

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

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Kate Williams

**Biodiversity
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The Bailey Wildlife
Foundation



U.S. DEPARTMENT OF
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Maryland Energy
ADMINISTRATION
Powering Maryland's Future

BOEM



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

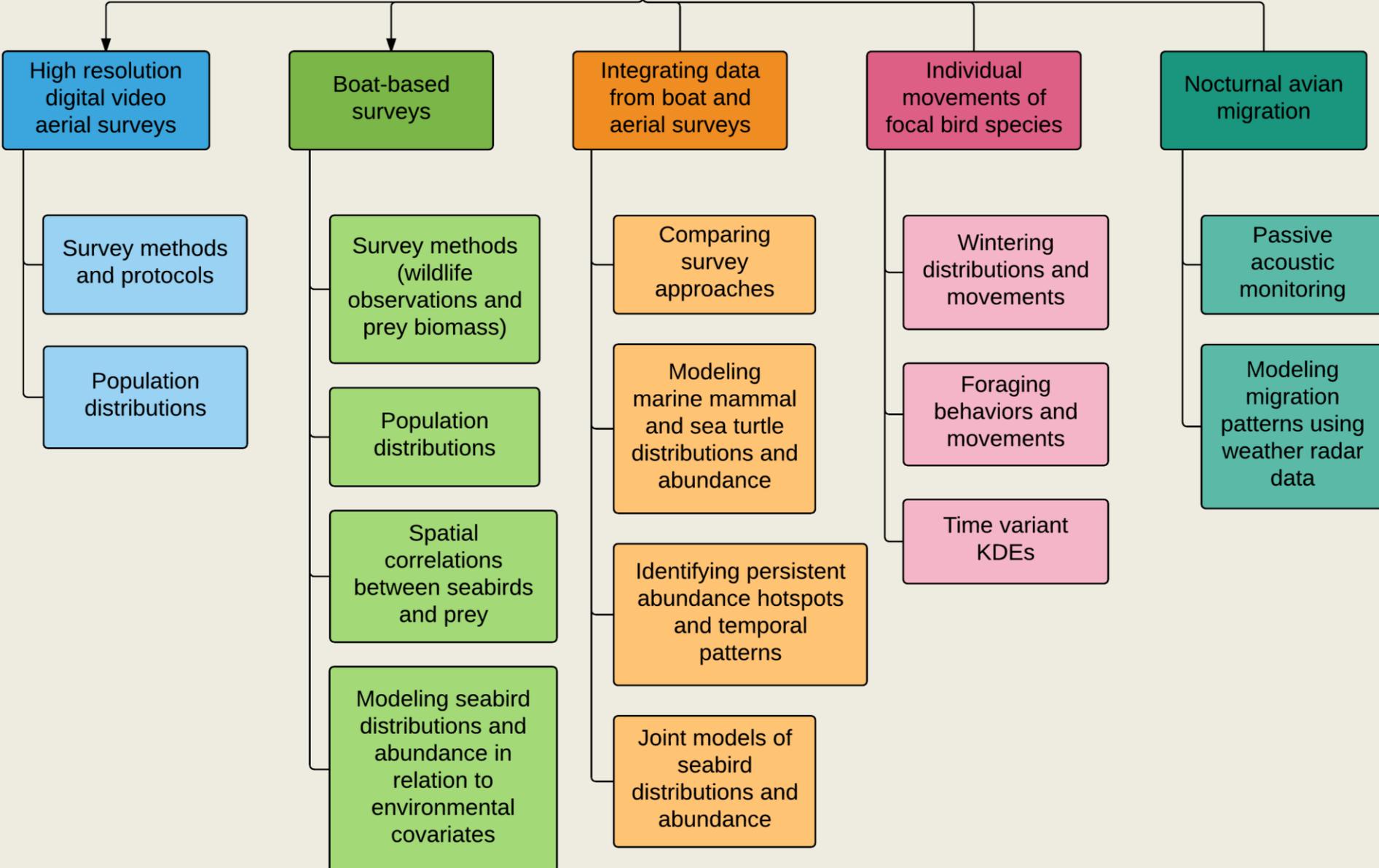
- Provide baseline ecological data and analyses
 - Wildlife distribution patterns
 - Understand causes of these patterns
 - Movements (site fidelity, population connectivity)
- Develop technological resources for future monitoring and assessments



What makes this study important?

- 2+ years of baseline data for wind energy stakeholders
- Use of new technologies and approaches
- Scale of the study
 - Study area, # species observed, mix of tech
- Improved understanding of species composition and use →→ more sustainable offshore wind development

Mid-Atlantic Baseline Studies



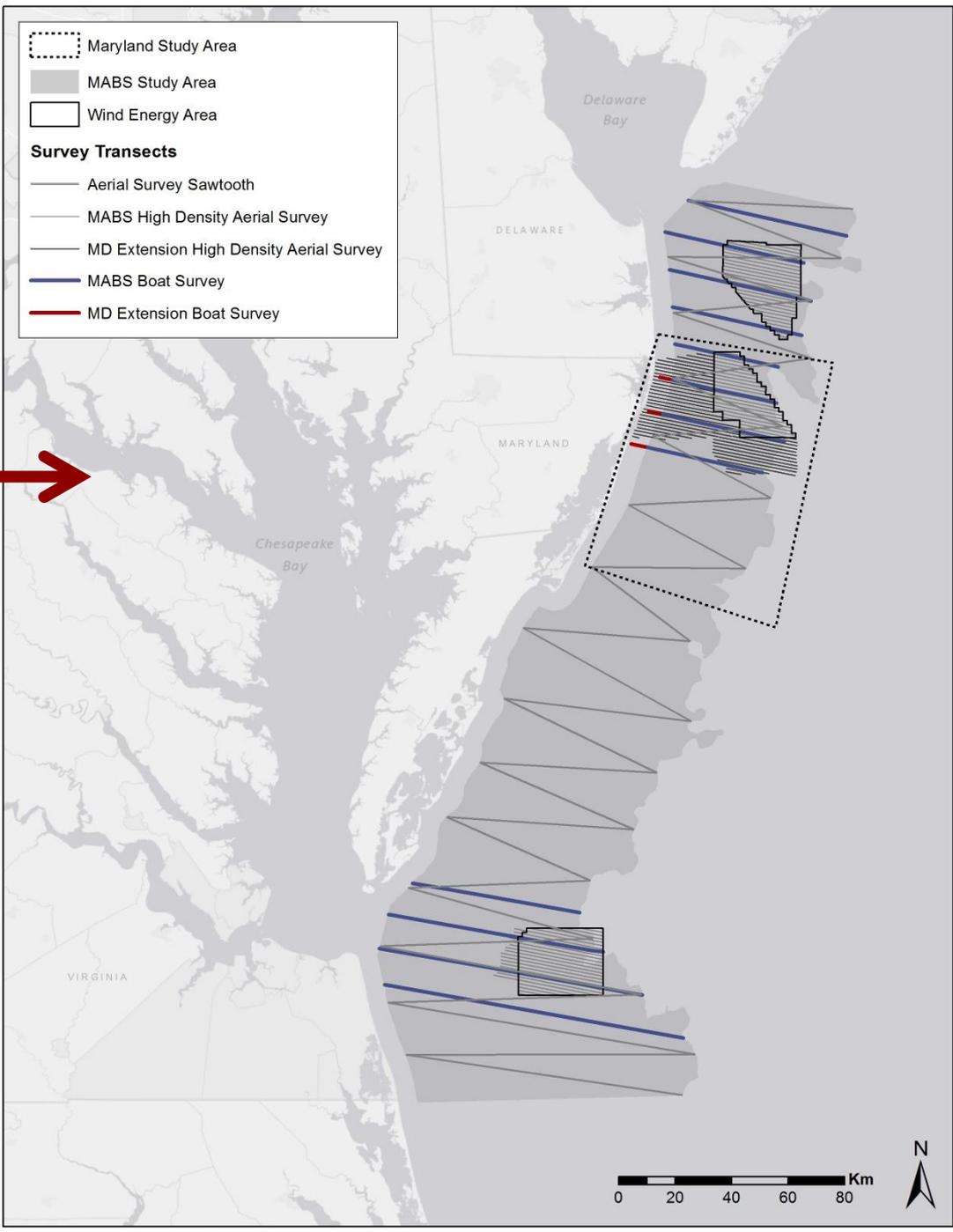
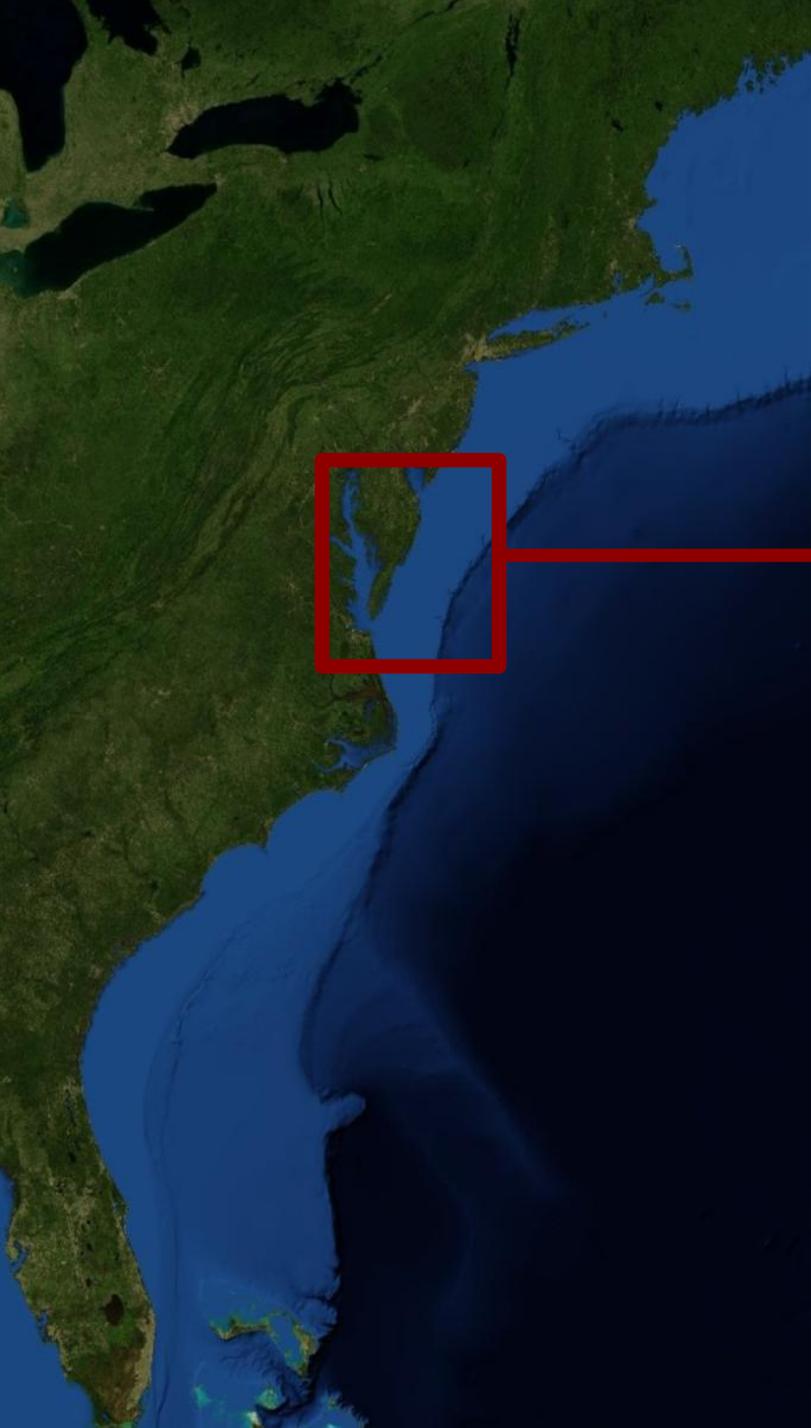
Key Findings

1. Boat-based and digital video aerial surveys each had specific advantages
2. Substantial variation in species composition and spatial patterns by season and year
3. Nearshore waters, particularly offshore of Chesapeake and Delaware Bays, were important to a wide range of species



Overview

- **Study methods**
- **Comparing boat-based and digital video aerial surveys**
 - Comparison study
 - Overall comparisons
- **Wildlife distributions, abundance, and movements**
 - Seasonal patterns
 - Persistent patterns
 - Case studies
- **Data access and final reports**
- **Discussion and questions**



Boat surveys

55' charter vessel

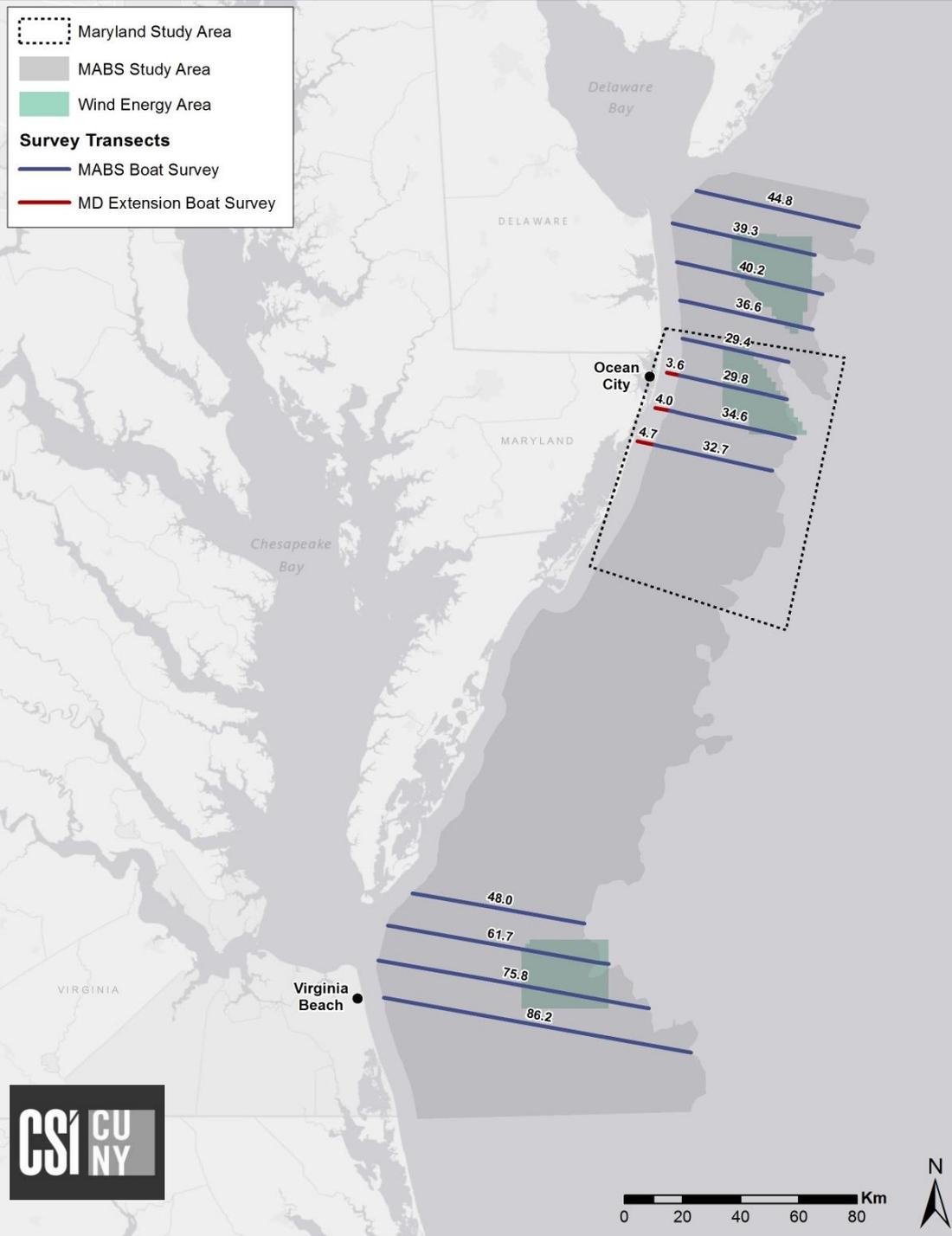
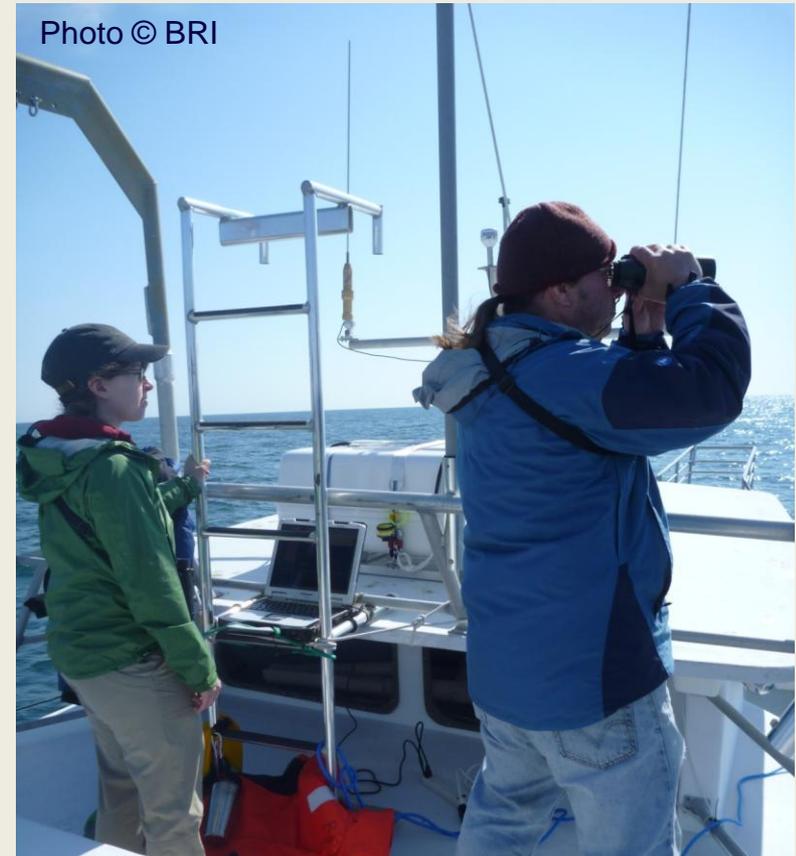


