Wildlife distributions and habitat use on the mid-Atlantic Outer Continental Shelf

Kate Williams

Biodiversity Research Institute

2 December 2015

K. Williams, I. Stenhouse, E. Connelly, S. Johnson, E. Adams, C. DeSorbo, M. Duron, A. Gilbert, C. Gray, D. Meattey, L. Savoy

B. Gardner, H. Goyert, N. Hostetter, R. Sollmann

R. Veit

D. Johnston, L. Pallin

A. Friedlaender

Funding Organizations:

U.S. Dept. of Energy WWPTO

Maryland Dept. of Natural Resources

Maryland Energy Administration

Other sources

Bureau of Ocean Energy Management

U.S. Fish and Wildlife Service

Sea Duck Joint Venture

The Bailey Wildlife Foundation

Collaborators:

HiDef Aerial Surveying, Inc.

Capt. Brian Patteson, Inc.

University of Oklahoma

USGS Patuxent Wildlife Research Center

Memorial University of Newfoundland

Canadian Wildlife Service

VA Dept of Game and Fisheries

DE Division of Fish and Wildlife

RI Division of Fish and Wildlife

University of Rhode Island

NC Wildlife Resource Commission

Inform offshore wind development

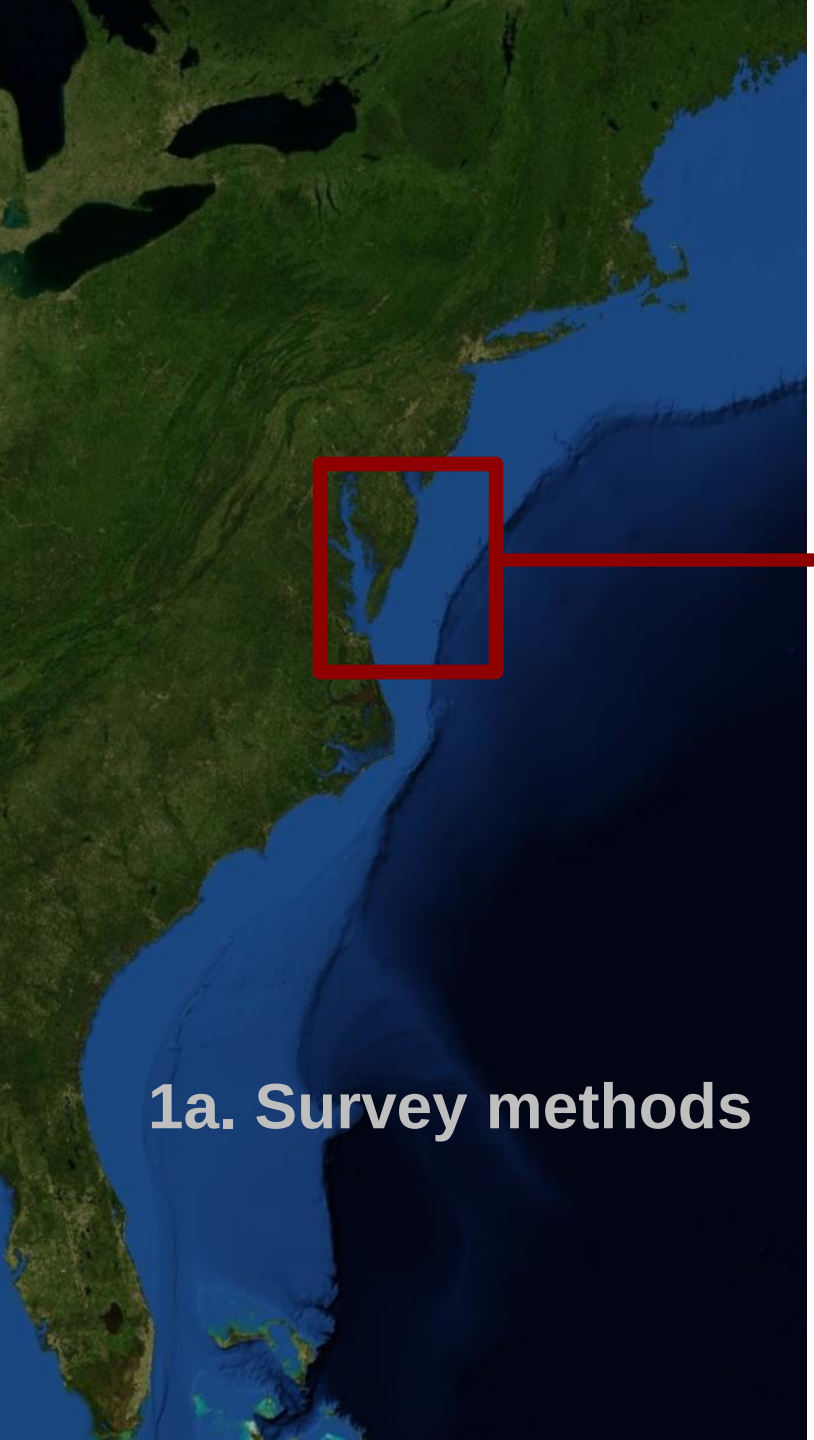
- Provide baseline ecological data and analyses
  - Wildlife distribution patterns
  - Understand causes of these patterns
  - Movements (site fidelity, population connectivity)
- Develop technological resources for future monitoring and assessments

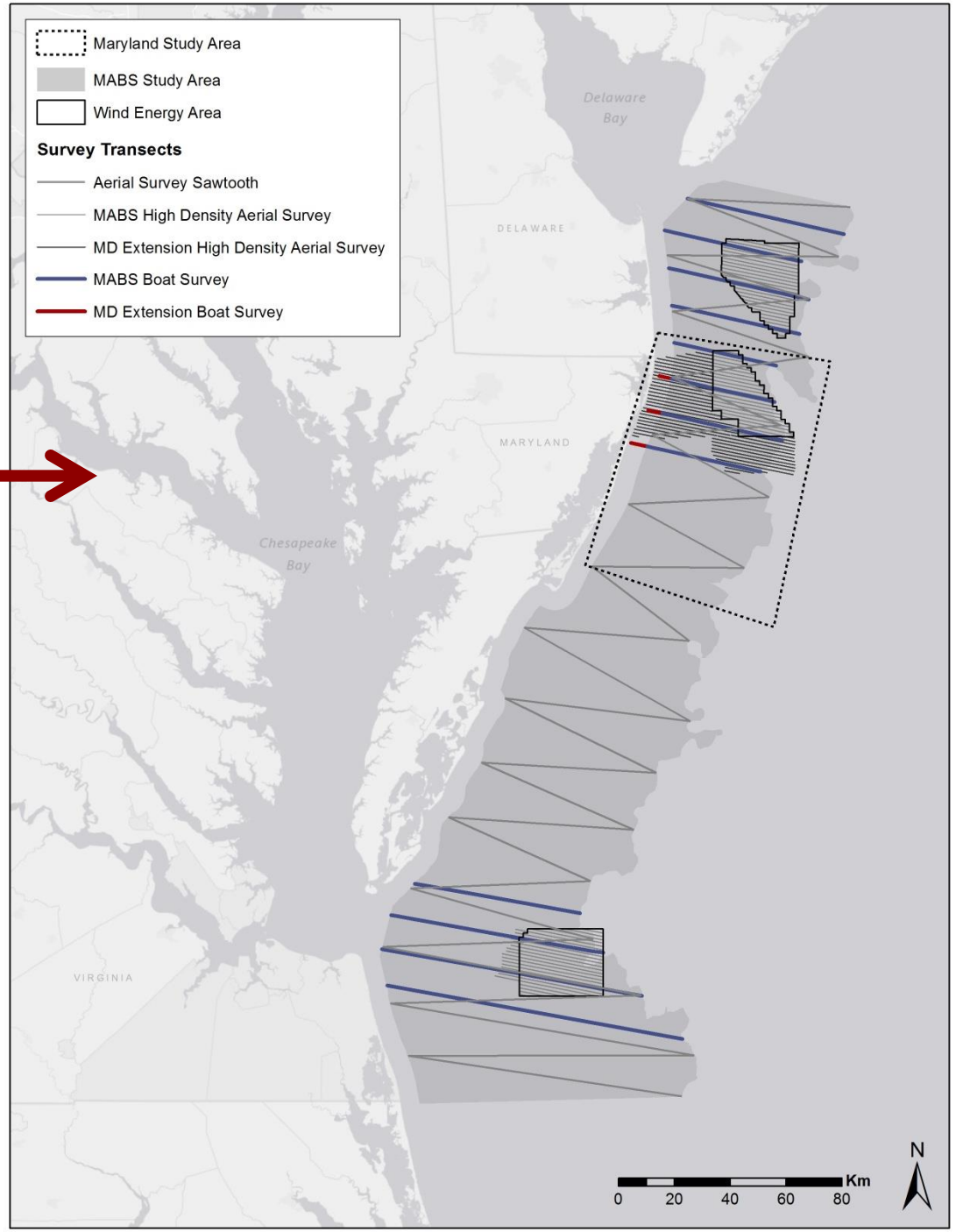
Photo courtesy Nysted HavmØllepark

Overview

1. **Boat-based and digital video aerial surveys**
   a. Survey methods
   b. Comparison study
   c. Overall comparisons
2. **Other study approaches**
   a. Satellite telemetry
   b. Nocturnal passive acoustics
   c. Weather radar
3. **Tradeoffs among methodologies**
4. **Analytical advances**
5. **Data access and final reports**
6. **Discussion and questions**

