UNIVERSITY OF MARYLAND CENTER FOR ENVIRONMENTAL SCIENCE
CHESAPEAKE BIOLOGICAL LABORATORY

September 12l 2023
MAFMC SSC

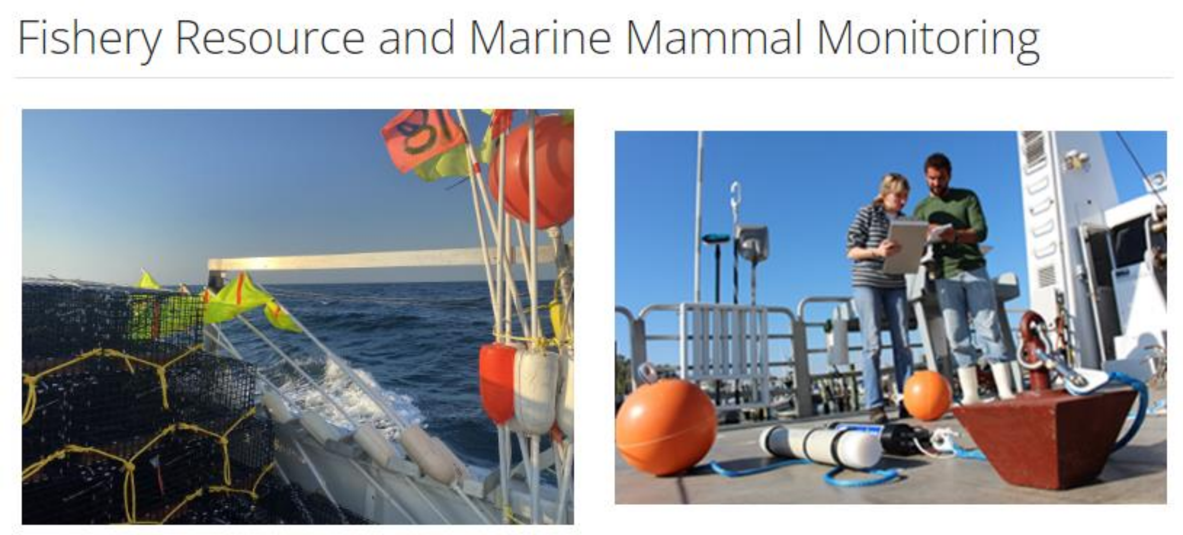
Dave Secor

TailWinds

Team for Assessing Impacts to Living resources from offshore WIND turbineS

US Wind
Fueling our future, naturally.

TailWinds



TailWinds assessment themes

- Fishery resource <u>and</u> marine mammals
- BACI design principles
    - Fishery resources, black sea bass (FRM)
    - Marine mammals (MMM)
- Dynamic Ocean Management
    - Real-time detections of baleen whales (RTWB)

Outline

- TailWinds monitoring design
- Findings from 2022-2023 deployments

Real-Time Whale Buoy

The TailWinds Team

Dave Secor
Fisheries Ecology,
Project Manager

Helen Bailey
Cetacean
Bioacoustics

Slava Lyubchich
Biostatistics,
Data Science

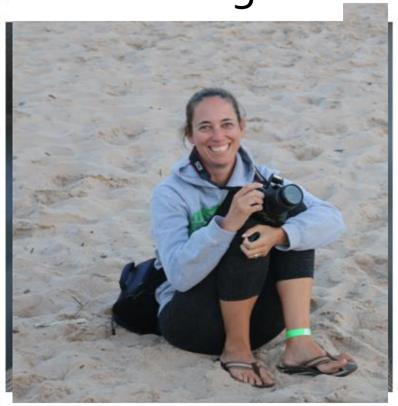
Evan Kostelecky

Robert Bell

Amber Fandel

Mike O'Brien

Becca Wingate



Kirsten Silva

Jamie Testa

Caroline Tribble

University of Maryland CENTER FOR ENVIRONMENTAL SCIENCE

US Wind — Fueling our future, naturally.

Maryland Energy Administration

MARYLAND DEPARTMENT OF NATURAL RESOURCES

WOODS HOLE OCEANOGRAPHIC INSTITUTION

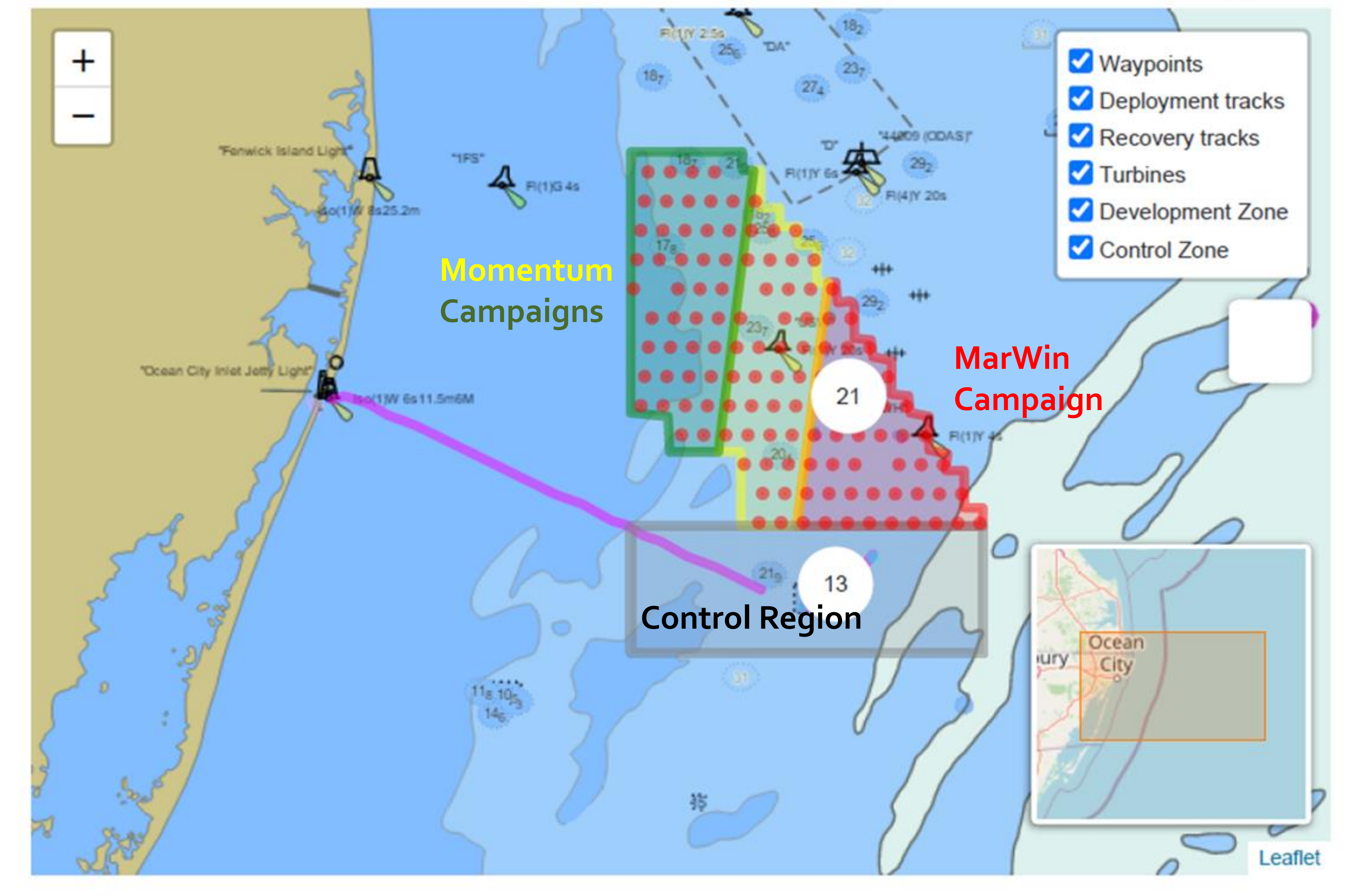
BLUE WAVE CONSULTING

TheCornellLab — K. Lisa Yang Center for Conservation Bioacoustics

TailWinds survey design and protocols of the FRM Program are consistent with BOEM (2023) and Responsible Offshore Science Alliance (ROSA 2021) guidance and include,

(1) A **hypothesis-driven**, **integrated survey** design
(2) At least 2 years each of pre-, construction, and post-construction data
(3) Use **of BACI and BAG** design principles
(4) Careful selection of control sites
(5) Survey stratification across key habitat features where feasible
(6) Survey sample size supported by **power analysis**
(7) Seasonal survey duration during periods of occurrence but also during periods that confirm absence
(8) Surveys should capture **local (turbine) and regional (farm, shelf region)** impacts
(9) Reporting of key metrics including CPUE, length, biomass, other demographic information, and diet data for key species
(10) Employment of **fishing vessel platforms**, trapping operations, and fishers in surveys
(11) Provision of data and data sharing
(12) Surveys must be compliant with the National Environmental Policy Act and **Marine Mammal Protection Act;** trap deployments should adopt best practices for avoiding protected species interactions (BOEM 2023).

US Wind MarWin and Momentum projects



- >1000 MW
- 121 x 18 MW turbines
- 0.77 x 1.02 nm grid
- 320 km²

Construction and Operations Plan

Volume I. Project Information

Revised May 2022

US Wind
Fueling our future, naturally.

Maryland Offshore Wind Project

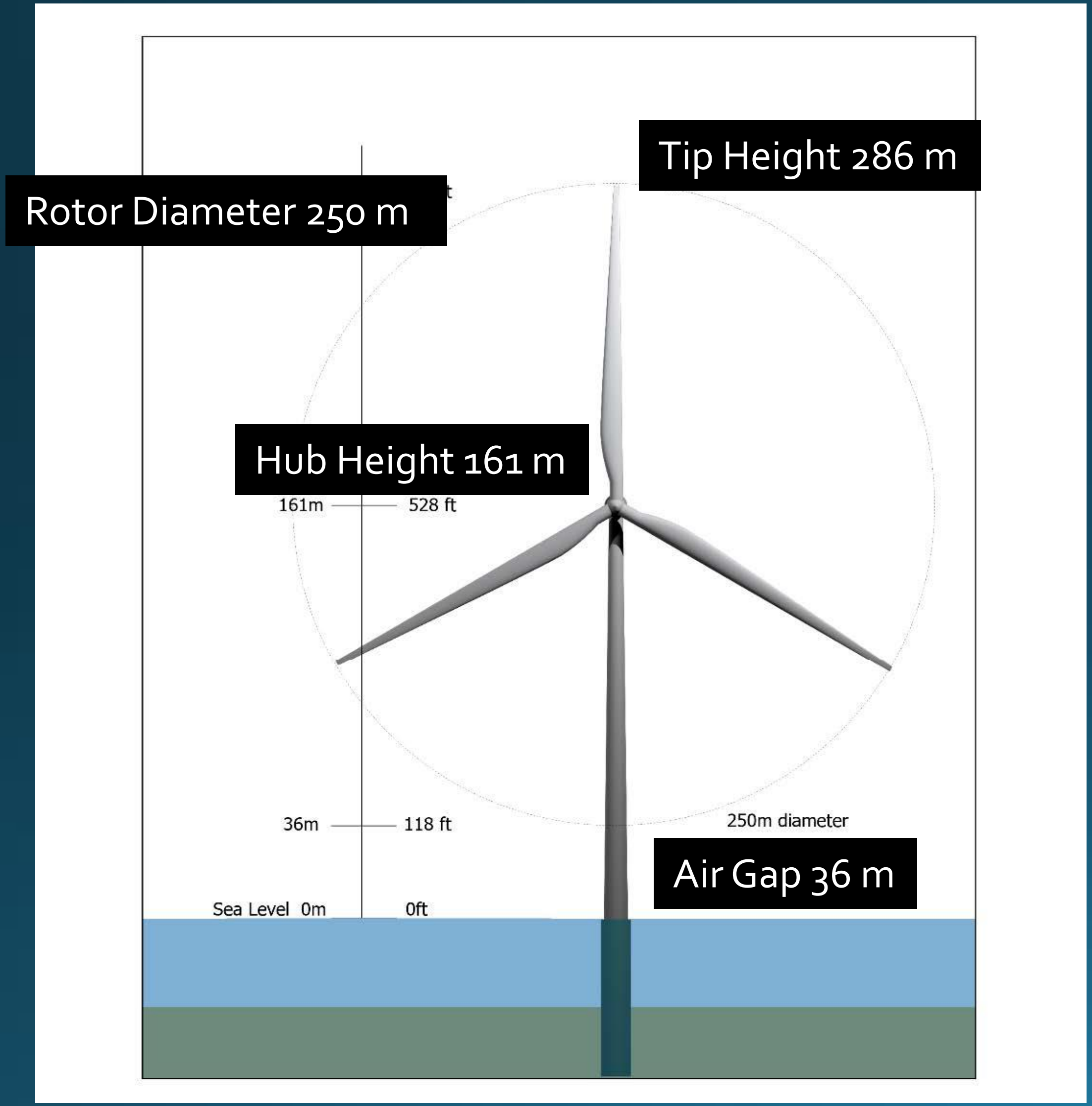
Prepared For:

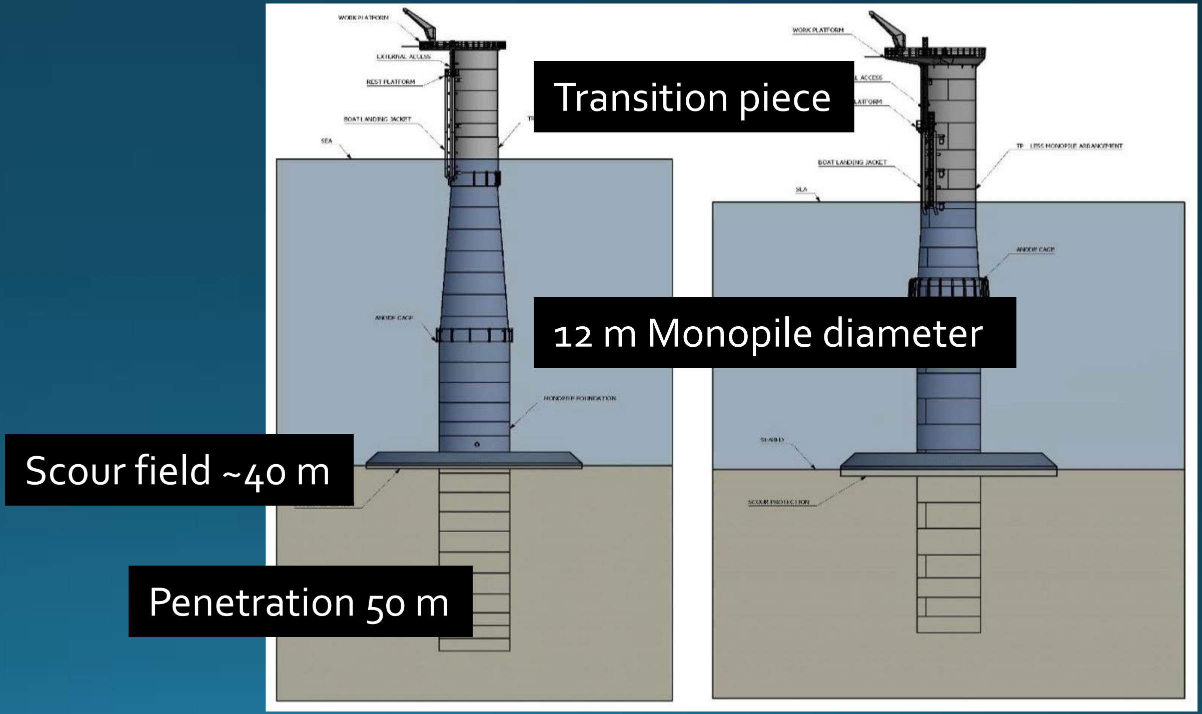
US Wind, Inc.
Baltimore, MD

Prepared By:

ESS Group, LLC, a TRC Company
Waltham, MA

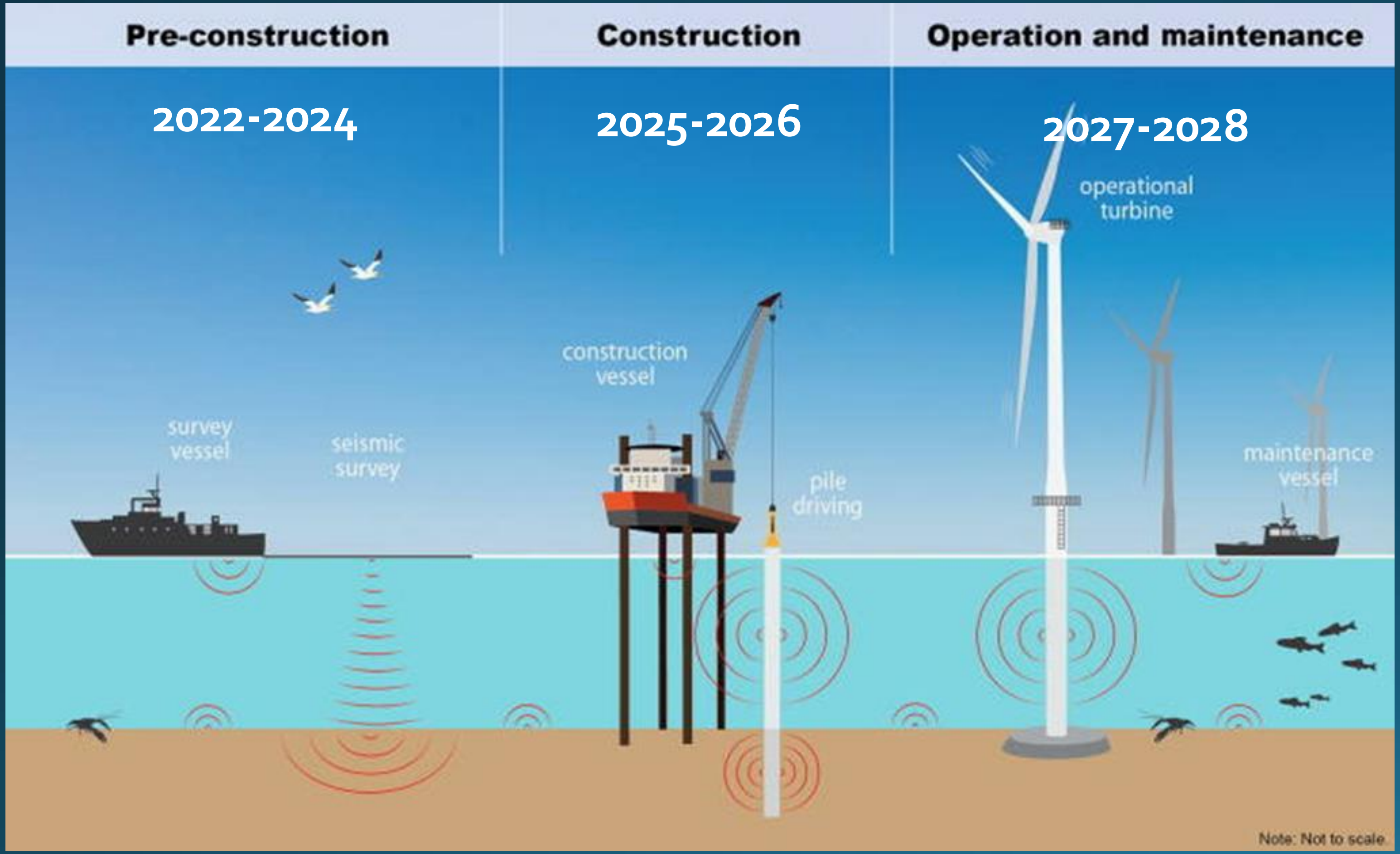
18 MW Turbine





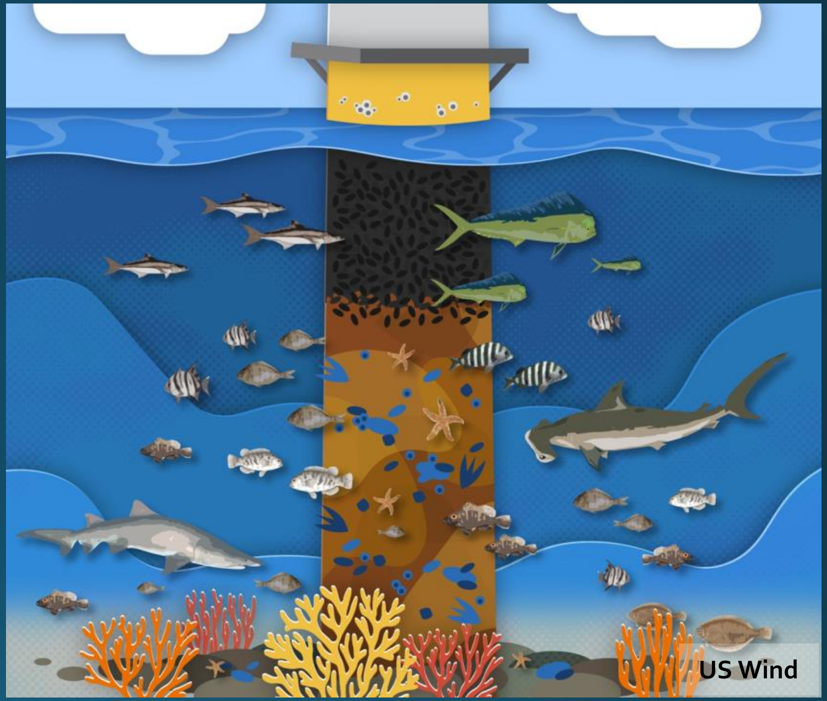
Hypothesized Impacts: local and project-scale