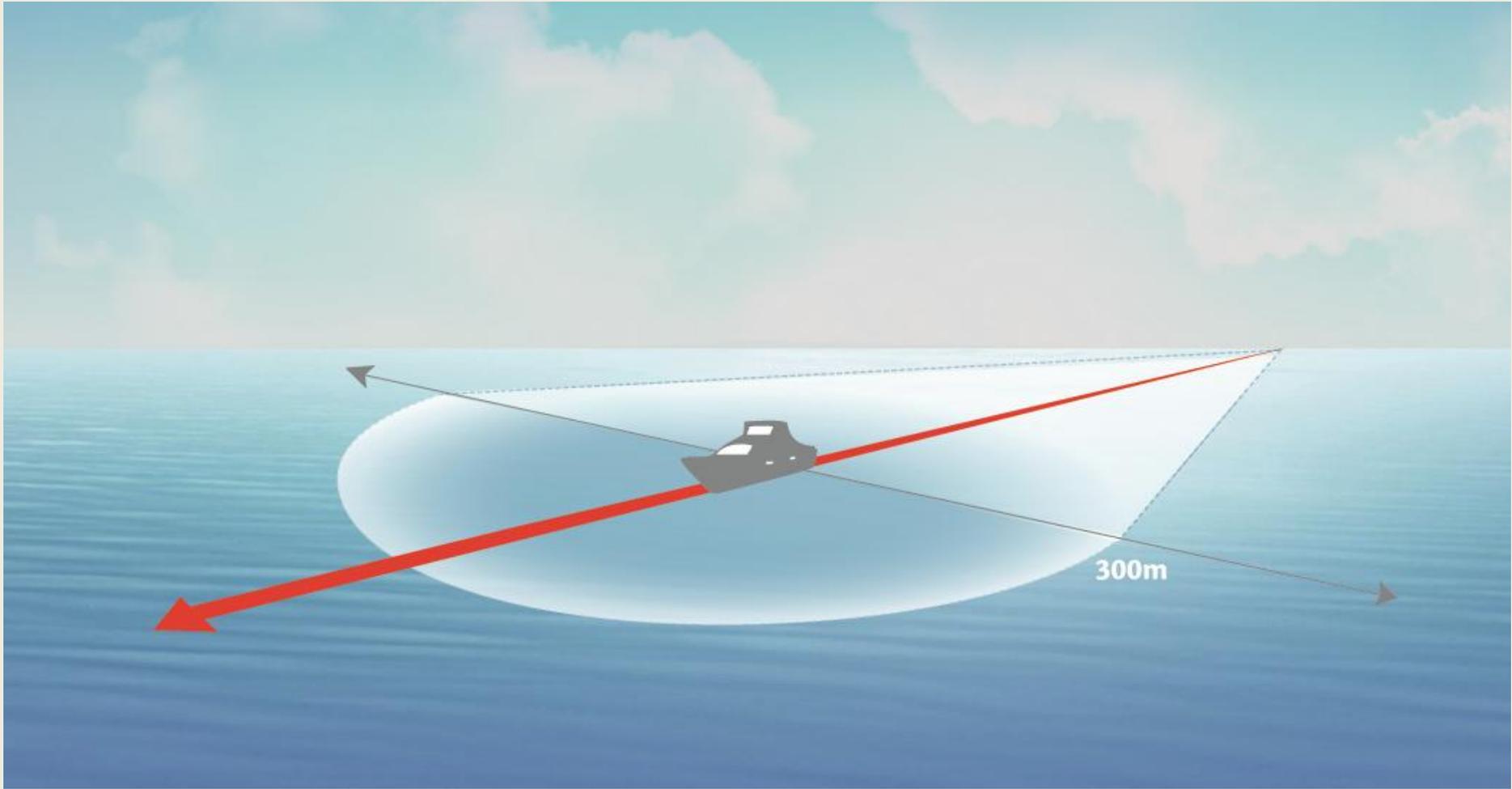
Photo courtesy of Capt.
Brian Patteson Inc.



Boat surveys

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

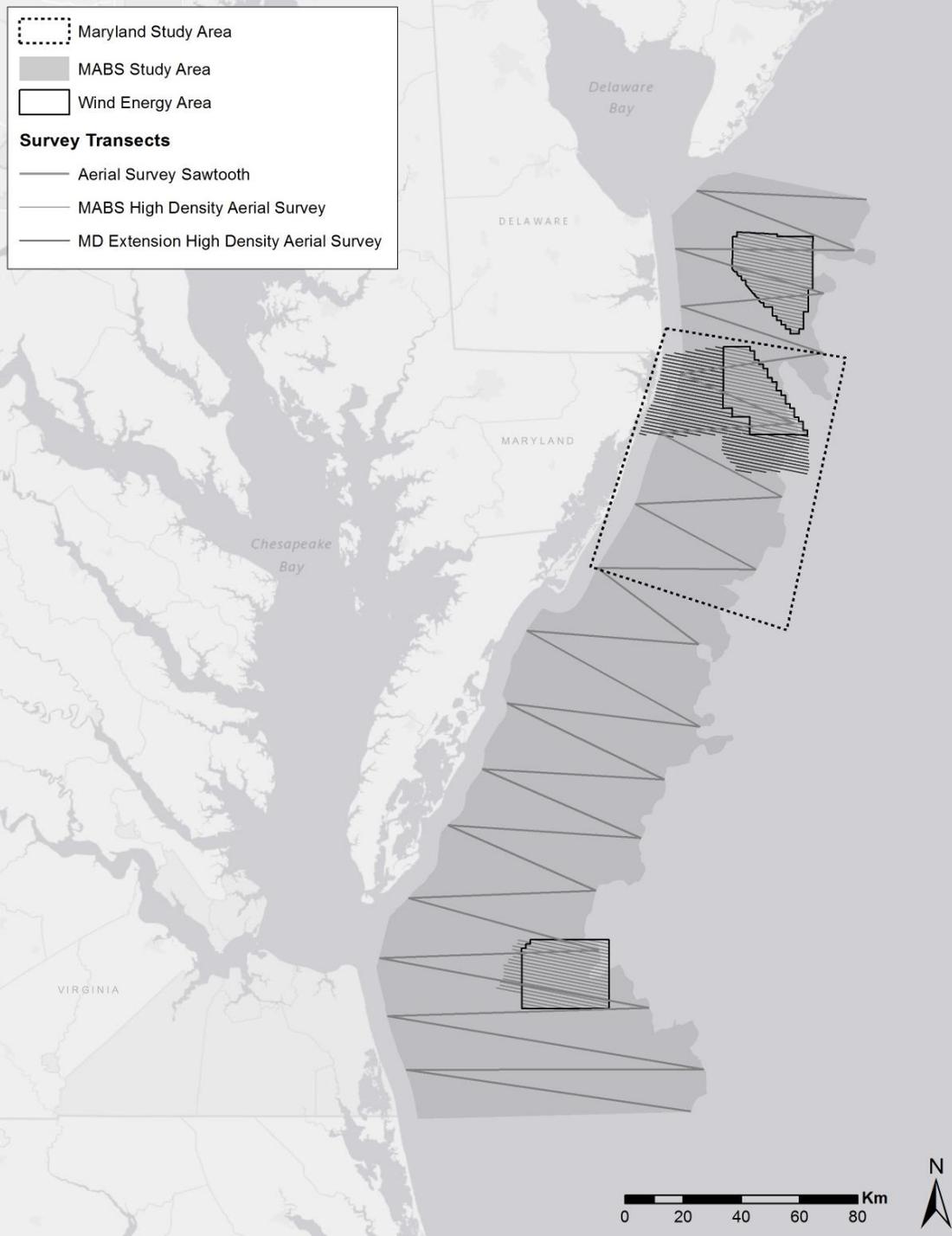




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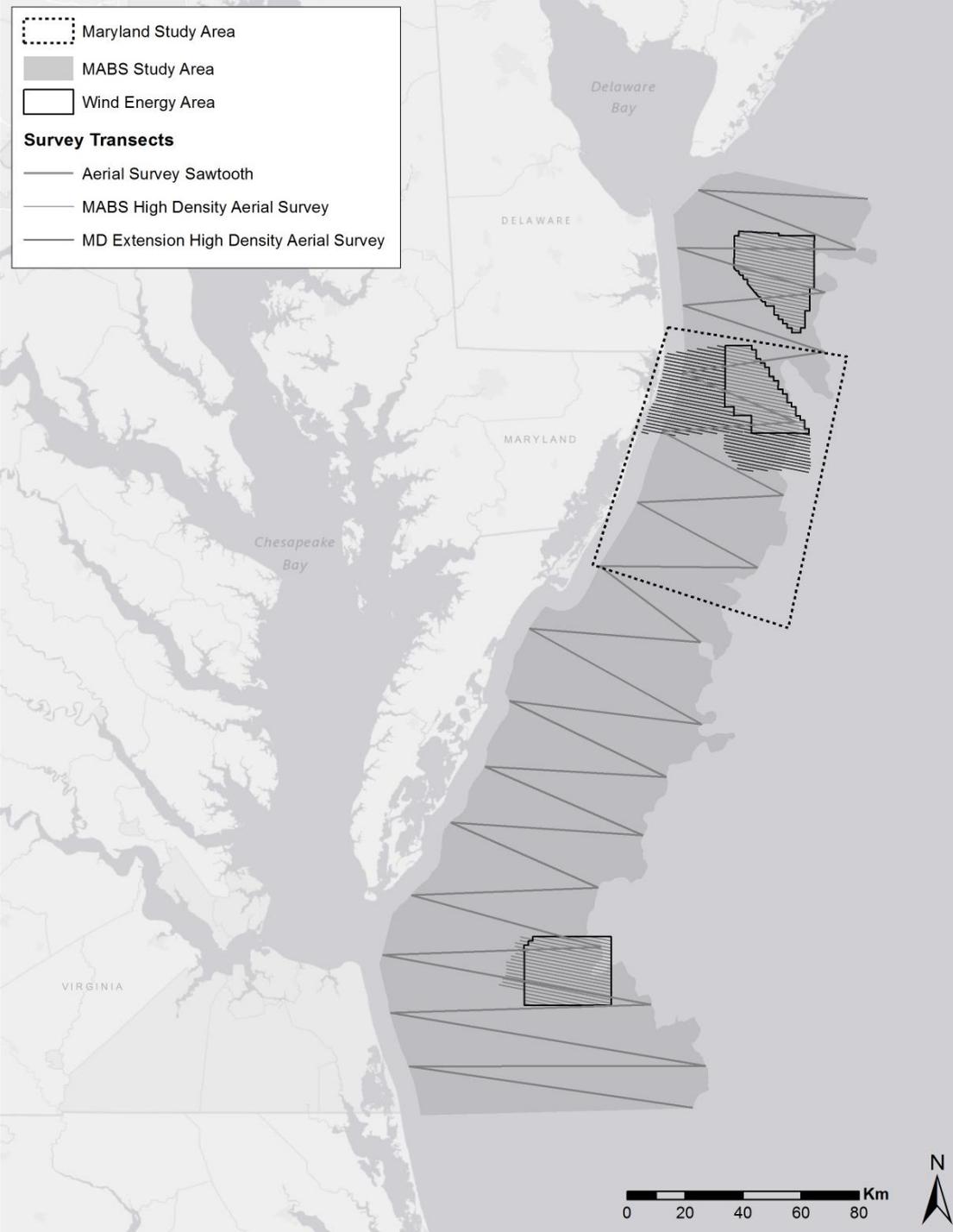
High resolution digital video aerial surveys

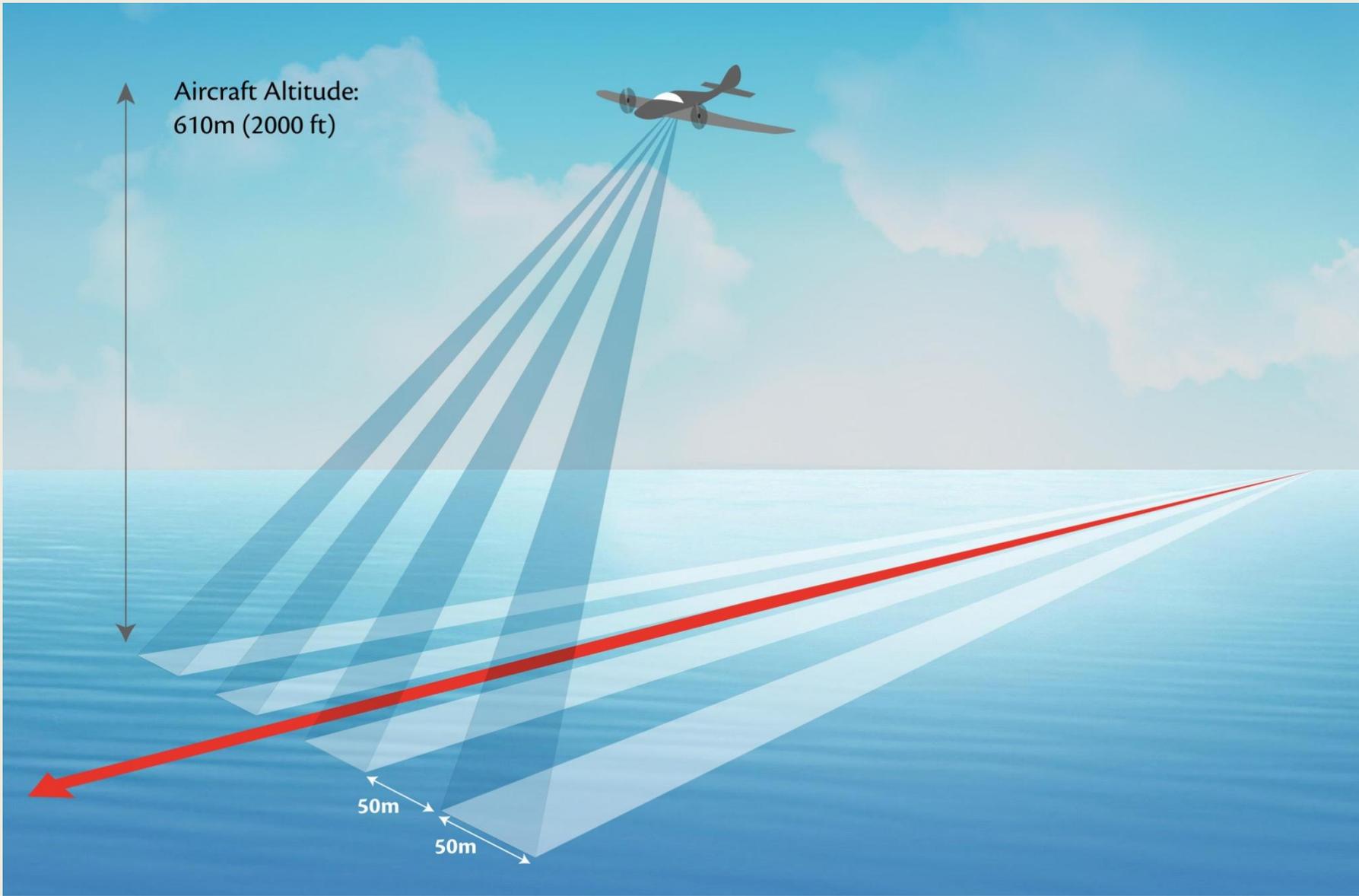
- 15 surveys/ 2 yrs
- 4 belly-mounted cameras