1a. Survey methods

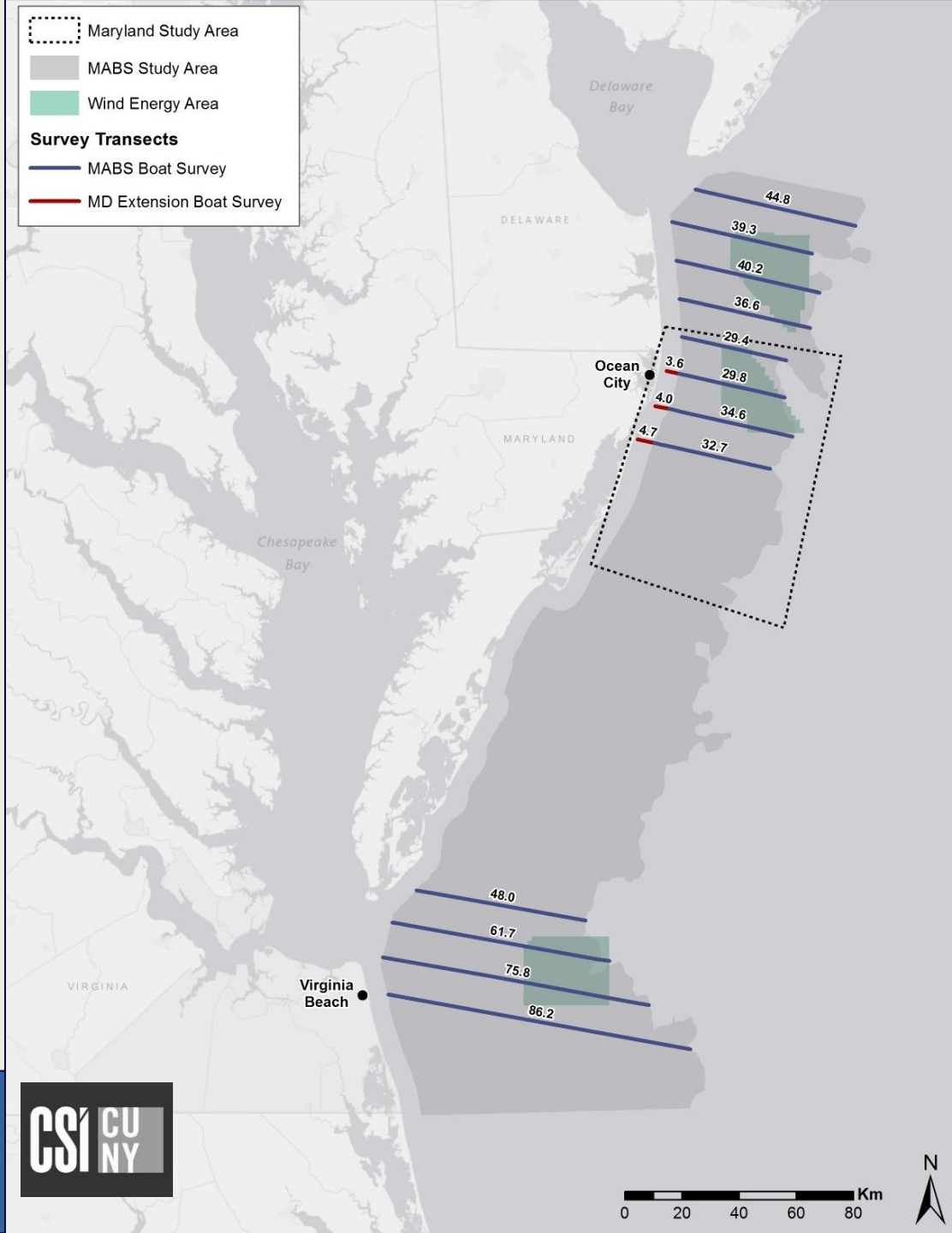




Boat surveys

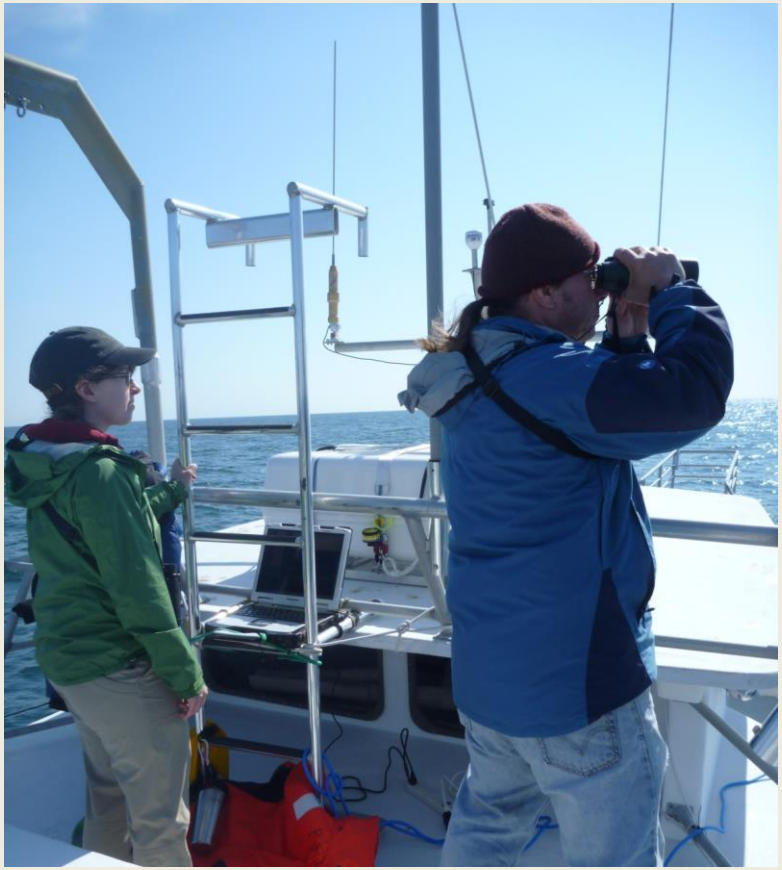
55’ charter vessel

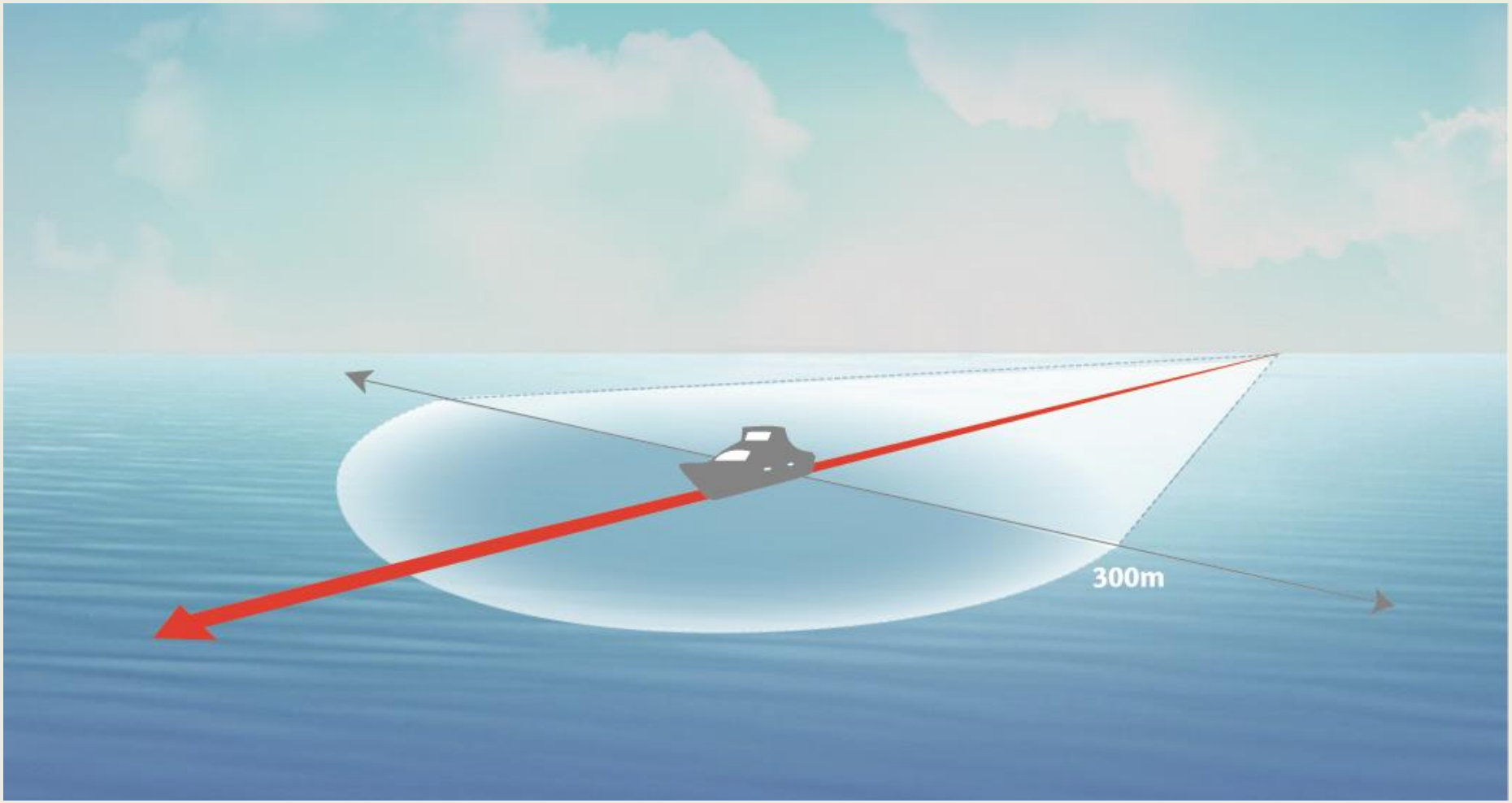
Photo courtesy of Capt. Brian Patteson Inc.



Boat surveys

- Combo strip and line transects @ 10 knots
- One observer and one recorder/observer (dLOG)
- Identify and record animals (distance, angle, behavior, etc.)



