Maine Research Array: Bird and Bat Data

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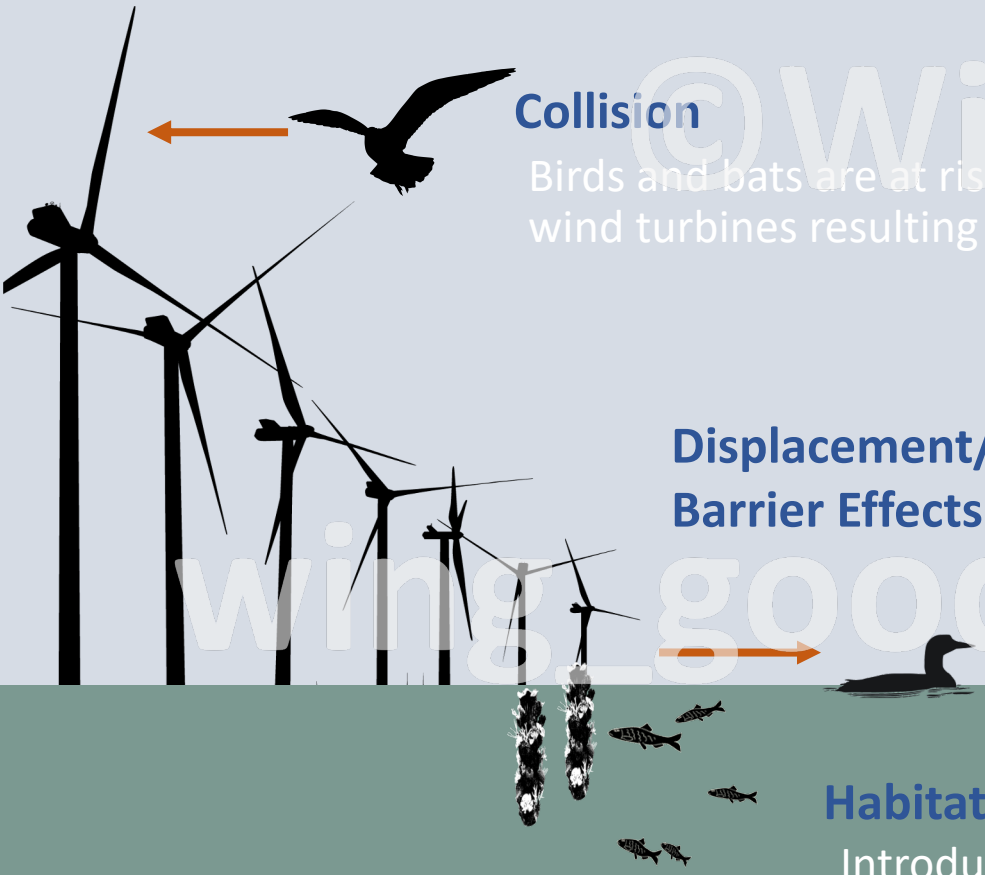
Photo by Nicholas Doherty on Unsplash

Impacts to birds and bats



Collision

Birds and bats are at risk of colliding with offshore wind turbines resulting in injury or mortality.

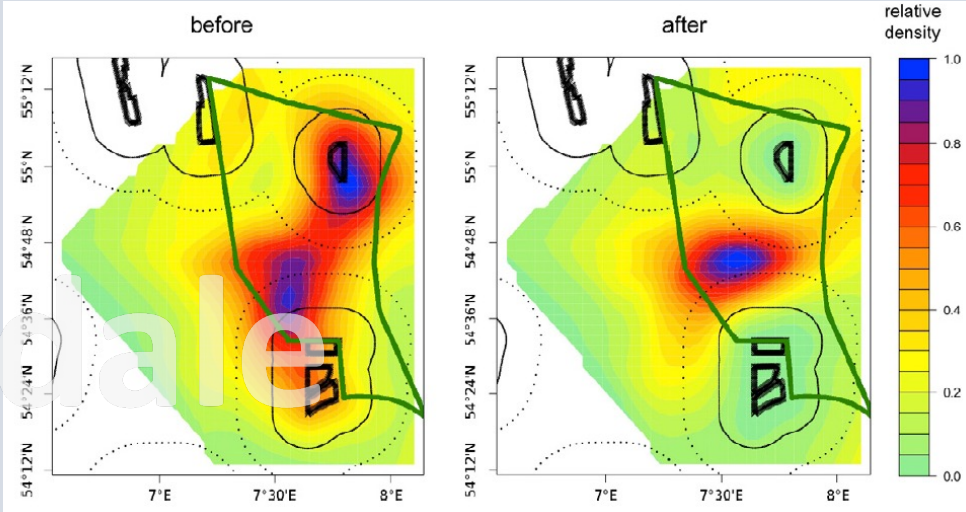
Displacement/ Barrier Effects

Species may avoid wind farms, resulting in displacement from areas previously used for activities such as foraging. Wind farms can also act as barriers to movement such as migration.

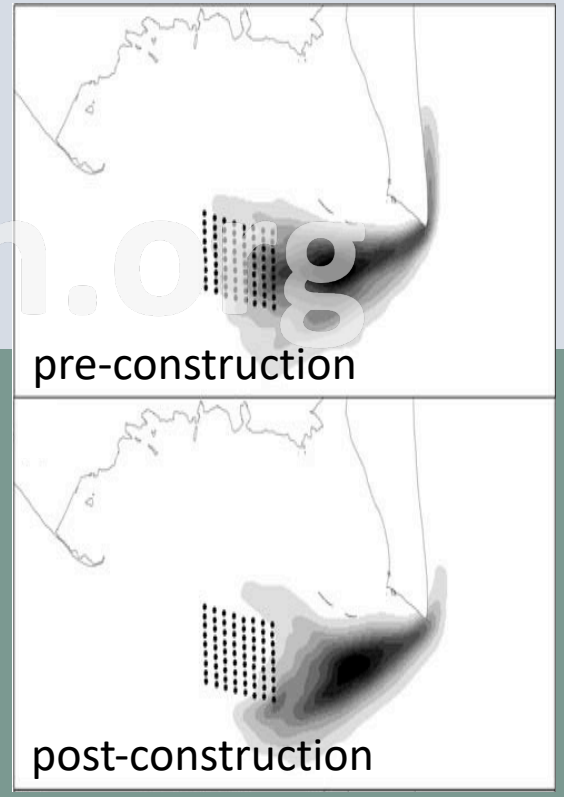
Habitat Change

Introduction of hard structures into marine environment can alter ecosystem structure, creating “artificial reefs”.

LOONS



SEA DUCKS



What are Adverse Effects?