Soundscape Disturbance



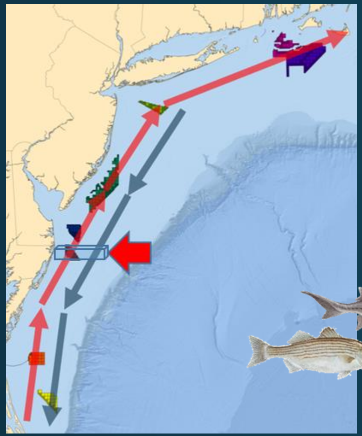
Year ranges for planned BACI phases

Reef Effect



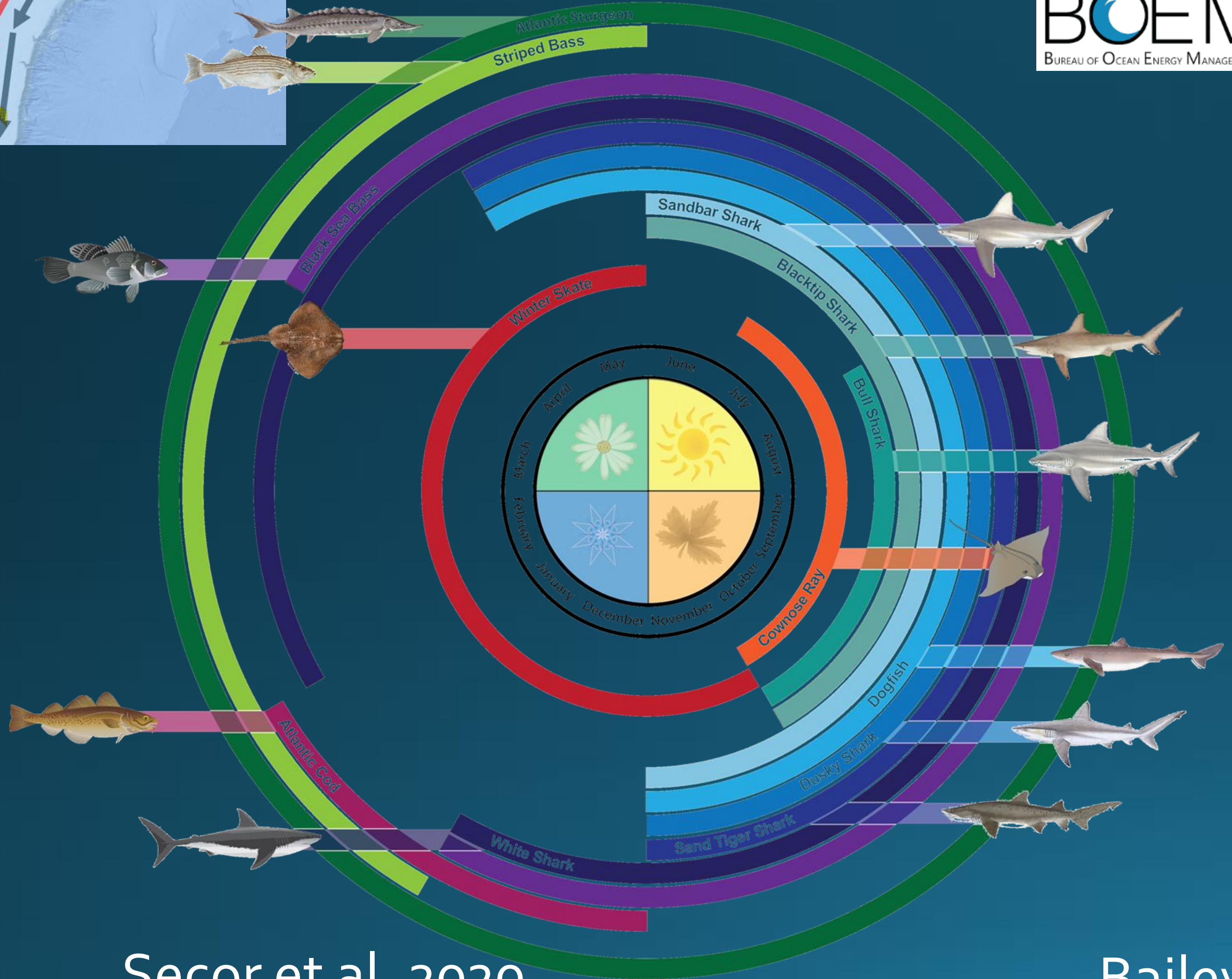
Note stratification

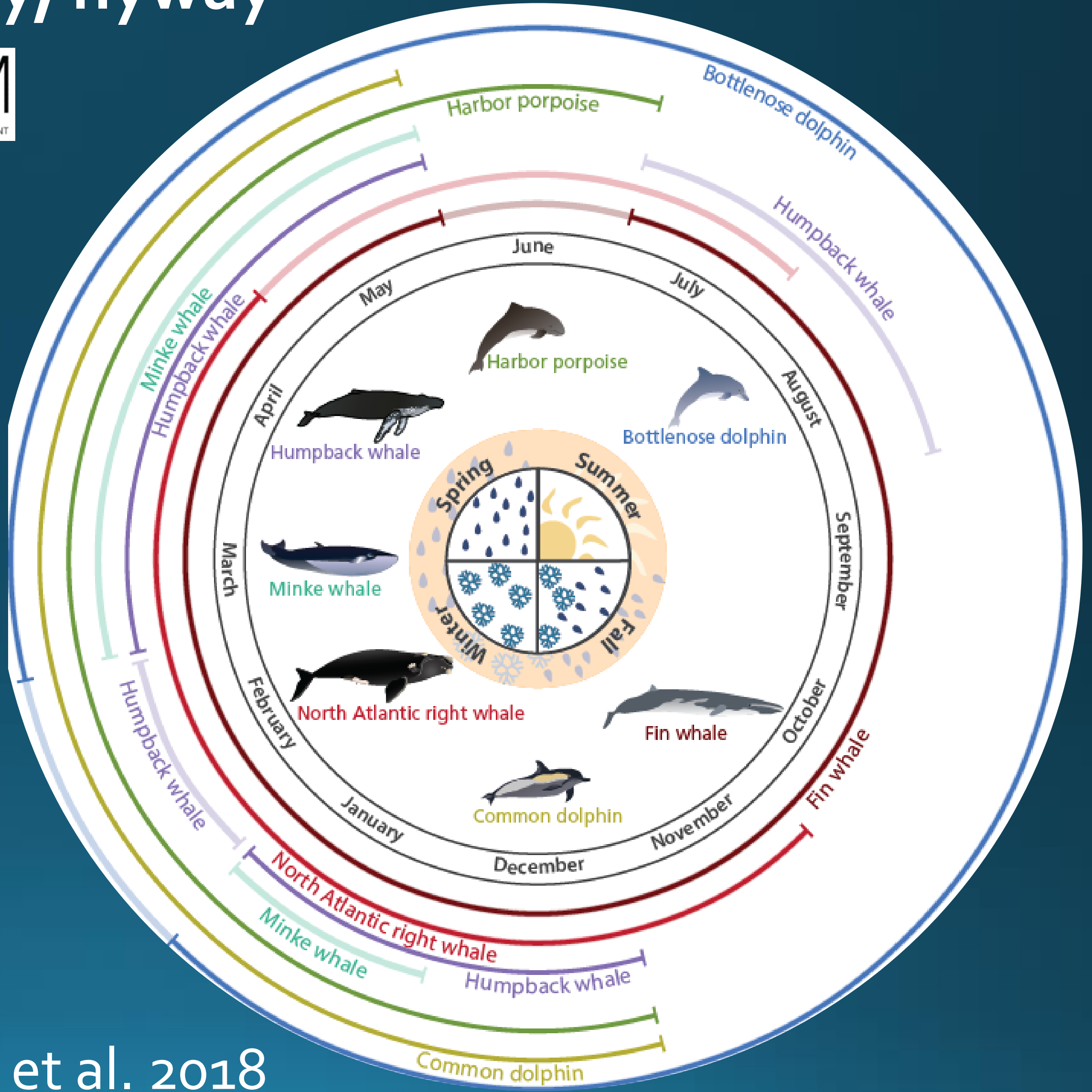
Hypothesized Impacts: regional and cumulative



Changed phenology, flyway

BOEM
Bureau of Ocean Energy Management





Secor et al. 2020

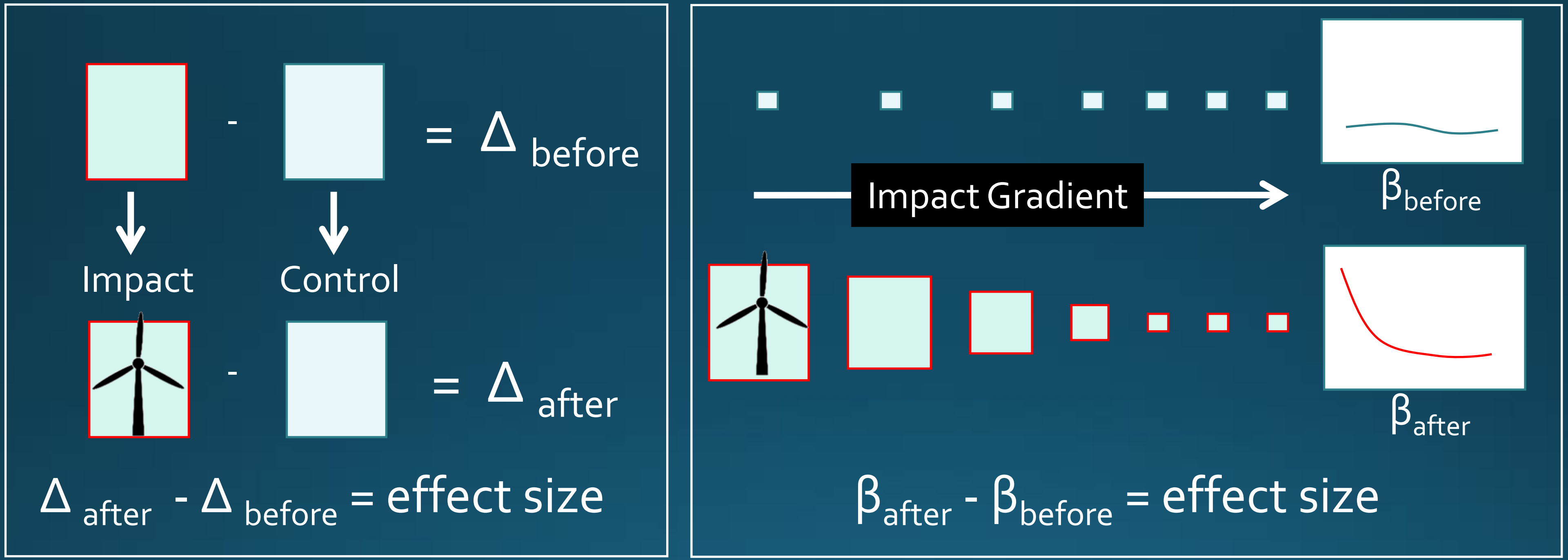
Bailey et al. 2018

https://espis.boem.gov/final%20reports/BOEM_2020-030.pdf

https://www.boem.gov/sites/default/files/documents/renewable-energy/studies/Maryland-PAM-Information-Sheet.pdf

Design premise: Local and project-scale impacts give attenuated signals

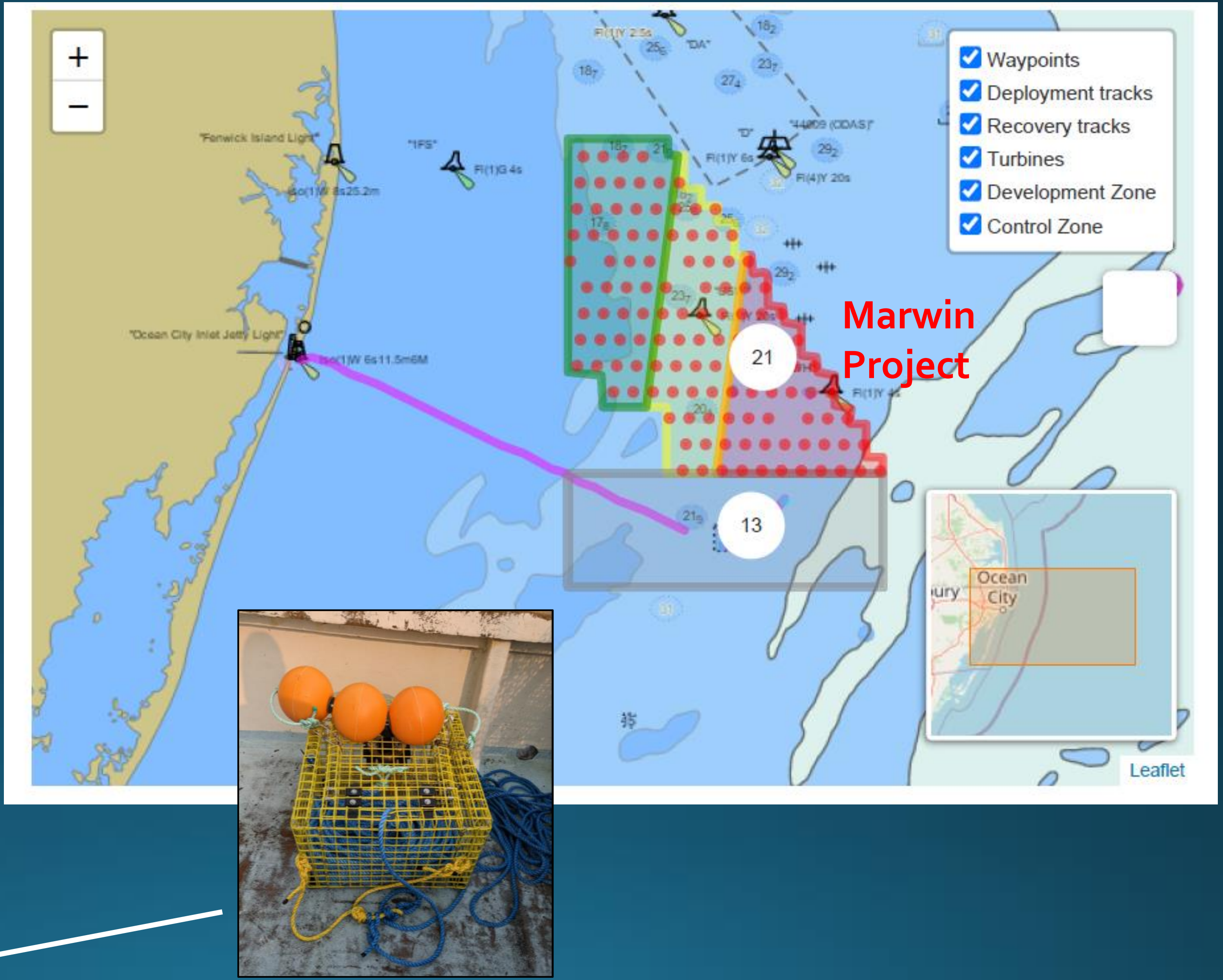
Before After Control Impact Design / Before After Gradient Design

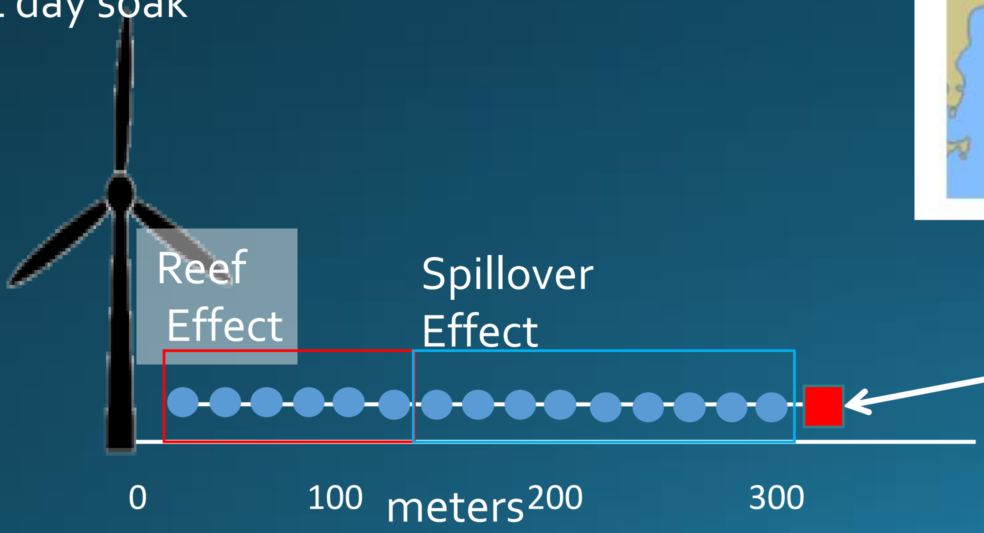


BACI and BAG designs both rely on baseline sampling (top rows) to assess impacts (bottom rows). BACI relies on careful control site selection. BAG designs do not require control sites and rely on incorporation of key impact and environmental gradients (Secor 2018).