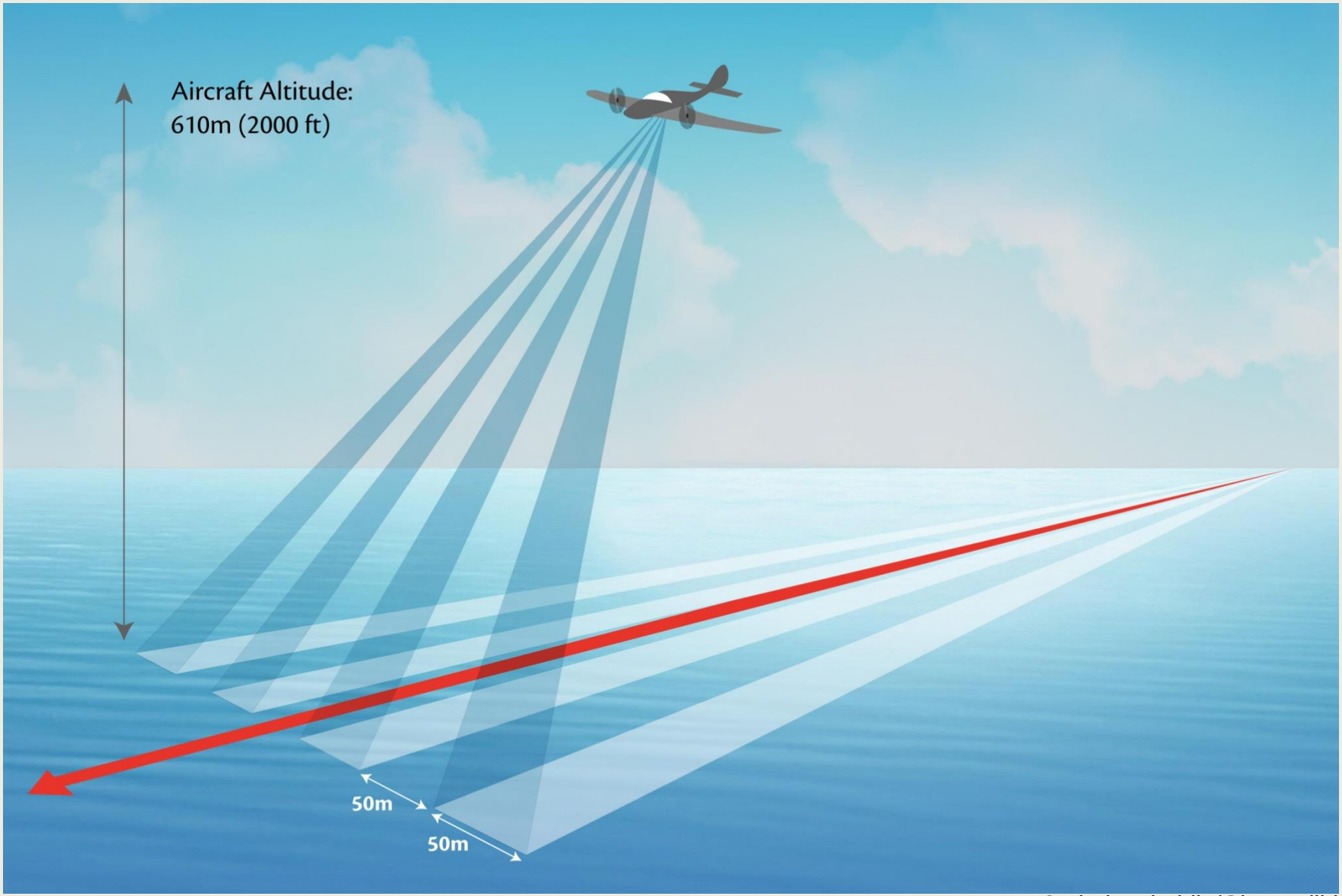


High resolution digital video aerial surveys

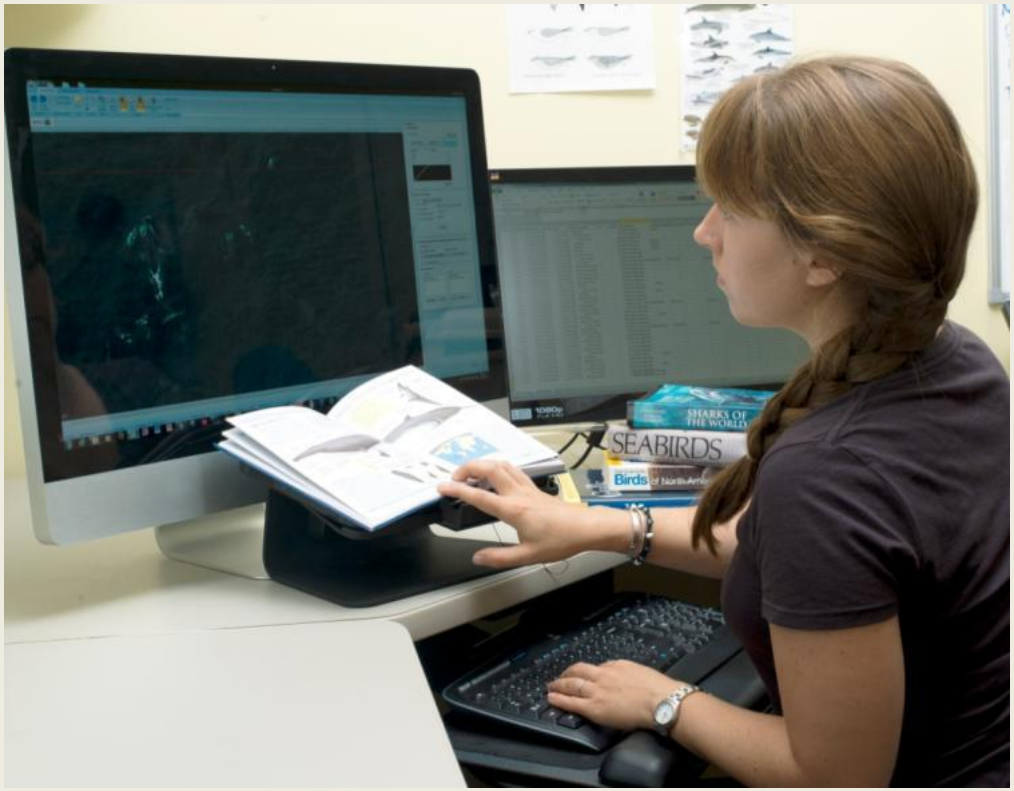
- 15 surveys/ 2 yrs
- 4 belly-mounted cameras
- 2 cm ground spatial resolution (GSR)
- GPS coordinates for each video frame
- ~8 frames/sec

