Bat Acoustic Monitoring in the Gulf of Maine

Preliminary 2024 results

June 13, 2025

Prepared for:

Maine Department of Inland Fisheries and Wildlife

353 Water St, Augusta, ME 04330

Prepared by:

Merra Howe, Wing Goodale, Ph.D., Josh Guilbert, Ph.D., Ethan Gilardi, and Bri Frankina

Summary

- With support from Maine Department of Inland Fisheries and Wildlife (IFW), from July—October 2024, the Biodiversity Research Institute (BRI) conducted a bat acoustic monitoring effort in the Gulf of Maine to better understand offshore bat activity in the context of forthcoming offshore wind development in the region.
- BRI worked in partnership with the Maine Department of Marine Resources (DMR), and fishermen, among others, to deploy Wildlife Acoustics SM4BAT detectors on three vessels that traversed different regions of the Gulf of Maine, five islands, and at two coastal sites.
- Detectors collected data for 223 monitoring nights, with 174 nights of bat acoustic activity.
- Data from vessels included 119 bat passes, representing all migratory tree bats and the big brown bat (*Eptesicus fuscus*), with the eastern red bat (*Lasiurus borealis*) most often detected.
- Eastern red bats were also found farthest offshore, with one pass recorded 136 km from Cape Cod, MA, and one pass detected within the Bureau of Ocean Energy Management (BOEM)-proposed Gulf of Maine offshore wind lease areas.
- Outreach and communications from this monitoring effort included a publication in *Northeastern Naturalist* in collaboration with the Canadian Wildlife Service, an ArcGIS StoryMap[1], and factsheets of the monitoring results for detector hosts.
- Findings from this effort will help inform and refine continued Gulf of Maine bat acoustic monitoring in 2025 with support from IFW, as well as future monitoring through support from the Maine Governor's Energy Office.

[1] https://storymaps.arcgis.com/stories/cc5301884fd94ad99a5d4296d33569f9

Table of Contents

List of Tables

List of Figures

1 Introduction

Offshore wind energy is being pursued in the Gulf of Maine (Gulf) to reduce dependence on fossil fuels; yet wind turbines pose a collision risk for bats. In October 2024, the Bureau of Ocean Energy Management (BOEM) leased four offshore wind energy areas to developers in the Gulf of Maine (Gulf; BOEM 2024). Collision with wind turbines is considered a threat to bats in the United States and Canada (Adams et al. 2024), and while offshore wind energy is an important renewable energy resource, it has the potential to negatively impact bats (Solick and Newman 2021). Efforts to collect data on bats in the offshore environment to understand these potential interactions have employed various approaches, such as stationary acoustic monitoring from wind turbine generators (e.g., Lagerveld et al. 2014; Normandeau Associates 2022), as well as visual observations from aerial surveys and vessels (e.g., Hatch et al. 2013).

Eight species of bats are known to be present in Maine, which can be split into two groups based on their wintering strategy: cave-hibernating bats and migratory tree-roosting bats. The five cave-dwelling species include northern long-eared bat (*Myotis septentrionalis*), tricolored bat (*Perimyotis subflavus*), little brown bat (*Myotis lucifugus*), big brown bat (*Eptesicus fuscus*), and eastern small-footed bat (*Myotis leibii*). Research conducted in other regions of the Atlantic Outer Continental Shelf indicates that cave-hibernating bats, which migrate from their summer habitats to hibernacula in the New England region (Perry 2013), may occur offshore but are generally not observed as frequently as migratory tree-roosting bats (Doucette et al. 2024; Dowling and O'Dell 2018; Thompson, Thompson, and Brigham 2015). The northern long-eared, little brown, eastern small-footed and tricolored bats are listed on Maine's endangered and/or threatened species list; the northern long-eared bat is also federally listed as endangered under the Endangered Species Act (ESA), and the tricolored bat is proposed as endangered under the ESA.

The three migratory tree-roosting species found in Maine include the eastern red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), and silver-haired bat (*Lasionycteris noctivagans*). In contrast with the cave-hibernating bats, these species fly to coasts or areas with a mild climate to winter (Cryan 2003), have historically been observed offshore (Solick and Newman 2021), and have been detected up to 44 km offshore in the mid-Atlantic region during fall migration (Hatch et al. 2013).

To date, information on the occurrence of these eight species in the Gulf has been based primarily on stationary acoustic monitoring survey efforts, where acoustic data were collected from bats at Maine islands and nearshore buoys (Peterson et al. 2014; Stantec Consulting Services Inc. 2016). These studies provide considerable temporal coverage of baseline bat activity in the region, but findings are limited spatially to nearshore locations. In particular, there remain data gaps on bat activity in the Gulf beyond the islands and in the offshore leases proposed by

BOEM for wind energy development, four of which are located 51 km northeast of Provincetown, Cape Cod, MA, and two of which are located 114 km southeast of Portland, ME. We installed bat acoustic detectors on marine vessels opportunistically transiting through the Gulf to provide new insights on bats offshore in the Gulf and at coastal and island sites for context, with monitoring efforts conducted in the summer through fall of 2024.

2 Methods

With support from the Maine Department of Inland Fisheries and Wildlife (IFW) and through funding provided by Maine Federal Aid in Wildlife Restoration Grant (Grant/Award Number: W-87-R), BRI conducted a bat acoustic monitoring effort in the Gulf of Maine from the end of July through October 2024. During this period, BRI worked in partnership with the Maine Department of Marine Resources (DMR), fishermen, and Shoals Marine Lab, among others, to deploy Wildlife Acoustics SM4bat detectors on three vessels that transited through different regions of the Gulf of Maine (Figure 1). Detectors were also deployed on five islands and at two coastal sites (Figure 2). BRI installed a Wildlife Acoustics SM4Bat detector with a SMM-U2 ultrasonic microphone extended on a 10 ft pole at each site, with a GPS puck to collect coordinates of offshore bat acoustic detections included with vessel deployments.

Device settings were made in accordance with survey protocols established by the U.S. Fish and Wildlife Service (USFWS) in the Range-wide Indiana Bat Summer Survey (IBat) Guidelines (USFWS 2023), with the detector programmed to record in full spectrum at a sampling rate of 256 kHz, and all sounds below 16 kHz filtered out. Detectors were programmed to record 1 hour before sunset and 1 hour after sunrise for island and coastal sites, and continuously for vessel deployments. BRI checked detectors every 2-4 weeks, swapping out batteries and SD data cards at each visit.

For processing and analysis, BRI first filtered the raw data using the USFWS-approved software[2] Kaleidoscope Pro Version 5.6.8 (KPro) to remove files that contained only noise or poor-quality recordings unsuitable for species identification. Remaining audio files were again processed using KPro to identify acoustic files that may contain bat signals, denoted as possible bat passes. One of eight bat species was assigned to each possible bat pass file using the classifier Bats of North America 5.4.0 region, Maine. For audio files in which KPro recognized that a bat echolocation may be present in the audio file but was unable to confidently determine the species, a designation of NoID was given. Following the automated classification, all possible bat passes, including NoID files, were reanalyzed by SonoBat 30, a second USFWS-approved program for bat

[2] https://www.fws.gov/media/automated-acoustic-bat-id-software-programs

species identification, which measures additional call characteristics in the full frequency spectrum.

Experienced acoustic technicians then manually vetted possible bat passes, with files examined for call quality and species-specific features (i.e., maximum and minimum frequency, duration, multiple pulses within a call, and call shape). If all parameters were present, a species-level identification was made to confirm or change the auto-identification in each possible bat pass. If the information was insufficient to identify species, calls were classified by a file's phonic and recording quality characteristics (Table 1). Coastal and island data were vetted to assess species presence by monitoring night, while all possible bat passes collected offshore were vetted.

3 Results

Bat detectors collected data for 223 monitoring nights across sites and platforms, with 174 nights of bat acoustic activity. All eight bat species found in Maine were detected, including the five cave-dwelling species and the three migratory tree-roosting species. When data was examined temporally at one of the baseline island sites, 700-Acre Island, cave-dwelling species were consistently present during the monitoring period from mid-September through mid-October, while migratory tree-roosting species were absent by mid-October (Figure 3). When data was examined spatially by species across site types (vessel, island, coastal), eastern red bats were present more often than other species, and only eastern red, hoary, silver-haired and big brown bats were present offshore (Figure 4). In addition, presence across species was generally consistent between coastal and island sites, but lower offshore. When presence of bat group (cave-dwelling, migratory tree) was compared across specific sites, lower cave bat presence was observed at isolated offshore islands such as Monhegan, while presence at wooded large islands such as 700-Acre was similar to that at coastal sites (Figure 5).

For data collected from vessels, 119 bat passes were confirmed of all migratory tree bats and one cave-dwelling bat, the big brown bat, with eastern red bat the most common species (Figure 6, Figure 7). In addition, one eastern red and one silver-haired bat pass were acoustically detected during daytime hours, while a second eastern red bat was incidentally observed from the Acadia Explorer during the daytime. Passes examined by nearest distance to the coastline revealed that eastern red bats are found furthest offshore, with one pass recorded 136 km from Cape Cod, MA. In addition, one pass was detected within the BOEM-proposed Gulf of Maine offshore wind lease area. Finally, BRI found several examples of bats potentially following vessels, with subsequent passes ranging from a period of 4 to 33 minutes recorded along vessel tracklines (Figure 6, Figure 7). BRI worked with the Canadian Wildlife Service (CWS) to compile and compare results between a CWS spring 2024 monitoring effort and BRI's fall monitoring effort on the fishing

vessel Maria Jo-Ann, which were published in *Northeastern Naturalist* in May 2025 (Goodale et al. 2025, Attachment A).

4 Discussion

Main takeaways from this work in the Gulf of Maine include:

- Bat activity at a given site is influenced by temporal and spatial factors such as distance to shore, and likely also influenced by factors such as weather patterns, island size, light levels, local habitat, and detector height and mounting substrate.
- Bats are present offshore in the Gulf of Maine, including during daytime hours, and at varying distances from the coastline, but that activity levels offshore appear lower than at coastal and island sites.
- Bats may be associating with and following vessels.
- Partners and detector hosts were interested in results on bat activity at their sites and platforms.

Main lessons learned regarding study design and methods:

- Maximize detector deployments on vessels to capture acoustic data across spatial and temporal gradients in the offshore environment. Buoys offer a potential stationary platform offshore.
- Utilize continuous recording cycles and comprehensive data vetting for all offshore detector deployments.
- Maintain consistent monitoring efforts between sites for post-hoc comparisons.
- Integrate collection of covariate data with detector deployments.
- Utilize external power sources, e.g., solar panels, for detectors recording continuously.
- Integrate GPS pucks and utilize locking housing cases for all mobile detector setups.
- Maximize partner involvement and sharing of findings.

Key outcomes:

- Collaboration with Canadian Wildlife Service to publish the offshore results in *Northeastern Naturalist* (Attachment A).
- Development of a StoryMap[3] to support outreach efforts.
- Development of outreach materials that were distributed to project partners (Attachment B).