- **Hazards**: physical changes to the environment
- **Vulnerability**: documented sensitivity to hazards
- **Exposure**: present in a development area
- **Adverse effects**
  - Direct: mortality and injury; Direct effects are the result of a stimulus response relationship
  - Indirect: a chain of effects pathways that can lead to adverse effects

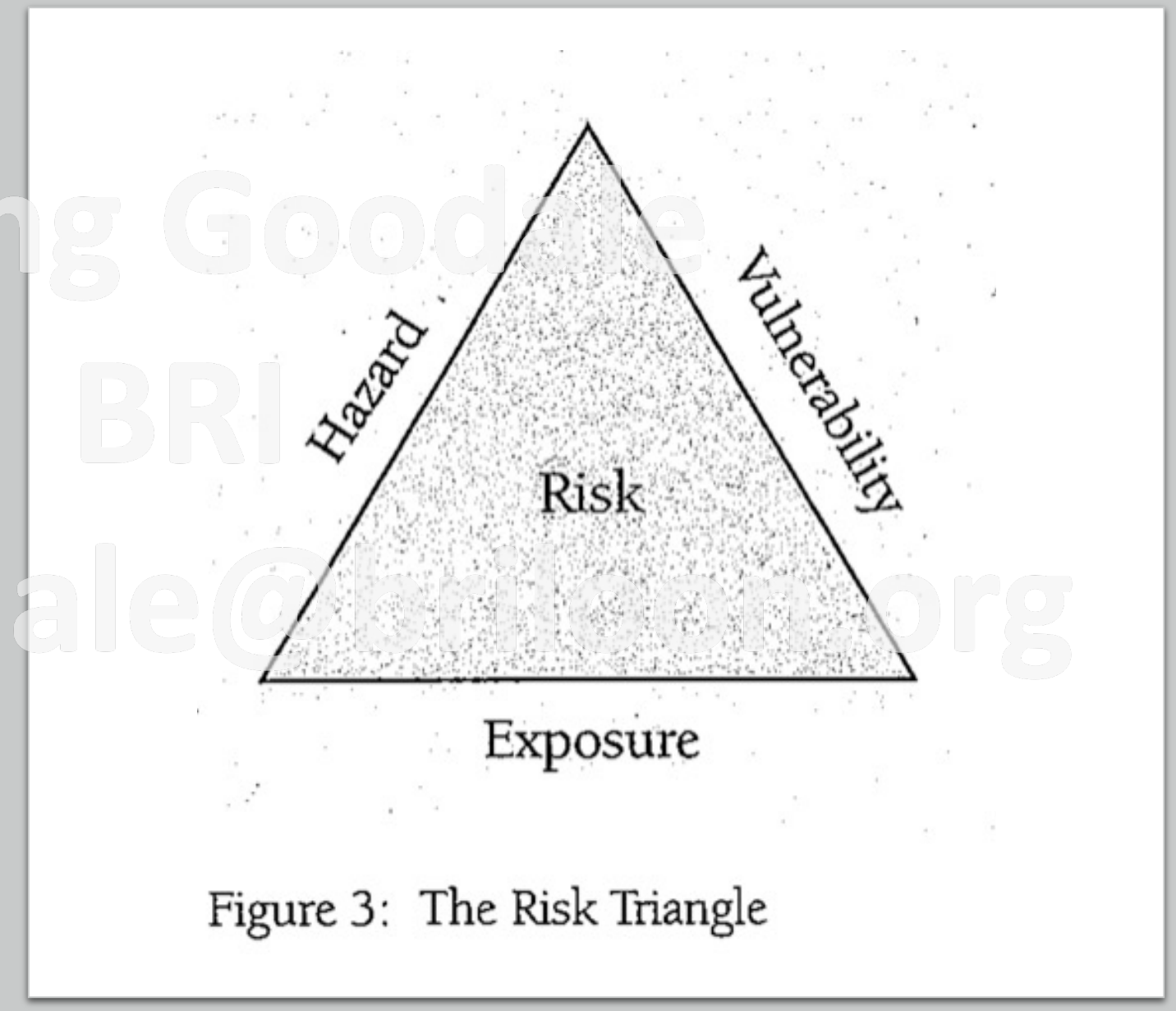
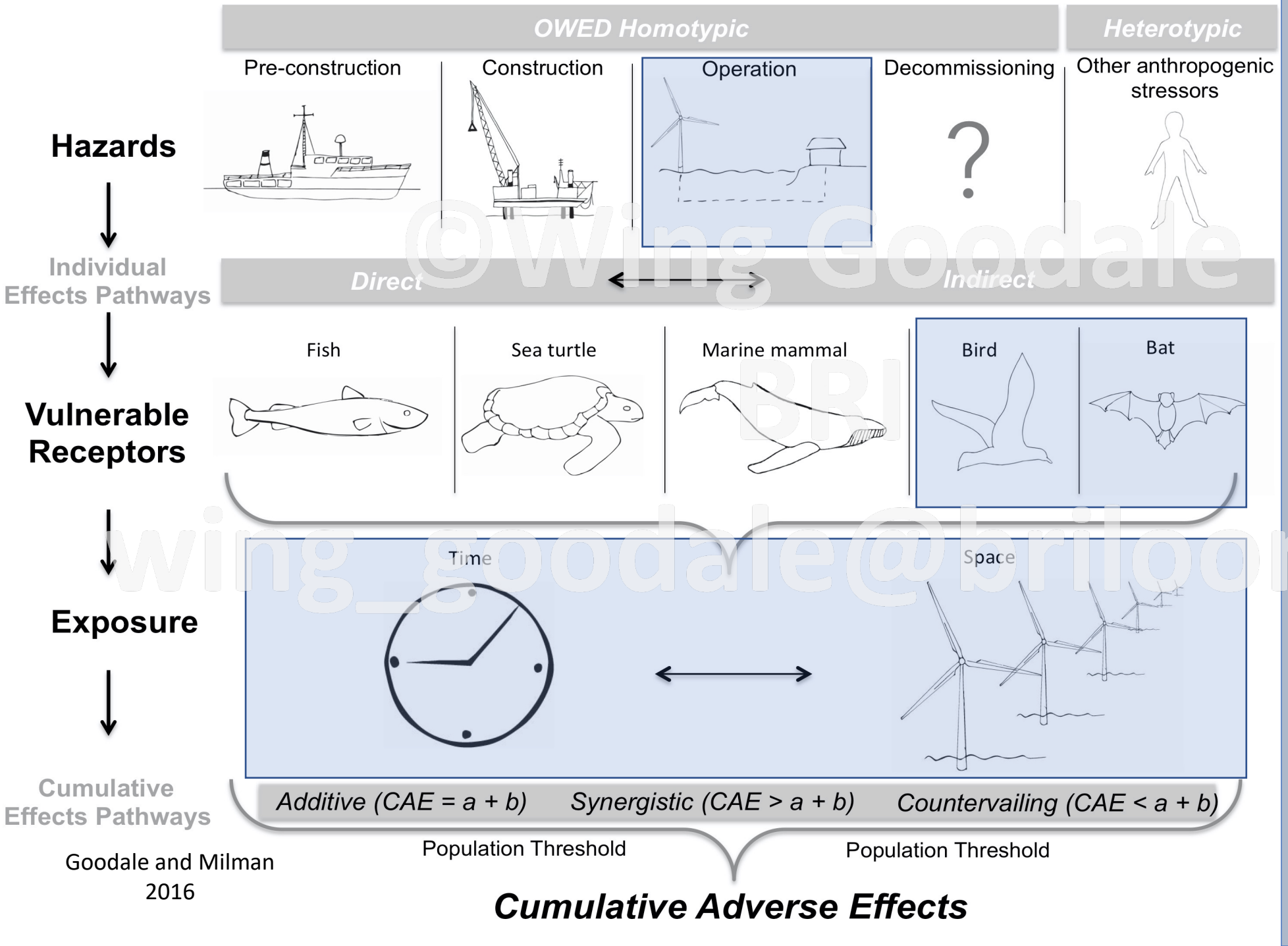


Figure 3: The Risk Triangle

Crichton 1999



Goodale and Milman 2016

Effects are going to be variable by species and development phase

Data on Hazards

- Existing data from fixed bottom turbines
- Hazards from floating are likely similar to fixed bottom
- Potential differences
  - Reef effect, currents, upwelling, and micro habitat changes
  - More perching opportunities
  - Avoidance of large turbines
- Unique aspects of GOM
  - Species
  - Geography