High resolution digital video aerial surveys

- 2 cm ground spatial resolution (GSR)
- GPS coordinates for each video frame
- ~8 frames/sec





Aircraft Altitude:
610m (2000 ft)

50m

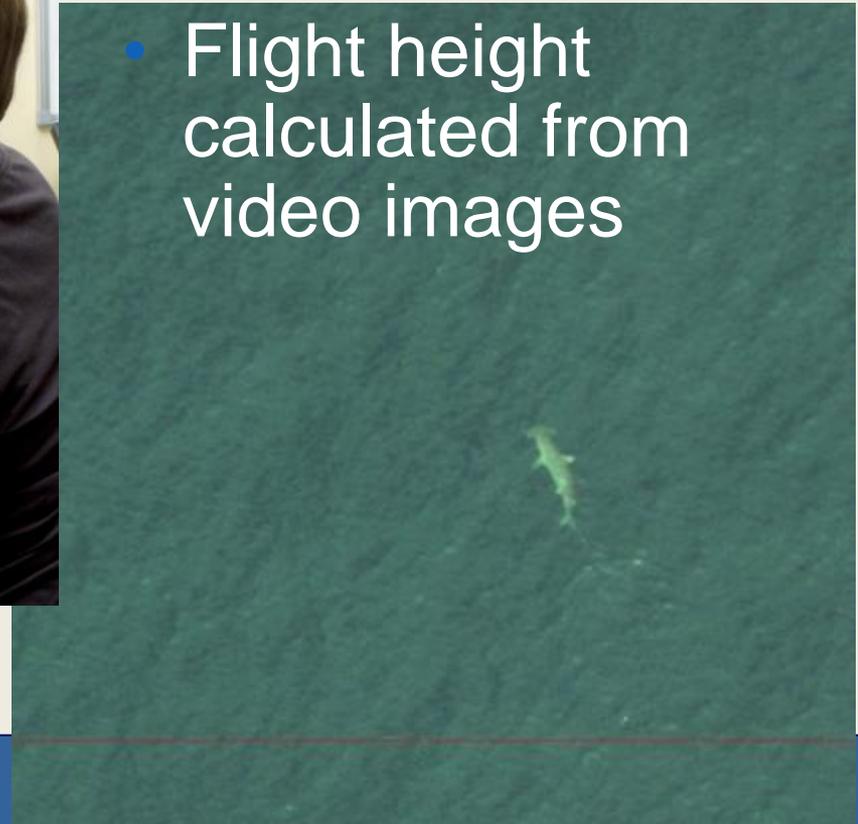
50m

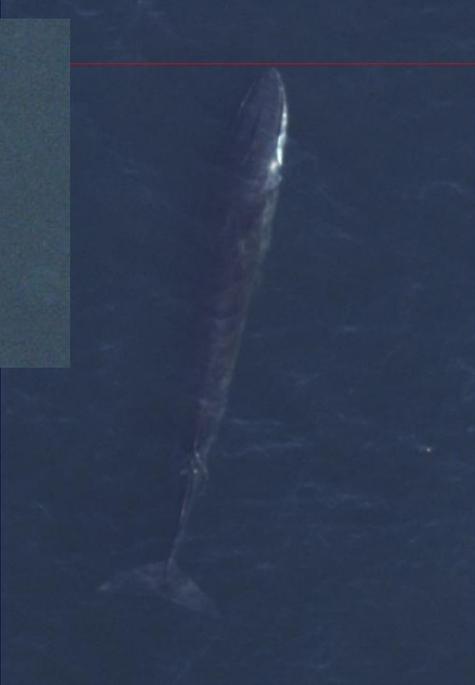
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Video Review



- Full QA process
- Flight height calculated from video images





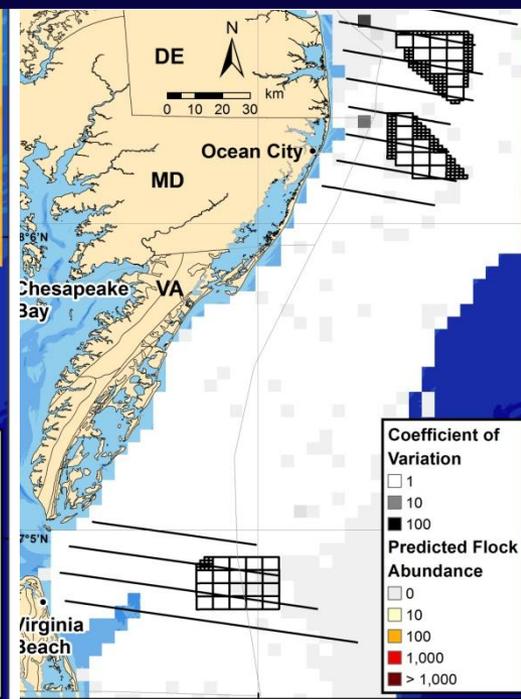
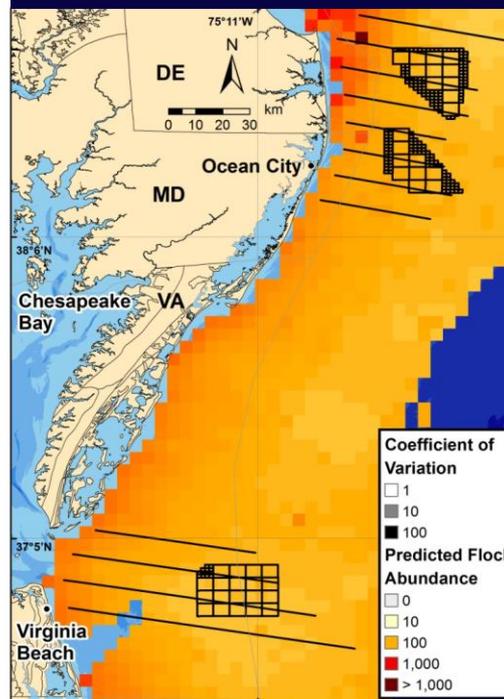
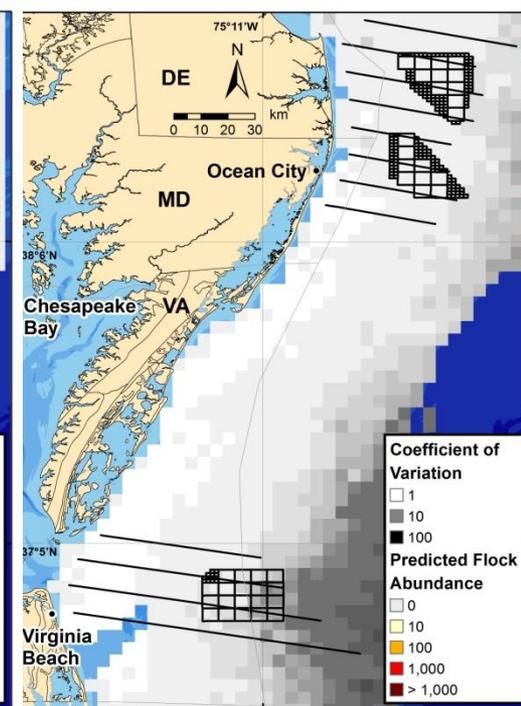
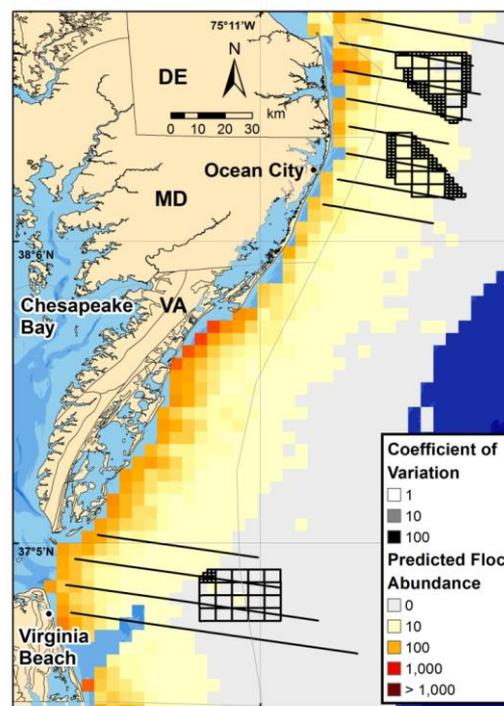
Images courtesy of HiDef Aerial Surveying ,Ltd.

Modeling

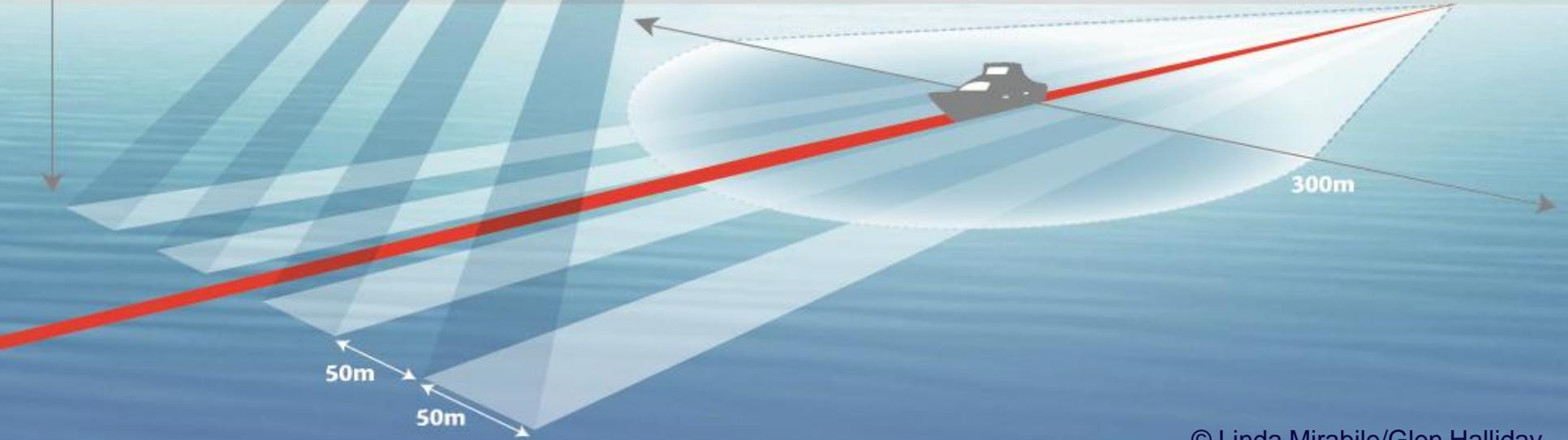
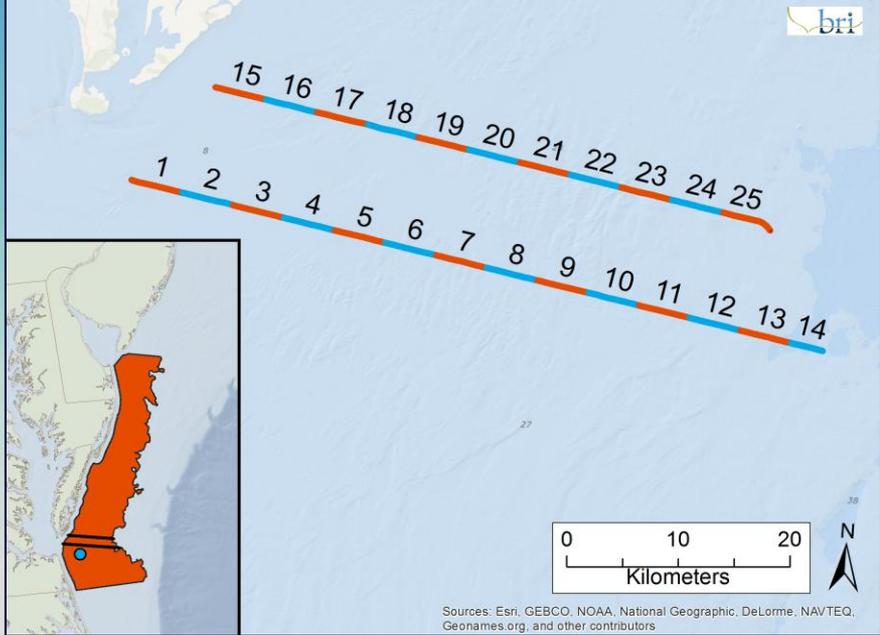
- Seabird GLMs (NCSU)
 - Hierarchical community distance sampling model
 - Habitat modeling
 - Species ID model
 - Comparison of boat and aerial habitat models
 - Integrated modeling framework
- Marine mammal GAMs (Duke)
 - Distance sampling with environmental covariates
- Sea turtle GAMs (Duke)
 - Abundance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



Aircraft Altitude:
610m (2000 ft)



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Boat-aerial comparison study