[3] https://storymaps.arcgis.com/stories/cc5301884fd94ad99a5d4296d33569f9

- Presentation of findings at the 2025 Northeast Association of Fish and Wildlife Agencies meeting.

5 References

Adams, Amanda M., Luis A. Trujillo, C. J. Campbell, Karin L. Akre, Joaquin Arroyo-Cabrales, Leanne Burns, Jeremy T. H. Coleman, et al. 2024. "The State of the Bats in North America." *Annals of the New York Academy of Sciences*, October, nyas.15225. https://doi.org/10.1111/nyas.15225.

Bureau of Ocean Energy Management (BOEM). 2024. "Atlantic Wind Lease Sale 11 for Commercial Leasing for Wind Power Development on the U.S. Gulf of Maine Outer Continental Shelf-Final Sale Notice." Federal Register. September 17, 2024. https://www.federalregister.gov/documents/2024/09/17/2024-21081/atlantic-wind-lease-sale-11-for-commercial-leasing-for-wind-power-development-on-the-us-gulf-of.

Cryan, P.M. 2003. "Seasonal Distribution of Migratory Tree Bats (*Lasiurus* and *Lasionycteris*) in North America." *Journal of Mammalogy* 84 (2): 579–93.

Doucette, Kayla M., Krista J. Patriquin, Hugh G. Broders, and Andrew G. Horn. 2024. "Soundwaves in the North Atlantic: Detecting the Offshore Bats of Sable Island." *Proceedings of the Nova Scotian Institute of Science (NSIS)* 53 (2): 305–19. https://doi.org/10.15273/pnsis.v53i2.12328.

Dowling, Zara R, and Danielle I O'Dell. 2018. "Bat Use of an Island off the Coast of Massachusetts." *Northeastern Naturalist* 25 (3): 362–82. https://doi.org/10.1656/045.025.0302.

Hatch, Shaylyn K., Emily E. Connelly, Timothy J. Divoll, Iain J. Stenhouse, and Kathryn A. Williams. 2013. "Offshore Observations of Eastern Red Bats (Lasiurus Borealis) in the Mid-Atlantic United States Using Multiple Survey Methods." Edited by Justin David Brown. *PLoS ONE* 8 (12): e83803. https://doi.org/10.1371/journal.pone.0083803.

Lagerveld, S., B. J. Poerink, R. Haselager, and H. Verdaat. 2014. "Bats in Dutch Offshore Wind Farms in Autumn 2012." *Lutra* 57 (2): 61–69.

Normandeau Associates. 2022. "Postconstruction Bird and Bat Monitoring at the Coastal Virginia Offshore Wind Pilot Project: First Annual Report. Submitted to Dominion Energy."

Perry, Roger W. 2013. "White-Nose Syndrome in Bats: An Overview of Current Knowledge for Land Managers." USDA Forest Service. https://www.srs.fs.usda.gov/pubs/gtr/gtr_srs184.pdf.

Peterson, T. S., S.K. Pelletier, S.A. Boyden, and K.S. Watrous. 2014. "Offshore Acoustic Monitoring of Bats in the Gulf of Maine." *Northeastern Naturalist* 21:154–63.

Solick, Donald I., and Christian M. Newman. 2021. "Oceanic Records of North American Bats and Implications for Offshore Wind Energy Development in the United States." *Ecology and Evolution* 11 (21): 14433–47. https://doi.org/10.1002/ece3.8175.

Stantec Consulting Services Inc. 2016. "Long-Term Bat Monitoring on Islands, Offshore Structures, and Coastal Sites in the Gulf of Maine, Mid-Atlantic, and Great Lakes- Final Report." Tompsham, ME: U.S. Department of Energy.

Thompson, R.H., A.R. Thompson, and R.M. Brigham. 2015. "A Flock of *Myotis* Bats at Sea." *Northeastern Naturalist* 22 (4).

USFWS. 2023. “Range-Wide Indiana Bat and Northern Long-Eared Bat Survey Guidelines.” *U.S. Fish and Wildlife Service, Region 3, Bloomington, MN*. https://www.fws.gov/sites/default/files/documents/USFWS_Range-wide_IBat_%26_NLEB_Survey_Guidelines_2023.05.10_0.pdf.

6 Tables and Figures

Table 1. Vetting criteria for identification of bat acoustic signals.

Manual Call Definition	Call Identifier	
No bat calls are present in the file	Noise	NO BAT PASS
Species can be identified	Silver-haired bat Eastern red bat Hoary bat Big brown bat Little brown bat Tricolored bat Northern long-eared bat Eastern small footed	CONFIRMED BAT PASS; SPECIES LEVEL ID
Calls above 40 kHz with steep drops in frequency at the end of the body of the call are indisputably from the Myotis genus	40KHzMyo	CONFIRMED BAT PASS; PHONIC GROUP LEVEL ID
Call has five or more good quality pulses above 35 kHz	HiF	
Call has five or more good quality pulses below 35 kHz	LoF	
Call has fewer than five good quality pulses above 35 kHz	HiFrag	
Call has fewer than five good quality pulses below 35 kHz	LoFrag	

Figure 1. Island and coastal sites with bat acoustic detectors during fall 2024 monitoring effort.

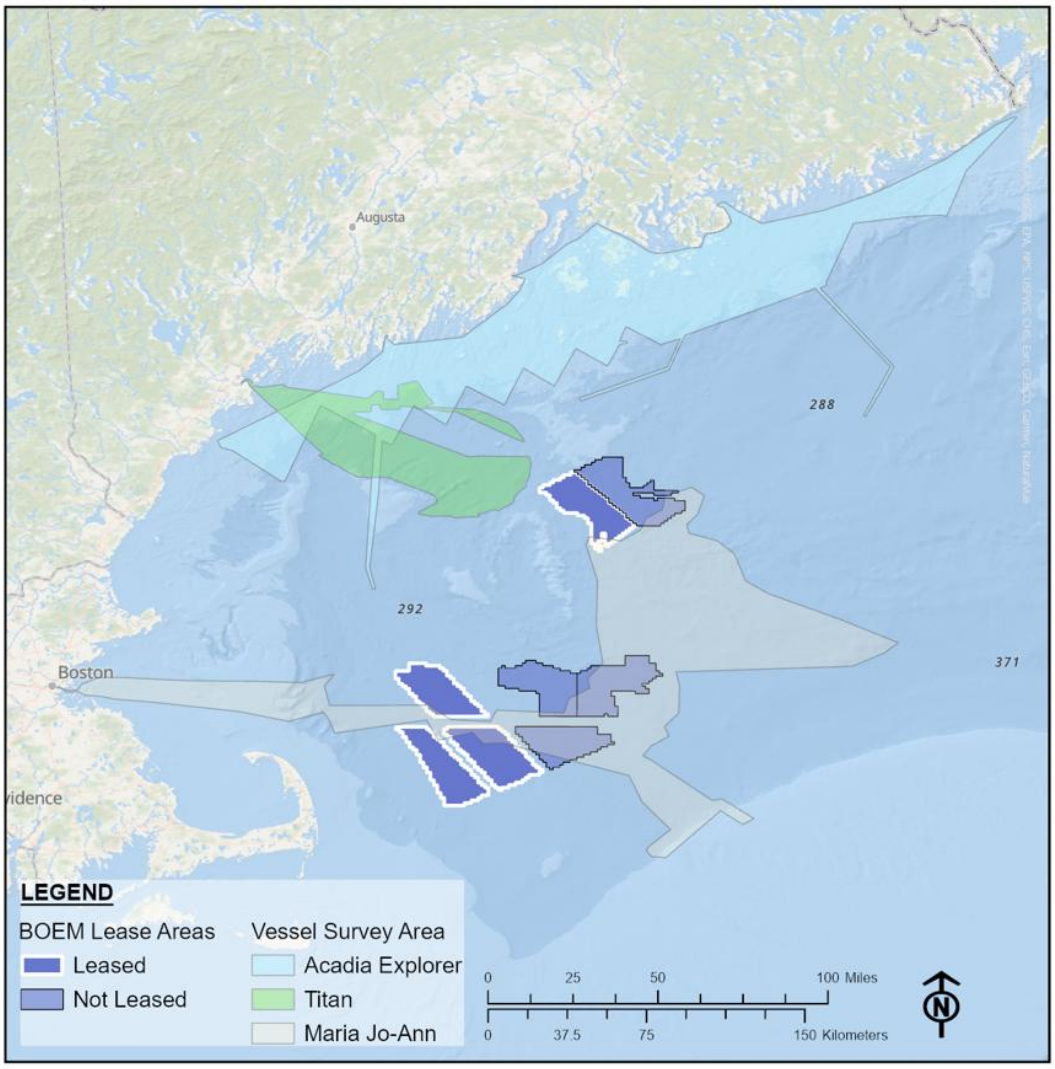
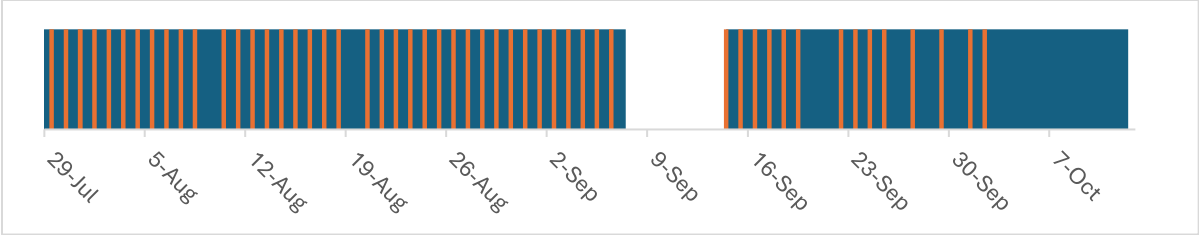
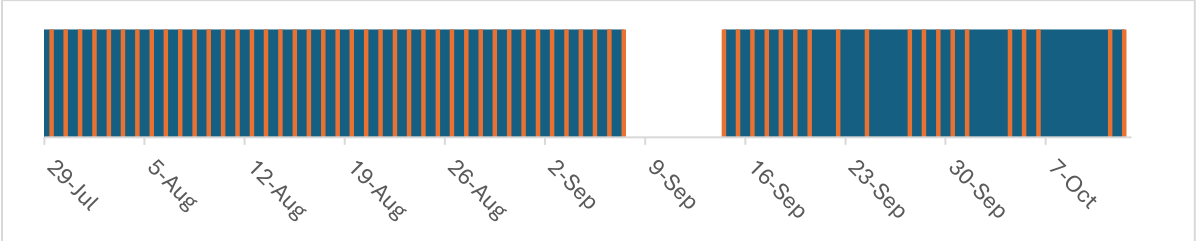


Figure 2. Monitoring areas of each vessel detector platform in the Gulf of Maine for 2024 fall effort.