bri

HiDef AERIAL SURVEYING

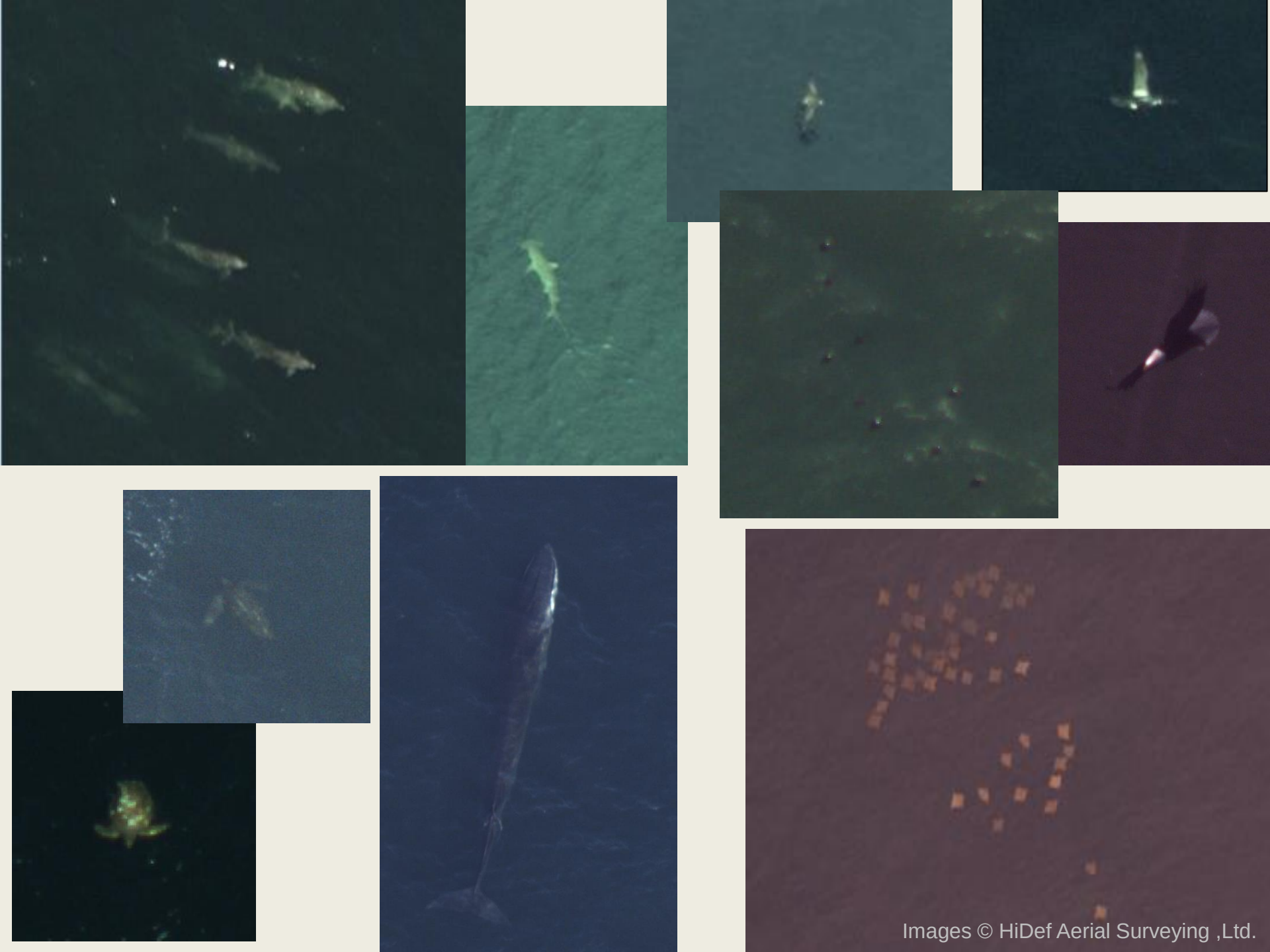


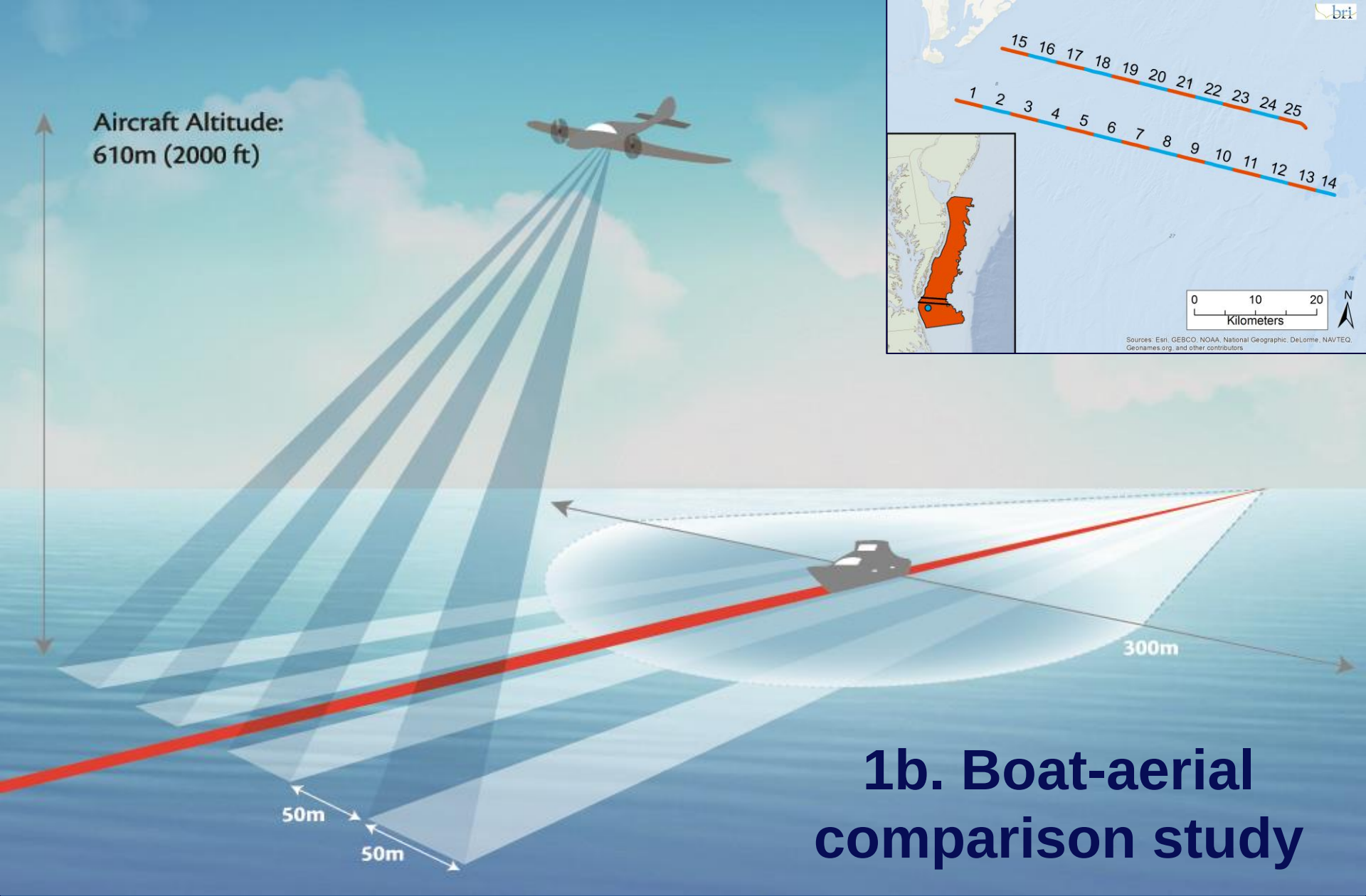
Video Review



- Full QA process
- Flight height calculated from video images

Duron et al. 2015; Hatch et al. 2013





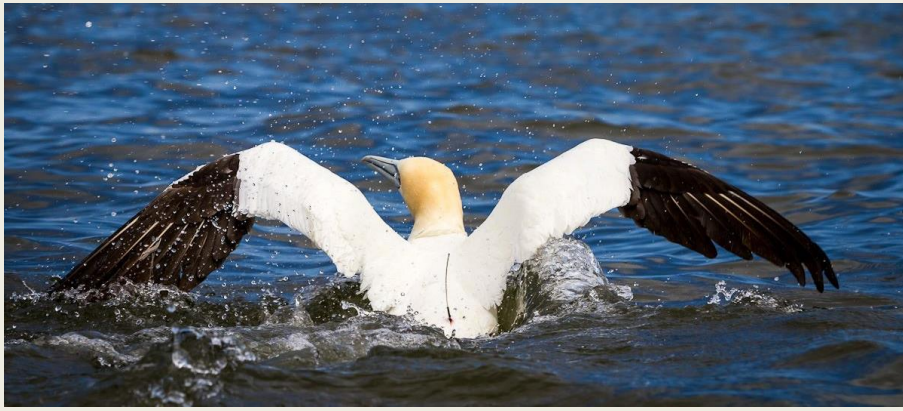
1b. Boat-aerial comparison study

bri

HiDef AERIAL SURVEYING

CSI CUNY

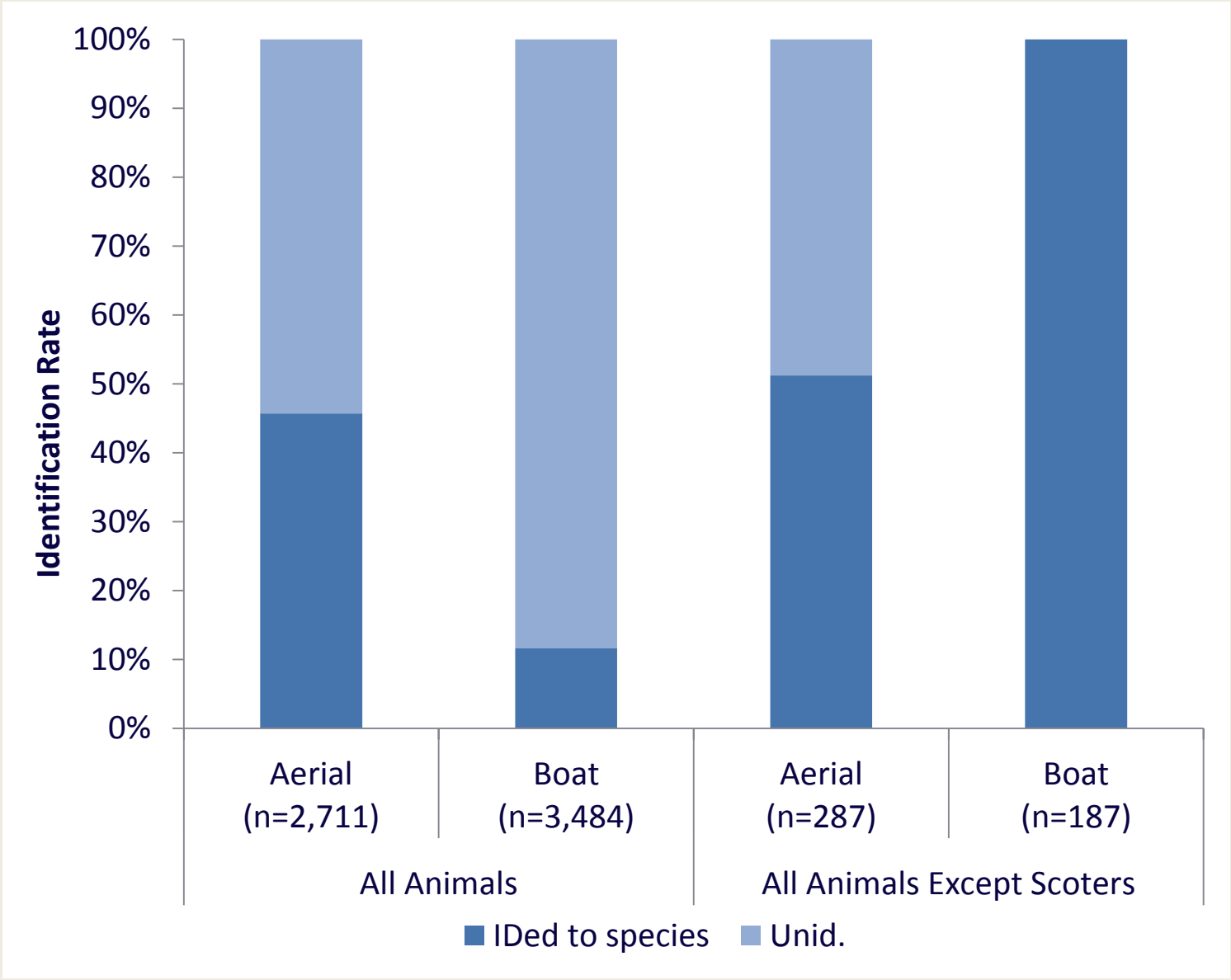
Boat-aerial comparison study



Northern Gannets

- **Analyses:**
  - ID rates
  - Boat disturbance
  - Abundance estimates

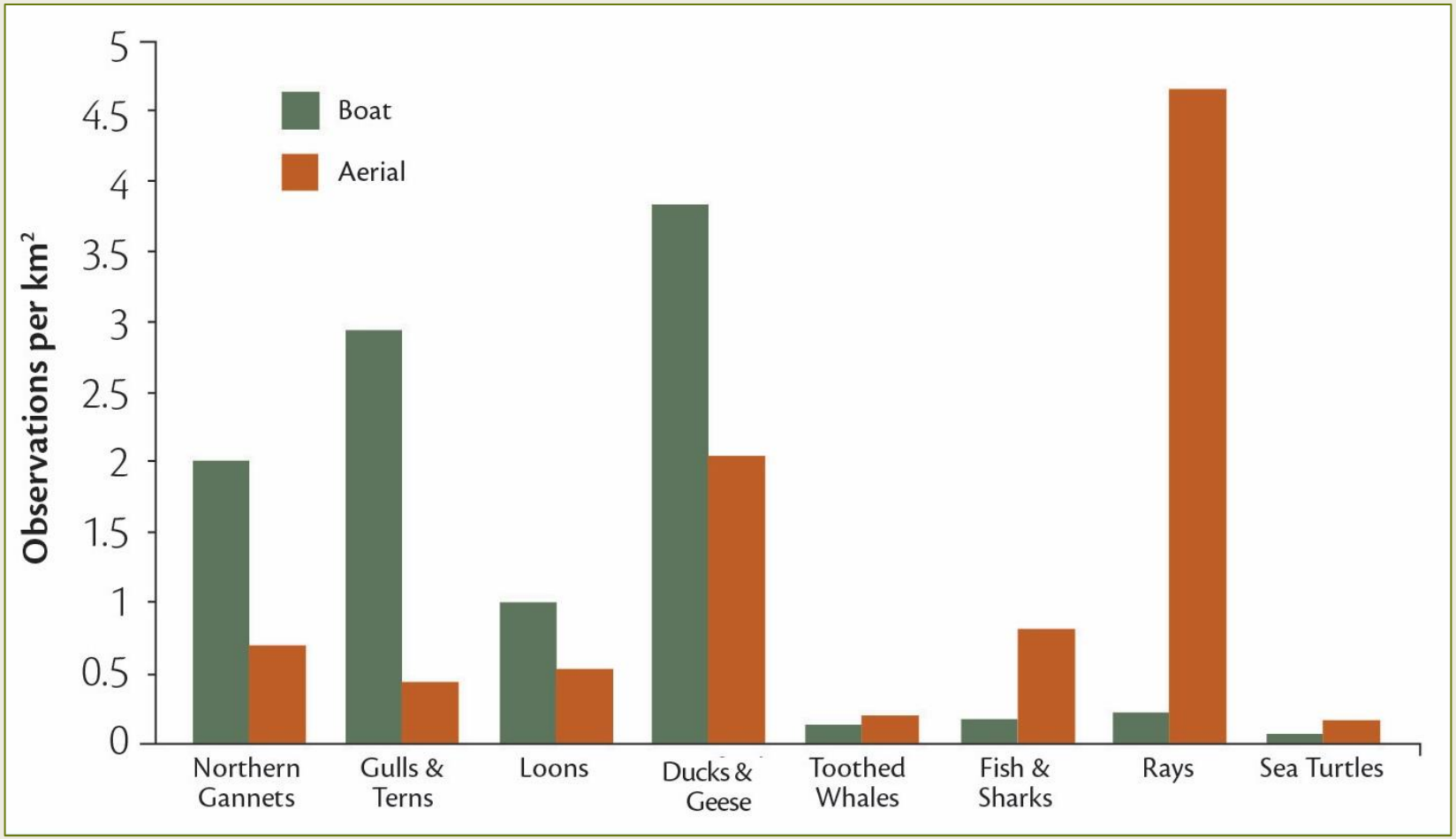
Scoters


Identification Rate
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Aerial (n=2,711)
Boat (n=3,484)
Aerial (n=287)
Boat (n=187)
All Animals
All Animals Except Scoters
IDed to species
Unid.

Other findings: comparison study

- Disturbance/attraction may bias boat survey results for some species
- Comparison of abundance estimates:
  - Distance-corrected boat estimates higher than bootstrapped aerial estimates
  - Good correlation for scoter abundance between the two methods, not so for gannets
- Need to develop better approaches for measuring detection and availability biases for digital aerial video

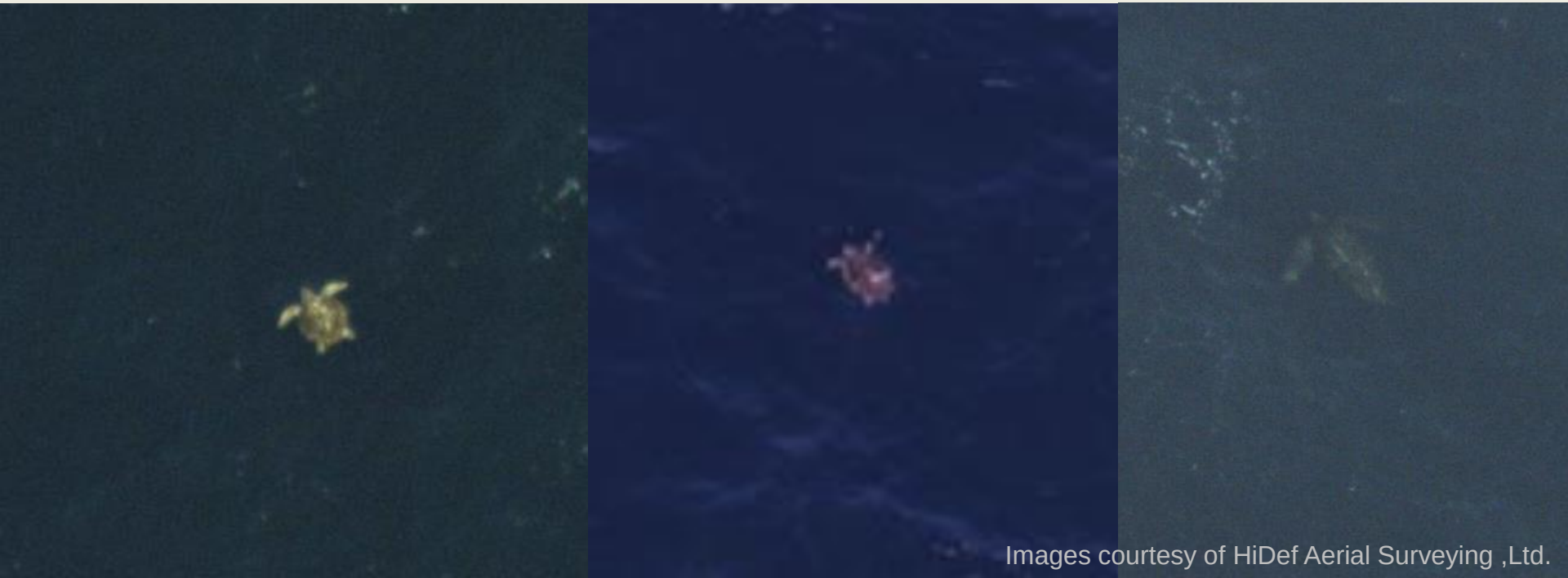
Overall comparison



Comparison of total effort-corrected boat and aerial survey counts across all surveys for selected taxa.

Sea turtles

- >12x as many turtles observed in digital aerial surveys as in boat-based surveys
- Also better detection in digital aerial surveys than visual aerial? (Normandeau Assoc. Inc. 2012)



Images courtesy of HiDef Aerial Surveying ,Ltd.