- **Analyses:**

- ID rates
- Boat disturbance
- Abundance estimates



Northern Gannets

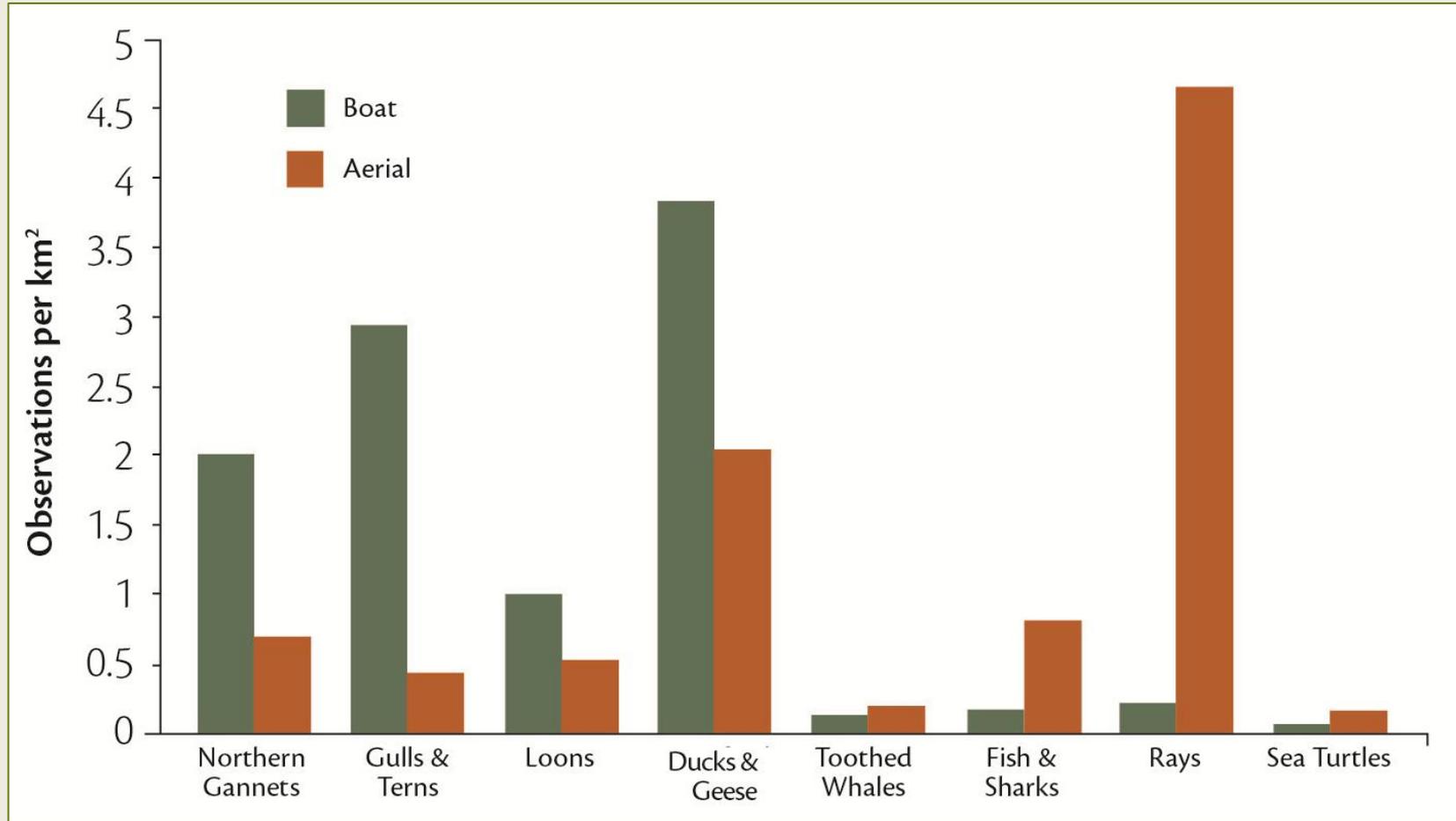


Scoters

Conclusions

- Lower aerial ID rates for many species groups
- 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 and Cownose Rays

- >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)
- >47,000 Cownose Rays during migration



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

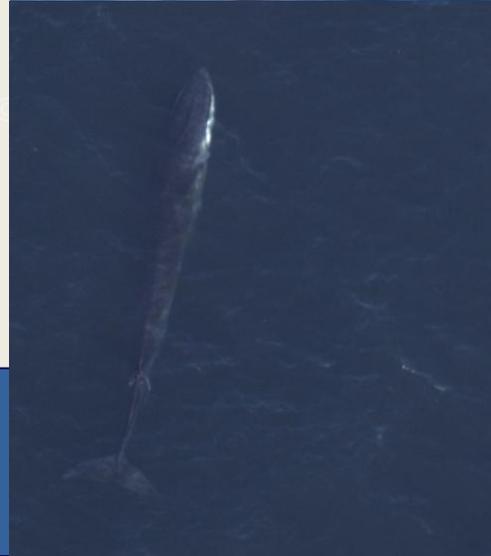
Aerial Surveys

- 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

Geographic and temporal patterns

- **Seasonal patterns**
 - Temporal bar charts (boat + aerial)
 - Model-predicted abundance (boat and/or aerial)
 - Utilization distributions (telemetry)
- **Persistent patterns**
 - Persistent hotspots of relative abundance (boat + aerial)
- **Case studies**
 - All of the above



Seasonal patterns and interannual variation

- The presence and relative abundance of species in the study area varied widely during non-breeding, breeding, and migratory periods.
- Wide variation in distribution and abundance patterns by taxon (see case studies)
- Also large amount of interannual variation in environmental conditions and distributions

Temporal Trends in Abundance

Temporal changes in relative abundance for taxonomic groups.

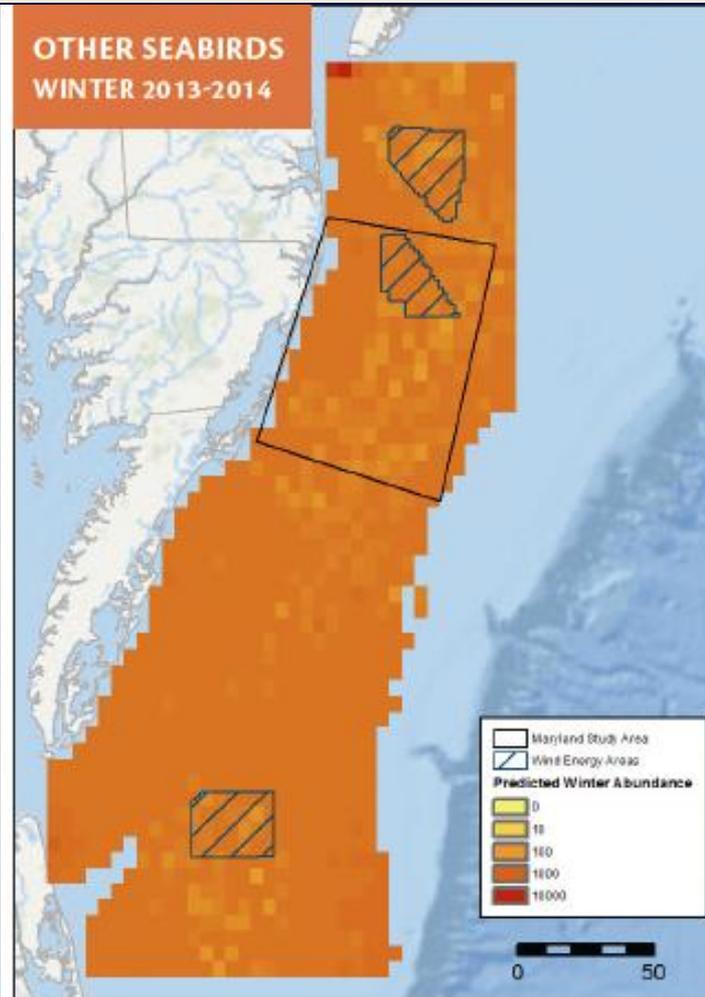
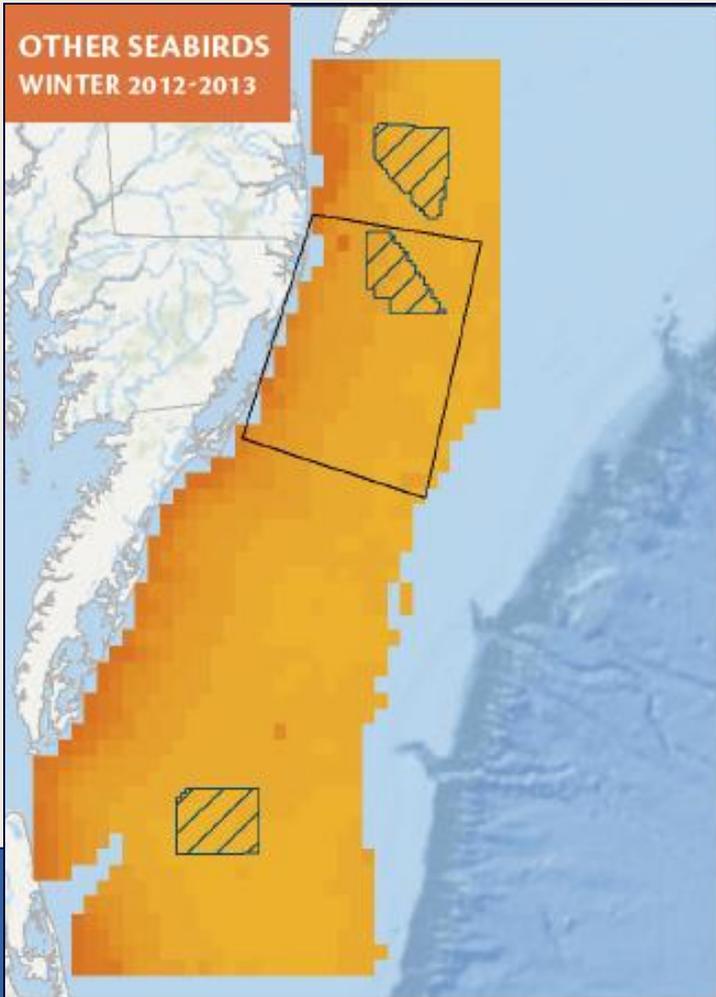
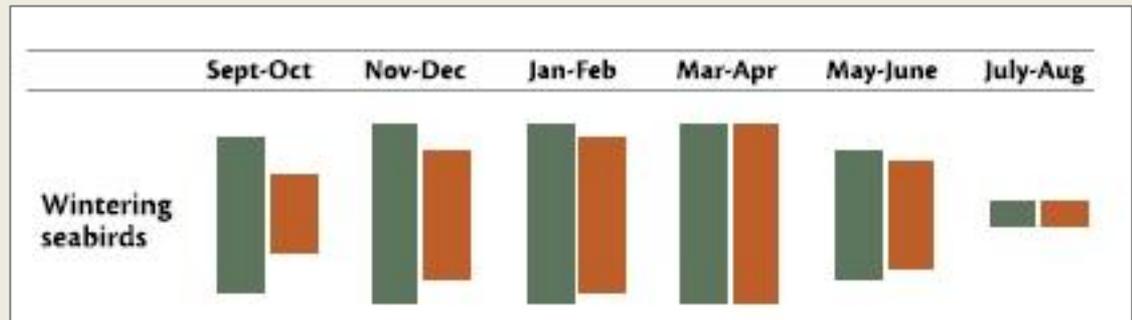
Data are from boat-based surveys (■) and high resolution digital video aerial surveys (■).

Species included in each category are listed in Williams *et al.* (2015).

*Forage fish were identified as schools, not as individuals, unlike the other animal groups.



Wintering Seabirds



Persistent Hotspots of Relative Abundance

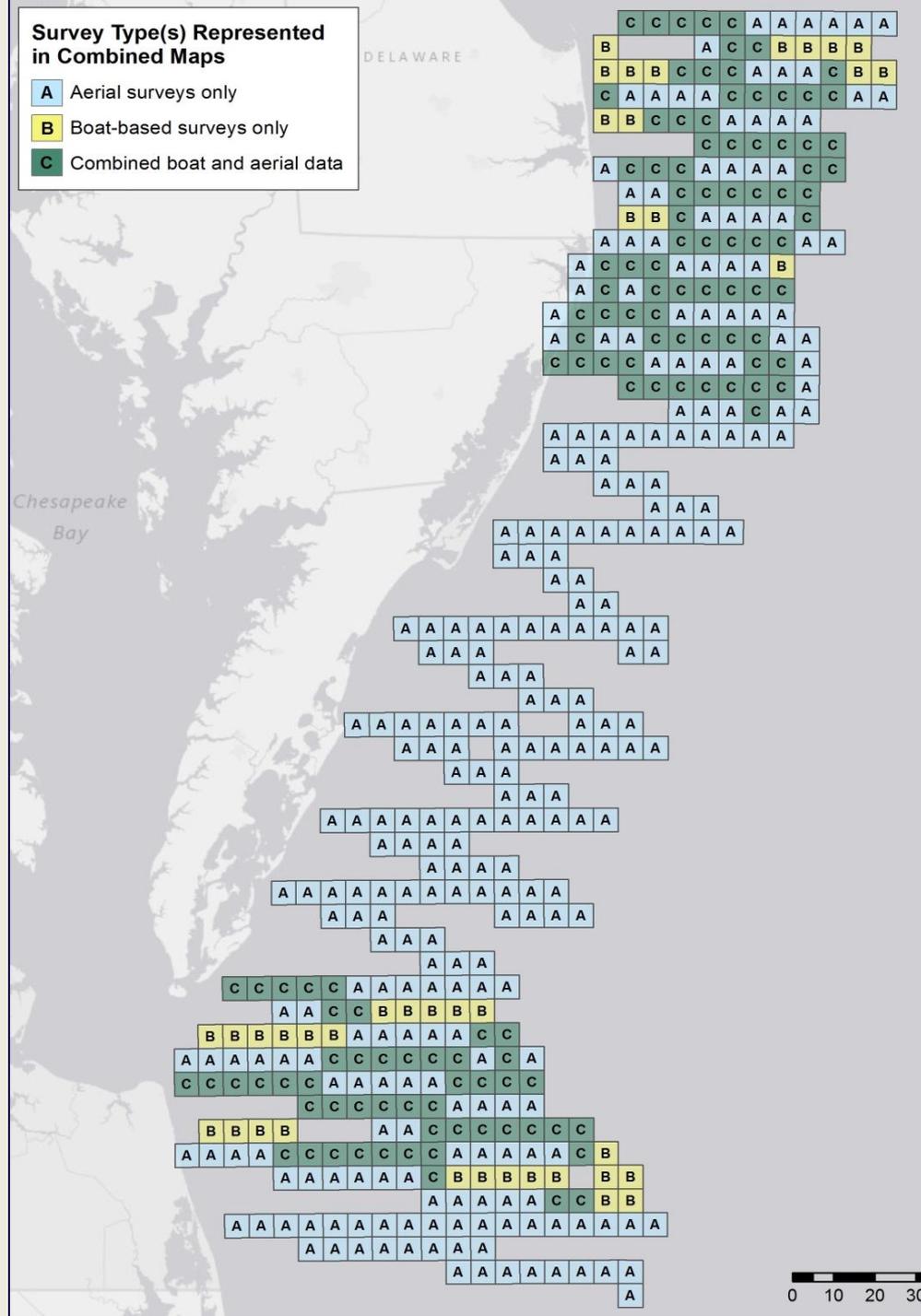
- Identify spatial patterns of species abundance that persist over time and may indicate the locations of important habitat areas (Santora & Veit 2013)
 - Identify locations where animals consistently observed in #s > standardized baseline

- Boat and aerial data handled independently:

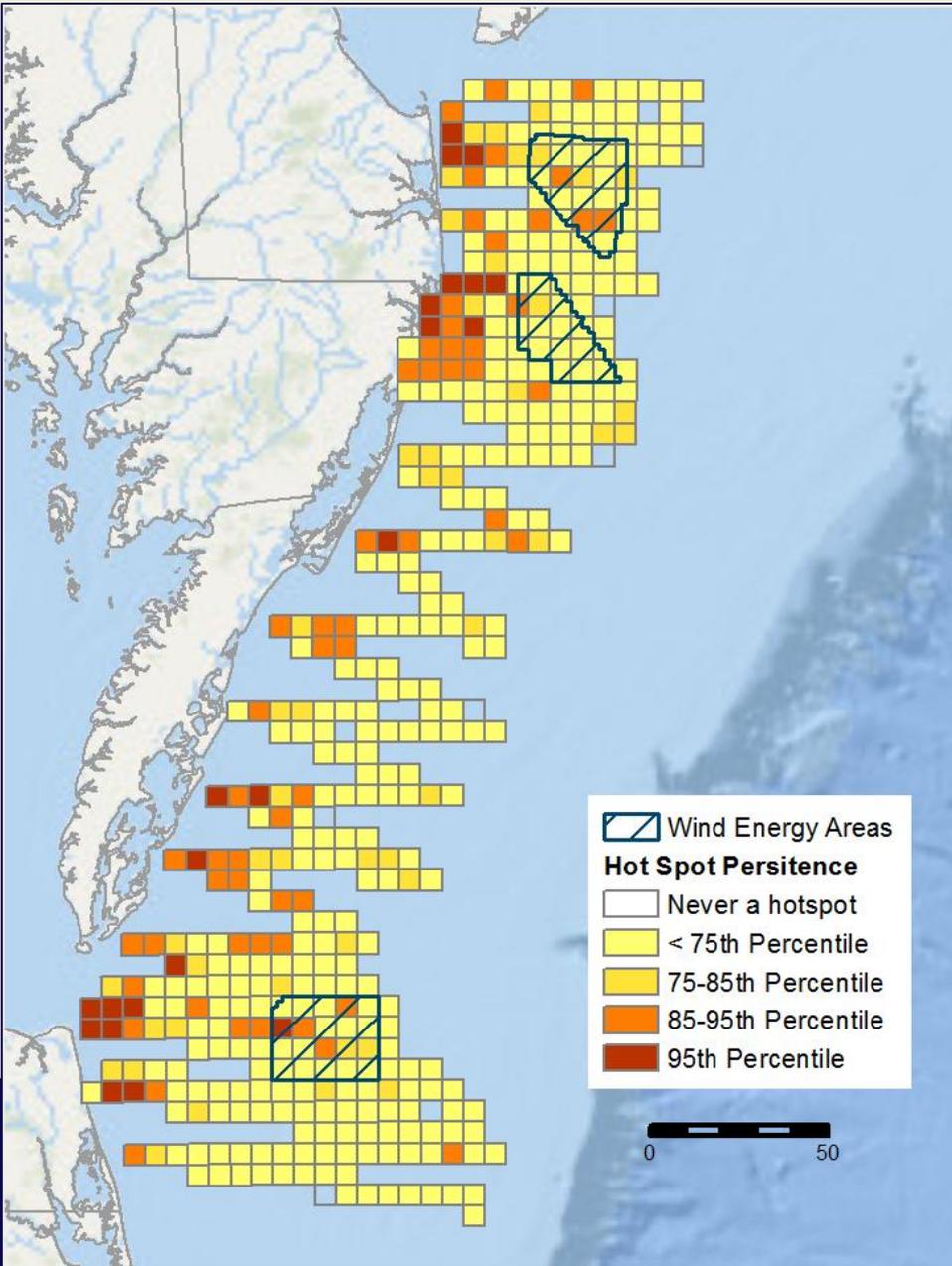
- Gamma distribution fitted to non-zero counts from each survey; top quartile = survey-specific hotspots