Gradient design element in Fishery Resource Monitoring, TailWinds

15 x 40" ventless and baitless pots per string
1 day soak

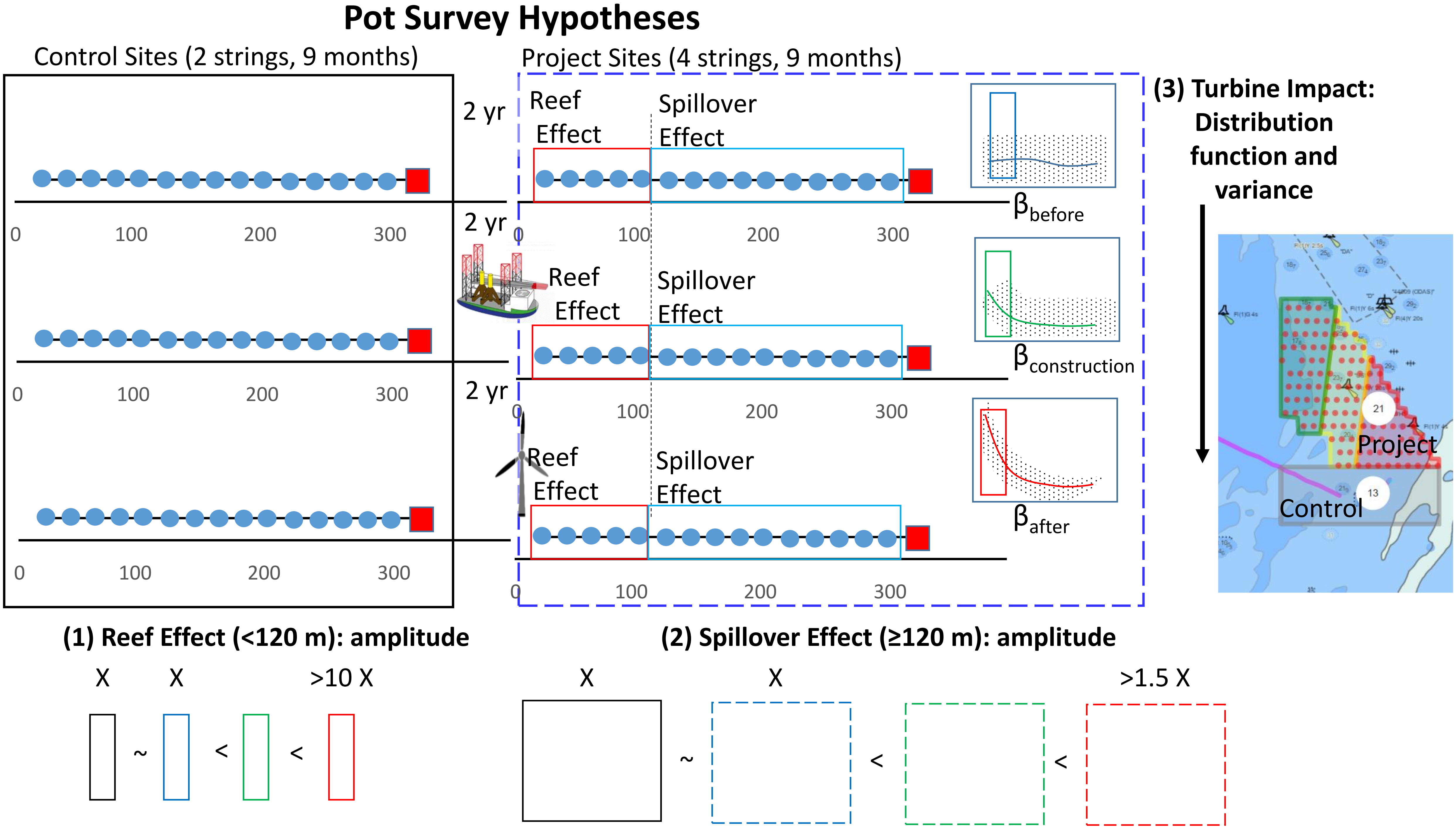




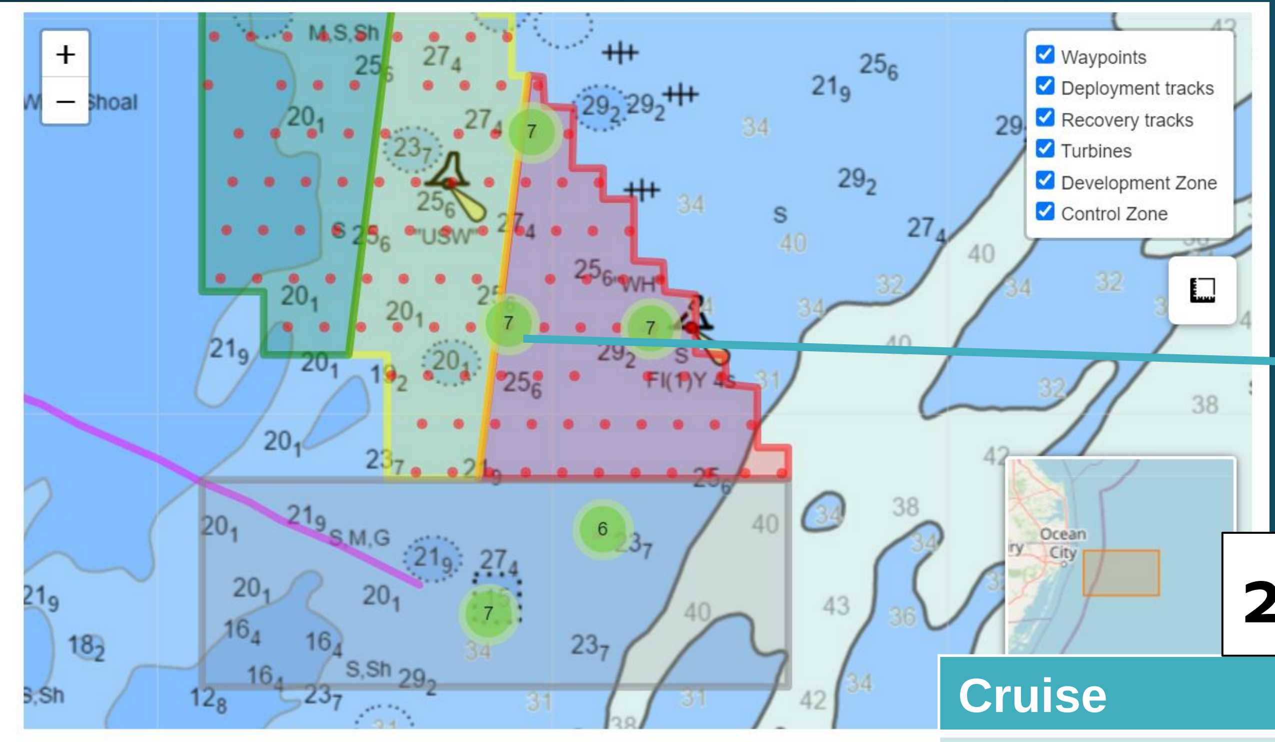
Each string, terminates with an Edgetech ropeless device

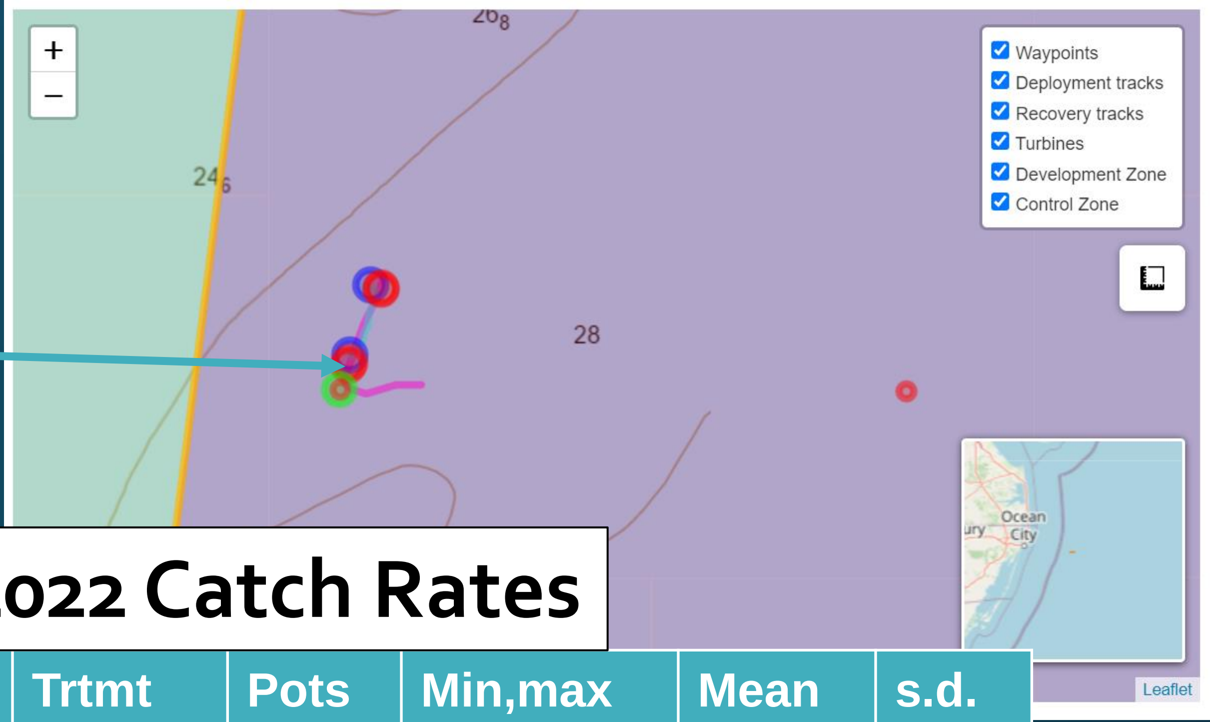
Ropeless Gear

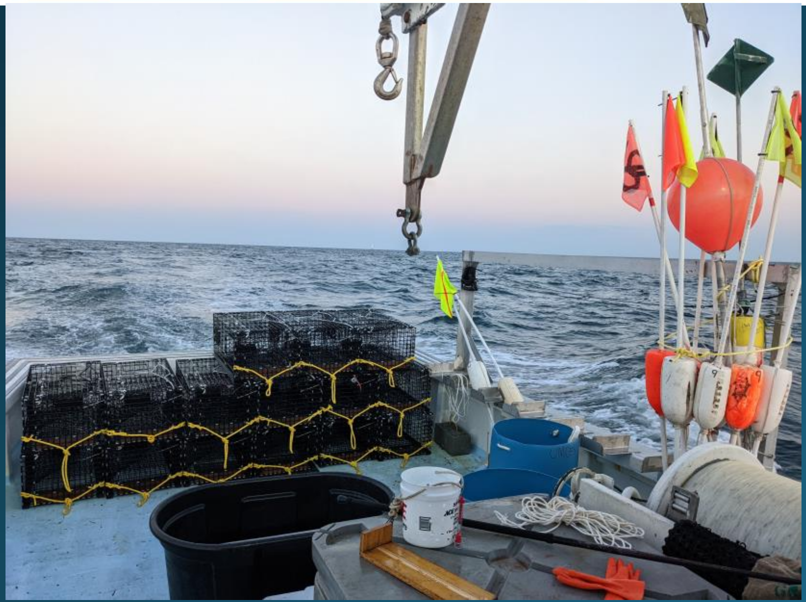
- Acoustically triggered
- Test and deploy from 2023



Pot Survey Hypotheses
Control Sites (2 strings, 9 months)
Project Sites (4 strings, 9 months)
2 yr
2 yr
2 yr
Reef Effect
Spillover Effect
0
100
200
300
β_{before}
$\beta_{construction}$
β_{after}
(3) Turbine Impact: Distribution function and variance
Project
Control
21
13
(1) Reef Effect (<120 m): amplitude
X
X
>10 X
~
<
<
(2) Spillover Effect (≥120 m): amplitude
X
X
>1.5 X
~
<
<