Cownose Rays

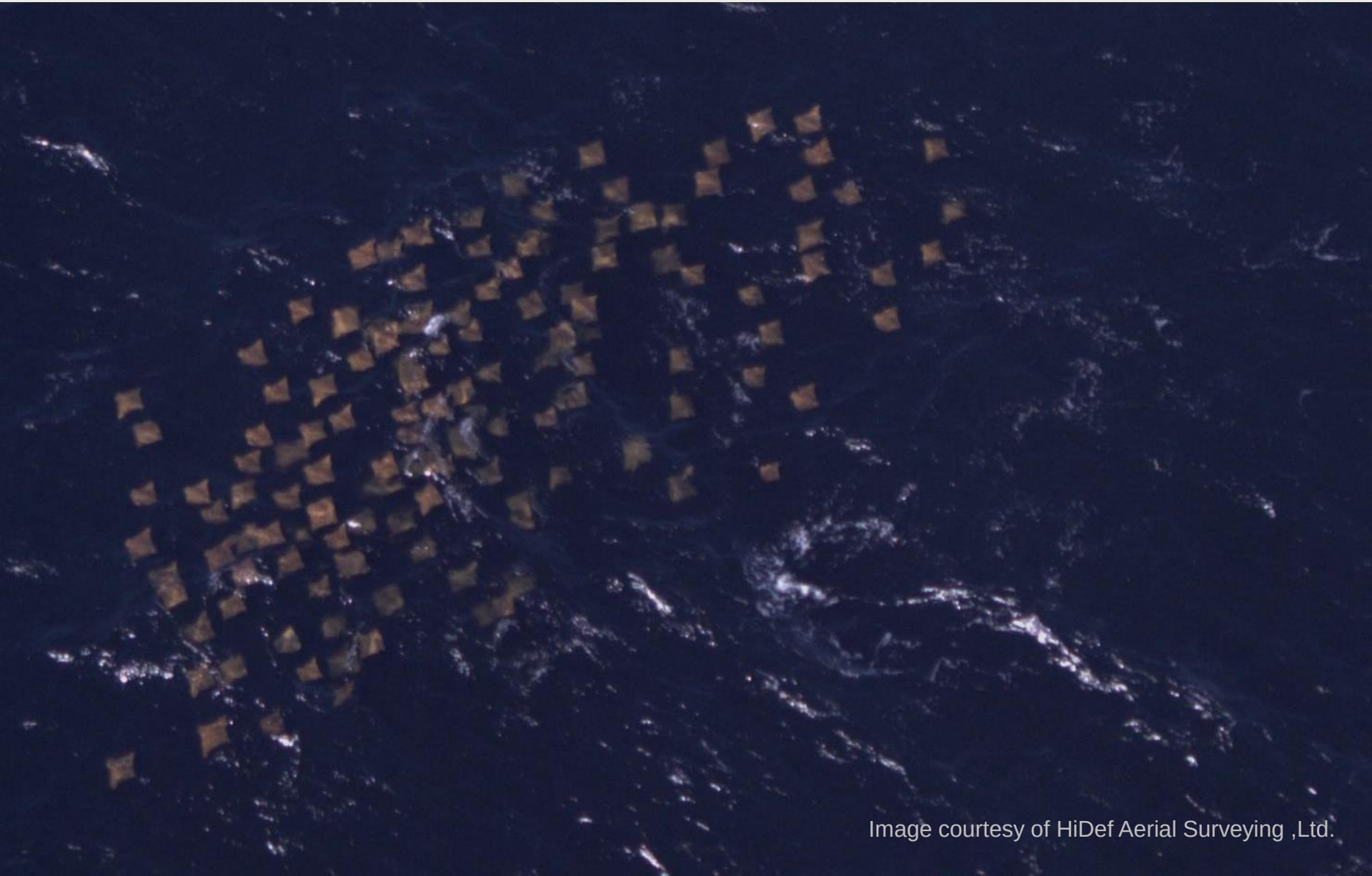


Image courtesy of HiDef Aerial Surveying ,Ltd.

Boat Surveys vs. Digital Aerial Surveys

	Advantages	Challenges
Boat Surveys	• Can record both in and outside strip width • Behavioral details • Species ID rates • Comparable with historic datasets	• Disturbance/displacement • Detection varies with distance, weather, and other factors • Slow survey pace • Observer biases • No opportunity for audits • No permanent record
Aerial Surveys	• Efficient • Less biased in some ways • Repeatable pre- and post-construction • Archivable • Auditable	• Relatively narrow strip width • Detection of small dark species • Identification rates • Weather effects on image quality

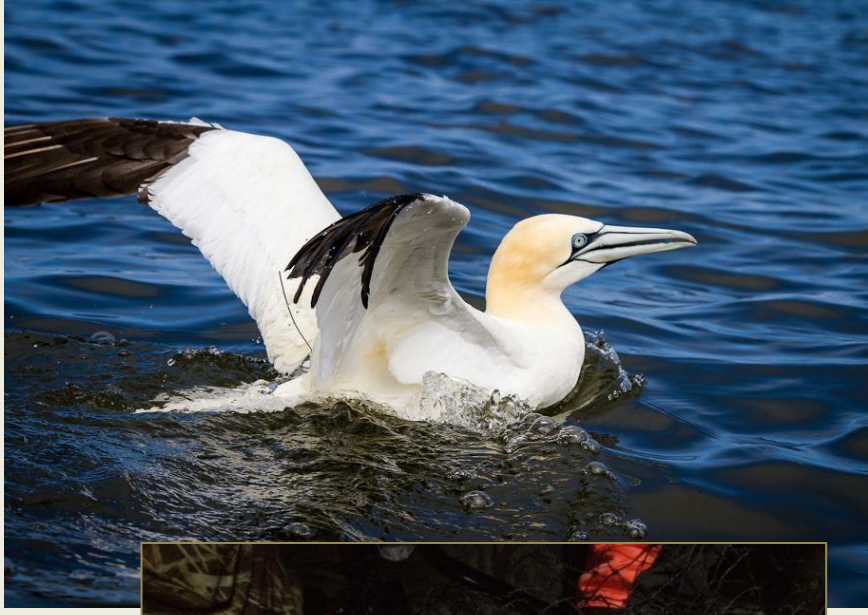
Overview

1. Boat-based and digital video aerial surveys
   a. Survey methods
   b. Comparison study
   c. Overall comparisons
2. **Other study approaches**
   a. Satellite telemetry
   b. Nocturnal passive acoustics
   c. Weather radar
3. **Tradeoffs among methodologies**
4. **Analytical advances**
5. **Data access and final reports**
6. **Discussion and questions**

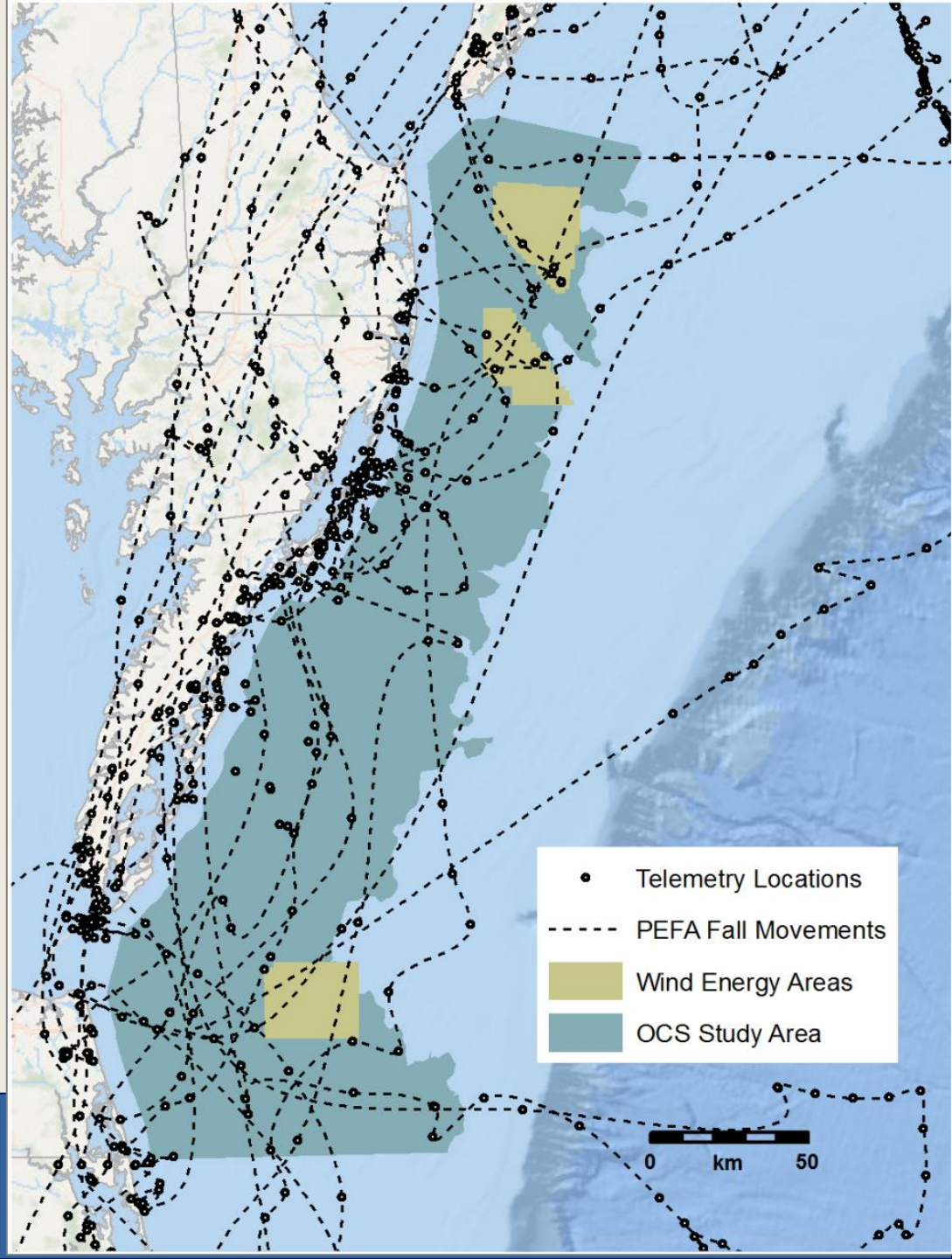
Individual Tracking

Winter captures

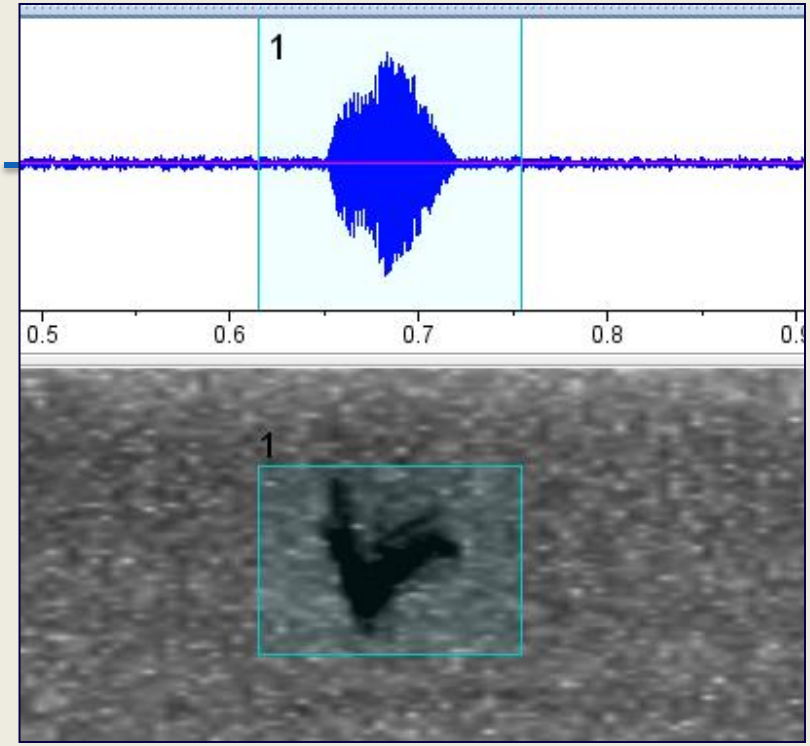
- Adults captured at sea using night-lighting
- Aged and weighed for PTT candidate assessment
- Telonics PTTs
- Seasonal duty cycles