- Datasets combined:

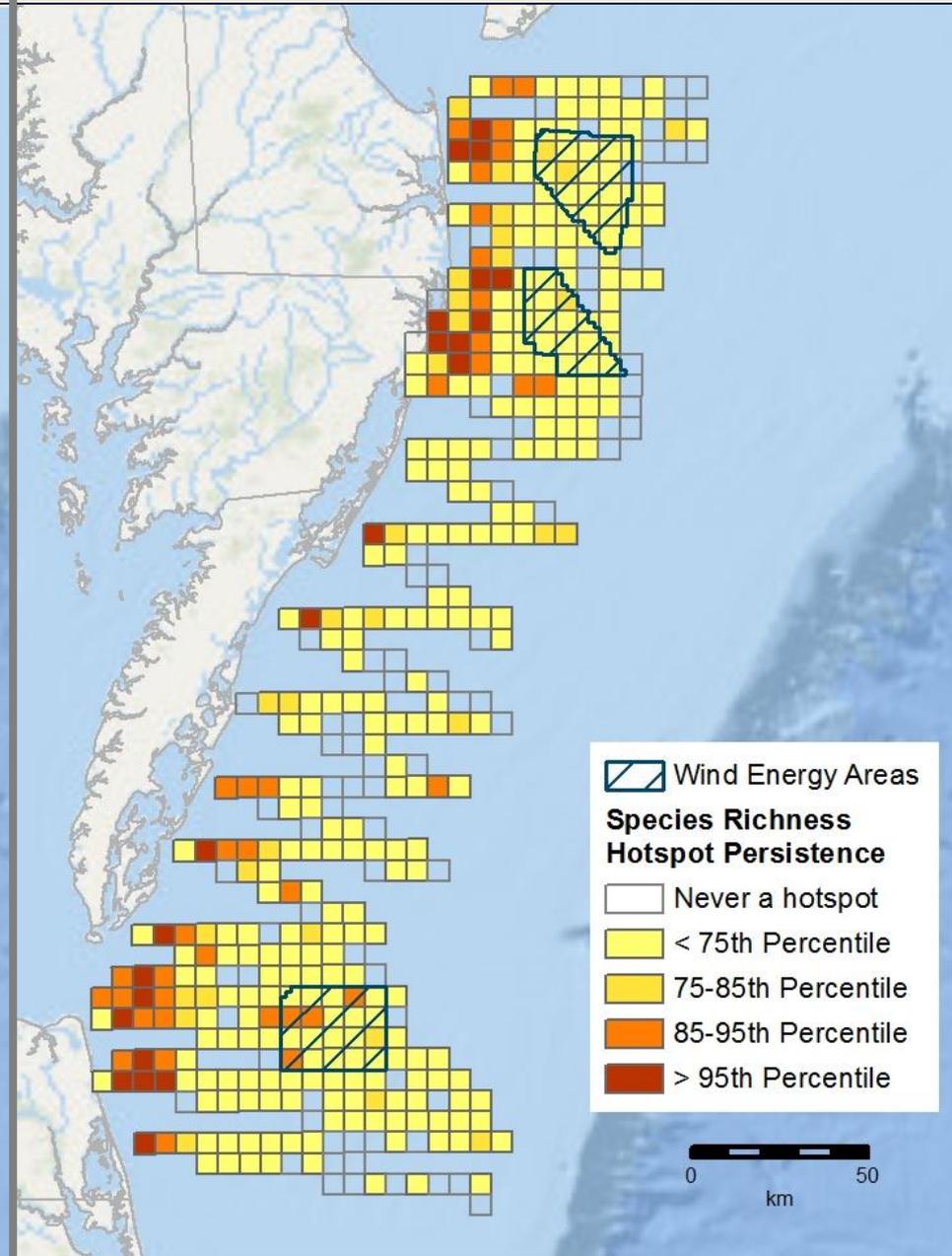
- Weighted by effort-corrected total abundance for each dataset
- Across all times surveyed: what % of time is block a hotspot?



Abundance (all species)



Species richness



[CASE STUDY]

Northern Gannets



© Jonathan Fiely-BRI

CONTEXT

- European studies indicate a range of possible effects, including collision mortality and displacement

TAKE HOME MESSAGES

- The broad-scale distribution in winter may increase likelihood of interaction with offshore wind
- Foraging areas defined by a wide variety of characteristics. Development could cause displacement almost anywhere across the shelf, but particularly within ~30-40 km of shore.

Seasonal Patterns:

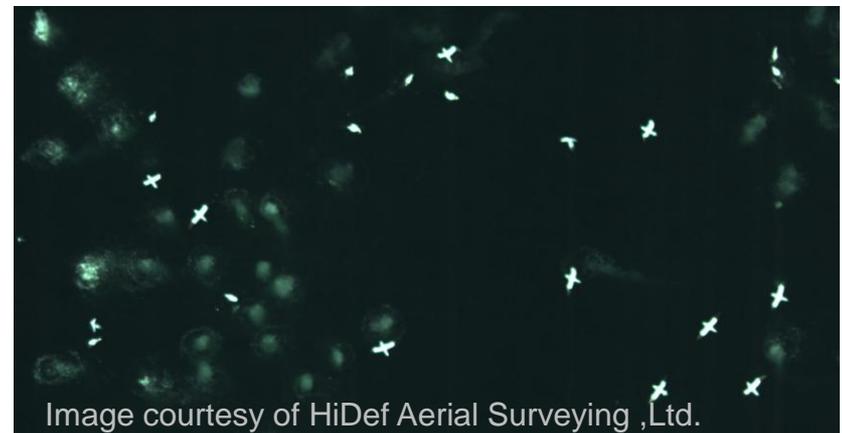
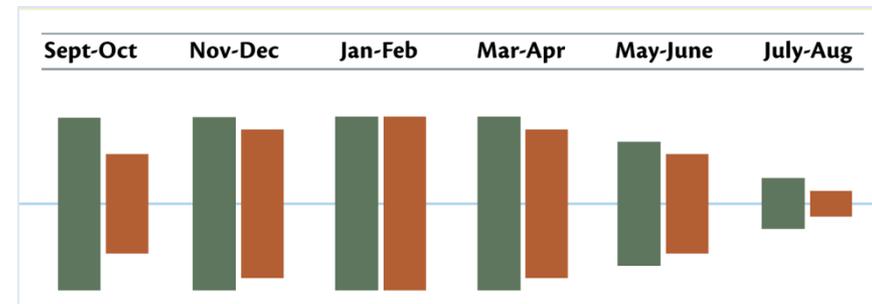
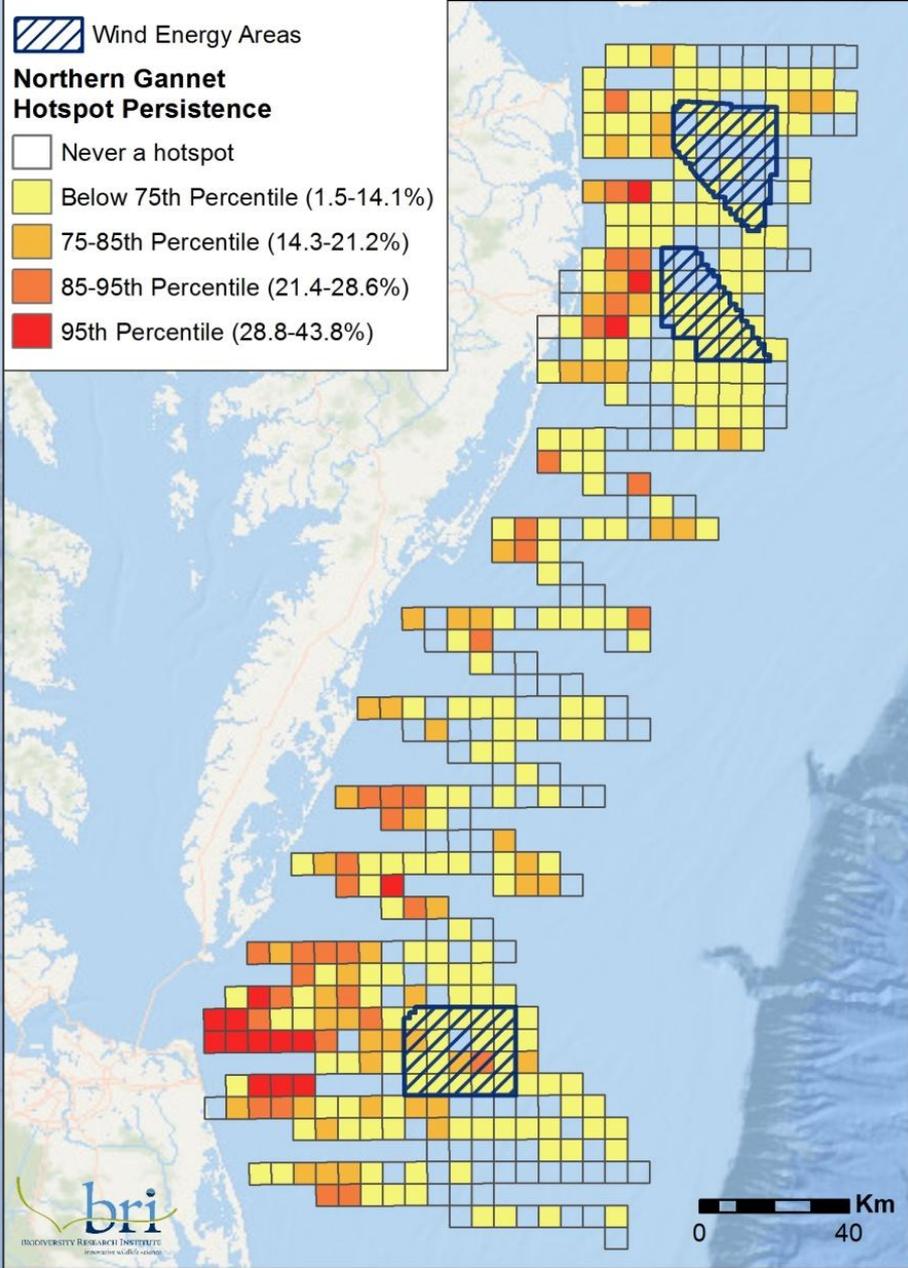
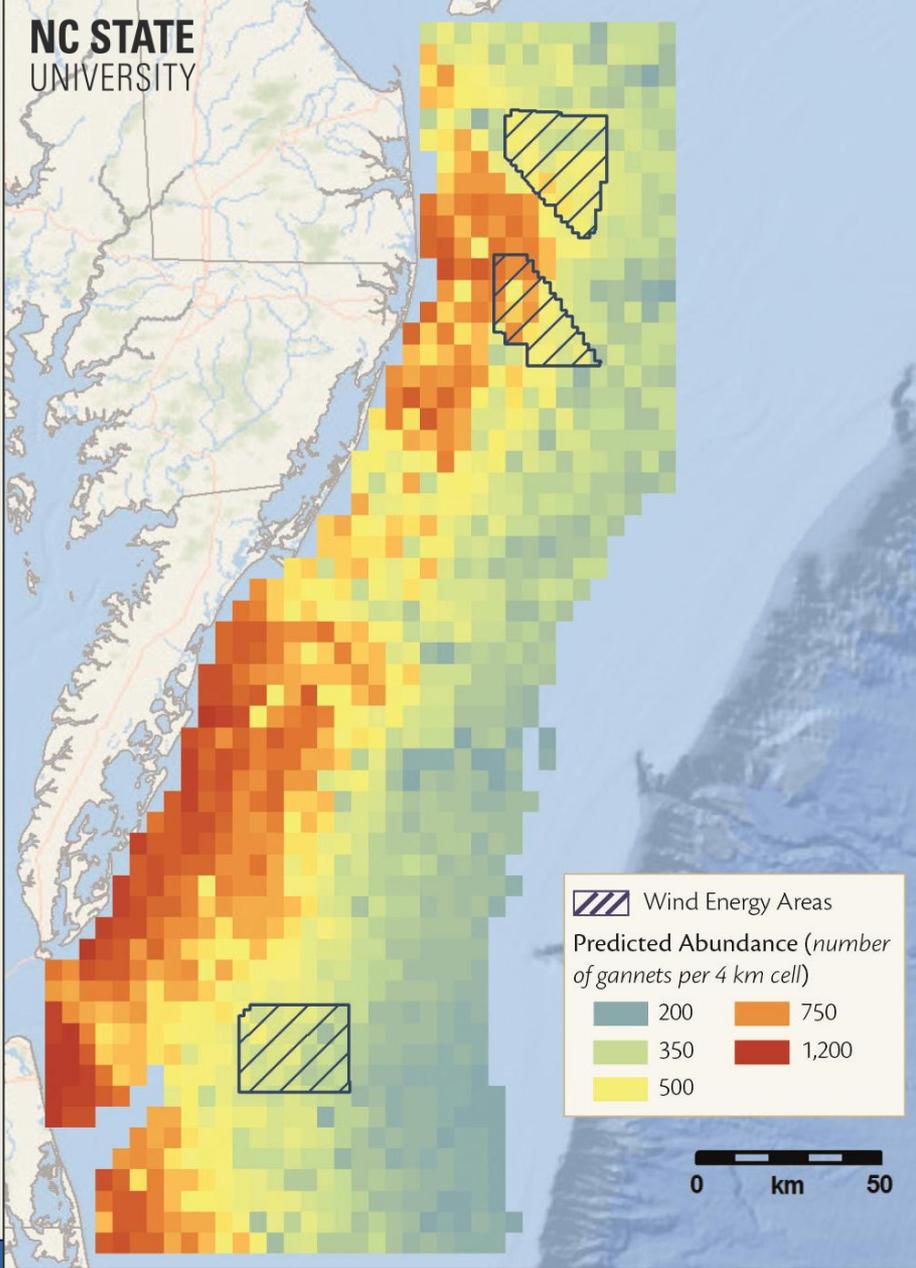


Image courtesy of HiDef Aerial Surveying ,Ltd.