A. Migratory Tree-Roosting Bat Species



B. Cave-Dwelling Bat Species

Figure 3. Bat presence by monitoring night at 700-Acre Island, a wooded island baseline monitoring site located 2 miles from shore. Each orange marker indicates bat presence by night by (A) migratory tree-roosting species and (B) cave-dwelling species, with the dark blue bar representing the monitoring period.

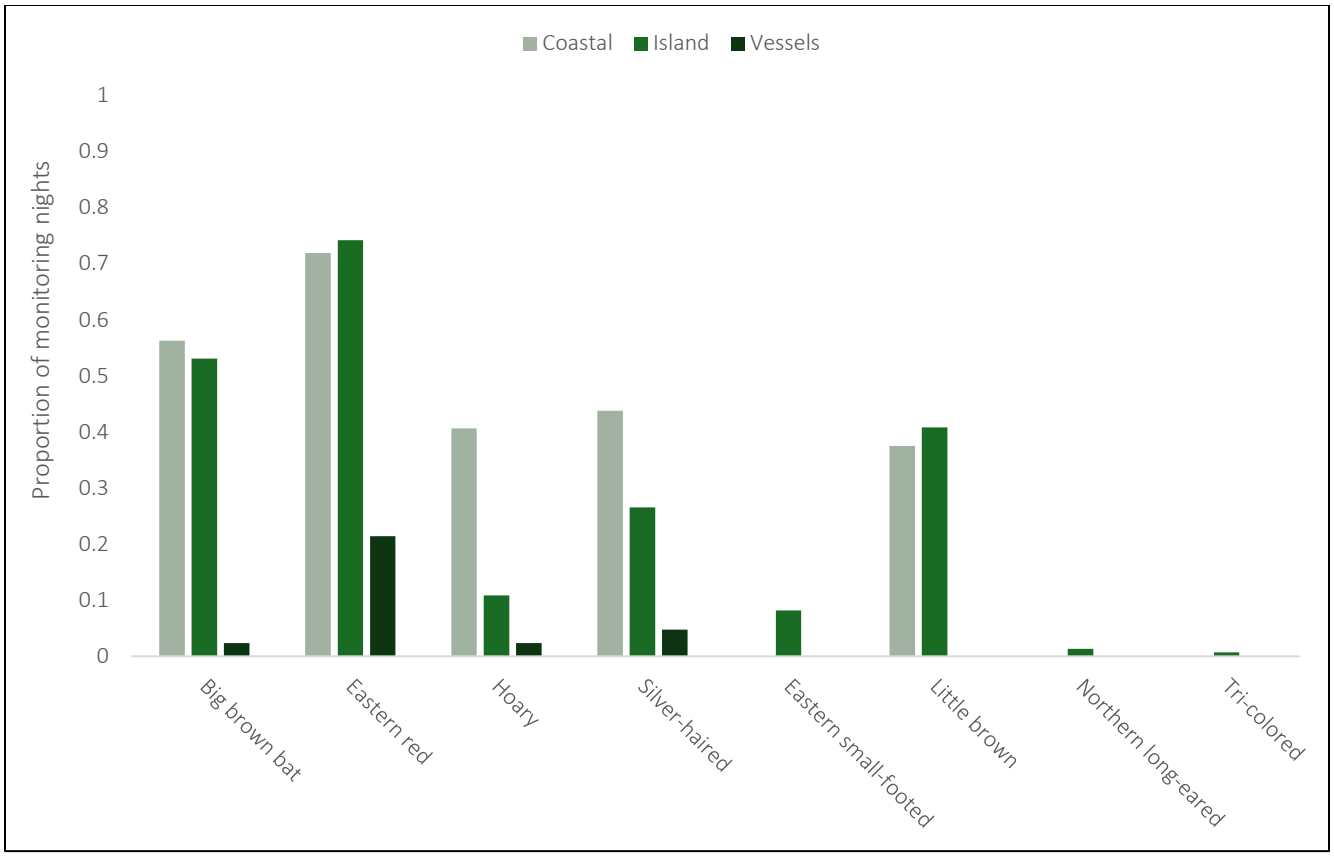


Figure 4. Proportion of total monitoring nights that species were present by site type (coastal, island, vessel).

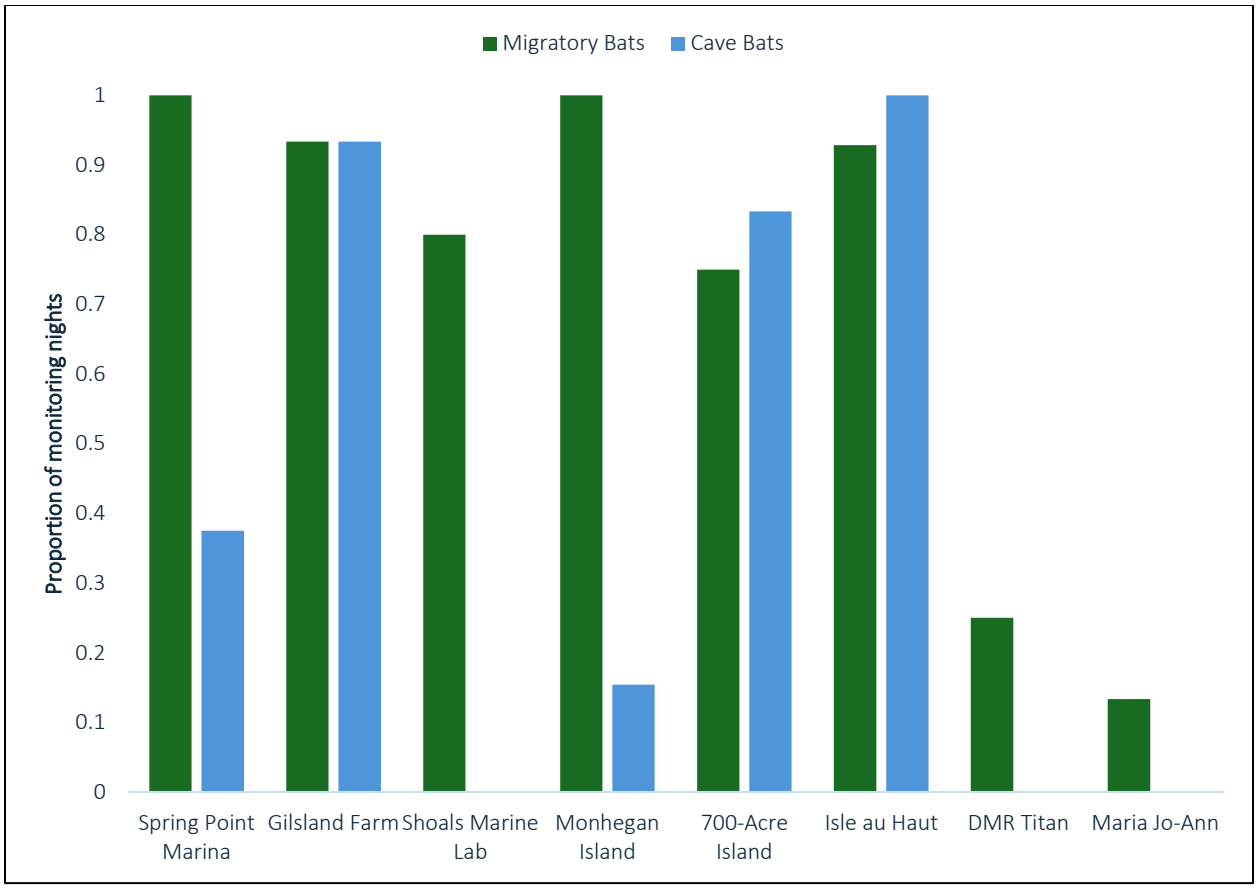


Figure 5. Proportion of monitoring nights with bats by species type (migratory, cave) across sites.

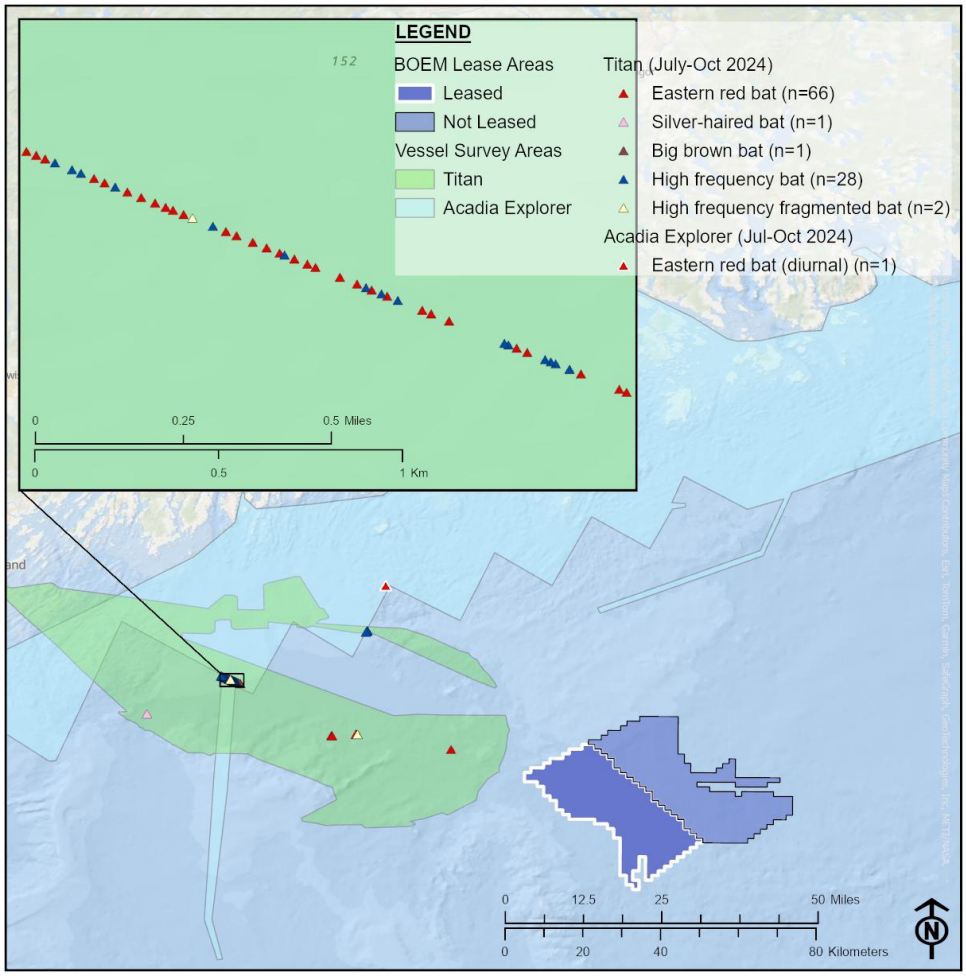


Figure 6. Results of the bat acoustic monitoring effort from the F/V Titan and M/V Acadia Explorer. Possible bat follow behavior of the F/V Titan is displayed in the callout box.