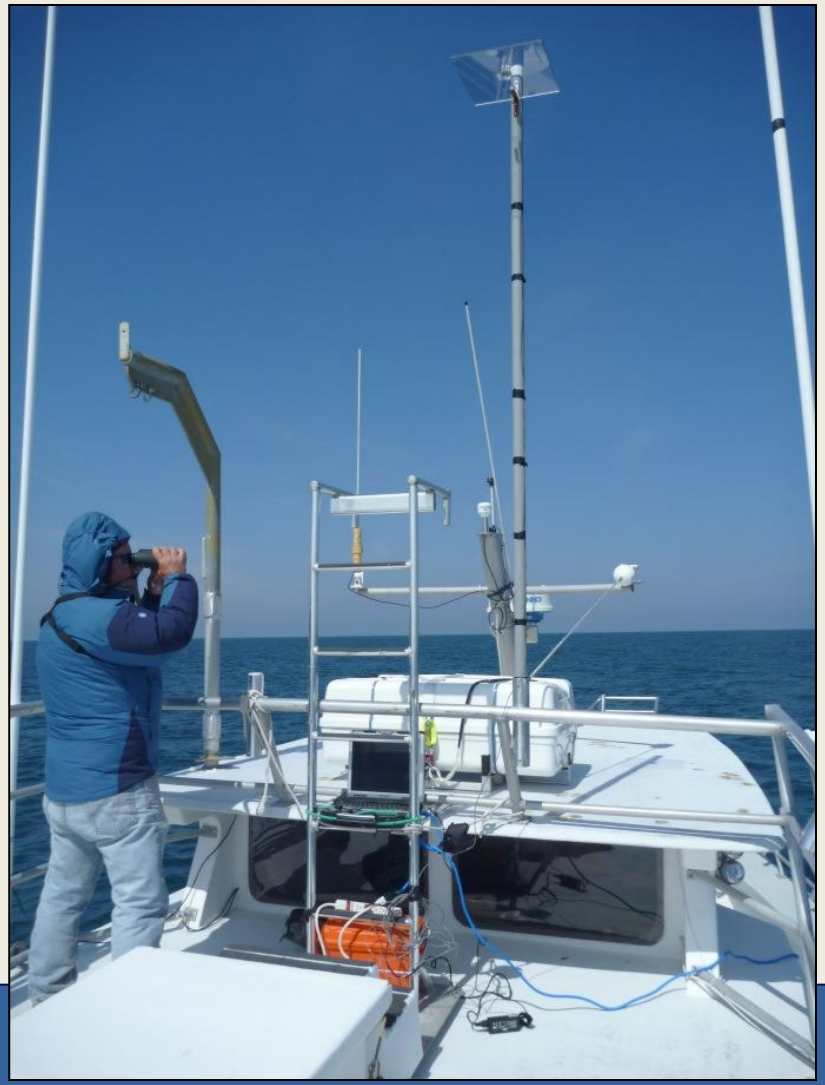


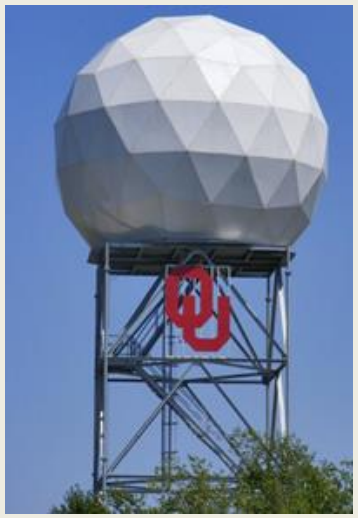
Migration and Population Connectivity



Acoustic Monitoring





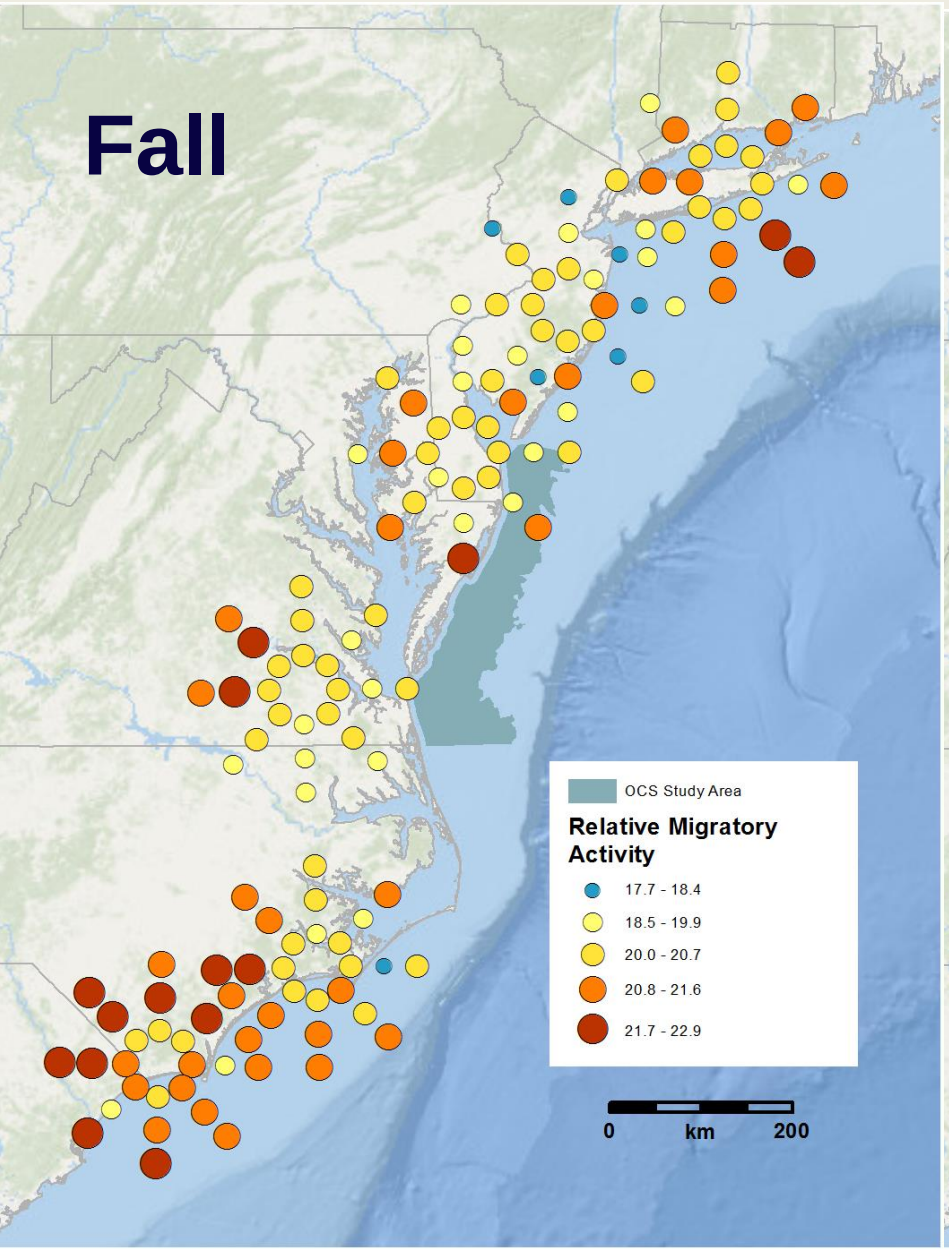


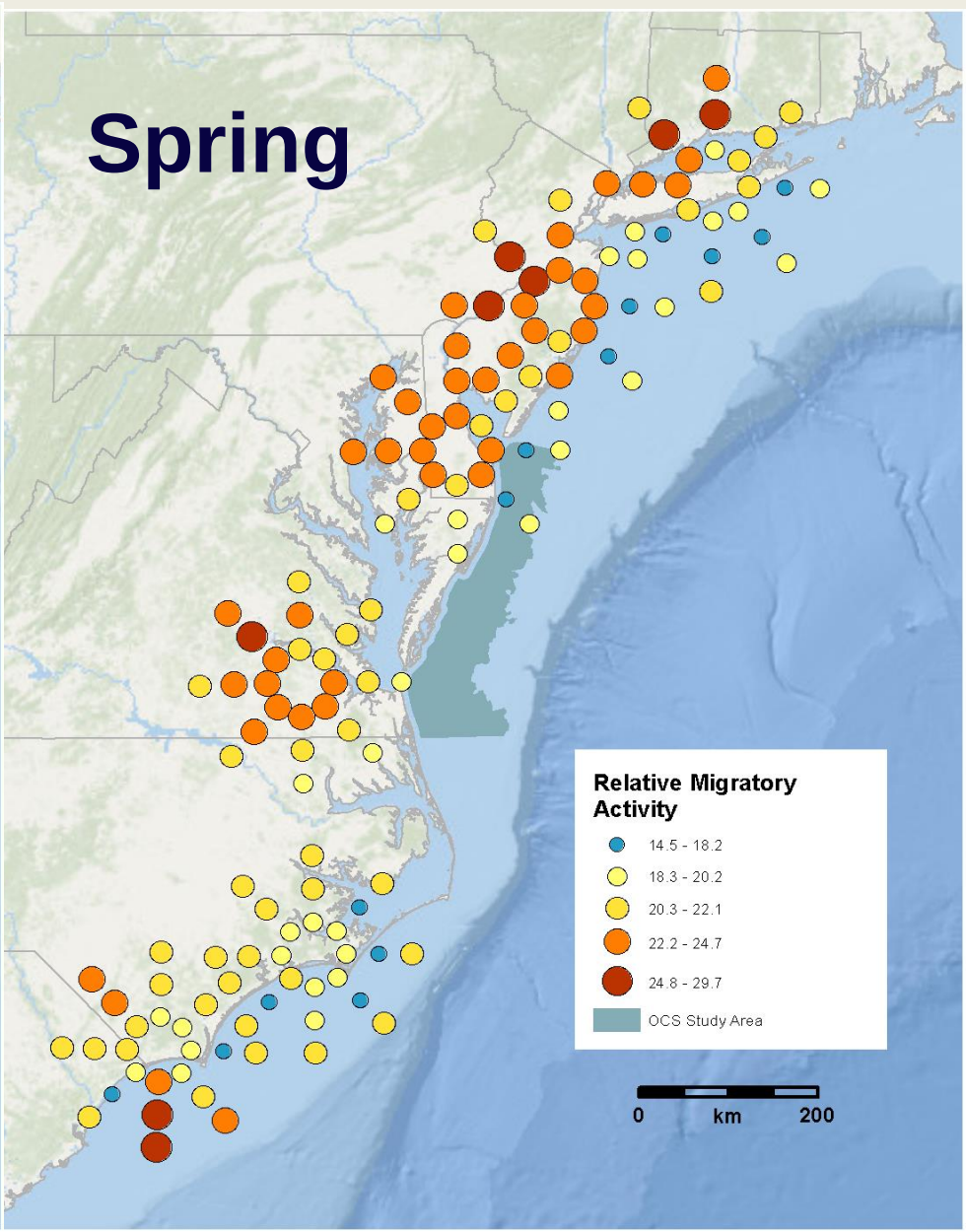
WSR-88 Radar (NEXRAD)

- Measures reflectivity in atmosphere
- Weather, birds, bats, insects…
- Filter out meteorological activity and focus on biological signal