Avian Data on Exposure: Surveys

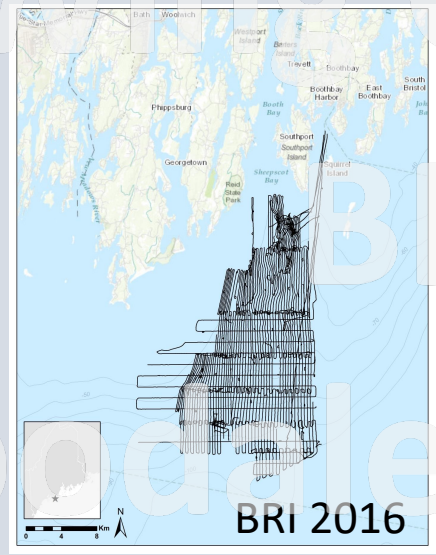
Regional

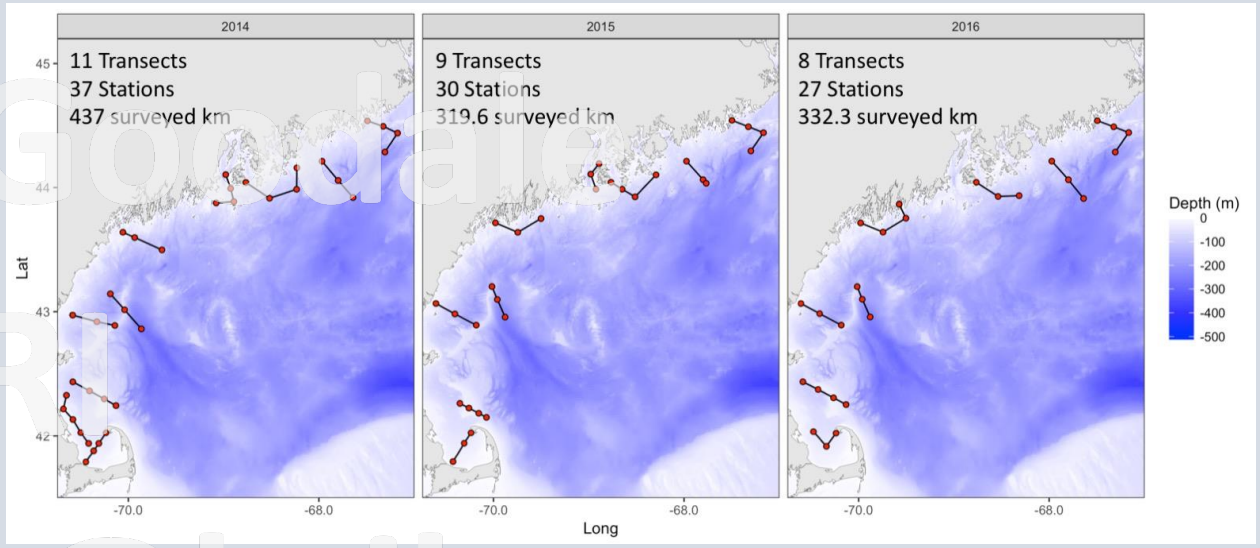
- *Gulf of Maine lacks large-scale high-density surveys*
- AMMAPS
- 1970s/80s Manomet/CSAP
- NOAA EcoMon
- NOAA Herring Acoustic
- Waterfowl (not offshore)
- Colonial seabird (not offshore)

Small Scale

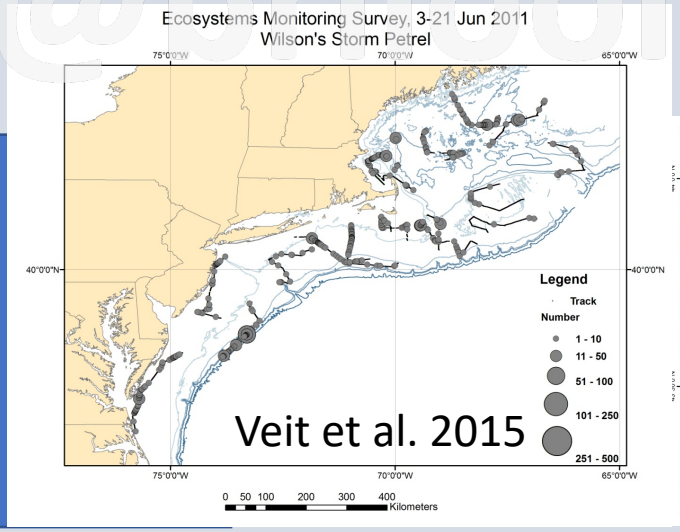
- Bold
- GOMCES
- Sea floor mapping

What's missing?

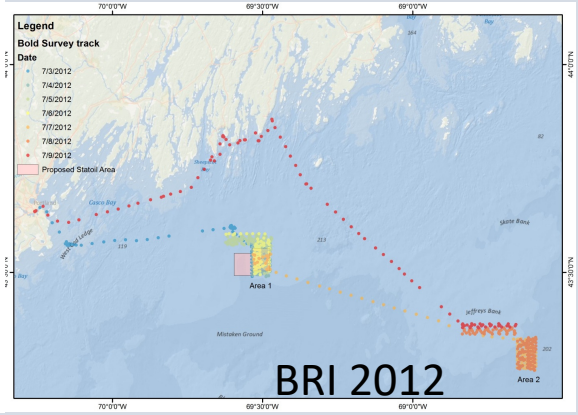




Allyn et al. 2017



Veit et al. 2015



BRI 2012

What can you learn?

- Spatiotemporal use patterns
- Local abundance (density)
- Local distribution
- Local seasonal changes

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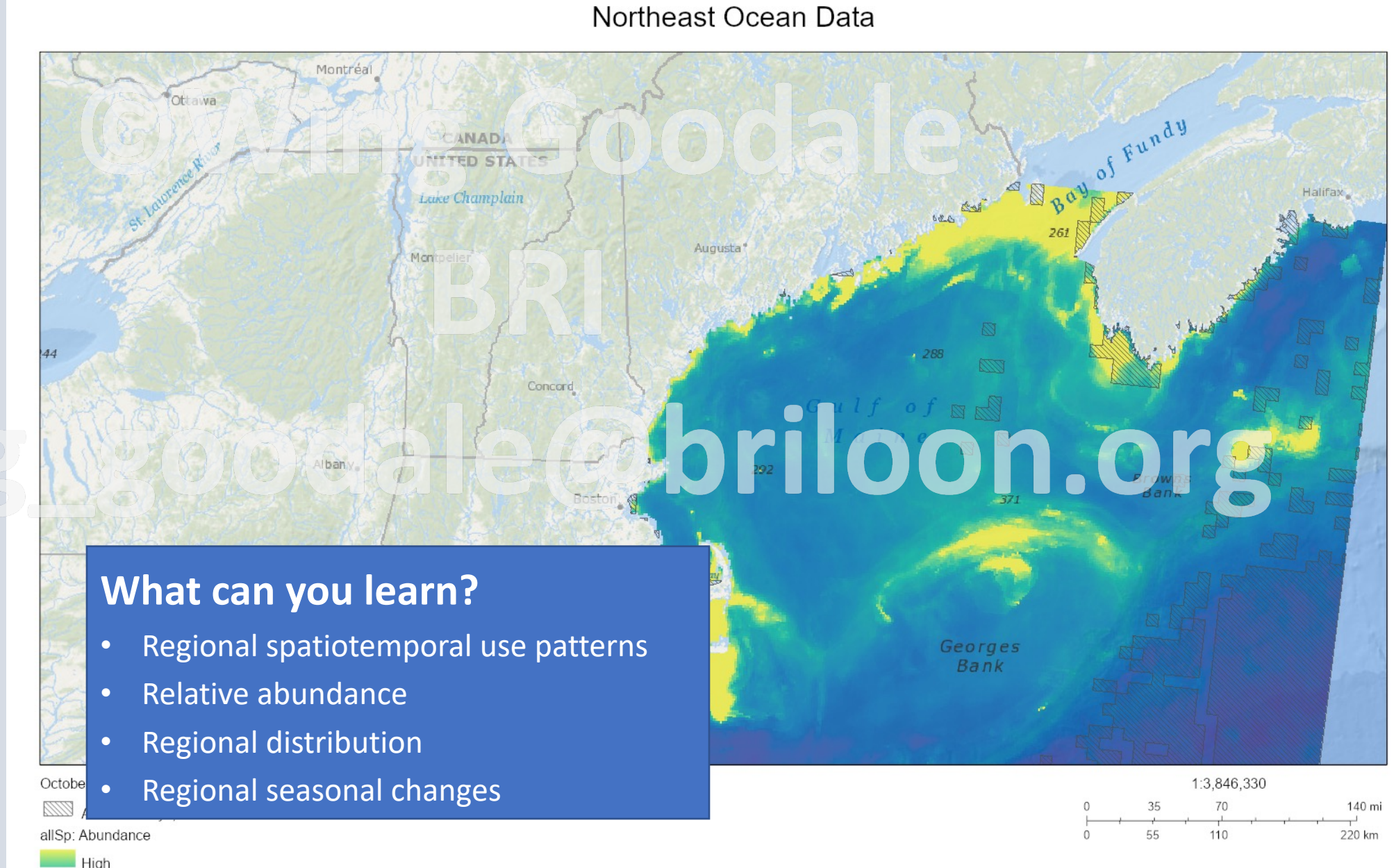
Avian Data on Exposure: Survey Models