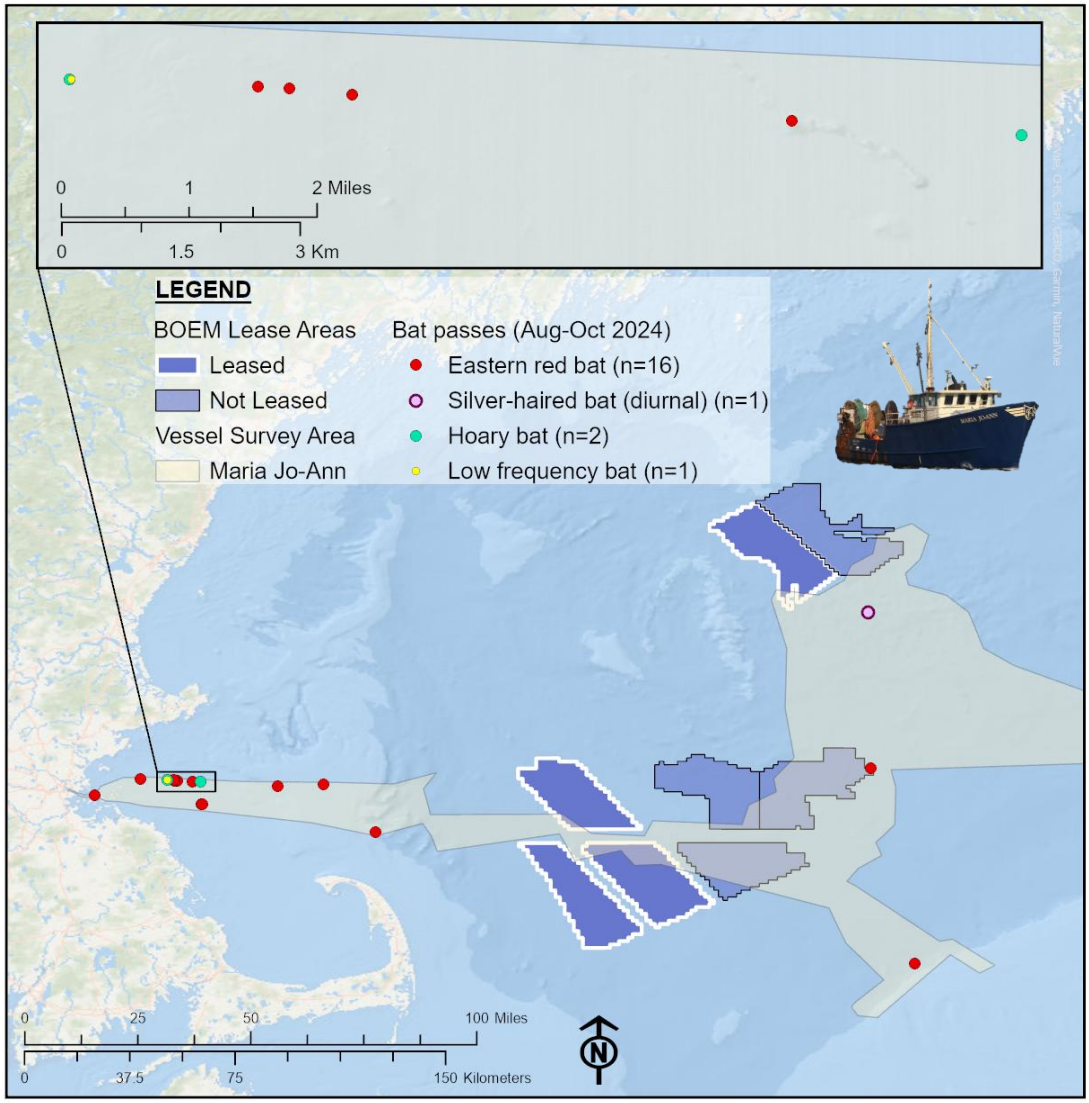


Figure 7. Results of the bat acoustic monitoring effort from the F/V Maria Jo-Ann. Possible bat follow behavior of the F/V Maria Jo-Ann is displayed in the callout box.

7 Attachment A: Northeastern Naturalist Paper

Goodale, M. W.; P. Knaga; S. Dodgin; E. Gilardi; J. M. Guilbert; M. Howe; B. Frankina; C. Stearns. Opportunistic Vessel-Based Detections of Migratory Bats in the Gulf of Maine. *Northeastern Naturalist 32(2), 168-178, (16 May 2025).* *https://doi.org/10.1656/045.032.0203*

Opportunistic Vessel-Based Detections of Migratory Bats in the Gulf of Maine

M. Wing Goodale[1,*], Paul Knaga[2], Sarah Dodgin[1], Ethan Gilardi[1], Joshua M. Guilbert[1], Marian Howe[1], Brianna Frankina[1], and Cory Stearns[3]

Abstract - Offshore wind energy is being pursued in the Gulf of Maine (Gulf) to reduce dependence on fossil fuels; yet wind turbines pose a collision risk for bats. Previous efforts to monitor bat activity in the Gulf have involved acoustic surveys from stationary platforms, such as buoys and islands. However, acoustic monitoring from vessels opportunistically transiting through the Gulf offers a promising method to capture bat activity further offshore and across both spatial and temporal gradients. To explore the utility of this approach and expand on the growing research on bat presence in the Gulf, acoustic bat detectors were deployed on marine vessels in the Gulf and collected data during periods from April through May and August through October 2024. A total of 69 offshore bat passes were recorded, including calls from *Lasiurus cinereus* (Hoary Bat), *Lasionycteris noctivagans* (Silver-haired Bat), and *Lasiurus borealis* (Eastern Red Bat). Eastern Red Bat and Silver-haired Bat detections were the furthest from shore (136 km and 169 km, respectively), indicating the presence of bats near offshore wind-lease areas during both spring and fall.

Introduction

Offshore wind energy is contributing to a broad effort to reduce carbon dioxide emissions. In October 2024, the Bureau of Ocean Energy Management (BOEM) leased 4 offshore wind-energy areas to developers in the Gulf of Maine (Gulf; BOEM 2024). Collision with wind turbines is considered a threat to bats in the US and Canada (Adams et al. 2024), and while offshore wind energy is an important renewable energy resource, it has the potential to negatively impact bats (Solick and Newman 2021). Efforts to collect data on bats in the offshore environment to understand these potential interactions have employed various approaches, such as stationary acoustic monitoring from wind-turbine generators (e.g., Lagerveld et al. 2014, Normandeau Associates 2022), as well as visual observations from aerial surveys and vessels (e.g., Hatch et al. 2013). Opportunistic sightings of bats from vessels have also occurred incidentally to other research efforts (e.g., Kennerley et al. 2024). Mobile acoustic monitoring with detectors deployed on vessels has also offered new insights into offshore bat activity at further distances from the coast, revealing links between bat activity and wind speed (Sjollema et al. 2014). This approach also has the potential to detect bats more frequently given the homogeneity of the landscape (Fisher-Phelps et al. 2017) and provide information on population trends (Evans et al. 2021).

[1]Biodiversity Research Institute, Portland, ME 04103. [2]Canadian Wildlife Service, Environment and Climate Change Canada, Dartmouth, NS B2Y 2N6, Canada. [3]Maine Department of Inland Fisheries and Wildlife, Augusta, ME 04330. [*]Corresponding author - wing.goodale@briwildlife.org.

Manuscript Editor: Trevor Peterson

Eight species of bats are known to be present in Maine, 5 of which are year-round residents (MEDIFW 2024). These species are separated into 2 groups based on their wintering strategy: cave-hibernating bats and migratory tree-roosting bats. Research conducted in other regions of the Atlantic Outer Continental Shelf indicates that cave-hibernating bats, which migrate from their summer habitats to hibernacula in the New England region (Perry 2013), may occur offshore but are generally not observed as frequently as migratory tree-roosting bats (Doucette et al. 2024, Dowling and O'Dell 2018, Thompson et al. 2015). Migratory tree-roosting bats, however, fly to coasts or areas with a mild climate to winter (Cryan 2003), have historically been observed offshore (Solick and Newman 2021), and have been detected up to 44 km offshore in the mid-Atlantic region during fall migration (Hatch et al. 2013).

To date, information on the occurrence of these groups in the Gulf has been based primarily on stationary acoustic-monitoring survey efforts by Peterson et al. (2014) and Peterson (2016), where acoustic data were collected from bats at Maine islands and nearshore buoys. These studies provide considerable temporal coverage of baseline bat activity in the region, but findings are limited spatially to nearshore locations. In particular, there remain data gaps on bat activity in the Gulf beyond the islands and in the offshore leases proposed by BOEM for wind-energy development, 4 of which are located 51 km northeast of Provincetown, Cape Cod, MA, and 2 of which are located 114 km southeast of Portland, ME. We installed acoustic bat detectors on marine vessels opportunistically transiting through the Gulf to provide new insights on bats offshore in the Gulf, with monitoring efforts conducted in the spring and fall of 2024.

Methods

The Canadian Wildlife Service, Environment and Climate Change Canada (ECCC-CWS), in support of the Regional Assessment of Offshore Wind Development in Nova Scotia (Government of Canada 2025), deployed an SM4Bat detector with a weatherproofed ultrasonic U2 microphone (Wildlife Acoustics, Maynard, MA), designed for recording echolocation calls of bats, on the Fisheries and Oceans Canada (DFO) vessel Canadian Coast Guard Ship (CCGS) *Teleost* from 11 April to 1 May 2024 (Table 1). The CCGS *Teleost* is a fisheries-research vessel used by DFO in the Maritime provinces, Quebec, and Newfoundland and Labrador regions. During the mission, DFO deployed oceanographic sampling equipment at fixed monitoring stations from southwestern Newfoundland to the Gulf. The CCGS *Teleost* mission operated 24 hours a day and only stopped during short periods (<4 hours) when the gear was in the water or when the vessel was in port. For this study, data were only analyzed from nights when the vessel was offshore between sunset and sunrise and the detector was operating; we refer to these nights as "monitoring nights". The CCGS Teleost made one 24-hour port stop on 25 April, which we excluded from the analysis. We georeferenced any confirmed bat acoustic detections using the ship's NMEA navigation GPS data.

For the fall monitoring effort, the Biodiversity Research Institute (BRI), with support from the Maine Department of Inland Fisheries and Wildlife, deployed a second SM4Bat detector with a U2 microphone cabled to an aluminum pole on the upper deck of the US fishing vessel (US F/V) *Maria Jo-Ann* from 19 August to 1 October 2024 (Table 1). While the detector was recording, the vessel made transits both in the daytime and at night to and from Georges Bank during 19–26 August, 8–16 September, 24 September–1 October. The vessel would make stops to tend fishing gear, but the vessel was never anchored during these periods. We derived locations of offshore acoustic bat detections made within the survey periods from an external GPS puck (Garmin 18x LVC, 5 m: Olathe, Kansas) connected to the SM4Bat detector. The device settings were in accordance with survey protocols established by the US Fish and Wildlife Service (USFWS) in the Range-wide Indiana Bat Summer Survey (IBat) Guidelines (USFWS 2023).