Images courtesy of the University of Oklahoma Animal Migration Research Group

Nocturnal avian migration





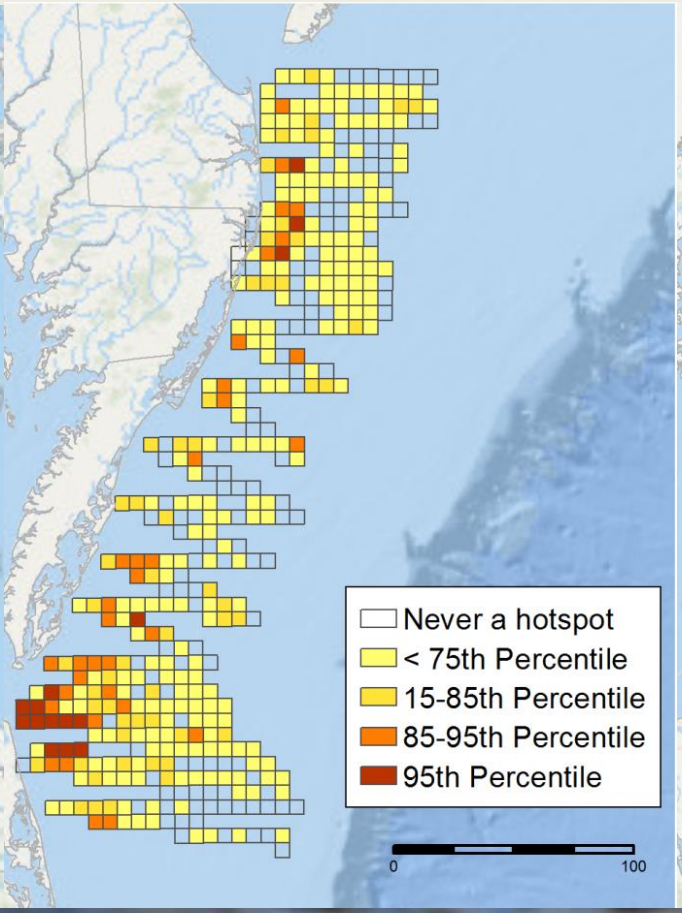
3. Tradeoffs among methodologies

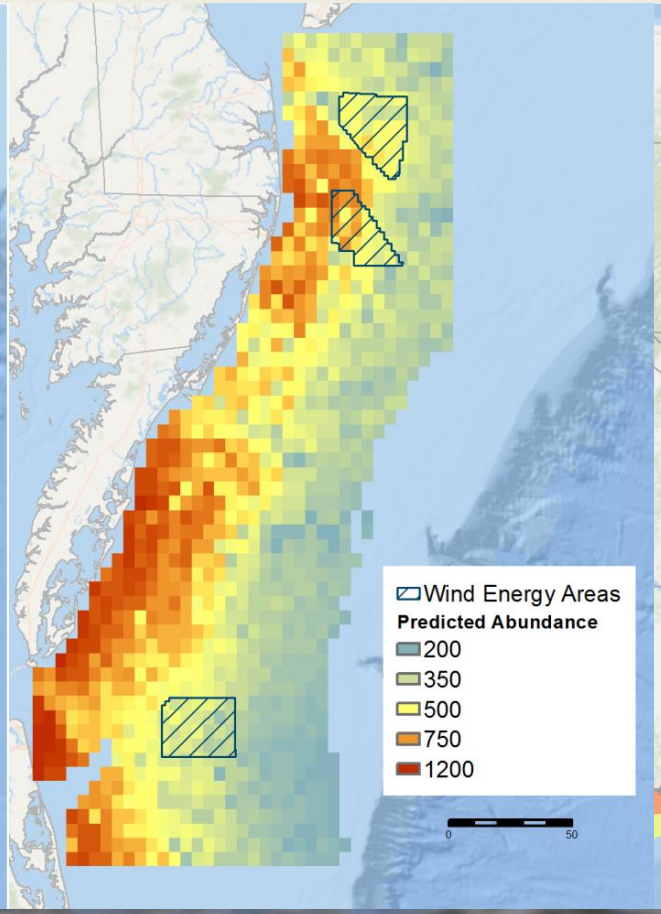
	Video Aerial Survey	Boat Survey	Satellite Telemetry	Avian Passive Acoustics	WSR-88 Weather Radar
Geographic Coverage	■	■	■	▫	■
Temporal Coverage	▫	▫	■	■	■
Population Distributions	■	■	■	—	■
Abundance*	■	■	—	▫	▫
Detection (marine mammals)	■	■	—	—	—
Detection (sea turtles)	■	▫	—	—	—
Detection (birds)	■	■	—	■	■
Species Identification	■	■	—	■	—
Behaviors	■	■	■	—	—
Movements	▫	▫	■	—	■
Diurnal Activities	■	■	■	—	—
Nocturnal Activities	—	—	■	■	■

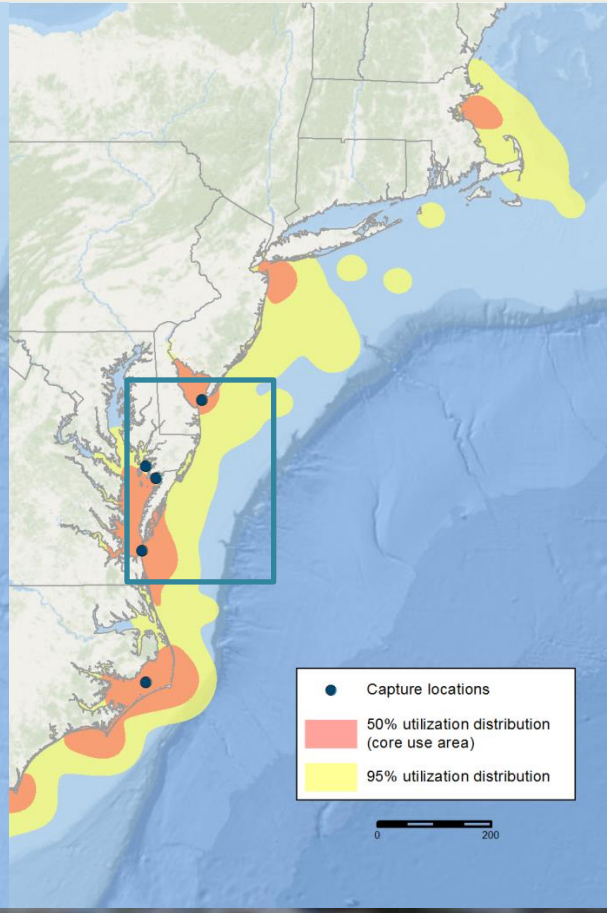
*Either absolute or relative abundance

■ = good ■ = fair ▫ = poor — = data not available

Northern Gannets







Overview

1. **Boat-based and digital video aerial surveys**
   a. Survey methods
   b. Comparison study
   c. Overall comparisons
2. **Other study approaches**
   a. Satellite telemetry
   b. Nocturnal passive acoustics
   c. Weather radar
3. **Tradeoffs among methodologies**
4. **Analytical advances**
5. **Data access and final reports**
6. **Discussion and questions**

Modeling

- Seabird GLMs (NCSU)
  - Hierarchical community distance sampling model
  - Habitat modeling
  - Species ID model
  - Comparison of boat and aerial habitat models
  - Integrated modeling framework
- Marine mammal GAMs (Duke)
  - Distance sampling with environmental covariates
- Sea turtle GAMs (Duke)
  - Abundance modeling with environmental covariates

- Distance to shore
- Seafloor slope
- Sediment grain size
  - Proxy for benthic assemblages
- Sea surface temperature
- Daily salinity
- Monthly chlorophyll anomaly
  - Index of extreme values of primary productivity at the sea surface

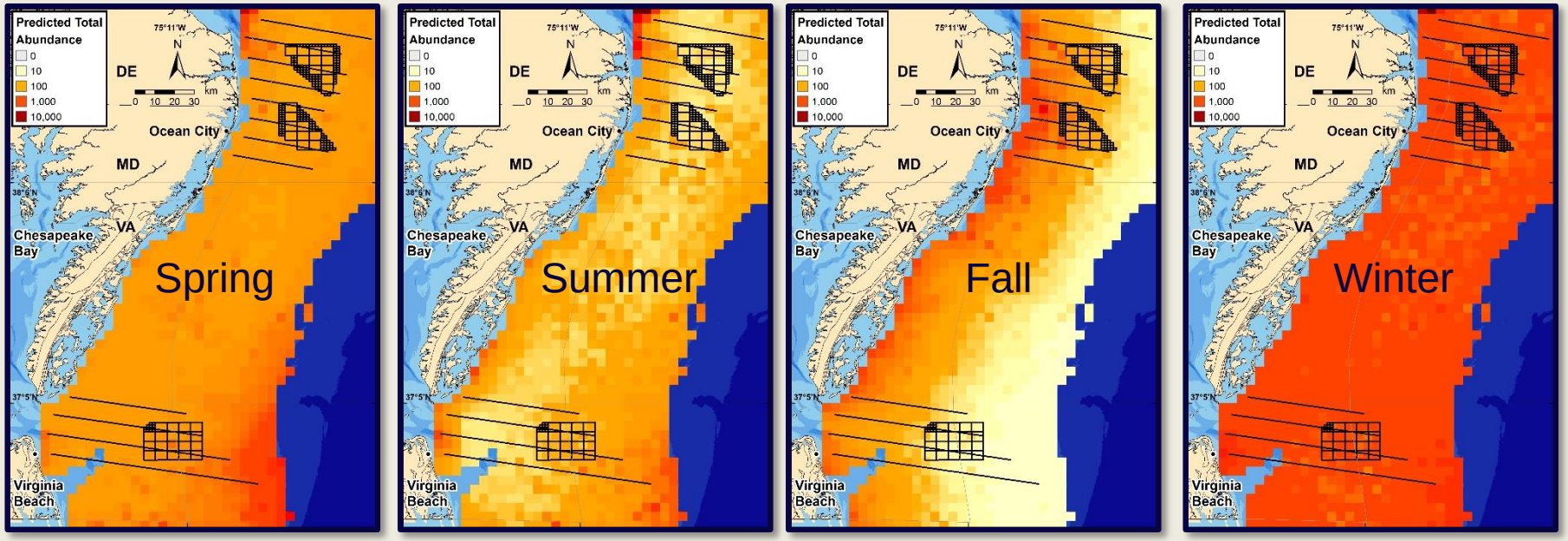
NC STATE UNIVERSITY

Duke UNIVERSITY

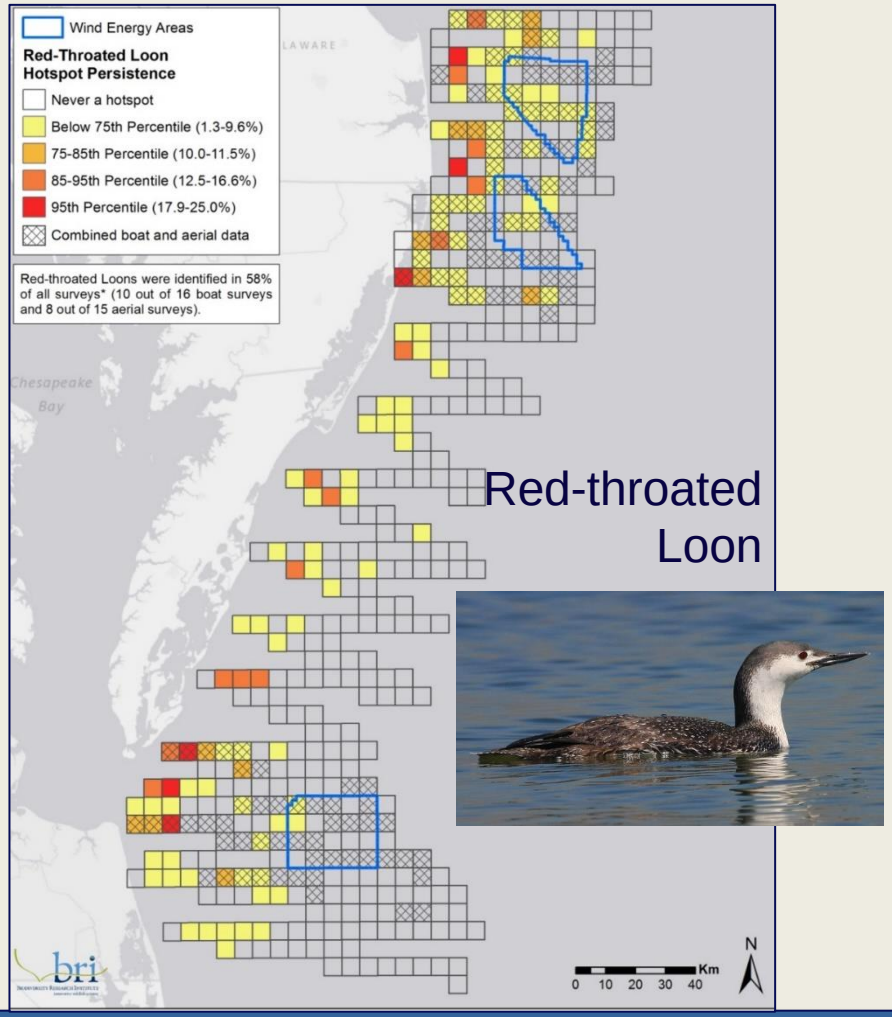
Hierarchical community distance sampling (hCDS) model