[CASE STUDY]

Red-throated Loons



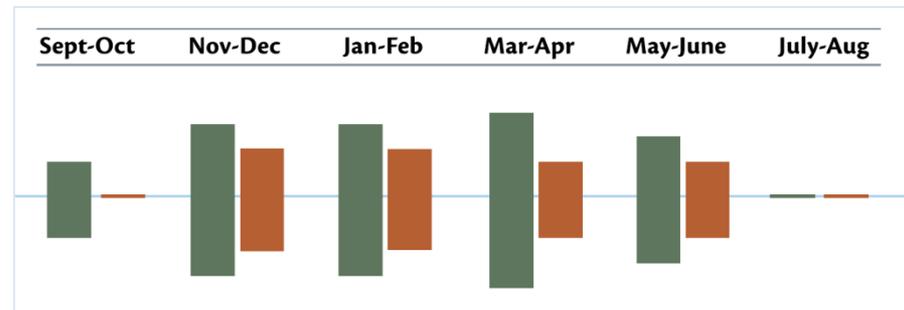
CONTEXT

- European studies indicate long-term, localized displacement, and disturbance by vessel traffic

TAKE HOME MESSAGES

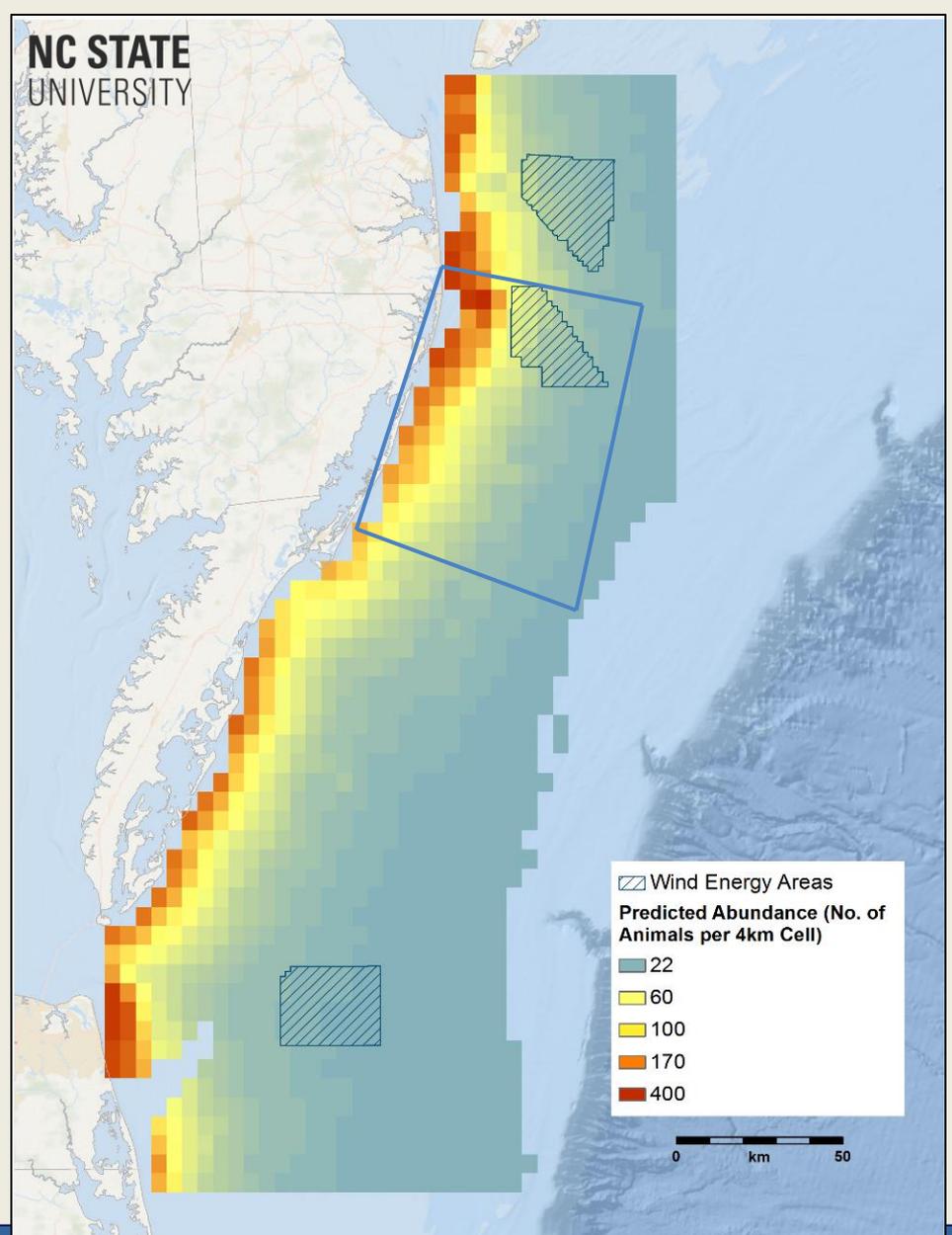
- In winter, most commonly located west (inshore) of the existing WEAs
- Overlap with existing mid-Atlantic WEAs during migration when moving farther offshore

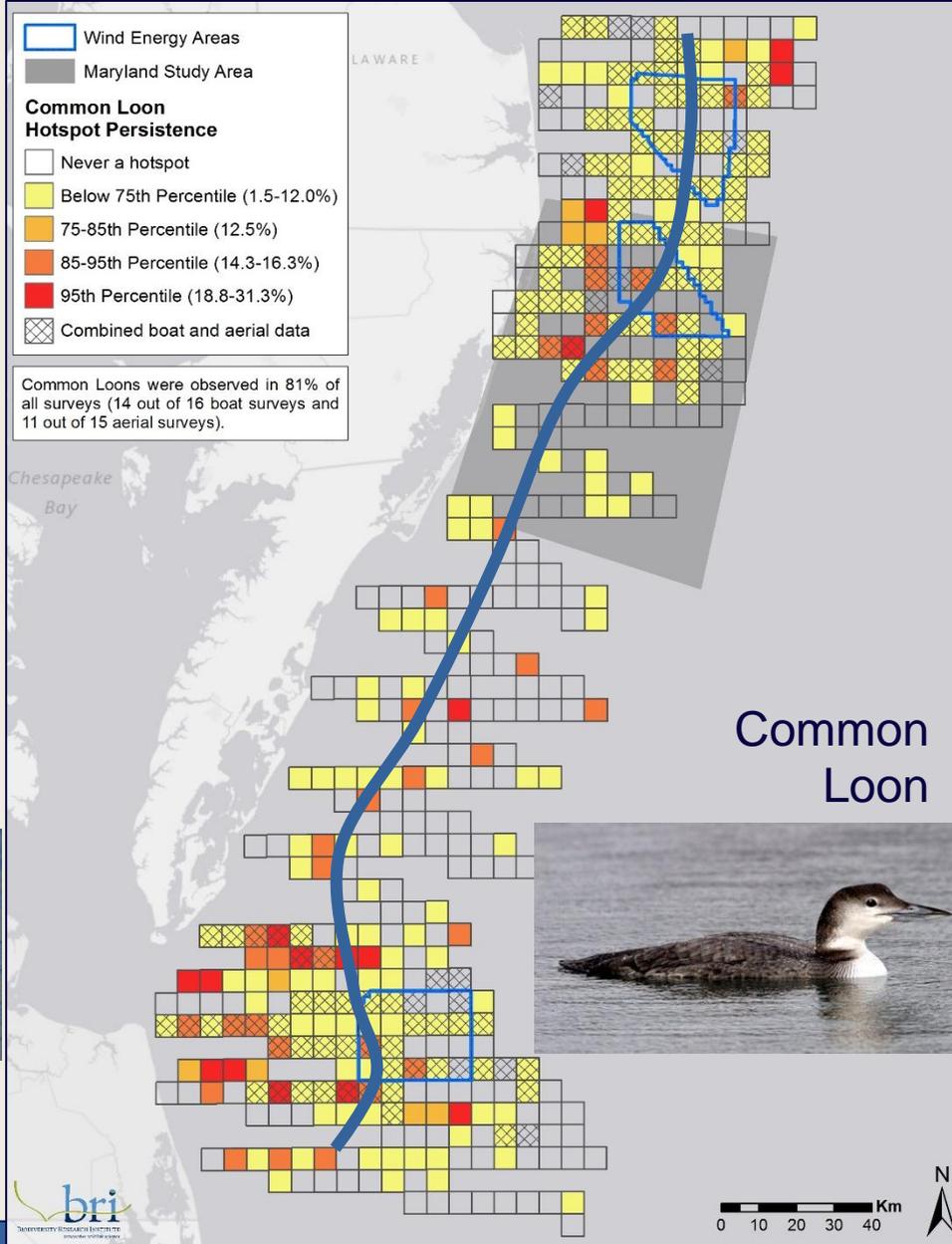
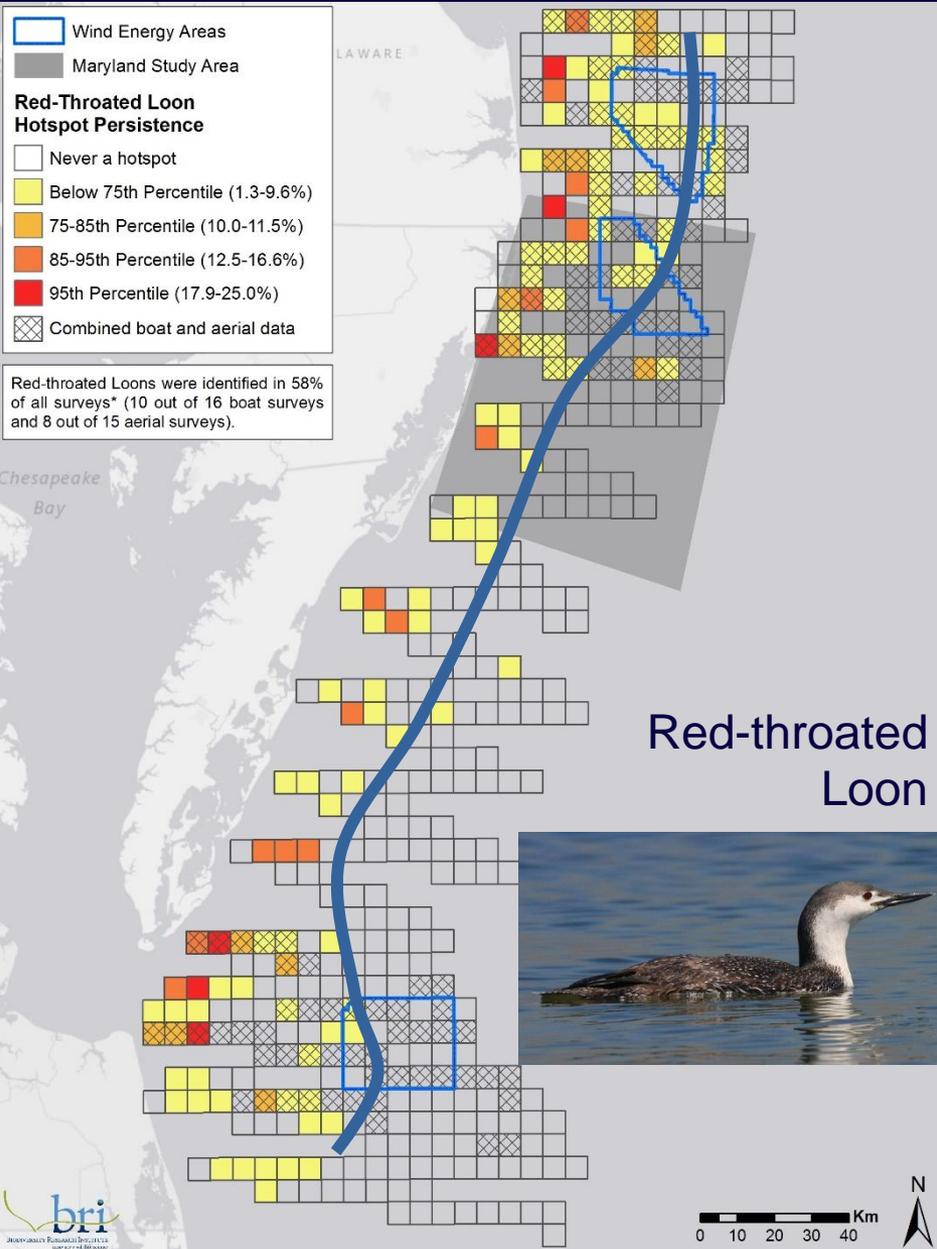
Seasonal Patterns:



© Rick Gray-BRI

Red-throated Loon





[CASE STUDY]

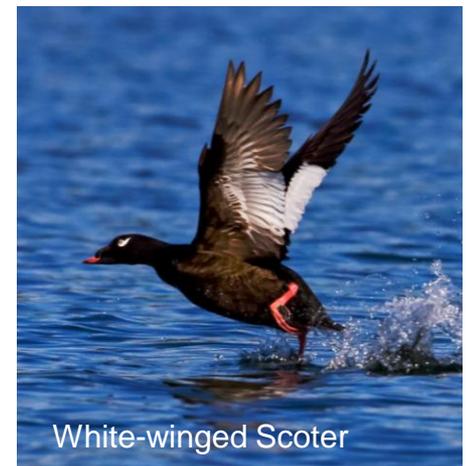
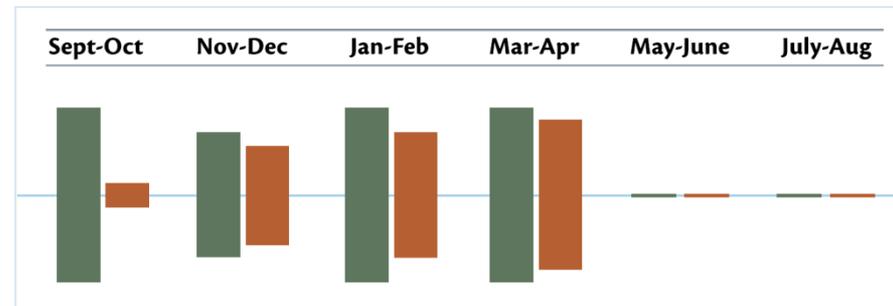
Scoters

**CONTEXT**

- European studies indicate long-term, localized displacement, and disturbance by vessel traffic