For both vessels, to assess survey effort, we overlaid the tracklines with 10 km by 10 km grid cells, in alignment with the grid-based sampling approach of the North American Bat Monitoring Program (Loeb et al. 2015). We calculated trackline length within each cell relative to the area of each grid cell and binned the data into 3 categories of effort for each vessel survey.

Initial processing of the Canadian acoustic data from the CCGS *Teleost* was conducted by ECCC-CWS and included filtering by a SonoBat 30 Batch File Scrubber (Arcata, CA) using an autofilter-low process. Filtering of the US acoustic data followed a similar process and was conducted by BRI in accordance with the USFWS survey protocols in the IBat Guidelines (USFWS 2023). We filtered the data in the USFWS-approved software (USFWS 2025) Kaleidoscope Pro Version 5.6.8 (KPro; Wildlife Acoustics, Maynard, MA) to remove files that contained only noise or

Table 1. Acoustic survey information for the CCGS *Teleost* and US F/V *Maria Jo-Ann* monitoring efforts. Survey extent based on NAD 1983 Contiguous US Albers projection.

	Vessel survey	
	CCGS *Teleost*	US F/V *Maria Jo-Ann*
Survey extent	43.0855776–43.4943748°N, 65.3243828-70.2969255°W	42.1840045–42.9435778°N, 67.3218177–71.1002533°W
Monitoring period	11–24 April, 26 April–1 May	19–26 Aug, 8–16 Sept, 24 Sept–1 Oct
Height of microphone above sea level	30 m	10 m
Sampling rate	256 kHz	256 kHz
Trigger window	2 sec	3 sec
Trigger level	12 dB	12 dB
16 kHz filter	Off	On
Recording schedule	1 hr before sunset to 1 hr after sunrise (UTC-03)	Continuous
Max file length	15 sec	15 sec
Bat pass identification process	SonoBat30 and manual vetting	Kaleidoscope Pro v. 5.6.8, SonoBat 30, and manual vetting

poor-quality recordings unsuitable for species identification. KPro then identified acoustic files that may contain bat signals, denoted as possible bat passes, assigning 1of 8 bat species to each possible bat-pass file using the classifier Bats of North America 5.4.0 region, Maine. For audio files in which KPro recognized that a bat echolocation pulse may be present in the audio file but was unable to confidently determine the species, a designation of NoID was given. Following the automated classification, we reanalyzed all possible bat passes, including NoID files, using SonoBat 30, a USFWS candidate program for bat species identification, which measures additional call characteristics in the full frequency spectrum.

Two experienced acoustic technicians manually vetted the filtered data from both efforts, including those files designated with NoID, to confirm the absence of identifiable bat tonal features. During the manual vetting process, we examined each file for call quality and species-specific features (i.e., maximum and minimum frequency, duration, multiple pulses within a call, and call shape; Szewczak 2022). If all parameters were present, we made a species-level identification to confirm or change the auto-identification in each possible bat pass. If the information was insufficient to identify species, we then classified calls by the file's phonic and recording-quality characteristics (Table 2). Low-frequency species, as noted in Table 2, produce calls from 20 kHz to 35 kHz, and high-frequency species produce calls from 35 kHz to 50 kHz. We denoted possible bat passes confirmed through the

Table 2. Manual bat vetting call criteria and call identifiers. Low-frequency (Low) species produce calls from 20 kHz to 35 kHz, and high-frequency (High) species produce calls from 35 kHz to 50 kHz. Confirmed = confirmed bat pass

Manual call definition	Call identifier	Phonic group	Classification
No bat calls present in the file	Noise	NA	No bat pass
Species can be identified	Silver-haired Bat	Low	Confirmed bat pass; species-level ID
	Big Brown Bat	Low	
	Hoary Bat	Low	
	Eastern Red Bat	High	
	Little Brown Bat	High	
	Tricolored Bat	High	
	Northern Long-eared Bat	High	
	Eastern Small-footed Bat	High	
Call has ≥5 good-quality pulses below 35 kHz	LoF	Low	Confirmed bat pass; phonic-group–level ID
Call has <5 good-quality pulses below 35 kHz	LoFrag	Low	
Calls above 40 kHz with steep drops in frequency at the end of the body of the call are indisputably from the *Myotis* genus	40KHzMyo	High[A]	
Call has ≥5 good-quality pulses above 35 kHz	HiF	High	
Call has <5 good-quality pulses above 35 kHz	HiFrag	High	

[A]Excluding Tricolored Bats and Eastern Red Bats.

manual vetting process to contain bat signals, either to the species level or classified by the file characteristics, as confirmed bat passes. We then processed confirmed bat passes with the 'batch buzz detector' in the Sonobat 30 NA Data Wizard to identify any feeding buzzes within the file that may indicate foraging activity.

Results

Within the Gulf study area, the CCGS *Teleost* traveled 956 km across 117 grid cells, and the US F/V *Maria Jo-Ann* traveled 1449 km across 111 grid cells (Fig. 1). Effort by the CCGS *Teleost* was more evenly distributed across the Gulf, while ef-

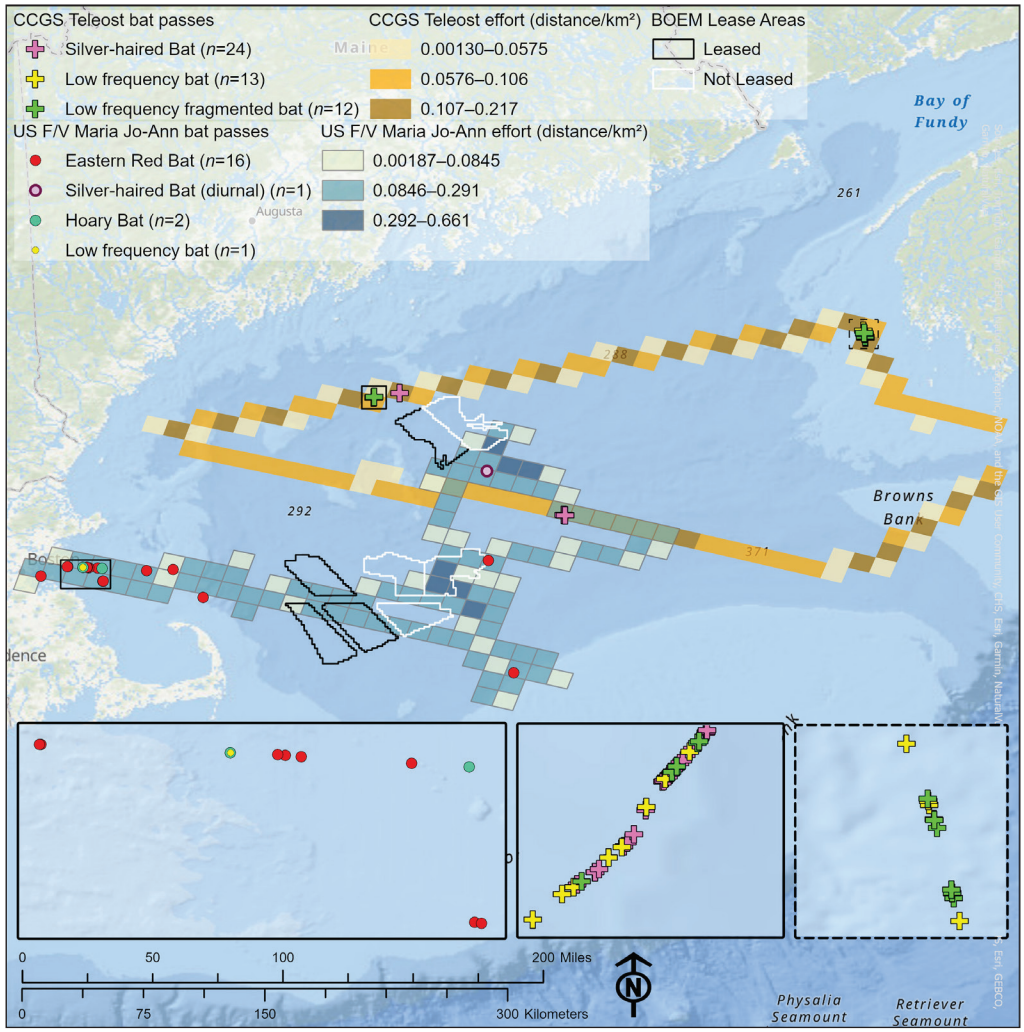


Figure 1. Survey effort of the US F/V *Maria Jo-Ann* and CCGS *Teleost* vessels within 100-km² grid cells. Bat passes recorded offshore in the Gulf in spring 2024 during the CCGS *Teleost* monitoring effort (n = 49) and fall 2024 during the US F/V *Maria Jo-Ann* (n = 20). Insets provide close up view of areas with concentrated call detections delineated by the solid-outlined rectangle and the solid- and dashed-outlined squares on the base map.

fort of the US F/V *Maria Jo-Ann* was more concentrated in areas that overlapped with the BOEM offshore wind-lease areas. The farthest distances the US F/V *Maria Jo-Ann* and the CCGS *Teleost* traveled from the contiguous mainland of New England and Nova Scotia were 190 km and 178 km, respectively.

A total of 49 confirmed bat passes were detected over 19 monitoring nights on the CCGS *Teleost* while transiting through the Gulf, including areas off the coast of southwest Nova Scotia (Fig. 1). All passes were recorded from 15 to 16 April. *Lasionycteris noctivagans* (LeConte) (Silver-haired Bat) was the only species-level identification possible (n = 24). The remaining passes were denoted as either LoF, defined as a call with ≥5 good-quality pulses below 35 kHz (n = 13), or LoFrag, defined as a call with <5 good-quality pulses below 35 kHz (n = 12). Either of these phonic-group classifications indicate the presence of low-frequency signaling species and could include either *Lasiurus cinereus* (Palisot de Beauvois) (Hoary Bat), Silver-haired Bat, or *Eptesicus fuscus* (Palisot de Beauvois) (Big Brown Bat). Of the 49 bat passes, feeding buzzes were identified in only 1 Silver-haired Bat file (n = 2). The 24 Silver-haired Bat passes were recorded from 65 to 169 km from land (Fig. 1, Table 3).