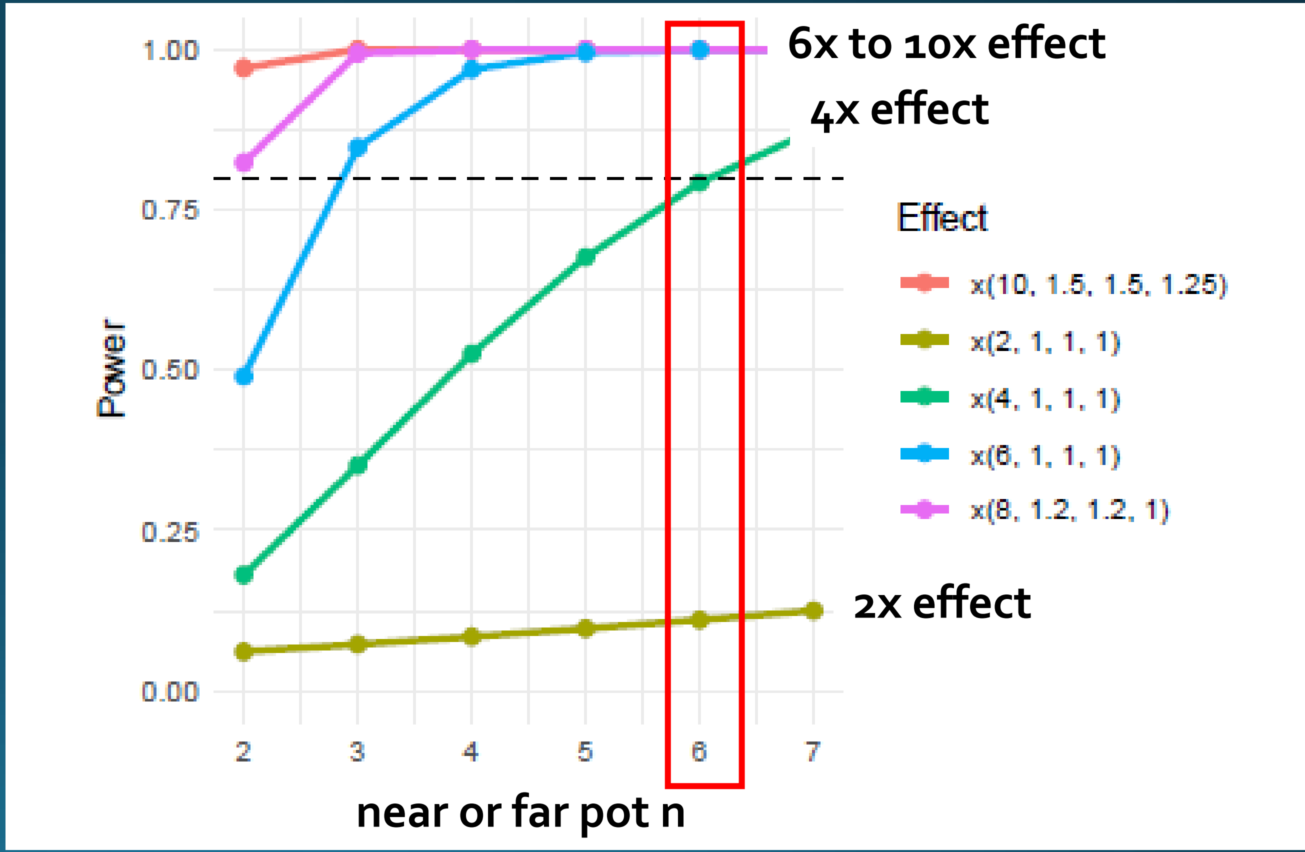
2022 Catch Rates

Cruise	Trtmt	Pots	Min,max	Mean	s.d.
June-Control	Near	18	1,2	1.4	0.5
	Far	10	1,5	2.5	1.7
June-Project	Near	6	1,2	1.2	0.4
	Far	9	1,2	1.2	0.5
July-Control	Near	18	1,6	3.0	2.0
	Far	11	1,3	1.6	1.0
July-Project	Near	13	1,3	1.2	0.6
	Far	4	1,1	1.0	0

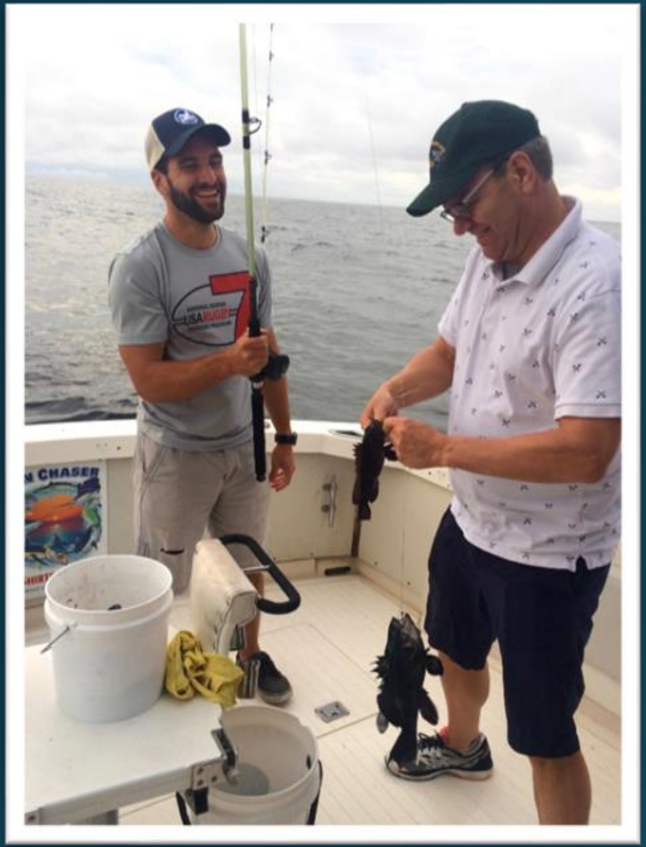
Pot Survey, 6+ years, 9 surveys/yr; 2 d/survey

BACI Period	Years	Monthly Surveys	N	Sites
TRIAL (BEFORE)	2022	May-Aug	4	4-6
BEFORE	2023-2024	Mar-Nov	9	6
CONSTRUCTION	2025-2026	Mar-Nov	9	6
AFTER	2027-2028	Mar-Nov	9	6

Power analysis



The Reef Effect: Recreational fishing

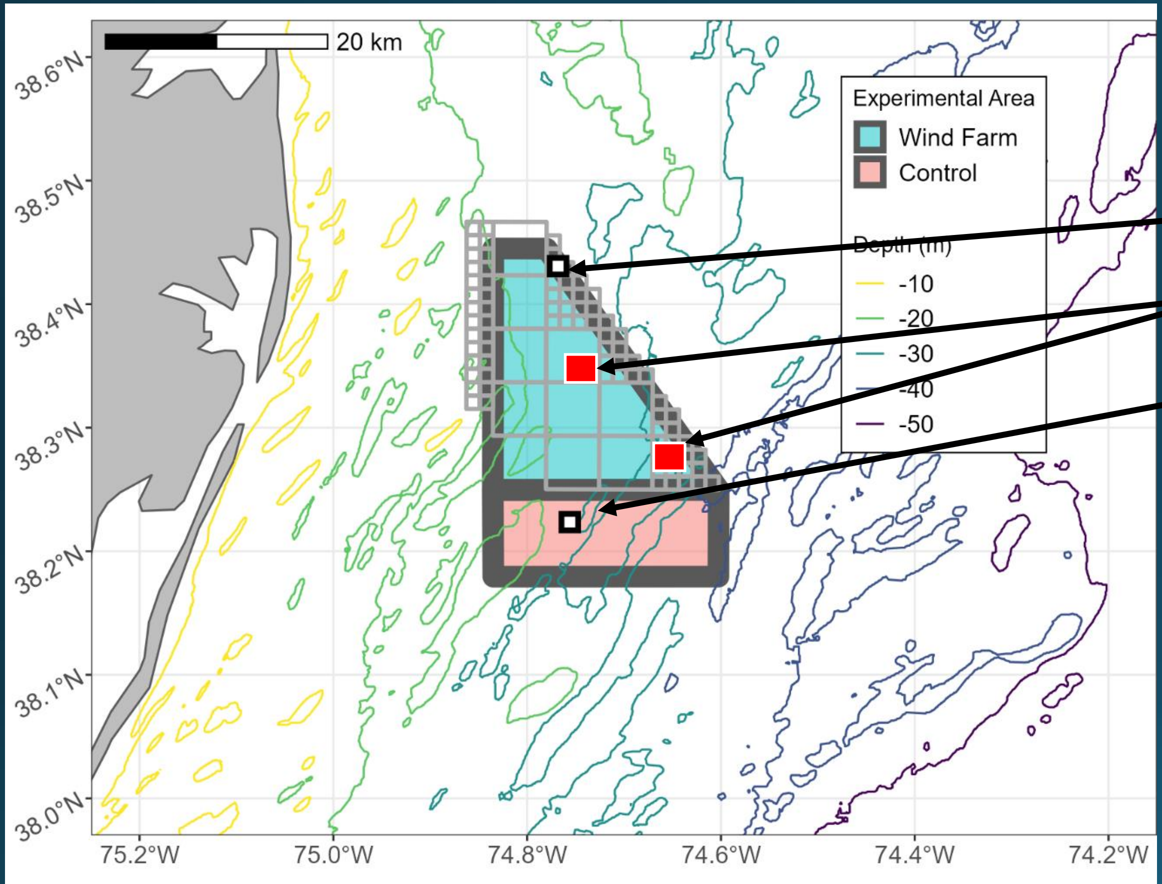


Key challenge: What's the control?

1. Use existing wreck sites as controls
2. Use controls as baselines to evaluate
    - Colonization by black sea bass
    - Relative catch rates

Photo by D. Monti

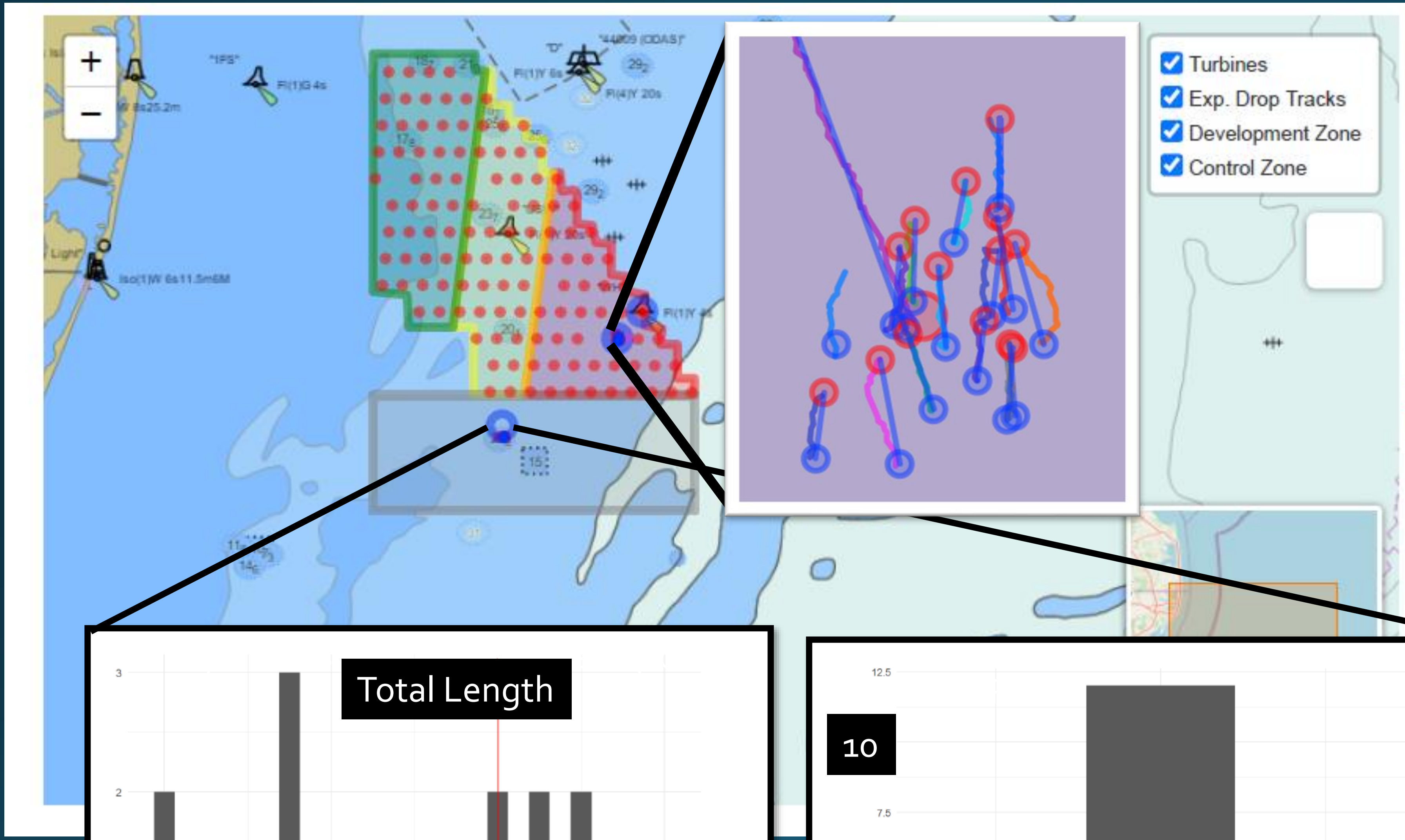
Recreational Survey Design Implementation
BACI Design

