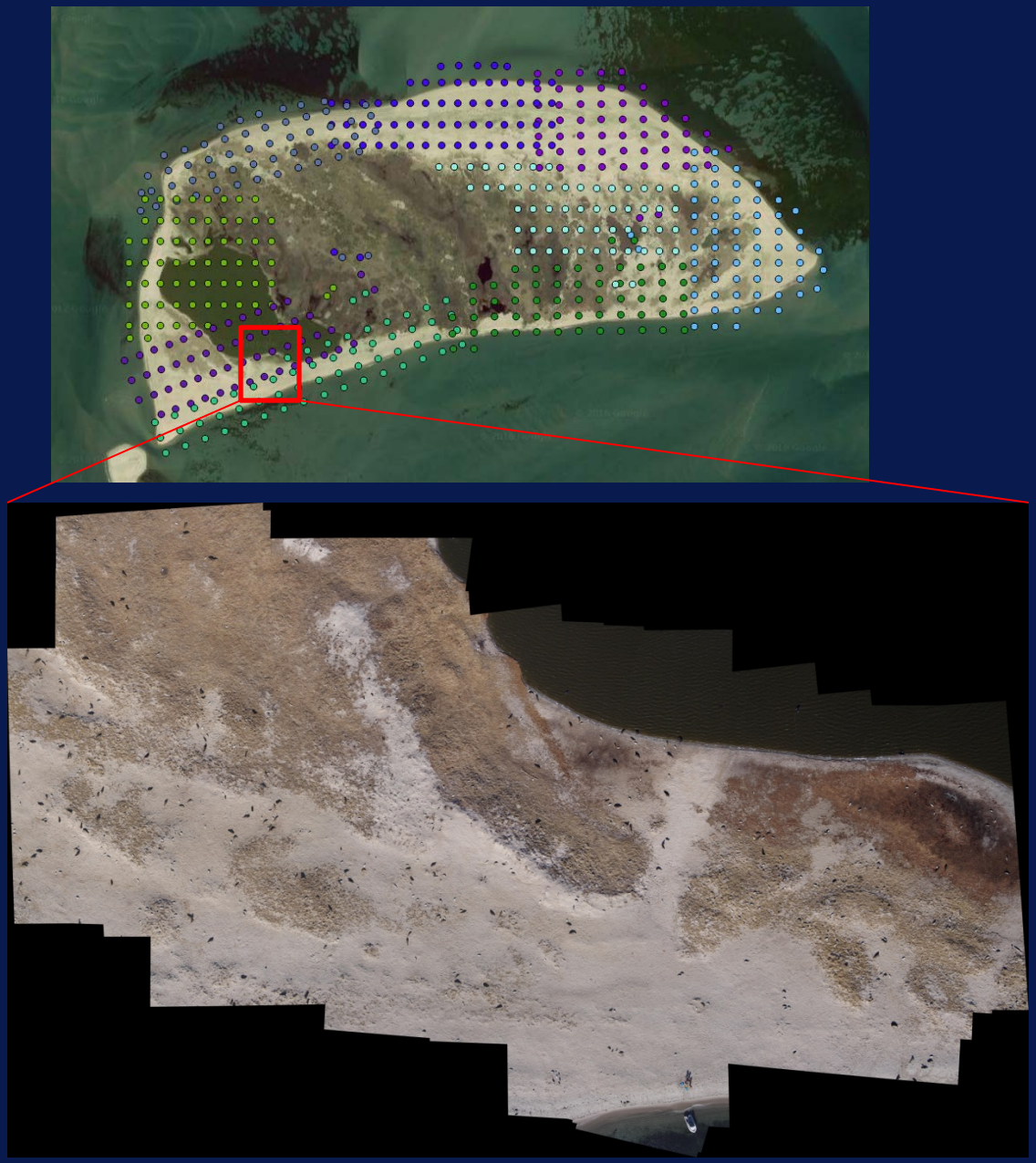
Identifying Pup Molt Stage



Systematic Sampling

Simulated flight settings:

- 1 hour 29 flight time
- 100 m altitude
- 20 mm lens
- Fly 5 m/s speed
- 40% overlap in imagery
- Requires 9 batteries



Documenting Anthropogenic Impacts

- Entanglements
- Brand marks

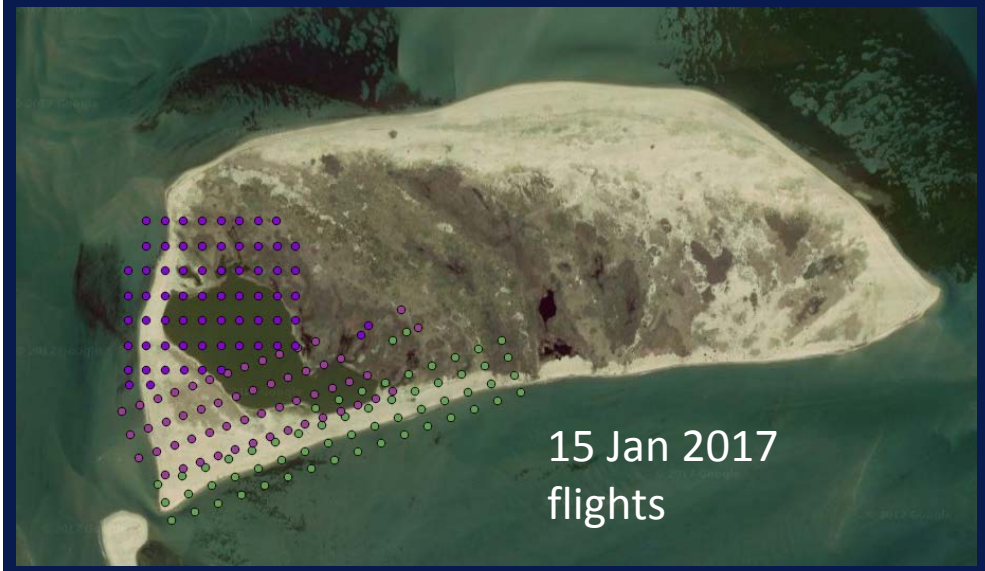
Impact to Society

- A fully operational UAS system at the NEFSC would allow us to routinely monitor pinniped populations at key index sites