The SM4Bat deployed on the *Maria Jo-Ann* collected data offshore from 19 August to 1 October for a total of 23 monitoring nights (Fig. 1). In total, 20 bat passes were collected and then assigned as *Lasiurus borealis* (Müller) (Eastern Red Bat; n = 16), Hoary Bat (n = 2), and Silver-haired Bat (n = 1), as well as 1 LoF pass that could not be identified to the species level (Table 3). No feeding buzzes were identified within the 20 bat passes. One pass of an Eastern Red Bat was detected within 0.4 km of the Gulf offshore wind-lease areas (Fig. 1). When passes were assessed relative to land, defined as the contiguous mainland, Eastern Red Bats were detected closest (0.6 km) and farthest (136 km) from land (Table 3). Hoary Bat passes were recorded 12 and 19 km from land, and the Silver-haired Bat was detected 127 km from land (Table 3).

Of particular interest, there are 2 discrete examples of multiple, subsequent bat passes occurring along the track of the CCGS *Teleost*, with a maximum separation of 5 minutes between passes. In the first example, 12 passes were recorded southwest of Yarmouth, NS, Canada, on 15 April (Fig. 1). Passes occurred along a 2.6-km track over 5.5 minutes. In the second example, 34 passes were recorded southeast of Boothbay Harbor, ME, on 16 April (Fig. 1), occurring along a 0.63-km track over 26 minutes. All passes from both examples were classified as either a Silver-haired Bat, or a LoF or LoFrag pass, which could also indicate the presence of Silver-haired Bats. Intervals between passes varied between 0.08 and 4.45 minutes, and no records of multiple bats in the same recording occurred.

Discussion

Our results demonstrate that tree bats are present in the Gulf during both spring and fall migration at varying distances from shore. The species, timing of fall occurrence, and distances from land are similar to and within the range of detections previously collected in the Gulf, as Peterson et al. (2014) and Peterson (2016)

Table 3. Summary of bat passes detected during each vessel survey, as well as percentage of monitoring nights with bat passes by monitoring period. Distance = min–max distance from coast (km), # = # of passes, % = percent nights with bats.

	Monitoring period			All bats		Eastern Red Bat		Silver-haired Bat		Hoary Bat	
Vessel survey	Dates	# of nights	%	#	Distance	#	Distance	#	Distance	#	Distance
CCGS *Teleost*	11–24 April	14	14.29	49	19–169	-	-	24	65–169	-	-
	26 April–1 May	5	0.00								
US F/V *Maria Jo-Ann*	19–26 August	8	50.00	20	0.6–136	16	0.6–136	1	127	2	12–19
	8–16 September	8	12.50								
	24 Sept–1 Oct	7	14.29								

acoustically detected the same 3 tree-roosting species, as well as cave-hibernating Big Brown Bats and an unidentified *Myotis* species, on Maine islands up to 42 km from the coast, with activity peaking between mid-August and mid-September. Our results also align with historical records in the Gulf, where Eastern Red Bats were collected from vessels 111.9–201.6 km from shore (Solick and Newman 2021). In addition, recent surveys on Sable Island National Park Reserve, Canada (175 km from the mainland), detected Eastern Red Bats, Hoary Bats, Silver-haired Bats, and *Myotis* spp. between late September and early December (2015–2016; Doucette et al. 2024), potentially extending the known duration of bat migration across the Gulf. However, these studies collected minimal detections of bats during the spring, with monitoring effort primarily focused on the fall, and thus our findings indicate that tree bats may occur more frequently offshore during the spring than previously thought. Our results reflect a need for a longer effort of offshore baseline monitoring from early spring through late fall to assess possible bat exposure to offshore wind projects.

The detection of an Eastern Red Bat within the boundary of a Gulf offshore wind-lease area demonstrates that tree-roosting bats, which as a group have high fatality rates at onshore wind facilities (Allison and Butryn 2020), may be exposed to future offshore wind projects in the Gulf. Fatality rates of tree-roosting bats from onshore turbines are also highest during the fall migration period (Allison and Butryn 2020), when bat passes were most frequently recorded offshore during this study. Importantly, further study is needed to understand if the bats detected were isolated individuals or represent a portion of the population that frequently uses the offshore environment, and if bats present offshore are vulnerable to collision.

The detections of multiple passes over a short time and distance suggest bats, in some instances, may follow vessels. Further, the timing between recordings and likely presence of a single species, Silver-haired Bat, suggest that 1 bat may have followed the vessel rather than successive bats flying past, although multiple occurrences of bats circling survey vessels have been documented (Solick and Newman 2021). Bats may either be drawn to vessels as a potential landing spot or for foraging opportunities (Brabant et al. 2020, Hüppop and Hill 2016) or attracted by emitted light, as some migratory European bats may be attracted by certain light wavelengths (Voigt et al. 2017, 2018). Though only 1 bat pass contained evidence of foraging activity, the absence of feeding buzzes does not equate to the absence of foraging activity. The data contained excessive background noise across the entire frequency range of bat pulses, which may have obscured the quieter feeding buzz pulses, and it is possible that foraging activity occurred outside of the microphone's detection range. Additional studies are needed to accurately assess bat behavior around vessels.

This study demonstrates the utility of marine vessels as an opportunistic platform to host acoustic bat detectors and collect meaningful information on bats offshore in the Gulf of Maine and beyond. Although the vessels participating in this study were conducting missions incidental to bat monitoring, they provided information on bats over 42 monitoring nights across 2400 km of trackline up to

190 km from shore. As such, these opportunistic vessel platforms offer a low-cost, minimal-effort approach to study bat occurrence at distances far from shore and over extended periods, when dedicated surveys would otherwise be cost-prohibitive. The uneven sampling effort of these opportunistic vessels can be mitigated by selecting vessels that have consistent and regular routes, as well as by pairing vessel deployments with stationary offshore sites, such as offshore islands and buoys. Collectively, consistent monitoring efforts using offshore vessels in the Gulf can help identify which species are most likely to be exposed to offshore wind-lease areas, the seasons when exposure is highest, and the environmental conditions that increase exposure. Ideally, bat surveys need to be conducted concurrently at onshore, coastal, nearshore, and offshore locations, to fully understand how bat activity in the Gulf is related to spatial and temporal variables, such as distance from shore and season, as well as environmental variables, such as temperature and wind speed. The utility of vessel-based mobile surveys could be increased by developing methods to account for multiple detections of individual bats and vessel-following behaviors vs individual encounters. Such developments could potentially allow for estimates of bat occupancy or relative abundance derived from mobile survey data.

Acknowledgments

The US element of this study was funded by a Maine Federal Aid in Wildlife Restoration Grant, Grant/Award Number W-87-R. We are grateful to Terry Alexander for introducing us to Robert Roberge, who graciously allowed us to deploy a bat detector on his fishing boat, the *Maria Jo-Ann*. The CCGS *Teleost,* managed by the Department of Fisheries and Oceans, Government of Canada, was conducting research in support of the Atlantic Zonal Monitoring program (Therriault et al. 1998).

Literature Cited

Adams, A.M., L.A. Trujillo, C.J. Campbell, K.L. Akre, J. Arroyo-Cabrales, L. Burns, J.T.H. Coleman, R.D. Dixon, et al. 2024. The state of the bats in North America. Annals of the New York Academy of Sciences 1541(1):115–128.

Allison, T.D., and R. Butryn. 2020. Summary of bat fatality monitoring data contained in AWWIC. 2nd Edition. 2 pp. American Wind Wildlife Institute Technical Report.Washington, DC. 27 pp. Available online at https://rewi.org/resources/awwic-bat-technical-report/. Accessed 31 March 2025.

Brabant, R., Y. Laurent, B.J. Poerink, and S. Degraer. 2020. Activity and behaviour of Nathusius' Pipistrelle, *Pipistrellus nathusii*, at low and high altitude in a North Sea offshore wind farm. Acta Chiropterologica 21:341–348.

Bureau of Ocean Energy Management (BOEM). 2024. Atlantic Wind Lease Sale 11 for commercial leasing for wind power development on the US Gulf of Maine Outer Continental Shelf—Final sale notice. Federal Register 89(180):76132–76146. Available online at https://www.federalregister.gov/documents/2024/09/17/2024-21081/atlantic-wind-lease-sale-11-for-commercial-leasing-for-wind-power-development-on-the-us-gulf-of. Accessed 31 March 2025.

Cryan, P.M. 2003. Seasonal distribution of migratory tree bats (*Lasiurus* and *Lasionycteris*) in North America. Journal of Mammalogy 84:579–593.

Doucette, K.M., K.J. Patriquin, H.G. Broders, and A.G. Horn. 2024. Soundwaves in the North Atlantic: Detecting the offshore bats of Sable Island. Proceedings of the Nova Scotian Institute of Science (NSIS) 53:305–319.

Dowling, Z.R., and D.I. O'Dell. 2018. Bat use of an island off the coast of Massachusetts. Northeastern Naturalist 25:362–382.

Evans, K.O., A.D. Smith, and D. Richardson. 2021. Statistical power of mobile acoustic monitoring to detect population change in southeastern US bat species: A case study. Ecological Indicators 125:article 107524.

Fisher-Phelps, M., D. Schwilk, and T. Kingston. 2017. Mobile acoustic transects detect more bat activity than stationary acoustic point counts in a semi-arid and agricultural landscape. Journal of Arid Environments 136:38–44.

Government of Canada. 2025. Regional assessment of offshore wind development in Nova Scotia: Final report. 535 pp. Available online at https://iaac-aeic.gc.ca/050/documents/p83514/160595E.pdf. Accessed 18 April 2025.

Hatch, S.K., E.E. Connelly, T.J. Divoll, I.J. Stenhouse, and K.A. Williams. 2013. Offshore observations of Eastern Red Bats (*Lasiurus borealis*) in the mid-Atlantic United States using multiple survey methods. PLoS ONE 8:e83803.

Hüppop, O., and R. Hill. 2016. Migration phenology and behaviour of bats at a research platform in the southeastern North Sea. Lutra 59:5–22.

Kennerley, W.L., L.T. Ballance, A. Orben, L.G. Torres, and D.I. Solick. 2024. First visual record of a Hoary Bat *(Lasiurus cinereus*) over the open ocean. Journal of North American Bat Research Notes 2:1–5.

Lagerveld, S., B.J. Poerink, R. Haselager, and H. Verdaat. 2014. Bats in Dutch offshore wind farms in autumn 2012. Lutra 57:61–69.

Loeb, S.C., T.J. Rodhouse, L.E. Ellison, C.L. Lausen, J.D. Reichard, K.M. Irvine, T.E. Ingersoll, J.T.H. Coleman, et al. 2015. A plan for the North American Bat Monitoring Program (NABat). US Department of Agriculture, Forest Service, Southern Research Station, Asheville, NC. 100 pp. Available online at https://www.fs.usda.gov/treesearch/pubs/48442. Accessed 16 January 2025.

Maine Department of Inland Fisheries and Wildlife (MEDIFW). 2024. Bats. Available online at https://www.maine.gov/ifw/fish-wildlife/wildlife/species-information/mammals/bats.html. Accessed 21 October 2024.

Normandeau Associates. 2022. Post-construction bird and bat monitoring at the Coastal Virginia Offshore Wind Pilot Project: First annual report. Submitted to Dominion Energy, Richmond, VA. 127 pp.