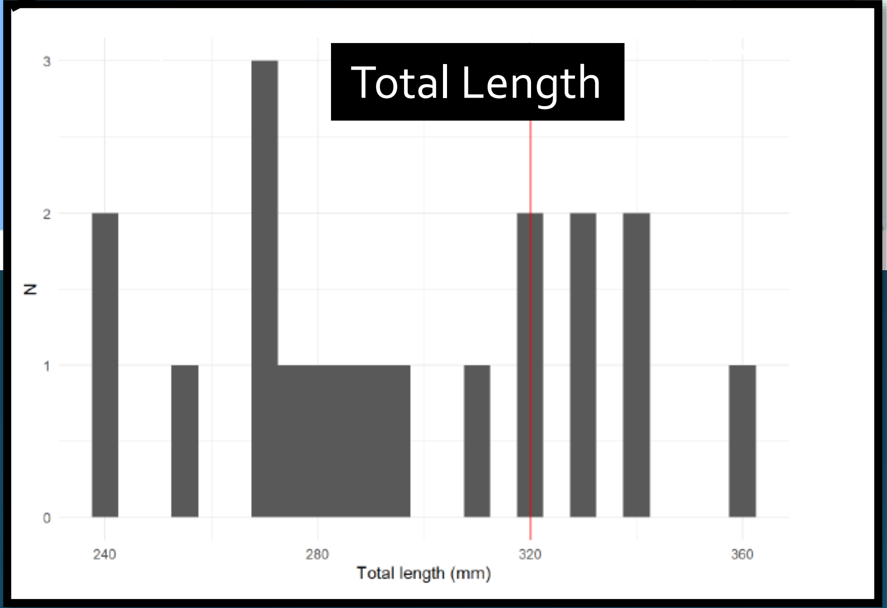


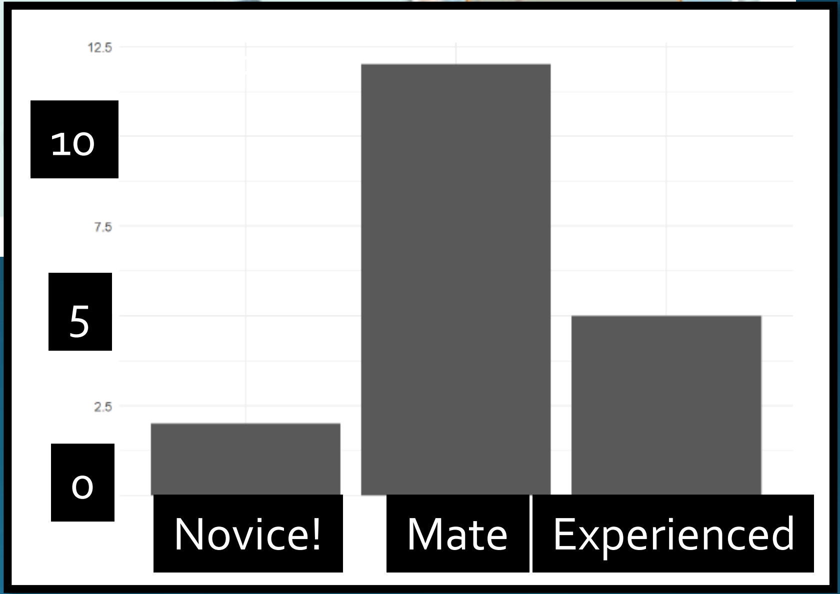
Control Wreck 1: Great Eastern Reef (<2 m relief)

Treatment Planned Turbine Foundations (BACI)

Control Wreck 2: USS *Saetia* (2-4 m relief)







Methods

- 15 min water column jigging
- 15 x 3 min “drops”
- 3 anglers

Recr. Survey, 6+ years, 6 surveys/yr; 2 d/survey

BACI Period	Years	Monthly Surveys	N	Sites
TRIAL (BEFORE)	2022	May-Aug	2	2
BEFORE	2023-2024	May-Oct	6	4
CONSTRUCTION	2025-2026	May-Oct	6	4
AFTER	2027-2028	May-Oct	6	4

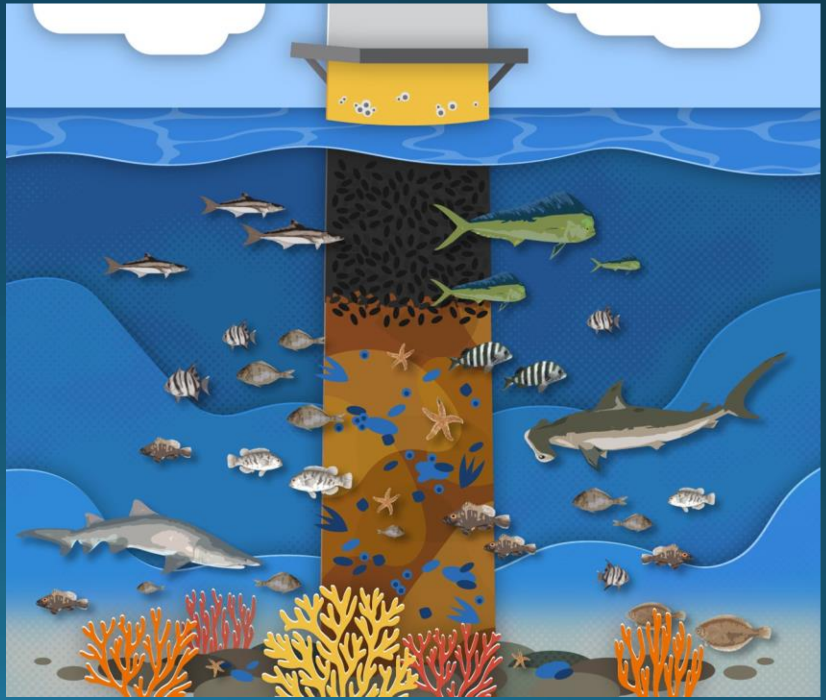
Do we have sufficient power....Not quite relevant (yet)

- Black sea bass dominant at control wreck sites
- Only Northern sea robin caught at project sites (structureless)
- Will not be able to evaluate power until turbines are in place

Biological Sampling

Hypotheses

1. Smaller fish initially colonize sub-foundations
2. Condition indices higher for sub-foundations than for wrecks (density-dependence)
3. Diet less diverse on sub-foundations than on wrecks
4. Pelagic prey will be more important for sub-foundations than for wrecks



MMM Survey in the US Wind Lease Area OCS-A0490

Helen Bailey, Aaron Rice, Slava Lyubchich, David Secor

Objectives

1. Three-phase BACI, two years each
2. Arrays of,
   - F-Pods (dolphins and porpoises)
   - Rockhoppers (whales and dolphins)
   - Biotelemetry InnovaSea receivers (tagged fishes and turtles)
3. Marine mammal exposure to ambient and induced sound
4. Temporal and spatial incidence of vocalizing marine mammals
5. Develop, apply species ID and localization algorithms whales and dolphins





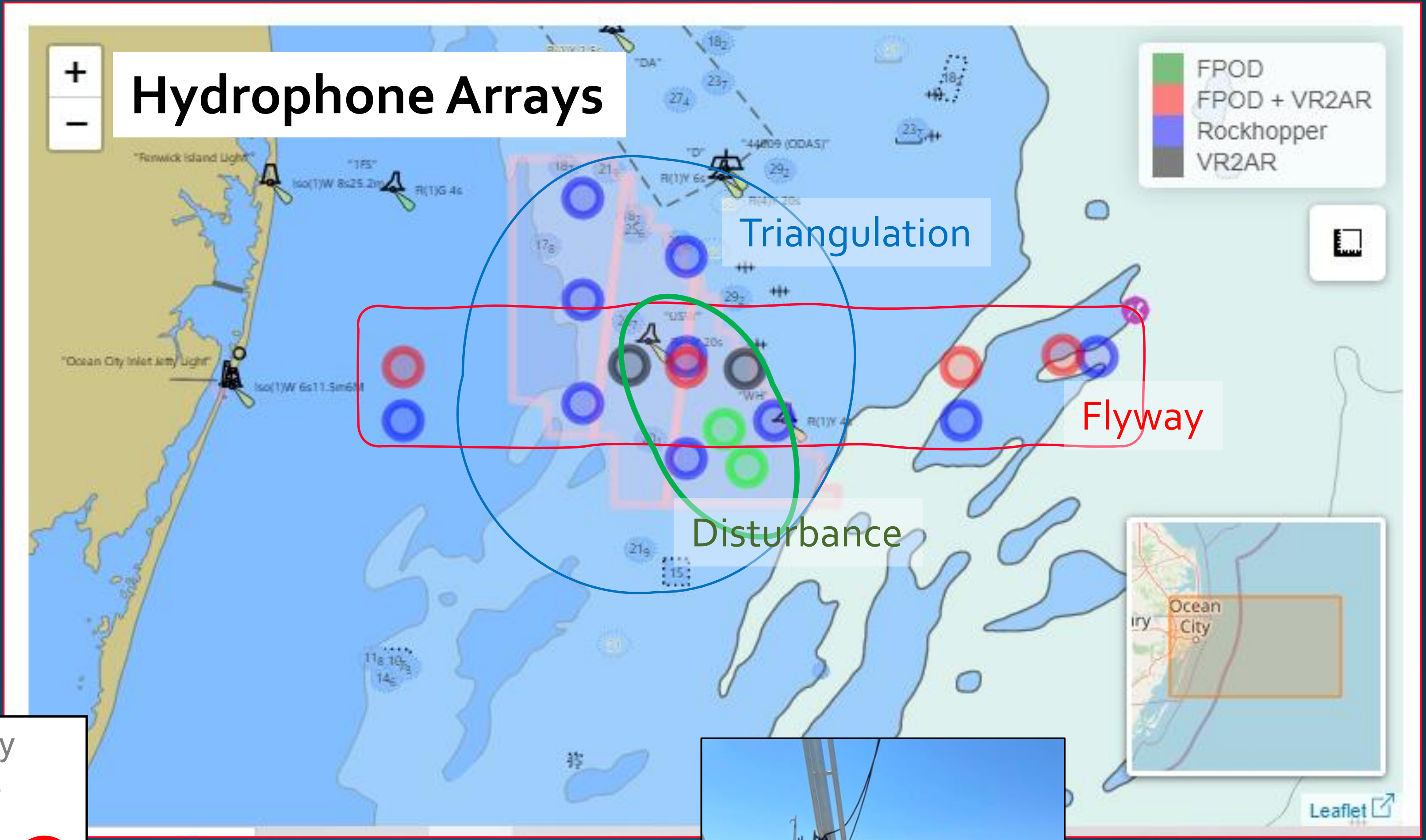


Whales and dolphins

Rockhoppers

TheCornellLab
K. Lisa Yang Center for Conservation Bioacoustics

Incidence,
Hotspots,
Phenology,
& Flyway
N=10



Dolphins and porpoise

F-PODS

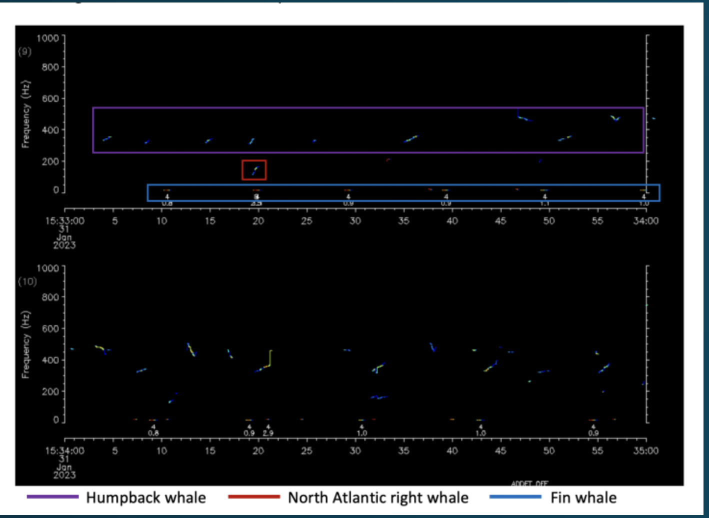
Incidence,
Behavior,
Disturbance,
& Flyway
N=6

Fishes & turtles

Telemetry Receiver

Incidence,
Phenology,
& Flyway
N=6

Symphonic whales (wind ensemble)