TAKE HOME MESSAGES

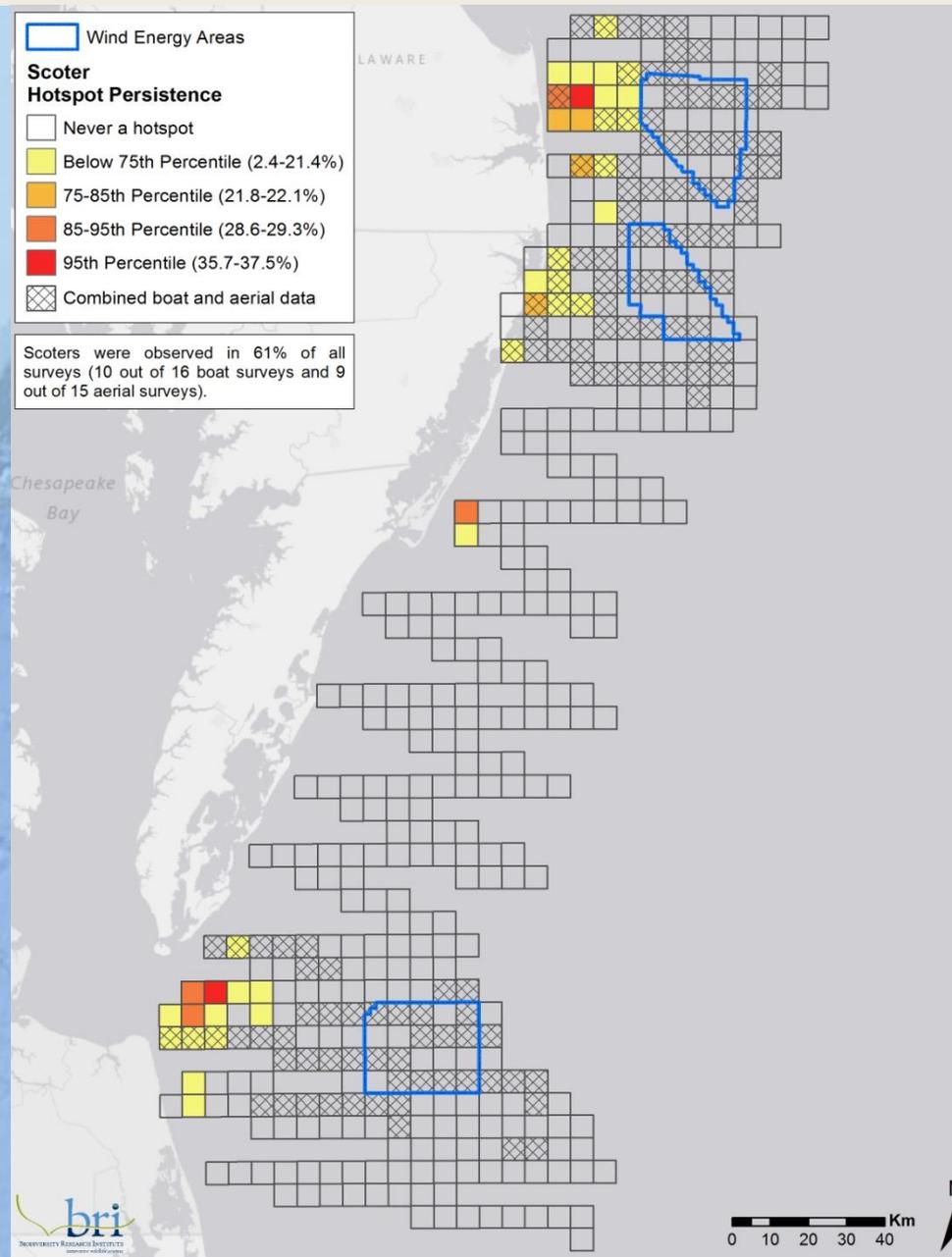
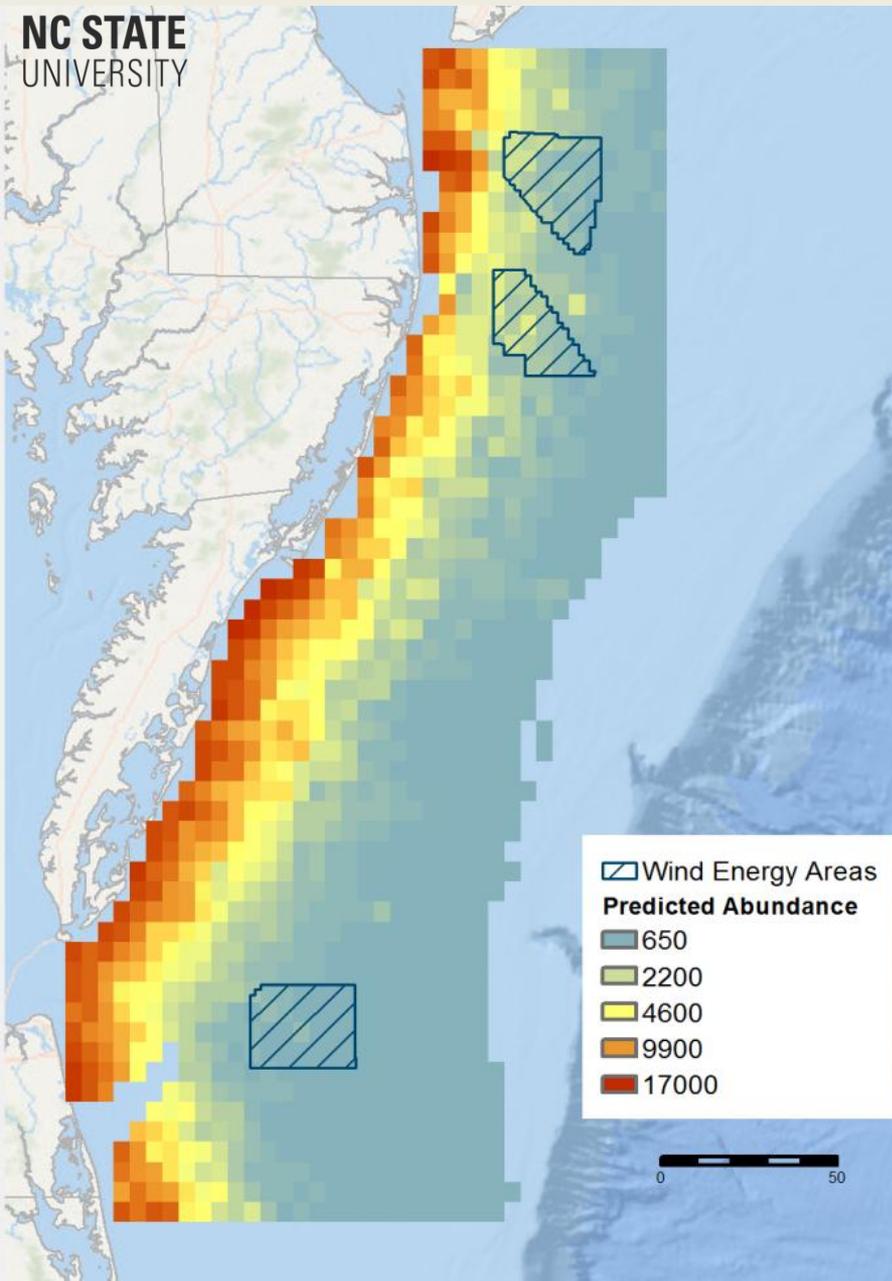
- In winter, most commonly located west (inshore) of the existing WEAs (distributions largely driven by water depth)
- Construction and operations activities in the mid-Atlantic, including vessel traffic, is most likely to cause localized displacement of scoters if these activities occur within about 20 km of shore

Seasonal Patterns:

Photos © Daniel Poleschook

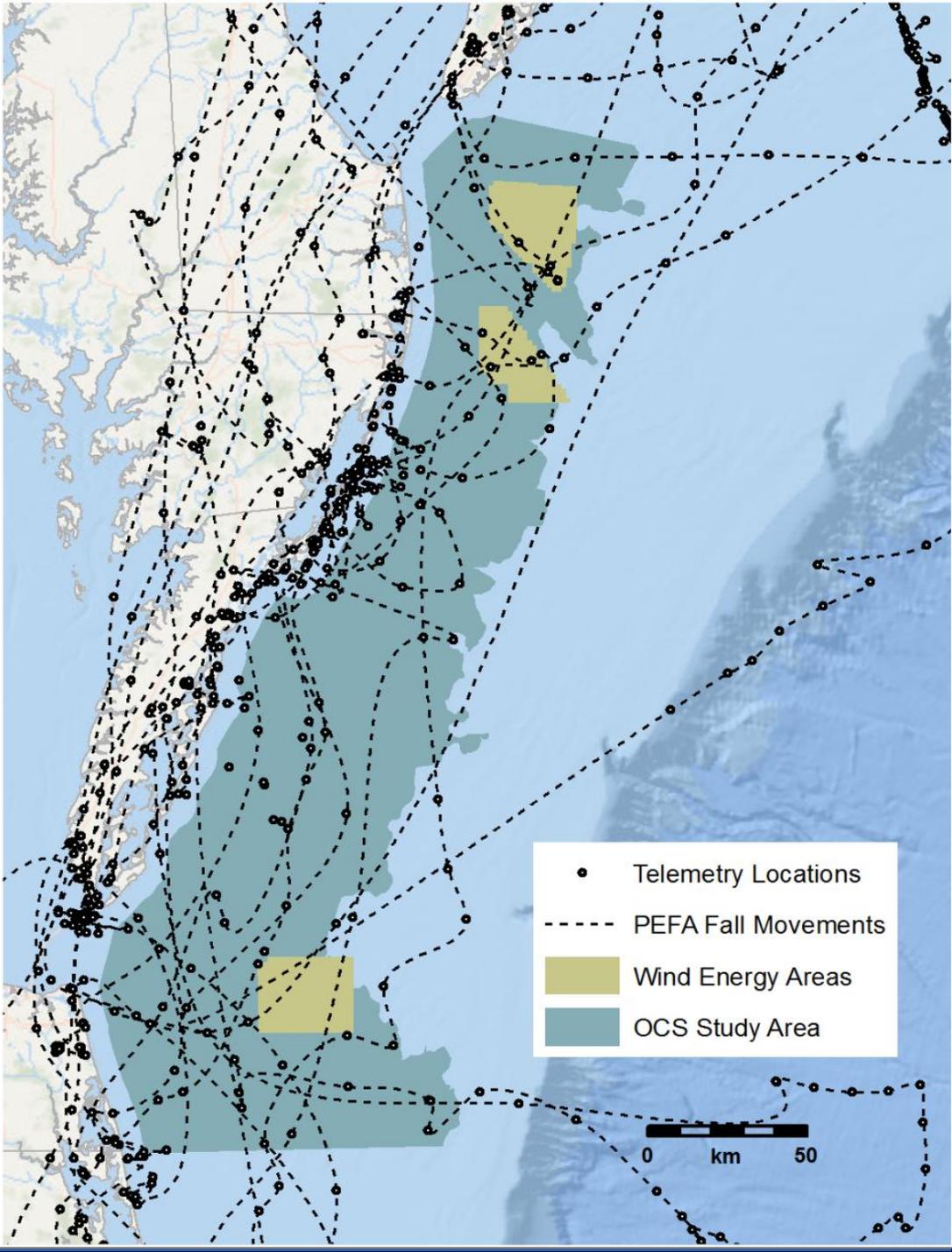
White-winged Scoter

All Scoters (BLSC, SUSC, WWSC)



Peregrine Falcon migration

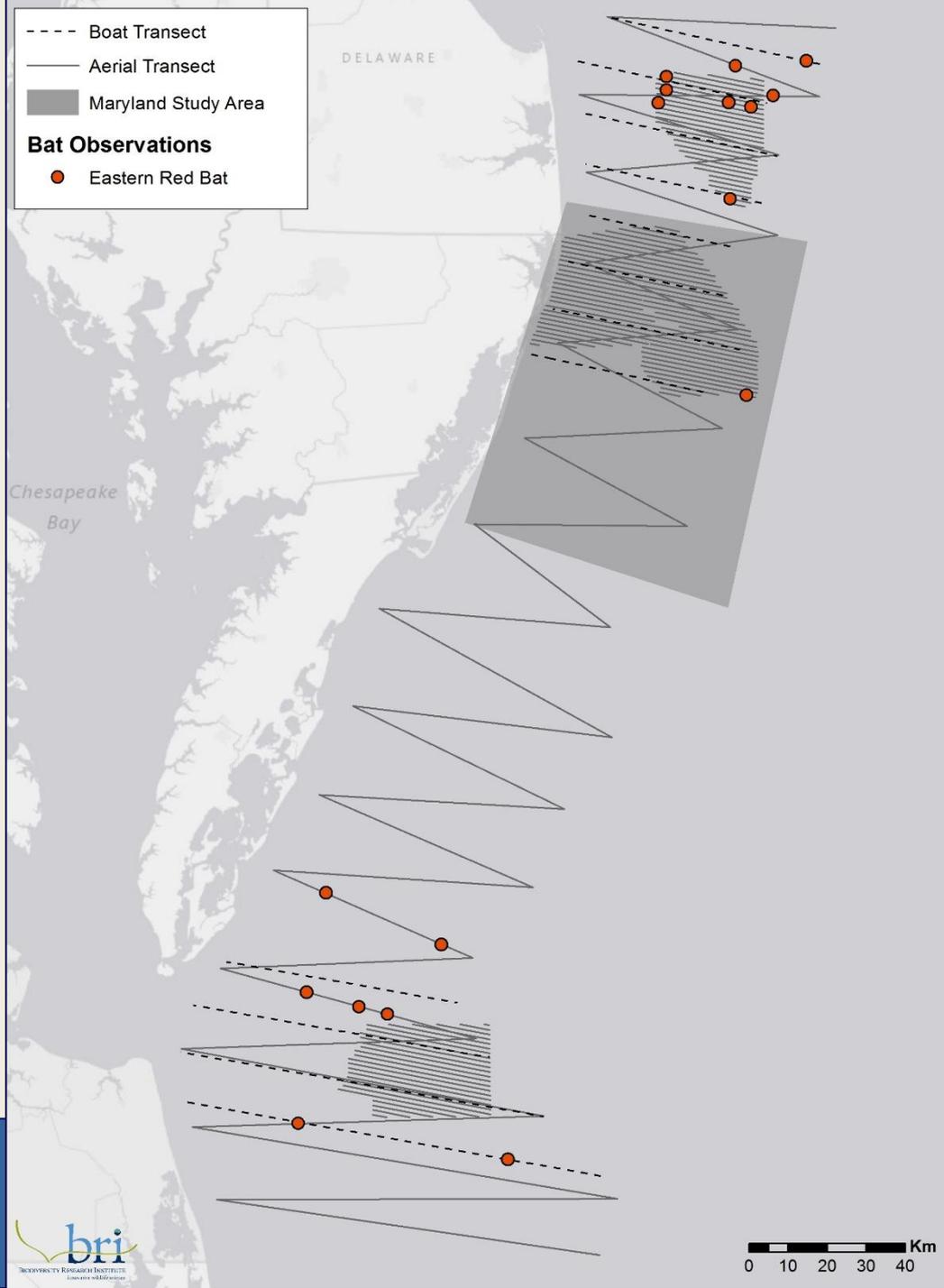
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Bats

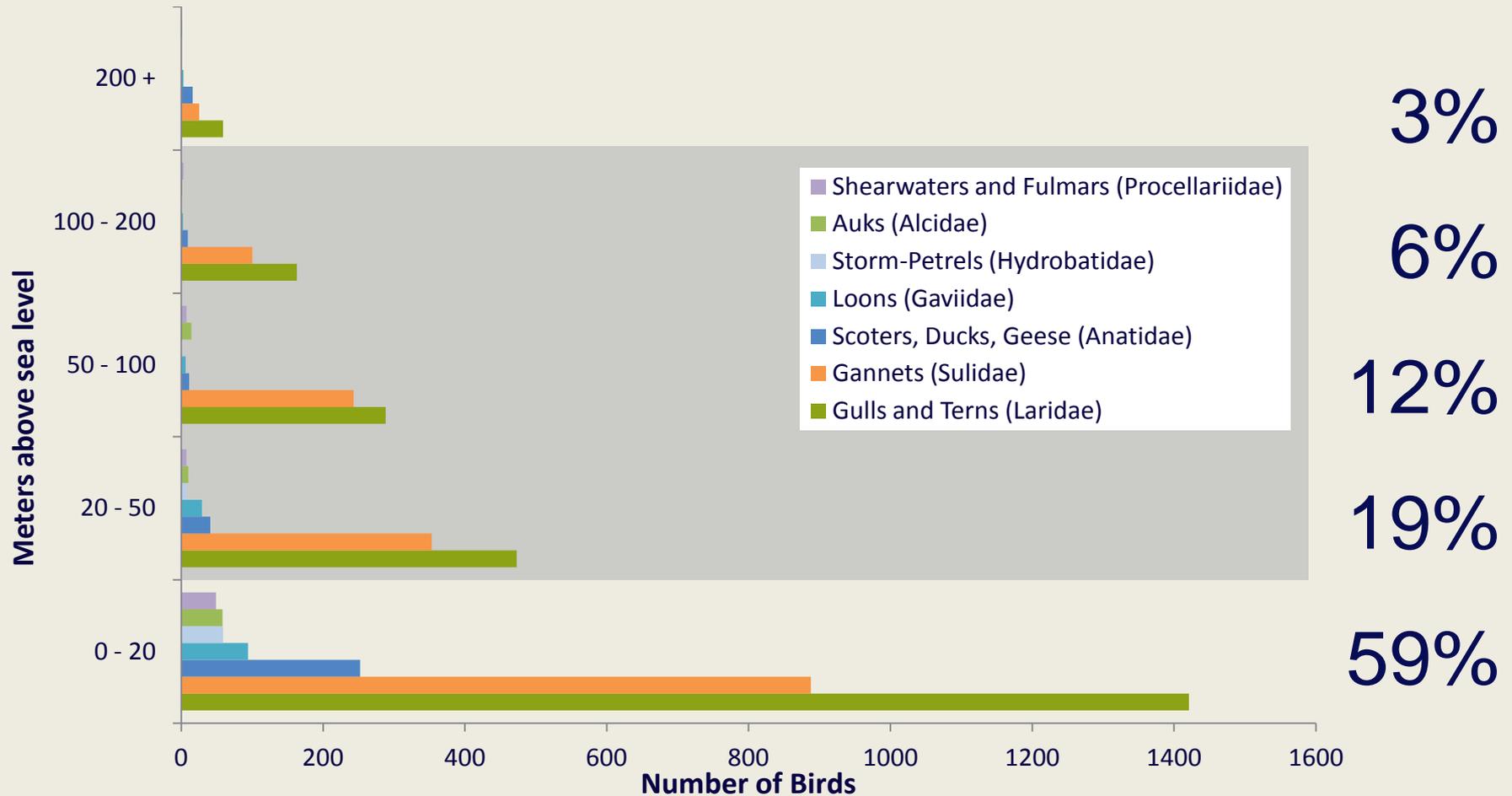
- 17 bats observed in surveys, mostly in digital aerial survey (~90%)
- Fall migration (September)
- 16 - 65 km offshore
- >200 m flight height ($n=7$)