- **MDAT Marine Bird Abundance and Occurrence Models**
- Regional-scale seasonal predictions of relative density for 47 avian species
- Developed to support marine spatial planning on the Atlantic OCS (FL to ME)
- Provides excellent regional context



Avian Data on Exposure: Tracking Data

Many types

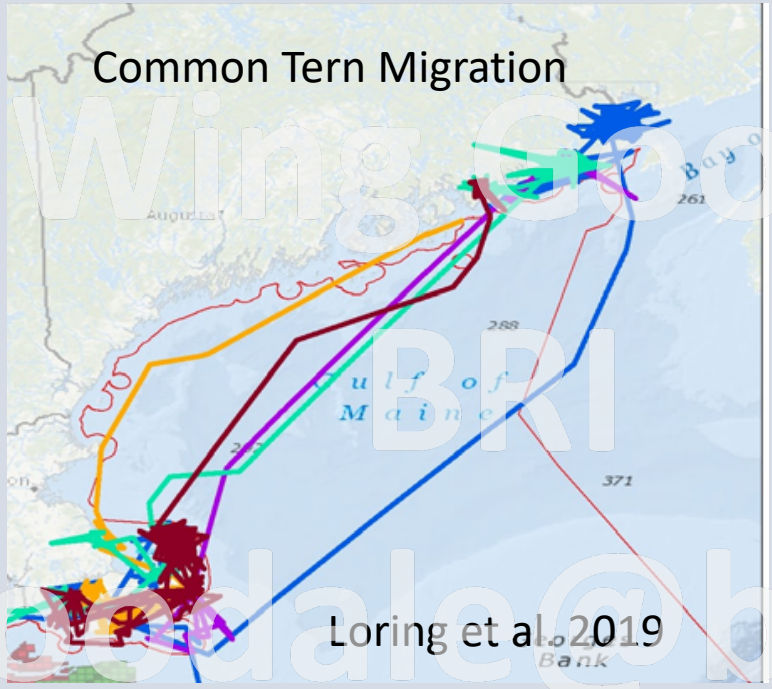
- Geolocators
- Motus tags
- Cellular GPS (GSM) tags
- Satellite GPS tags

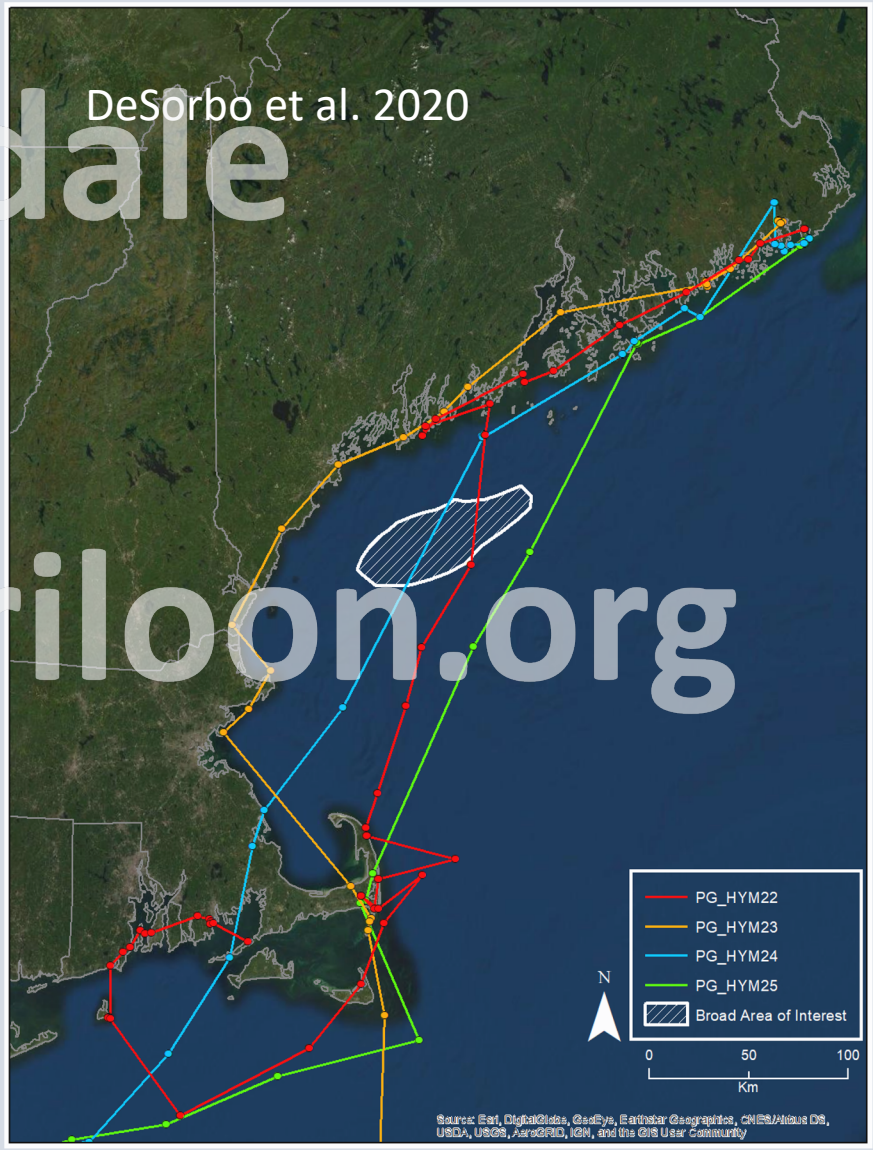
Species

- Non-marine migratory
  - Songbirds
  - Raptors
  - Wading birds
- Marine
  - Colonial nesters
  - Migratory