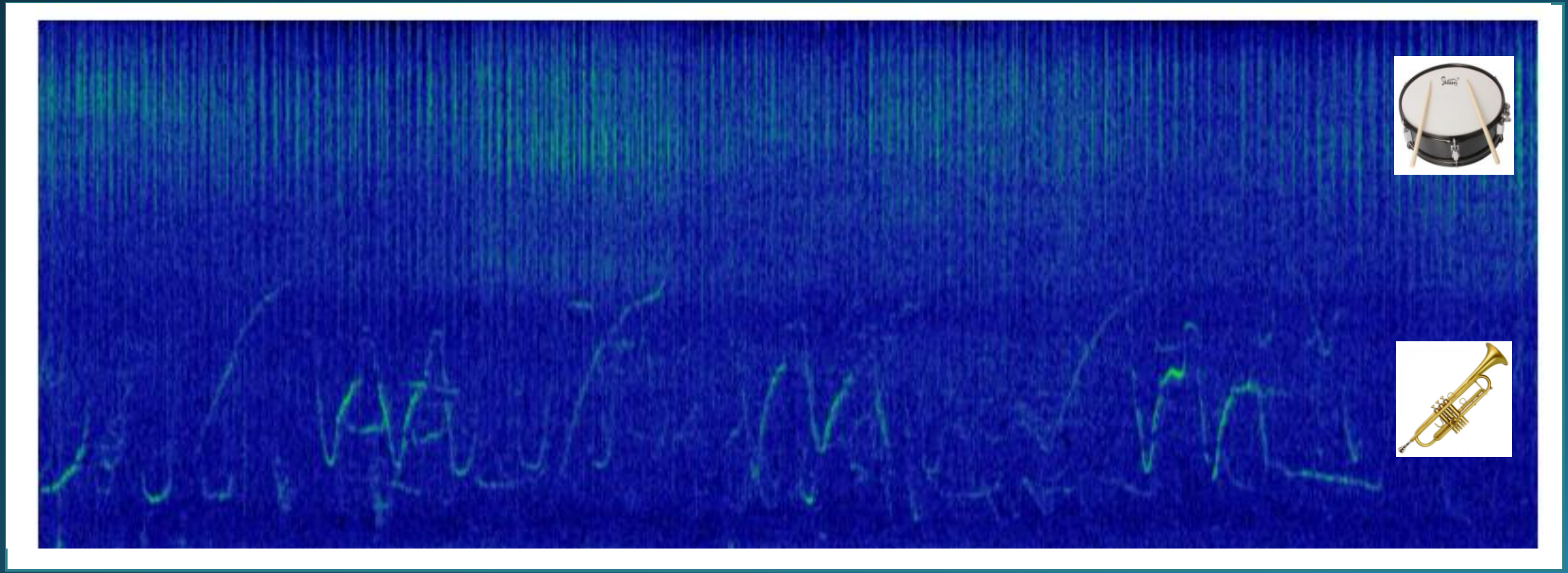
https://tailwinds.umces.edu/news/ (K. Silva)

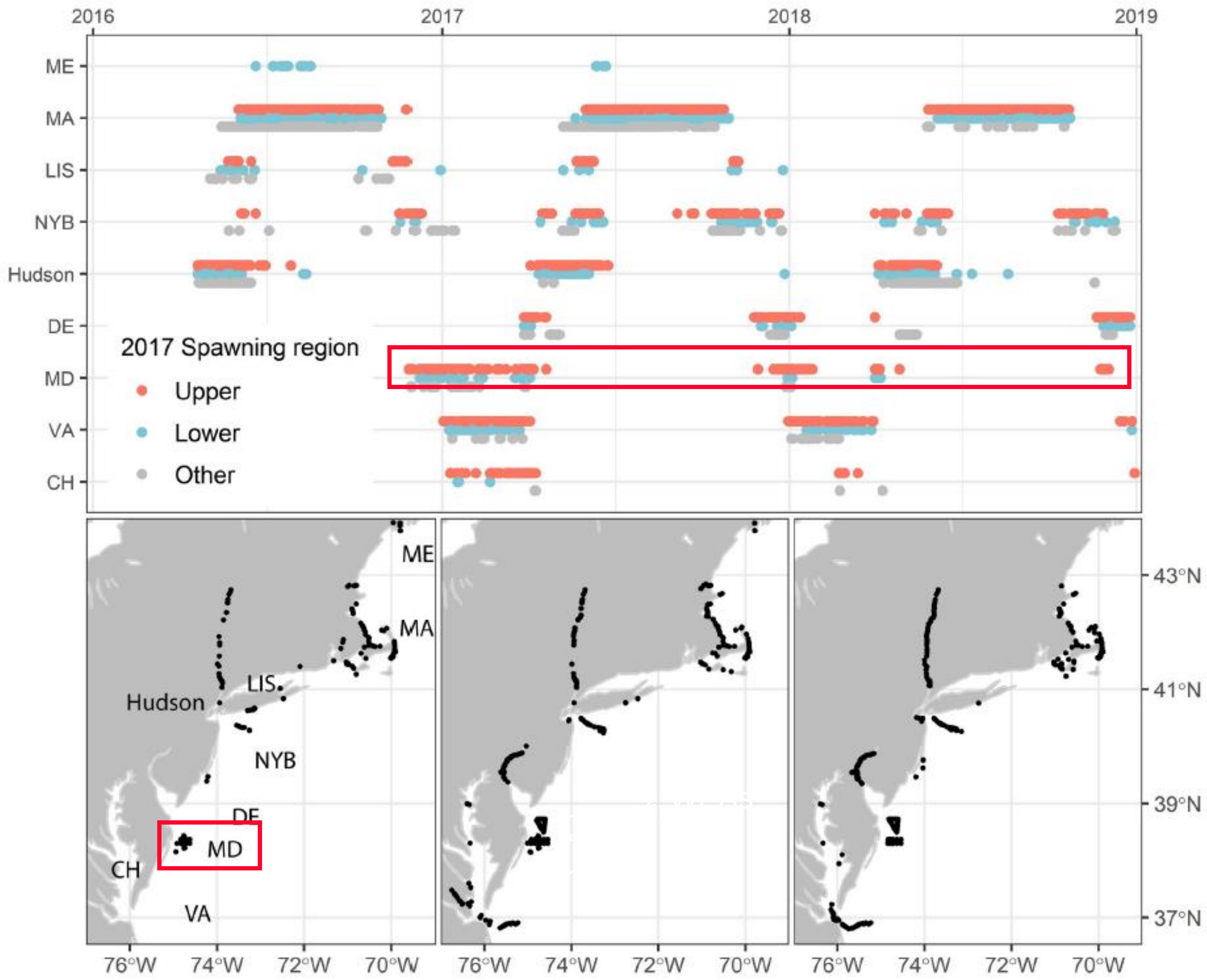
Ea. 6 mo. download
~200 TB acoustic data!

Careful listening in noisy soundscape

- 105-115 dB (H. Bailey, unpubl)
- Between a school dance and a chain saw

Dissonant dolphin clicks and whistles (bugle corps)



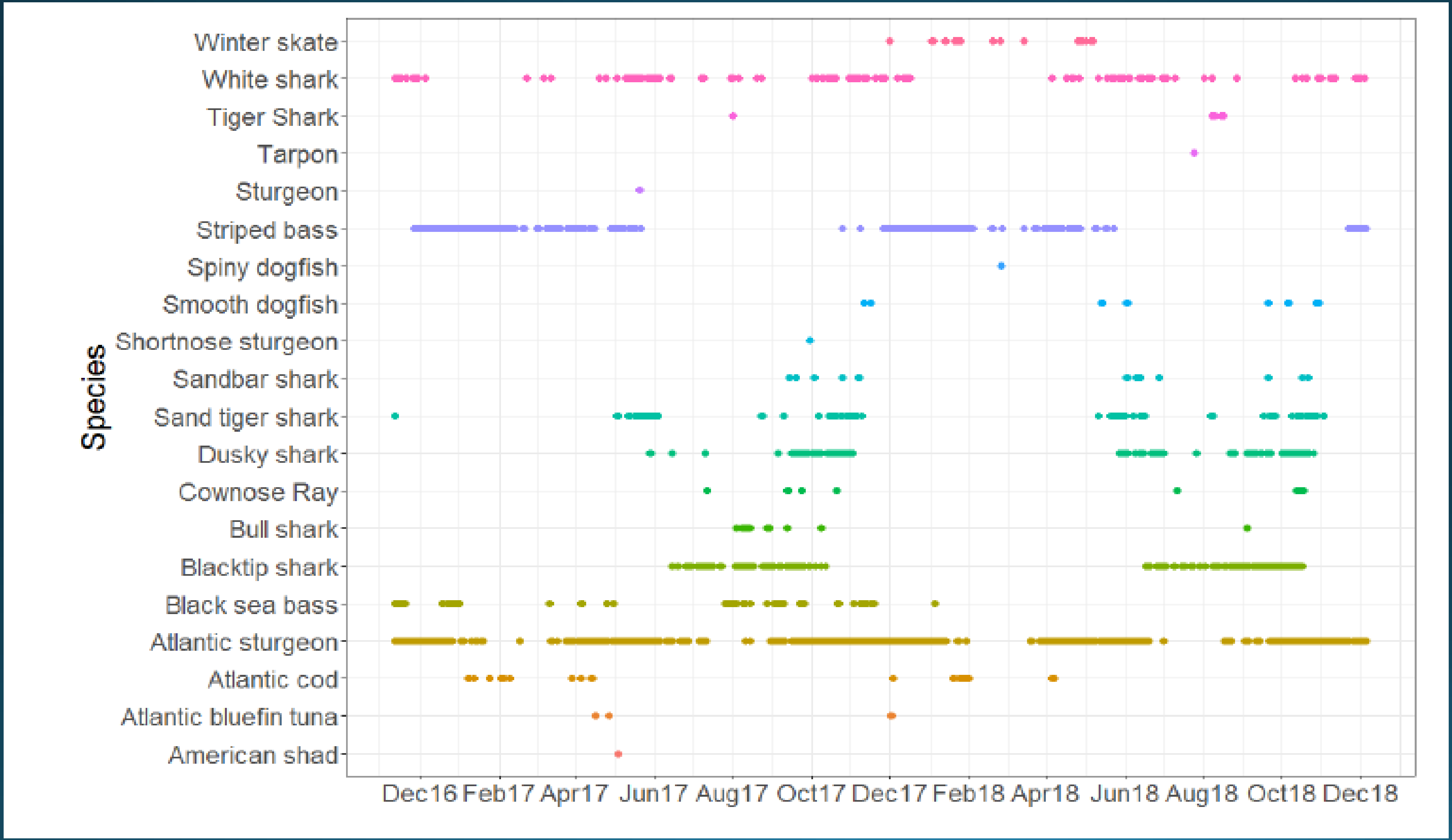


Striped Bass Flyway

- Hudson River striped bass
- Receiver arrayed across latitudes: coming attractions for OWFs

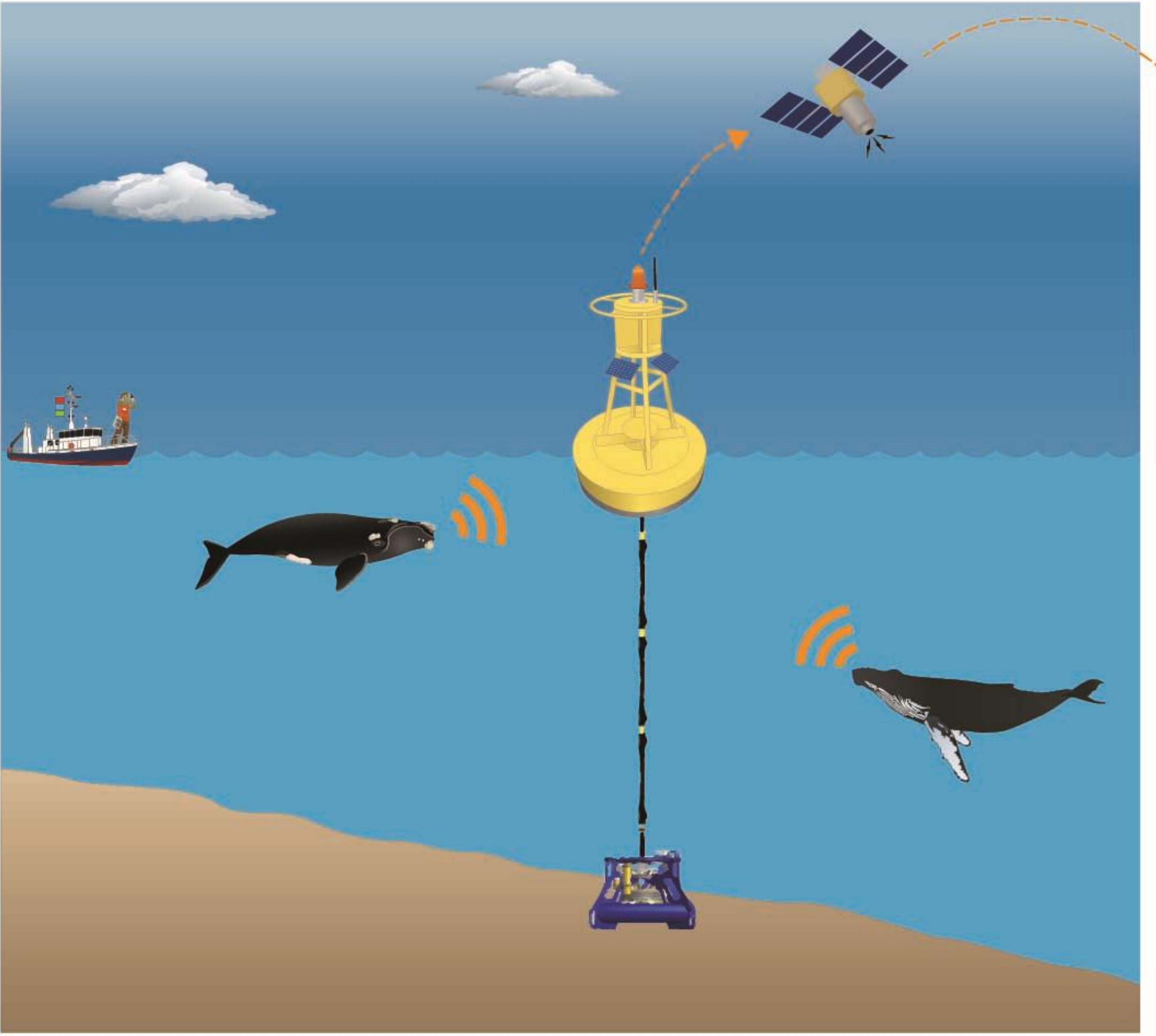
Secor, et al. 2021. Plos One 15(11):e0242797