Eastern Red Bats



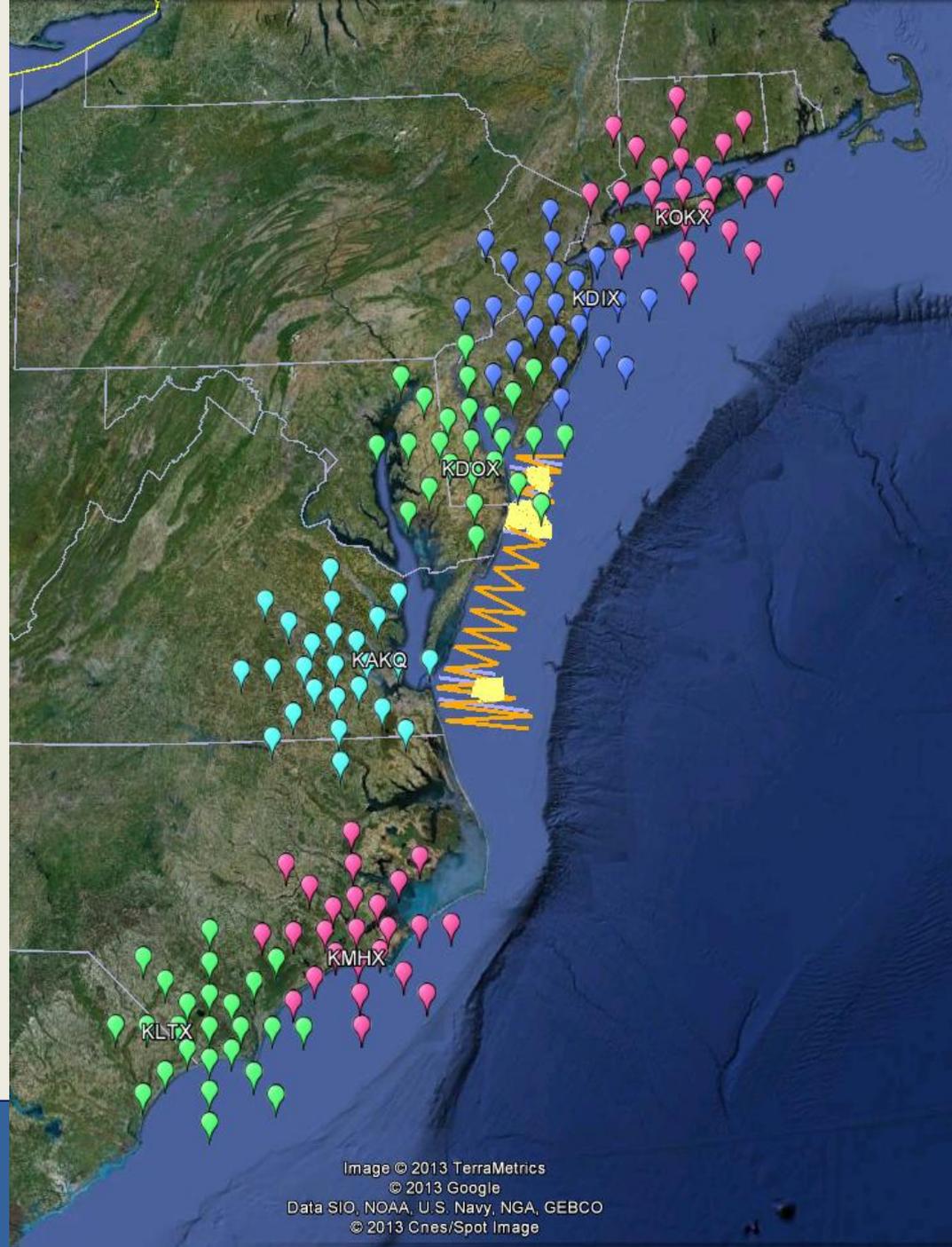
Flight height estimation (n=5,299)

Parallax in digital video

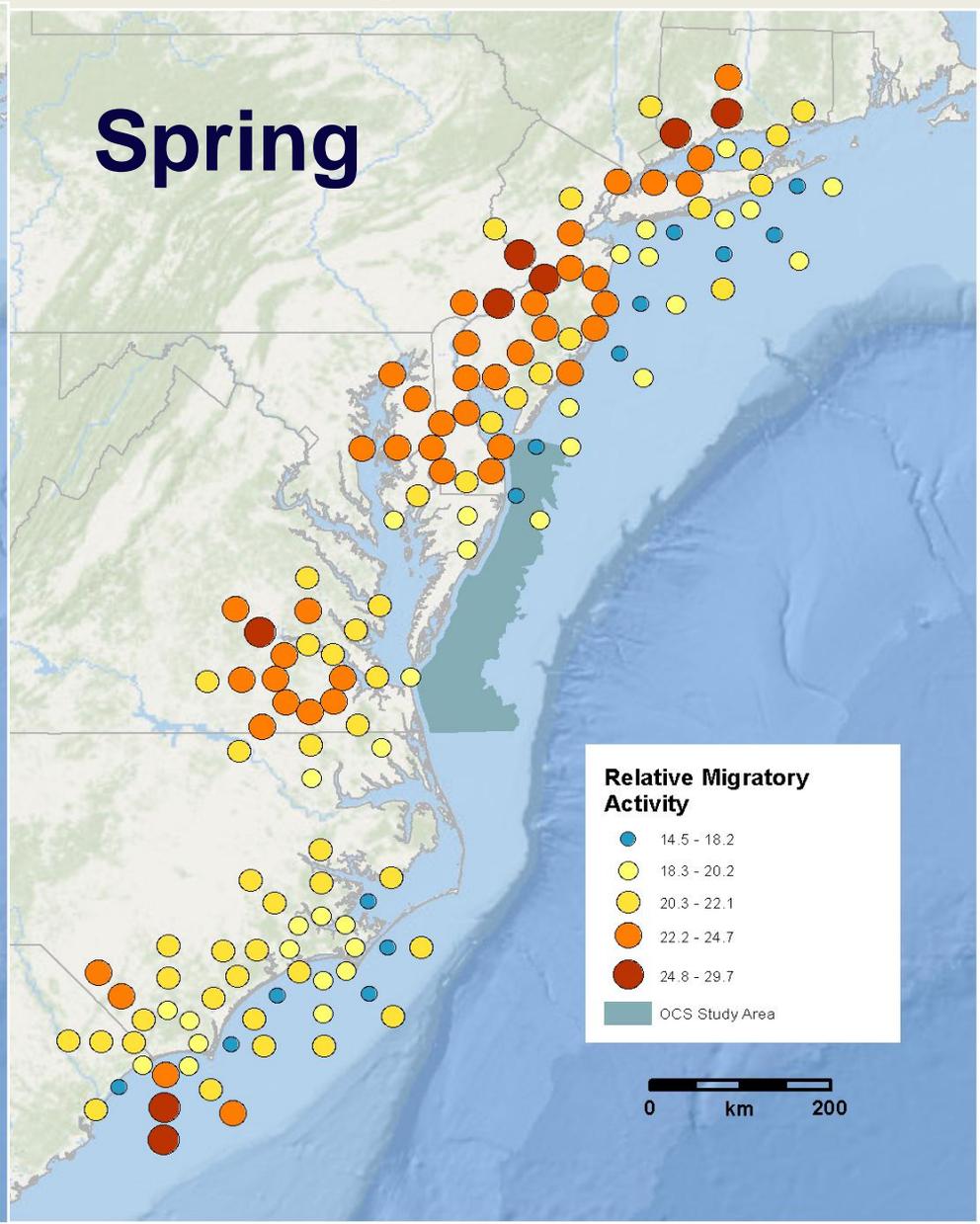
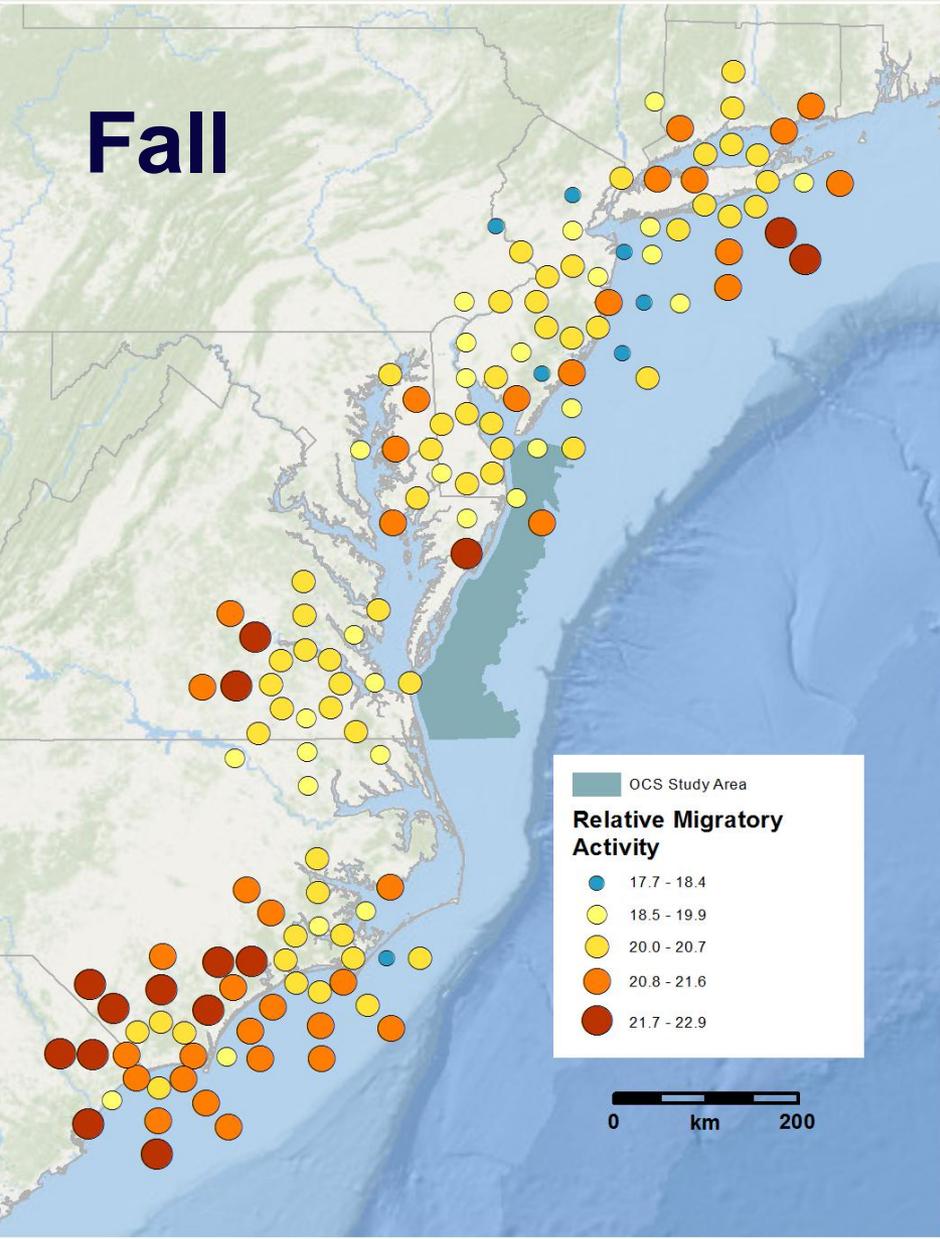


WSR-88D Radar (NEXRAD)

- 6 radars
- 144 sites
- Measure of average flight activity during 6 hr period around midnight
- Compare radar activity between sites across the landscape



Nocturnal avian migration



Overall Summary

- Optimal survey approach will depend on study location and goals
- Common nearshore distribution patterns in the mid-Atlantic; bays have a strong influence
- Wide variation in distribution and abundance patterns (annually, seasonally, and between taxa)

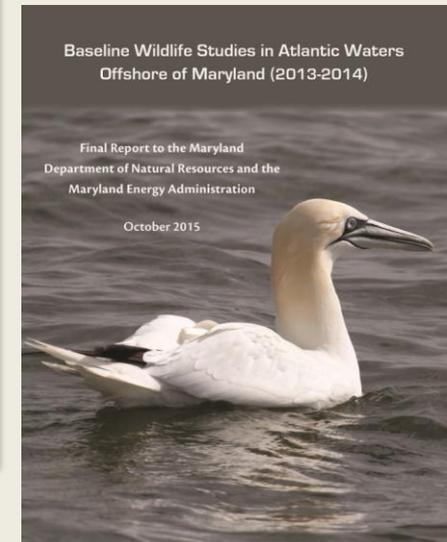
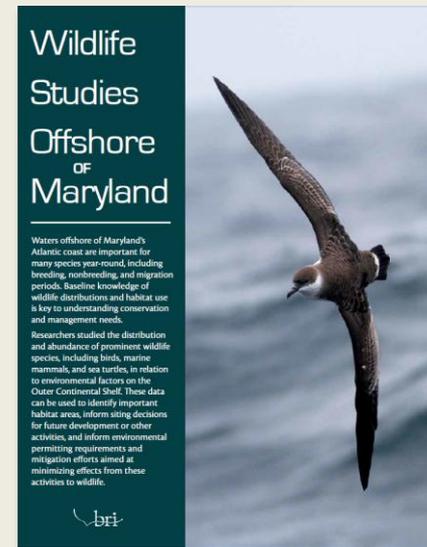
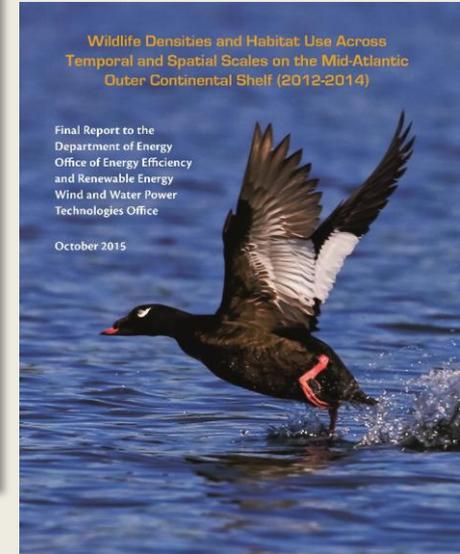
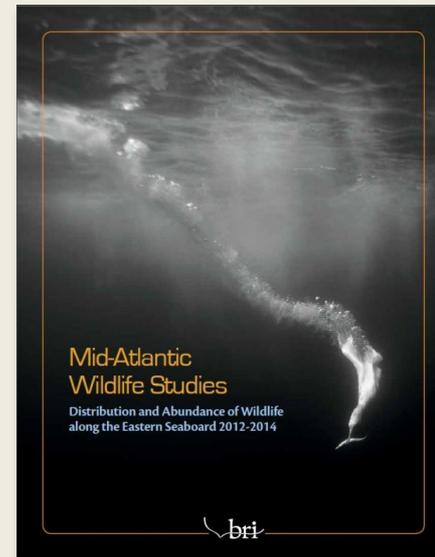
Implications

- Siting
- Permitting
- Potential mitigation approaches
- Exposure = first step



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/>)



Upcoming Webinars

- Wildlife patterns
 - DOE Environmental Studies Series webinar
 - Tuesday, November 17, 11 am -12 pm EST
 - <http://tethys.pnnl.gov/events/mid-atlantic-baseline-study-webinar>
- Study methods and methods comparison
 - IEA Task 34 WREN webinar
 - Tuesday, December 2, 11 am-12:30 pm
 - <http://tethys.pnnl.gov/events/wildlife-monitoring-and-wind-energy>

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