Data source

- MoveBank
- Researchers





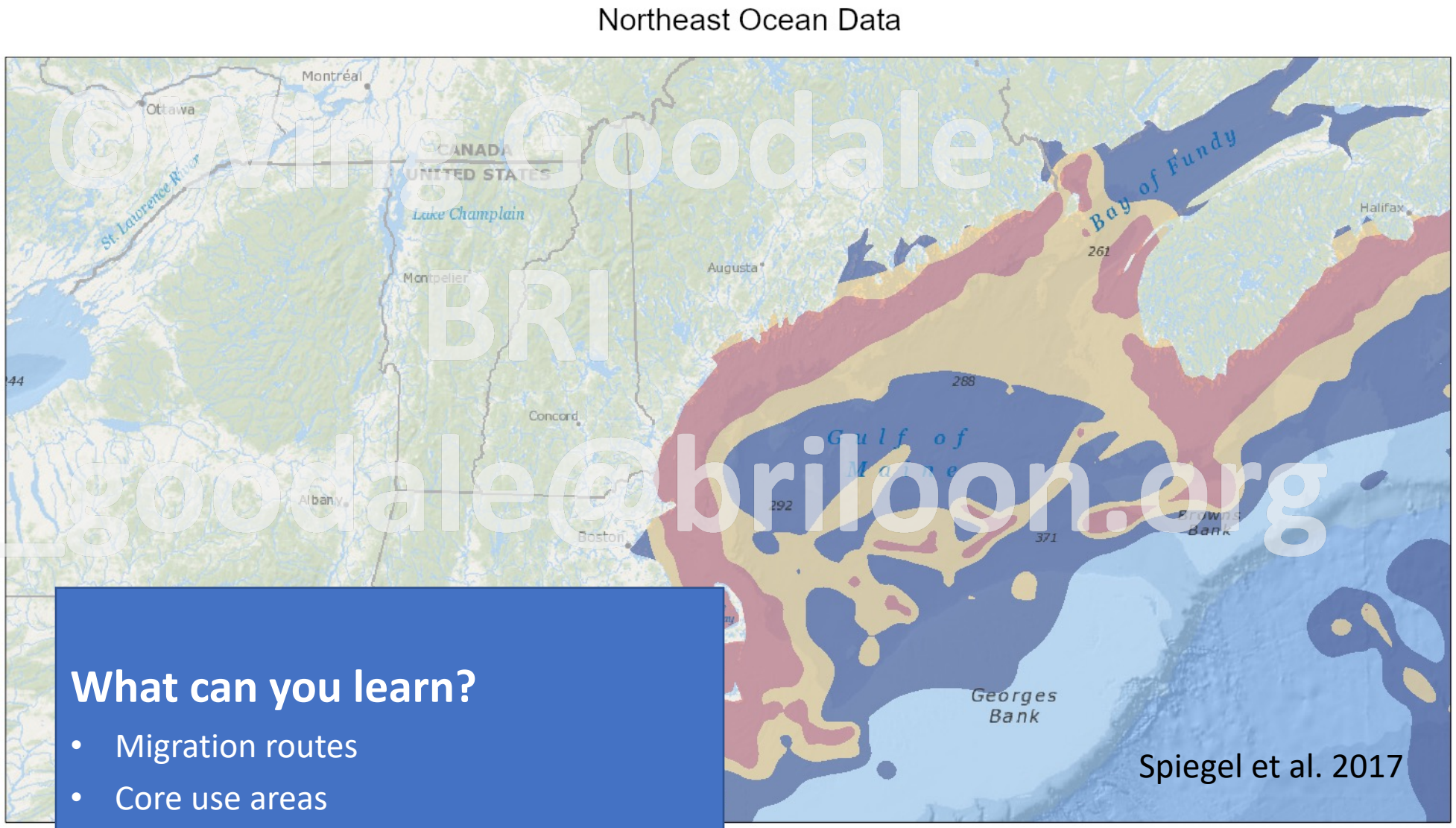
What can you learn?

- Migration routes
- Foraging areas, distance
- Phenology
- Spatial resolution and sample size limitations

Avian Data on Exposure: Tracking Models

Movement Models

- Aggregate positions
- Account for direction of movement
- Account for time
- Model over space



Avian Data on Exposure: Coastal Use

Breeding data

- Seabird colonies (some managed)
- Wading bird rookeries

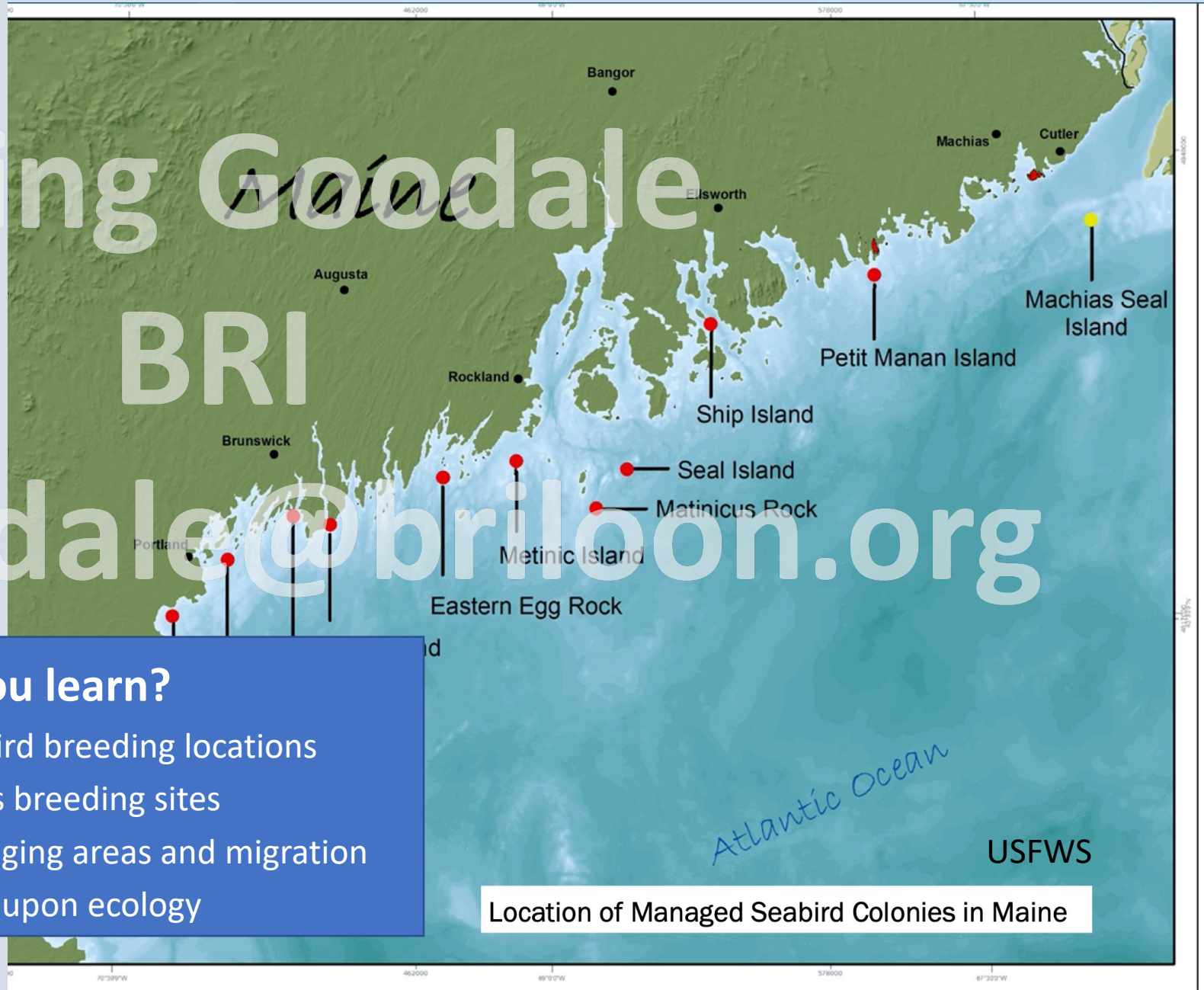
General knowledge on migratory staging areas and routes

- Seabirds
- Shorebirds
- Songbirds: NEXRAD

Bird banding stations

- Species composition
- Body condition
- Phenology

What are key sources?