Multi-species Flyway – 20 tagged species



RTWB in the US Wind Lease Area OCS-A0490

Helen Bailey, Mark Baumgartner, David Secor



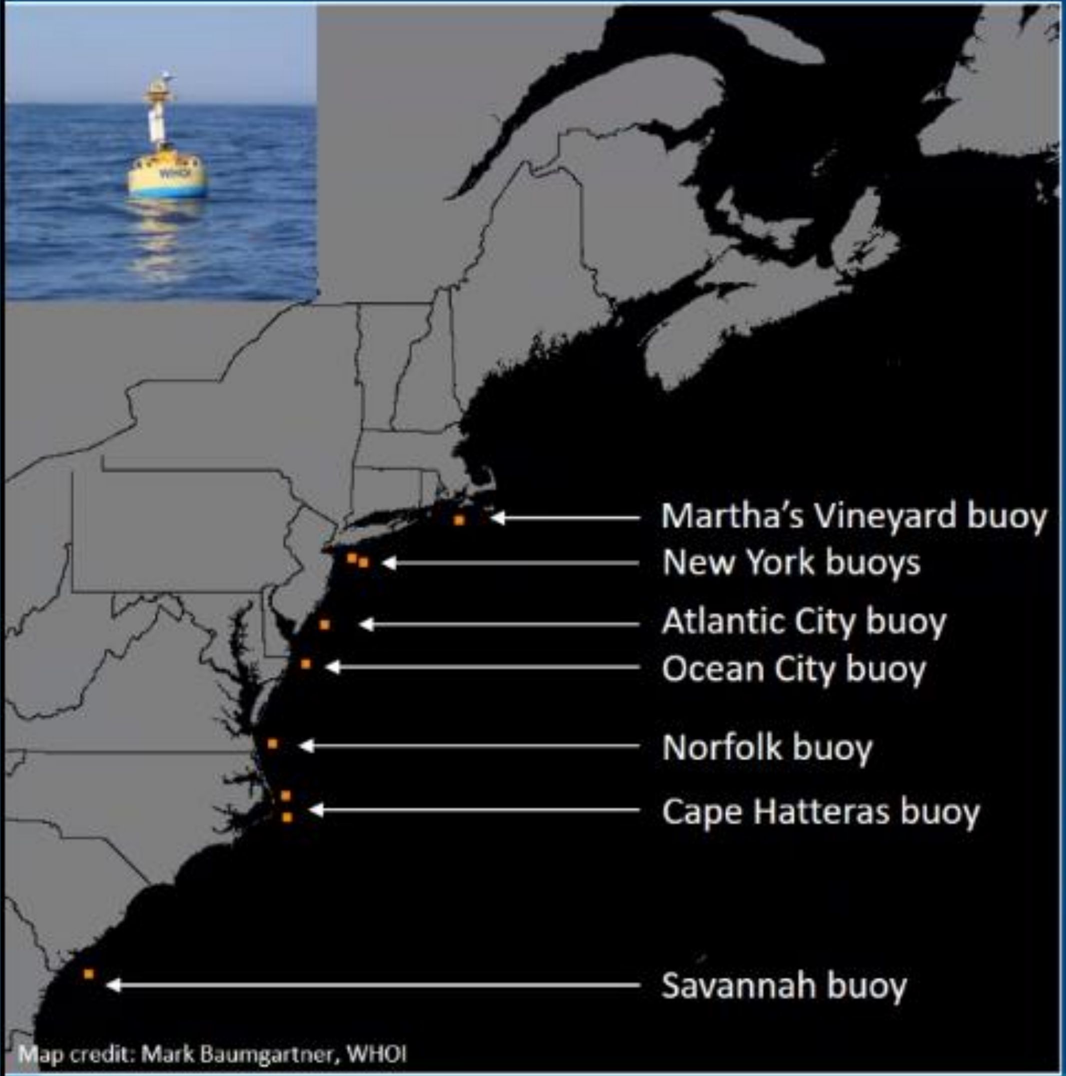
University of Maryland Center for Environmental Science

WHOI

Maryland Department of Natural Resources

Maryland Energy Administration

Robots4Whales Buoys Operated by WHOI



Buoy	Partners	Funder
Martha's Vineyard	WHOI	Orsted, NOAA
New York Bight	WHOI, WCS	Equinor
Atlantic City	WHOI	Orsted, New Jersey
Ocean City	WHOI, UMCES	Maryland, U.S. Wind
Norfolk	WHOI, USC	CMA-CGM
Cape Hatteras	WHOI, NAVFAC	NAVFAC
Savannah	WHOI, USC	CMA-CGM

WHOI – Woods Hole Oceanographic Institution
WCS – Wildlife Conservation Society
UMCES – University of Maryland Center for Environmental Science
USC – University of South Carolina
NAVFAC – Naval Facilities Engineering Systems Command

WHOI

TailWinds Monitoring Projects The Species The Team For Reference What's New

Baseline monitoring for marine mammals

Bailey, H., Fandel, A. D., Silva, K., Gryzb, E., McDonald, E., Hoover, A. L., Ogburn, M. B., & Rice, A. N. (2021). **Identifying and predicting occurrence and abundance of a vocal animal species based on individually specific calls.** *Ecosphere*, 12(8). https://doi.org/10.1002/ecs2.3685

Bailey, Helen, Aaron N. Rice, Jessica E. Wingfield, Kristin B. Hodge, BJ Estabrook, Dean Hawthorne, Aran Garrod, et al. (2019). **Determining Habitat Use by Marine Mammals and Ambient Noise Levels Using Passive Acoustic Monitoring Offshore of Maryland.** *Sterling (VA): US Department of the Interior, Bureau of Ocean Energy Management* https://espis.boem.gov/final%20reports/BOEM_2019-018.pdf

Bailey, H., Lyubchich, V., Wingfield, J., Fandel, A., Garrod, A., and Rice, A.N. (2019) **Empirical evidence that large marine predator foraging behavior is consistent with area-restricted search theory.** *Ecology*, 100: e02743. https://doi.org/10.1002/ecy.2743

Garrod, A., Fandel, A. D., Wingfield, J. E., Fouda, L., Rice, A. N., and Bailey, H. (2018) **Validating automated click detector dolphin detection rates and investigating factors affecting performance.** *The Journal of the Acoustical Society of America*, 144: 931-939. https://doi.org/10.1121/1.5049802

Fouda, L., Wingfield, J. E., Fandel, A. D., Garrod, A., Hodge, K. B., Rice, A. N., and Bailey, H. (2018) **Dolphins simplify their vocal calls in response to increased ambient noise.** *Biology letters*, 14: 20180484. https://doi.org/10.1098/rsbl.2018.0484

Wingfield, J.E., O'Brien, M., Lyubchich, V., Roberts, J.J., Halpin, P.N., Rice, A.N. and Bailey, H., 2017. **Year-round spatiotemporal distribution of harbour porpoises within and around the Maryland wind energy area.** *PLOS ONE*, 12(5), p.e0176653 https://doi.org/10.1371/journal.pone.0176653

Bailey, H., Brookes, K.L. and Thompson, P.M. (2014) **Assessing environmental impacts of offshore wind farms: Lessons learned and recommendations for the future.** *Aquatic Biosystems*, 10: 8. https://doi.org/10.1186/2046-9063-10-8

Baseline monitoring for migratory fishes

O'Brien, M.H.P., Secor, D.H., 2021. **Influence of thermal stratification and storms on acoustic telemetry detection efficiency: a year-long test in the US Southern Mid-Atlantic Bight.** *Animal Biotelemetry* 9, 8. https://doi.org/10.1186/s40317-021-00233-3

Bangley, C.W., T.H. Curtis, D.H. Secor, M.B. Ogburn. 2020. **Search for important habitat for juvenile dusky sharks (Carcharhinus obscurus) in the Northwest Atlantic Ocean using acoustic telemetry and spatial modeling.** *Marine and Coastal Fisheries* 12:348-363. https://doi.org/10.1002/mcf2.10120

Fandel, A.D., A. Garrod, A.L. Hoover, J.E. Wingfield, V. Lyubchich, D.H. Secor, K.B. Hodge, A.N. Rice, And H. Bailey. 2020. **Effects of intense storm events on dolphin occurrence and foraging behavior.** *Scientific Reports* (2020) 10:19247 https://doi.org/10.1038/s41598-020-76077-3

Rothermel, E.R., Balazik, M.T., Best, J.E., Fox, D.A., Gahagan, B.I., Haulsee, D.E., Higgs, A.L., O'Brien, M.H.P., Oliver, M.J., Park, I.A., and Secor, D.H. 2020. **Comparative migration ecology of striped bass and Atlantic sturgeon in the US Southern Mid-Atlantic Bight flyway.** *PLOS ONE* 15(6): e0234442. https://doi.org/10.1371/journal.pone.0234442

Secor, D, M O'Brien, E Rothermel, C Wiernicki, and H Bailey. (2020). **Movement and Habitat Selection by Migratory Fishes within the Maryland Wind Energy Area and Adjacent Reference Sites.** *Sterling (VA): U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs.* URL: https://espis.boem.gov/final%20reports/BOEM_2020-030.pdf

Baseline monitoring for reef fishes

Secor, D.H., Bailey, H., Carroll, A., Lyubchich, V., O'Brien, M.H.P., Wiernicki, C.J., 2021. **Diurnal vertical movements in black sea bass (Centropristis striata): Endogenous, facultative, or something else?** *Ecosphere* 12, e03616. https://doi.org/10.1002/ecs2.3616

Wiernicki, C.J., O'Brien, M.H.P., Zhang F, Lyubchich V, Li M, Secor, D.H., 2020. **The recurring impact of storm disturbance on black sea bass (Centropristis striata) movement behaviors in the Mid-Atlantic Bight.** *PLOS ONE* 15(12): e0239919. https://doi.org/10.1371/journal.pone.0239919

Secor, D.H., Zhang, F., O'Brien, M.H.P. and Li, M. 2019. **Ocean destratification and fish evacuation caused by a Mid-Atlantic tropical storm.** *ICES Journal of Marine Science*, 76(2). https://doi.org/10.1093/icesjms/fsx241

Guidance for offshore impacts on resource species

Responsible Offshore Science Alliance. 2021. **Offshore Wind Project Monitoring Framework and Guidelines.** URL: https://www.rosascience.org/wp-content/uploads/2022/09/ROSA-Offshore-Wind-Project-Montioring-Framework-and-Guidelines.pdf

Hutchison, Z.L., D.H. Secor, and A.B Gill. 2020. **The interaction between resource species and electromagnetic fields associated with electricity production by offshore wind farms.** *Oceanography* 33(4):96-107. https://doi.org/10.5670/oceanog.2020.409

Wiernicki, CJ, D Liang, H Bailey, and DH Secor. 2020. **The effect of swim bladder presence and morphology on sound frequency detection for fishes.** *Reviews in Fisheries Science and Aquaculture* 28:459-477. https://doi.org/10.1080/23308249.2020.1762536

Tailwinds.umces.edu