Perry, R.W. 2013. White-Nose Syndrome in bats: An overview of current knowledge for land managers. USDA Forest Service. Available online at https://www.srs.fs.usda.gov/pubs/gtr/gtr_srs184.pdf. Accessed 31 March 2025.

Peterson, T.S. 2016. Long-term bat monitoring on islands, offshore structures, and coastal sites in the Gulf of Maine, mid-Atlantic, and Great Lakes: Final Report. Prepared for US Department of Energy by Stantec Consulting Services, Inc, Topsham, ME. 171 pp.

Peterson, T.S., S.K. Pelletier, S.A. Boyden, and K.S. Watrous. 2014. Offshore acoustic monitoring of bats in the Gulf of Maine. Northeastern Naturalist 21:154–163.

Sjollema, A.L., J.E. Gates, R.H. Hilderbrand, and J. Sherwell. 2014. Offshore activity of bats along the Mid-Atlantic Coast. Northeastern Naturalist 21:154–163.

Solick, D.I., and C.M. Newman. 2021. Oceanic records of North American bats and implications for offshore wind-energy development in the United States. Ecology and Evolution 11:14433–14447.

Szewczak, J. 2022. Echolocation call characteristics of eastern North American bats. Cal Poly Humboldt Bat Lab, Arcata, CA. 7 pp. Available online at https://sonobat.com/download/Eastern_NA_Acoustic_Table.pdf. Accessed 31 March 2025.

Therriault, J., B. Petrie, P. Pepin, J. Gagnon, D. Gregory, J. Helbig, A. Herman, D. Lefaivre, M. Mitchel, B. Pelchat, J. Runge, and D. Sameoto. 1998. Proposal for a Northwest Atlantic zonal monitoring program. Canadian Technical Report of Hydrography and Ocean Sciences No. 194. Departement of Fisheries and Oceans Canada, Mont-Joli, QC, Canada. vii + 57 pp.

Thompson, R.H., A.R. Thompson, and R.M. Brigham. 2015. A flock of *Myotis* bats at sea. Northeastern Naturalist 22(4):N27–N30.

US Fish and Wildlife Service (USFWS). 2023. Range-wide Indiana Bat and Northern Long-eared Bat survey guidelines. 95 pp. US Fish and Wildlife Service, Region 3. Bloomington, MN. 76 pp. Available online at https://www.fws.gov/media/range-wide-indiana-bat-and-northern-long-eared-bat-survey-guidelines. Accessed 31 March 2025.

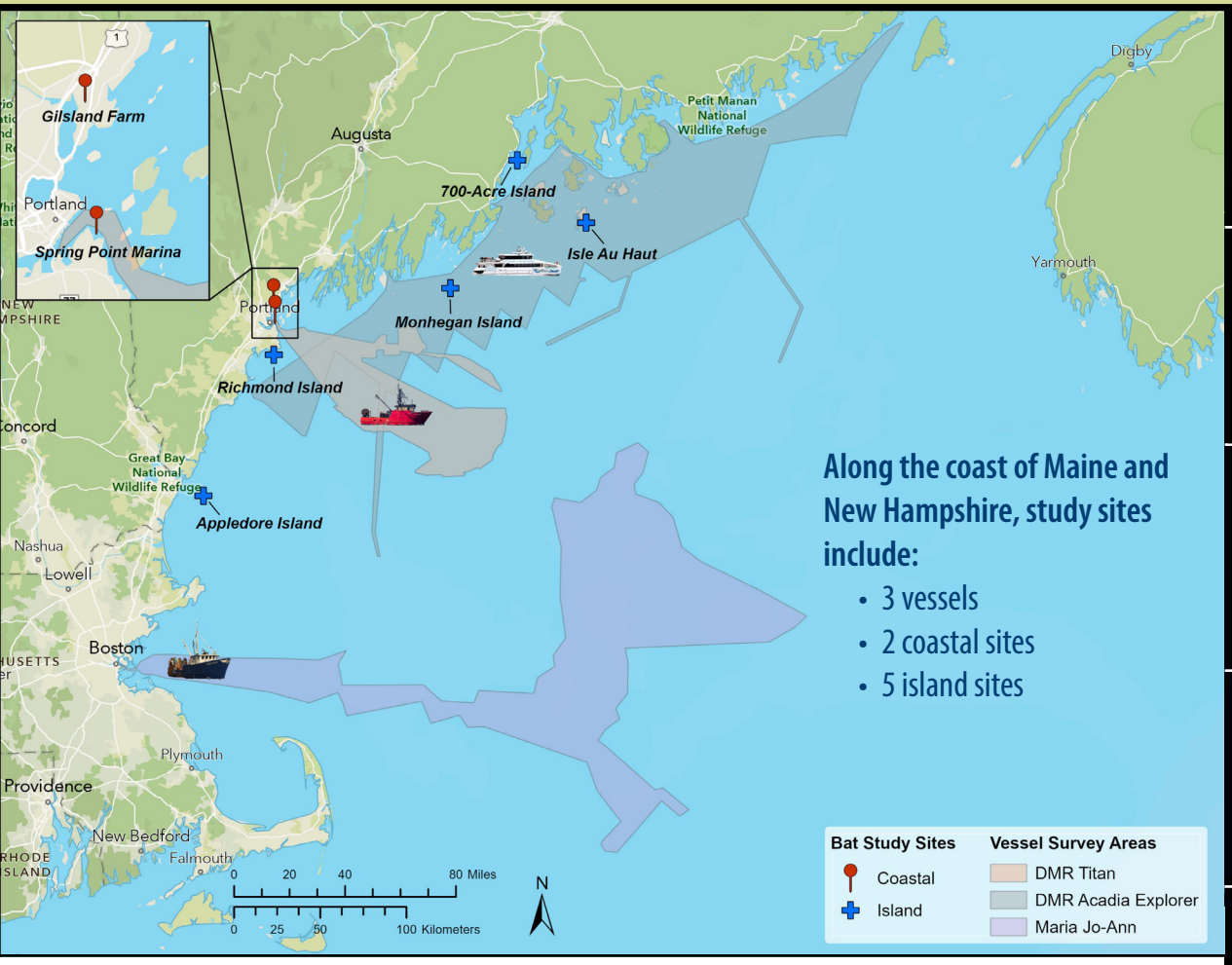
USFWS. 2025. Automated acoustic bat ID software programs. Available online at https://www.fws.gov/media/automated-acoustic-bat-id-software-programs. Accessed 18 April 2025.

Voigt, C.C., M. Roeleke, L. Marggraf, G. Petersons, and S.L. Voigt-Heucke. 2017. Migratory bats respond to artificial green light with positive phototaxis. PLoS ONE 12:1–11.

Voigt, C.C., K. Rehnig, O. Lindecke, and G. Pētersons. 2018. Migratory bats are attracted by red light but not by warm-white light: Implications for the protection of nocturnal migrants. Ecology and Evolution 8:9353–9361.

8 Attachment B: Outreach Materials

Acoustic Monitoring for Bats in the Gulf of Maine



Along the coast of Maine and New Hampshire, study sites include:

- 3 vessels
- 2 coastal sites
- 5 island sites


Big Brown Bat


Eastern Red Bat


Hoary Bat


Silver-haired Bat


Little Brown Bat


Northern Long-eared Bat


Eastern Small-footed Bat


Tricolored Bat

Project Approach

The Gulf of Maine is home to eight bat species: Eastern Red, Hoary, Northern Long-eared, Tricolored, Big Brown, Little Brown, Eastern Small-footed, and Silver-haired bat. Researchers from Biodiversity Research Institute and the Maine Department of Inland Fisheries and Wildlife teamed up to increase the understanding of bat activity in coastal and offshore areas in the Gulf of Maine using acoustic detectors.

Between July 2024 and October 2024, biologists deployed Wildlife Acoustics SM4 bat acoustic readers enclosed in a pelican case and microphone on pole across different sites (Figure 1). The bat detector is programmed to continuously record ultrasonic frequencies.

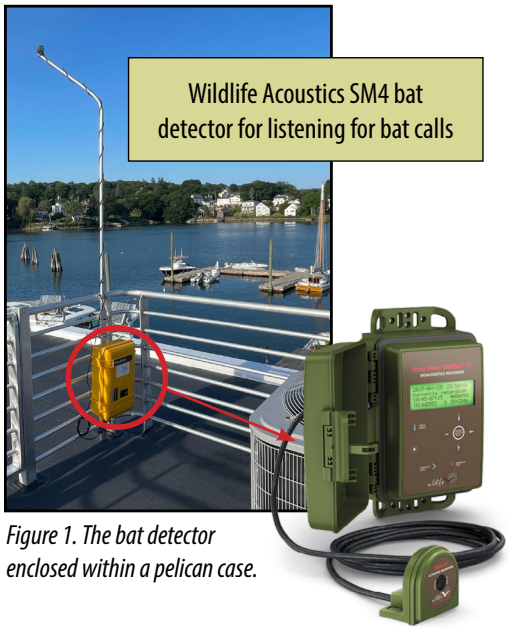


Figure 1. The bat detector enclosed within a pelican case.

700-Acre Island

Islesboro, Maine

Summary of Findings:

- **Monitoring period: 28 July 2024 to 12 October 2024**
- **Percentage of monitoring nights with bats: 93%**
- **Species detected: Big Brown, Eastern Red, Hoary, Silver-haired, Little Brown, Northern Long-eared, Eastern Small-footed, and Tricolored**

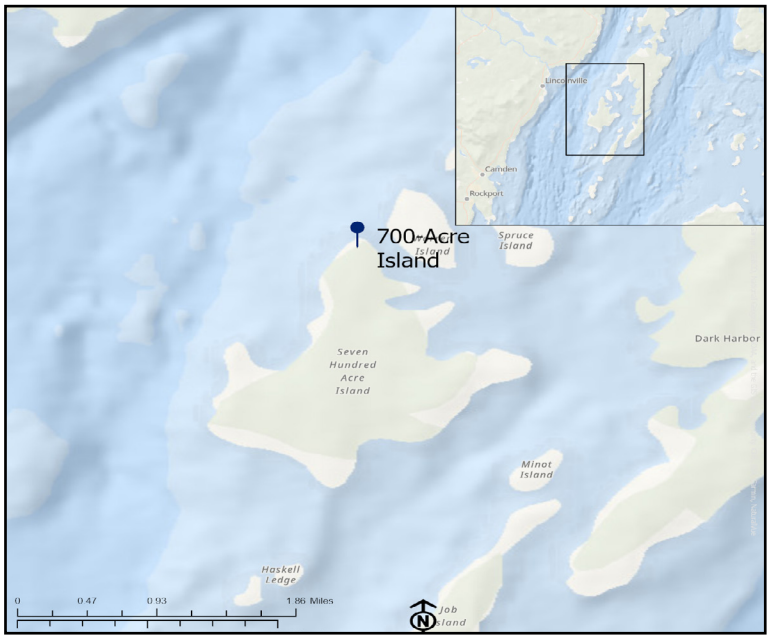


Figure 2. Map of 700-Acre Island.