Location of Managed Seabird Colonies in Maine

What can you learn?

- Primary seabird breeding locations
- Listed species breeding sites
- Potential foraging areas and migration routes based upon ecology

Bat Data on Exposure

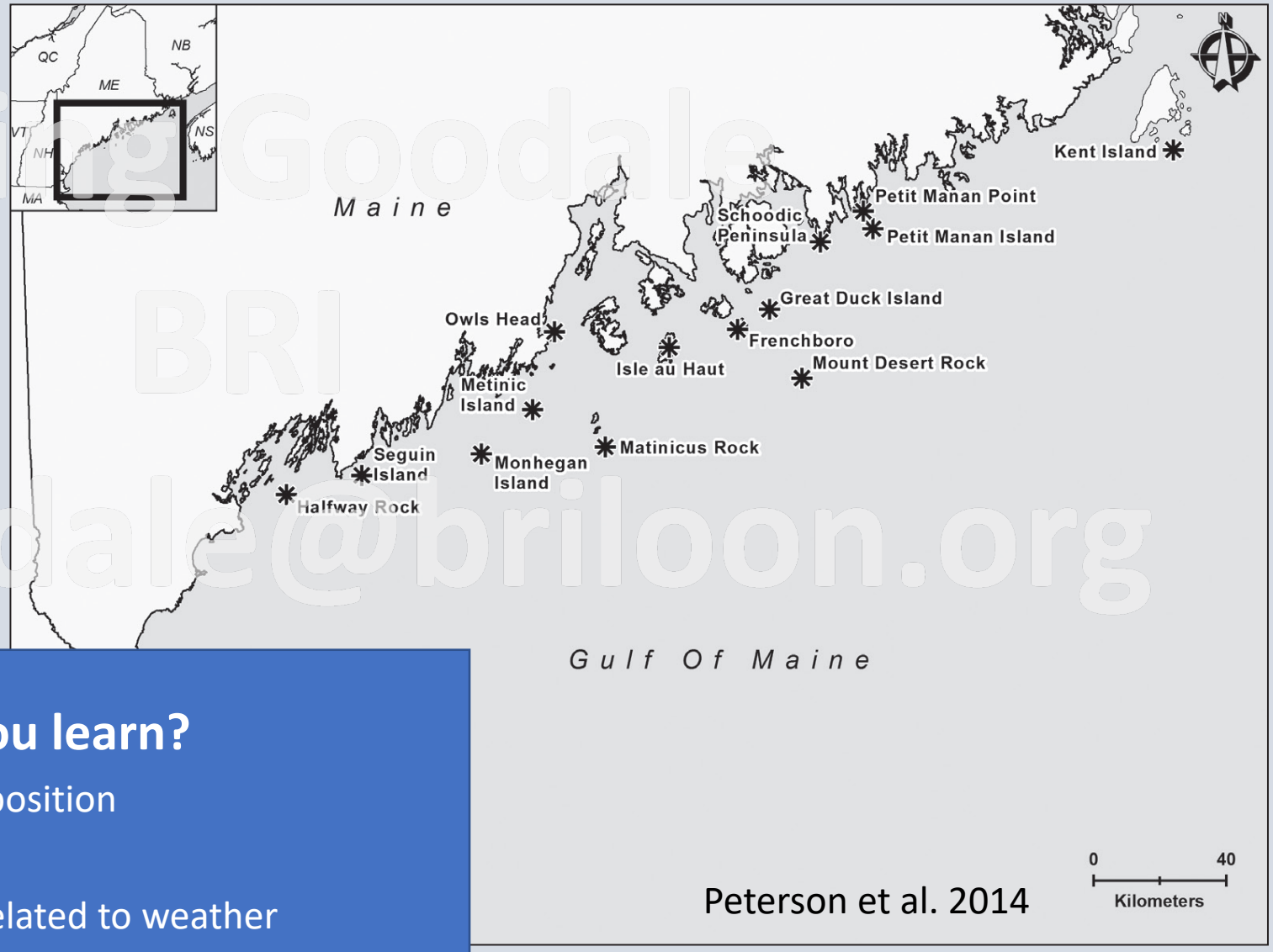
Types of data

- Acoustic
- Mist-netting
- Tracking
- Maternity roosts and hibernacula

Acoustics offshore

- Islands
- Buoys
- Boats

Key data sources?



Peterson et al. 2014

What can you learn?

- Species composition
- Timing
- Movement related to weather

Data on Vulnerability

Vulnerable to seabird species

- Collision: Gulls, cormorants, kittiwake
- Displacement: loons, auks, sea ducks, gannets

Collision vulnerability ranking

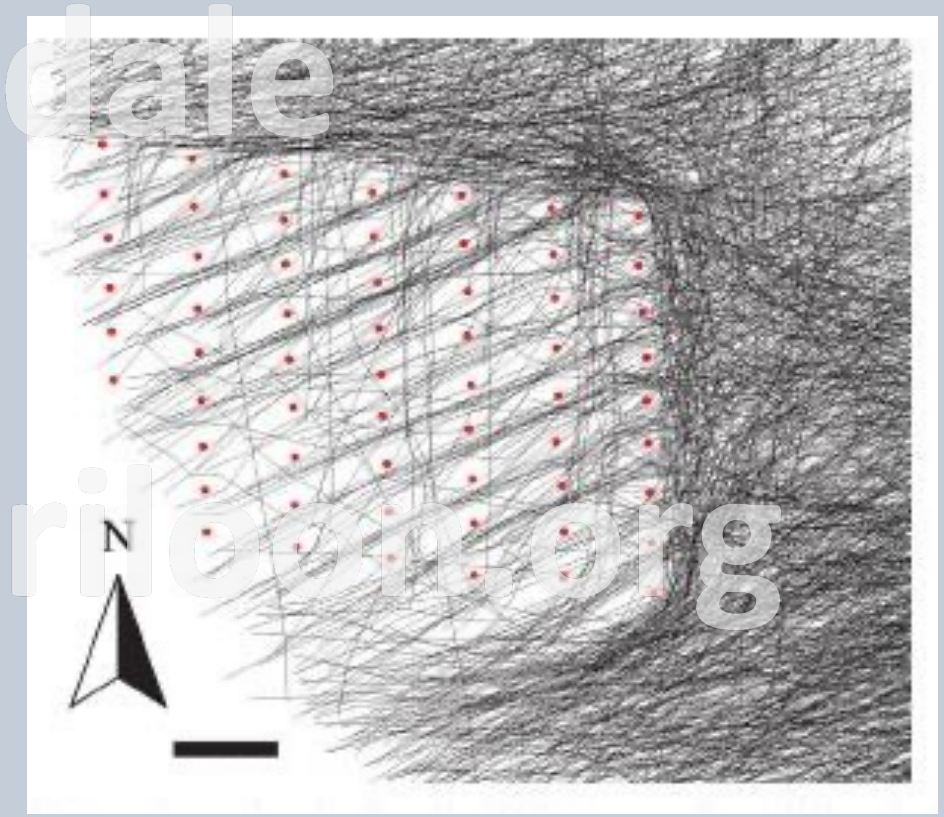
- Density (exposure), flight height, sitting/flying, flight speed, nocturnal activity, avoidance (macro, meso, micro)
- Flight height: North Atlantic Seabird Catalog & Loring et al. 2019
- Literature