- This would allow us to measure whether or not we are meeting recovery goals under the MMPA

Key Scientific/Technical Challenges

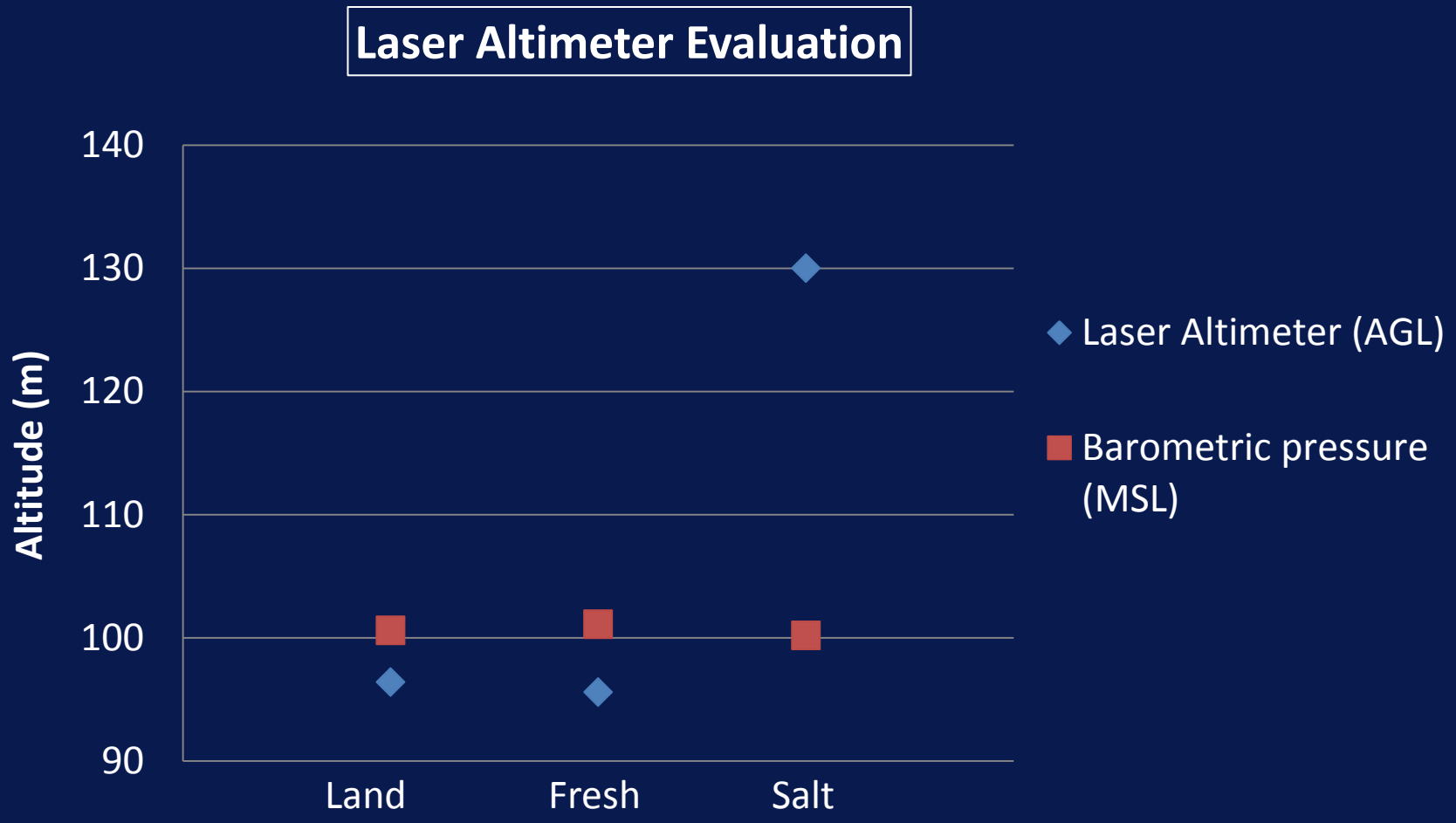
Flight



- Full survey of the island with APH-22 has yet to be achieved
- Accessing island by small boat in winter poses safety issues
- Cold weather shortens battery life
- Changing out sensors (cameras) can be time-consuming

Key Scientific/Technical Challenges

Sensors



Key Scientific/Technical Challenges

Data processing

- Accurate counts and estimates of variance
- Accurate size/morphological measurements
- Automated counts and measurements?
- Data storage

Future Directions

- APH-22 paired with fixed wing platforms to increase coverage while maintaining hovering capability

- Surveying out of Line of Sight for longer endurance – Could we fly from Nantucket?

- Flying multiple UASs simultaneously to increase efficiency of covering the island

Thank you!

- To NOAA UAS Program Office for supporting our research in 2017
- To AOC for supporting our missions