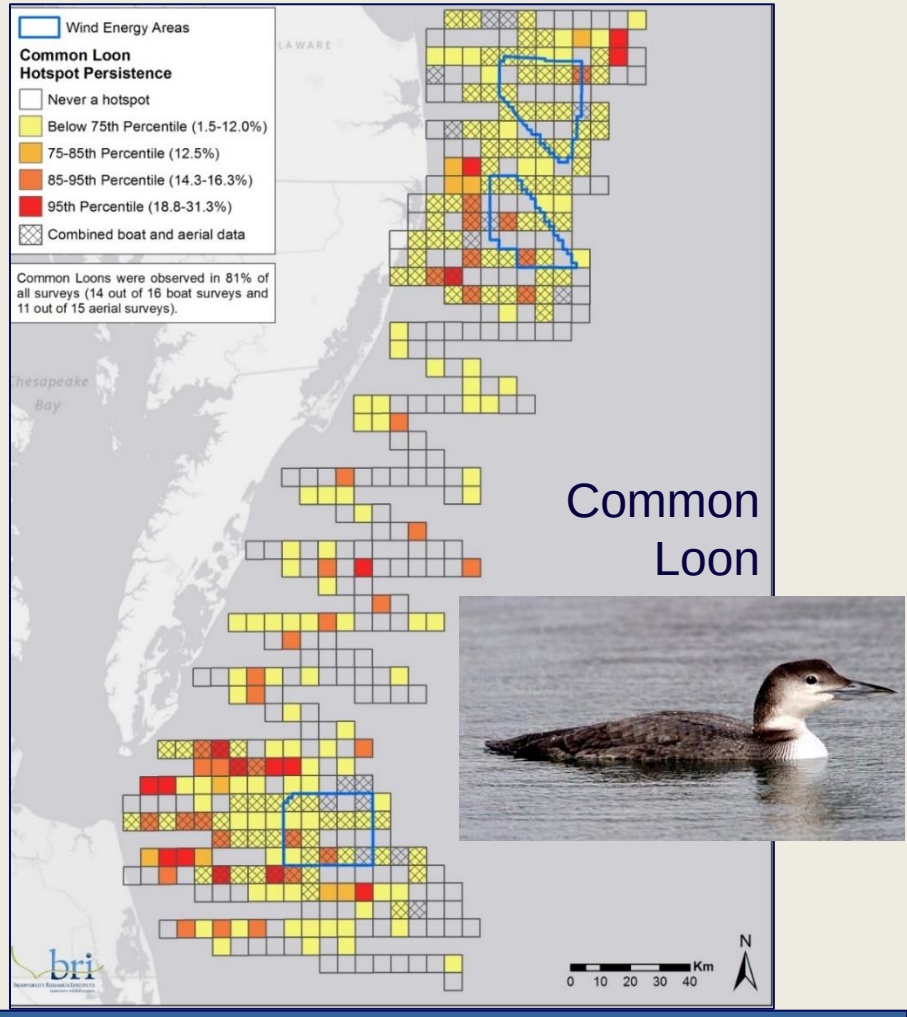
- How does habitat use among species compare to the community as a whole?
- Multi-species distance sampling approach
- Implemented in Bayesian framework
- Predicts seasonal seabird distribution and abundance

Predicted total seabird community abundance



Species ID model



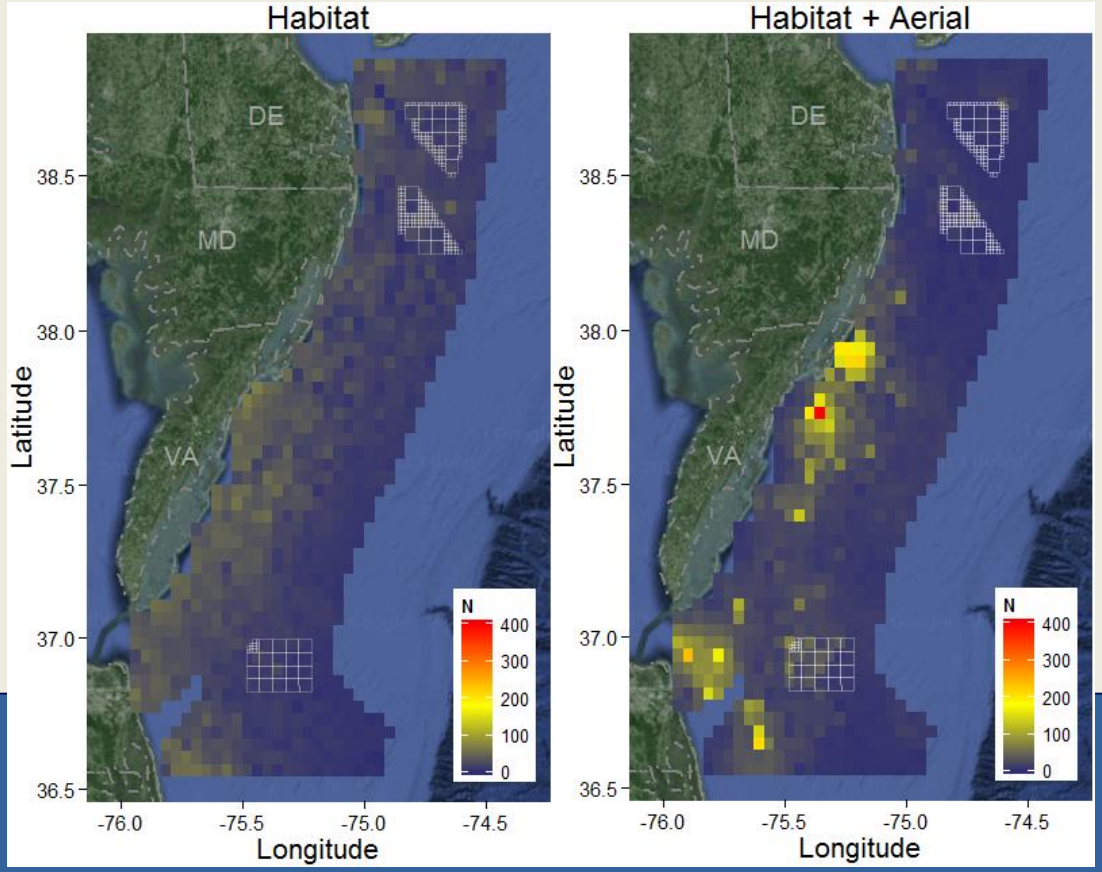


bri

NC STATE UNIVERSITY

Integrating boat and digital aerial survey data into joint models

- Compare boat and aerial models of seabird abundance with environmental covariates
- Develop an integrated model of distributions with environ. covars. using both survey datasets



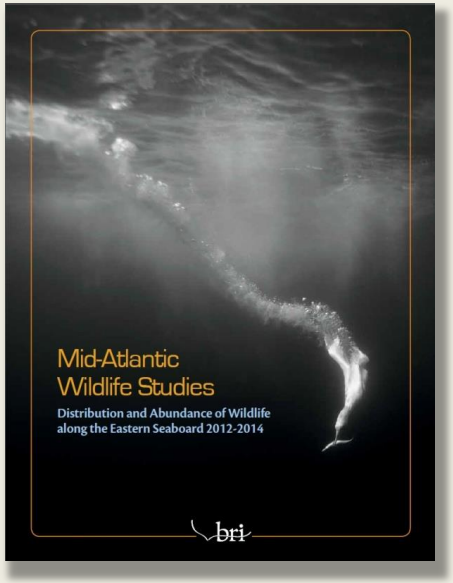
NC STATE UNIVERSITY

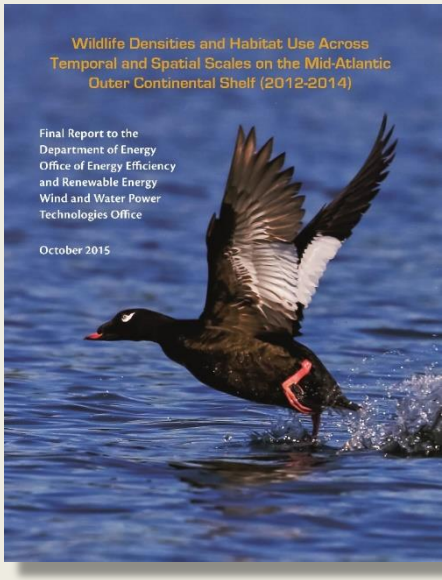
Overall Summary

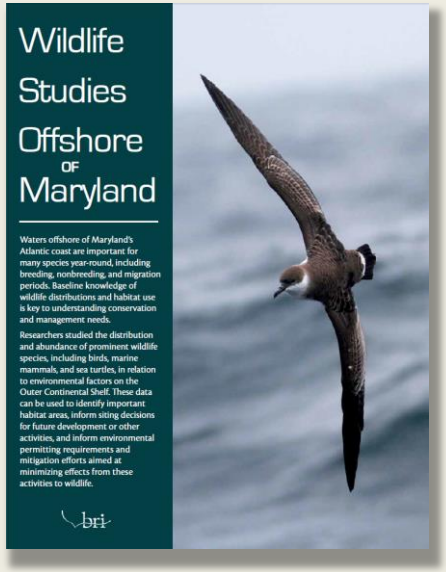
- Wide variation in distribution, abundance, and movement patterns (annually, seasonally, and between taxa)
- Optimal survey approaches will depend on study location and goals
- A combination of approaches may obtain the best results

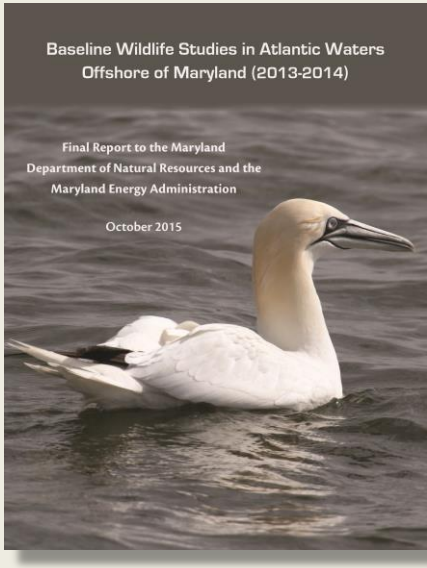
Reports and Data

- Final technical & summary reports
  - www.briloon.org/mabs/reports
  - Tethys Knowledge Base (http://tethys.pnnl.gov/knowledge-base)
- Survey data
  - www.briloon.org/mabs/data
  - Northwest Atlantic Seabird Catalog (FWS/BOEM)
  - MARCO Data Portal - Coming Soon!! (http://midatlanticocean.org/data-portal/)









This material is based upon work supported by:

(award DE-EE0005362)

Kate.williams@briloon.org

www.briloon.org/mabs