Displacement vulnerability ranking

- Avoidance (macro, meso): European studies
- Habitat flexibility: Literature

Population vulnerability ranking

- Conservation status and trends: State Status & Partners in Flight
- Vital rates (reproductive success and adult survivorship): Adult Survivorship score from Willmott et al. 2013

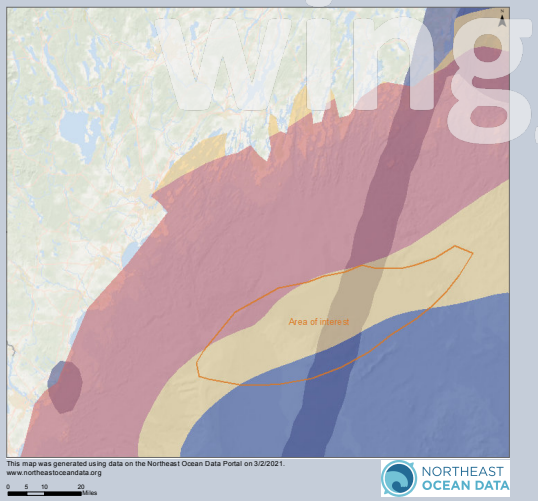


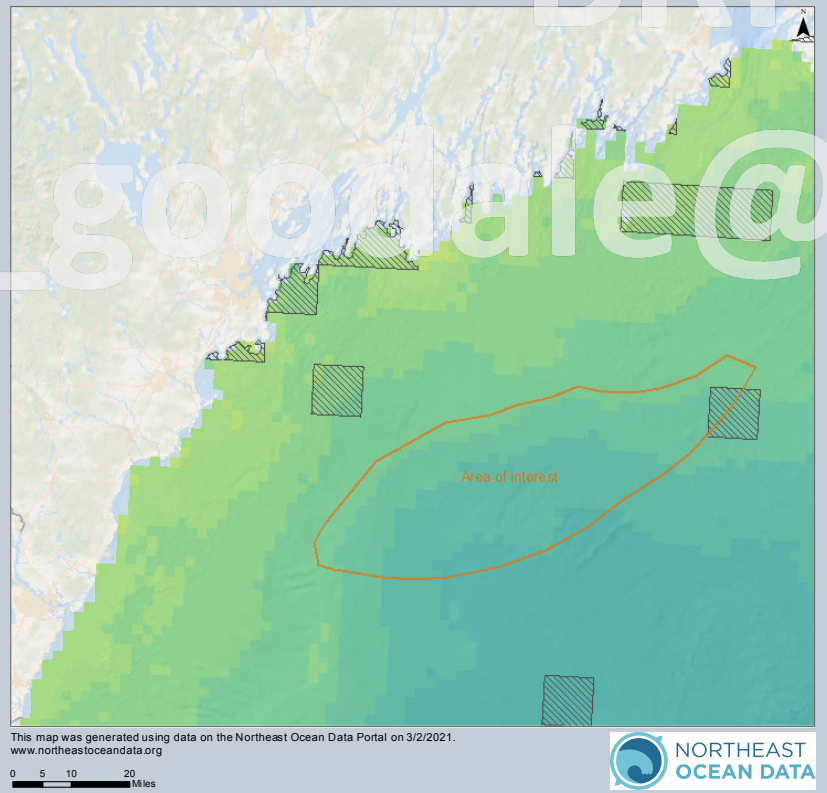
Desholm & Kahlert. 2005

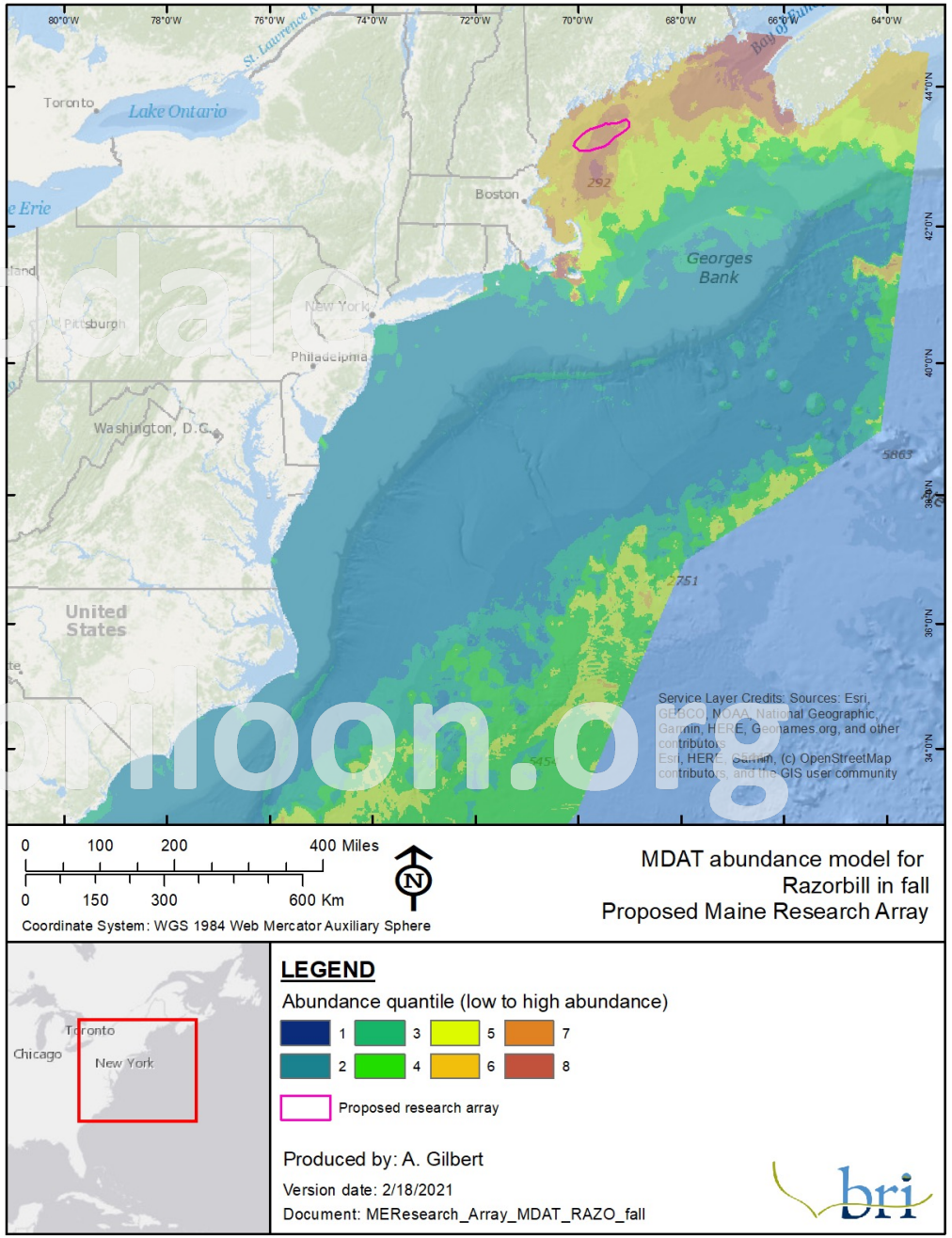
How do you use the data?

Exposure marine birds

- MDAT: Spatiotemporal variation in planning area
- MDAT: Regional context
- Tracking: migration routes
- Bats and terrestrial: qualitative







How do you use the data?

Relative Vulnerability Rankings

- Wade et al. 2016
- Kelsey et al. 2018

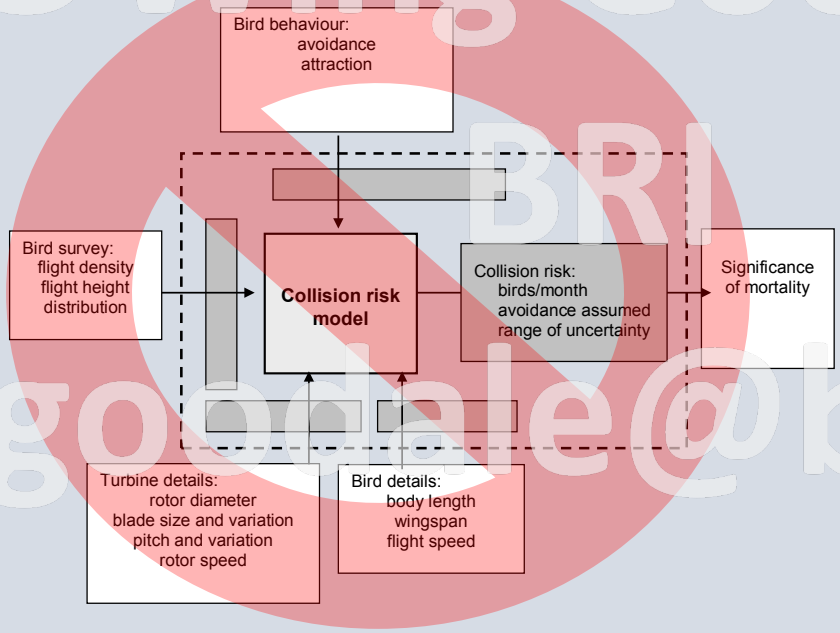
Collision Risk Models

- Band et al. 2012
- Stochastic European Model

Bats and terrestrial birds

- Literature
- Weight of evidence

Recognize Uncertainty!

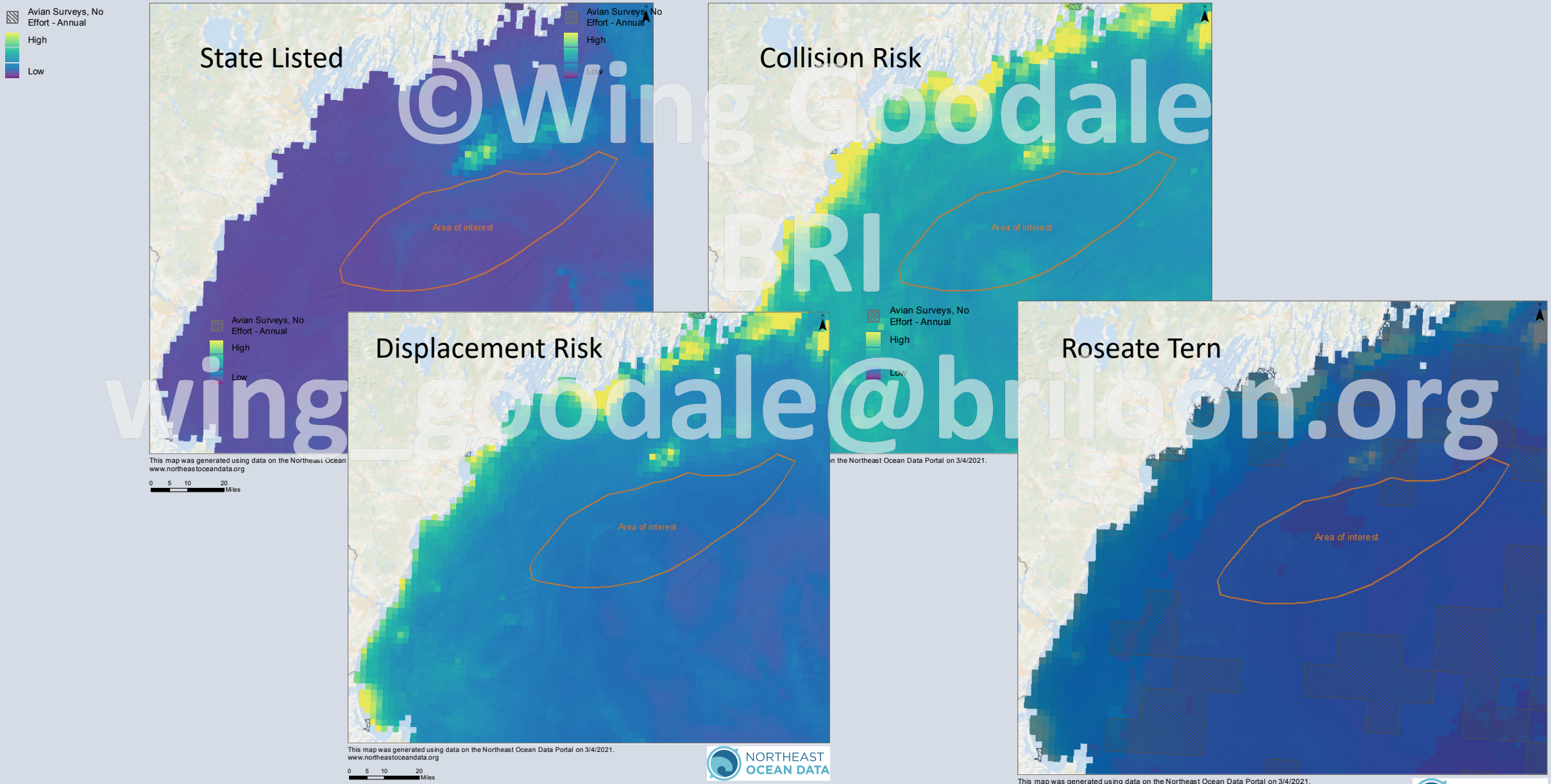


Band 2012

Furness et al. 2013

Species	Disturbance by ship and helicopter traffic	Habitat use flexibility	Conservation importance score	Species concern index value
Black-throated diver	5	4	16	32
Red-throated diver	5	4	16	32
Great northern diver	5	3	18	27
Common scoter	5	4	12	24
Common goldeneye	4	4	12	19
Greater scaup	4	4	11	18
Velvet scoter	5	3	11	16
Common eider	3	4	13	16
Black guillemot	3	4	13	16
Slavonian grebe	3	4	13	16
Common guillemot	3	3	16	14
Razorbill	3	3	16	14
Shag	3	3	15	14
Great cormorant	4	3	11	13
Little tern	2	4	13	10
Arctic tern	2	3	17	10
Atlantic puffin	2	3	16	10
Long-tailed duck	3	4	8	10
Roseate tern	2	3	15	9
Sandwich tern	2	3	15	9
Common tern	2	3	14	8
Great-crested grebe	3	4	7	8
Great black-backed gull	2	2	15	6
Black-legged kittiwake	2	2	14	6
Common gull	2	2	13	5
Black-headed gull	2	2	12	5
Little auk	2	2	9	4
Northern gannet	2	1	17	3
Herring gull	2	1	16	3
Great skua	1	2	16	3
Lesser black-backed gull	2	1	16	3
Arctic skua	1	2	14	3
White-tailed eagle	1	2	12	2
Manx shearwater	1	1	17	2
European storm-petrel	1	1	17	2
Leach's storm-petrel	1	1	16	2
Northern fulmar	1	1	16	2
Sooty shearwater	1	1	12	1

What does MDAT tell us?



What data is missing?

Survey data

- Are there any local surveys available

Local knowledge

- Fishing community
- Whale watching and birding trips

Tracking data

- GPS and satellite tracking studies not available on MoveBank

Behavioral vulnerability data

- Flight heights

Population vulnerability data

- State conservation status

Coastal concentration areas

- Colonial breeding sites
- Migratory staging
- Winter surveys

Thanks!
Questions?

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