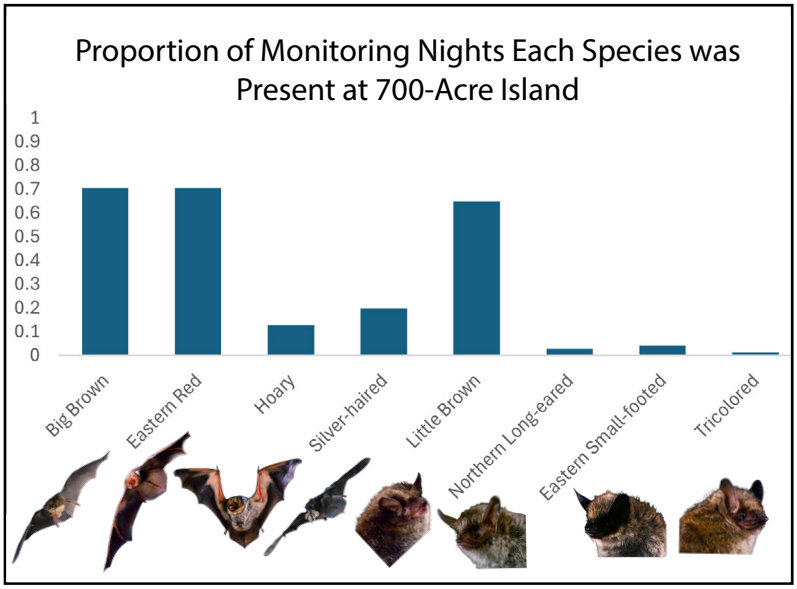


Figure 4. Proportion of monitoring nights and species detected.

Figure 3. Photo of deployment set up at 700 Acre Island.

Scan the QR to learn more about the project.

For more information, please contact the field leads:

Merra Howe
merra.howe@briwildlife.org

Wing Goodale
wing.goodale@briwildlife.org

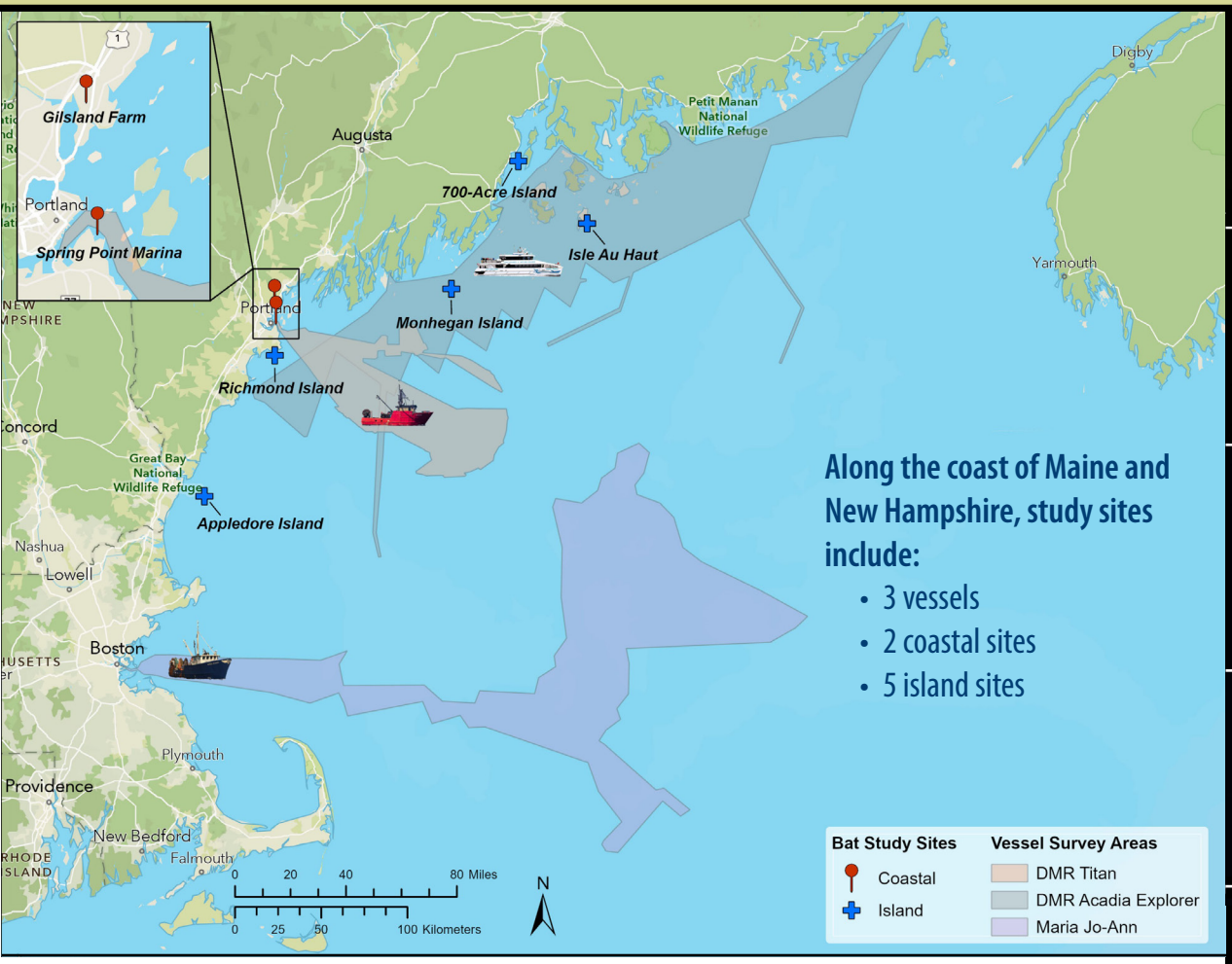
Photo credits: Front top to bottom: Big Brown Bat; Eastern Red Bat; Hoary Bat; Silver-haired Bat; Little Brown Bat; Northern Long-eared Bat; Eastern Small-footed Bat; Tricolored Bat © Merlin Tuttle Foundation. Figure 1 © BRI staff. Back: Figure 2, 3, and 4 © BRI staff.

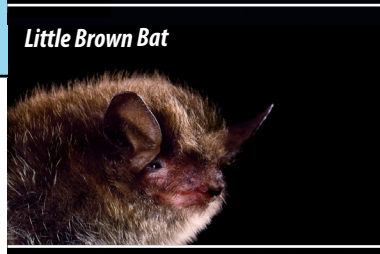
MAINE DEPT. OF INLAND FISHERIES AND WILDLIFE

bri
Biodiversity Research Institute
innovative wildlife science

276 Canco Road | Portland, Maine 04103
www.briwildlife.org

Acoustic Monitoring for Bats in the Gulf of Maine





Project Approach

The Gulf of Maine is home to eight bat species: Eastern Red, Hoary, Northern Long-eared, Tricolored, Big Brown, Little Brown, Eastern Small-footed, and Silver-haired bat. Researchers from Biodiversity Research Institute and the Maine Department of Inland Fisheries and Wildlife teamed up to increase the understanding of bat activity in coastal and offshore areas in the Gulf of Maine using acoustic detectors.

Between July 2024 and October 2024, biologists deployed Wildlife Acoustics SM4 bat acoustic readers enclosed in a pelican case and microphone on pole across different sites (Figure 1). The bat detector is programmed to continuously record ultrasonic frequencies.

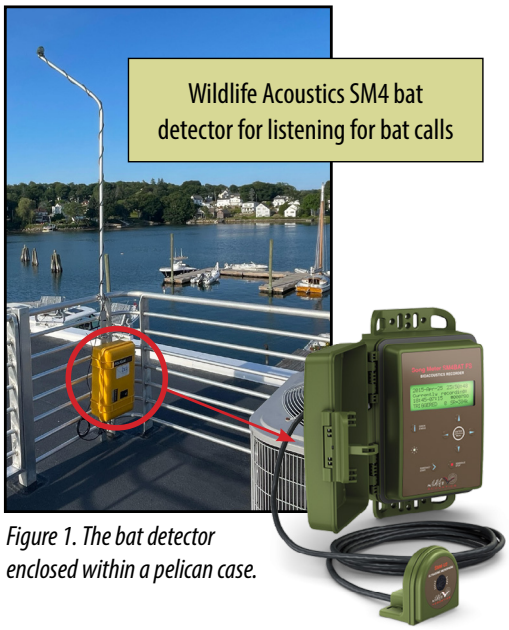


Figure 1. The bat detector enclosed within a pelican case.

DMR Acadia Explorer

Offshore mapping vessel

Summary of Findings:

- **Monitoring period: 16 July 2024 to 8 October 2024**
  - *Note: Data collection from the Acadia Explorer did not occur during the entire monitoring period and was limited to when the vessel was offshore and during daytime hours*
- **Species detected: Eastern Red (diurnal detection)**
  - *Fun fact: the acoustic detection of the Eastern Red Bat was also confirmed visually! In addition, there was a second visual detection of an Eastern Red Bat on a different day*

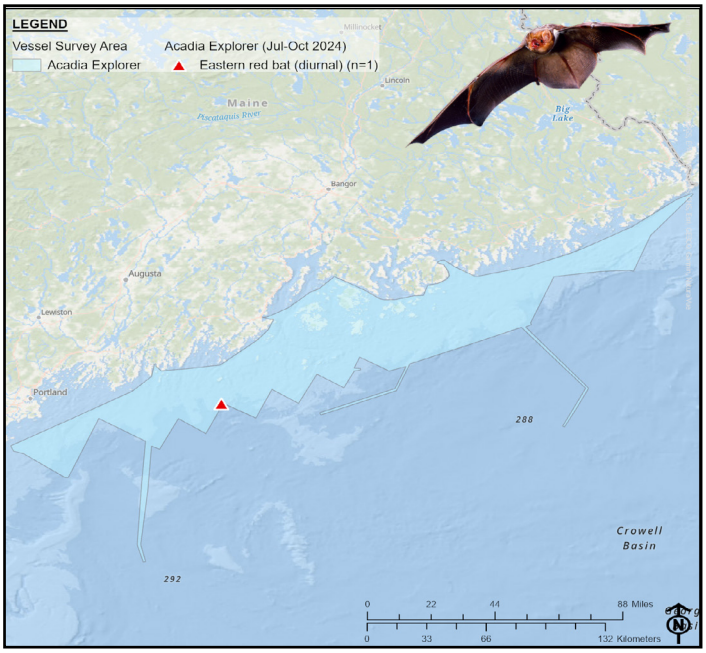


Figure 2. Map of DMR Acadia Explorer and offshore bat detections.

Figure 3. DMR Acadia Explorer vessel.

Scan the QR to learn more about the project.

For more information, please contact the field leads:

Merra Howe
merra.howe@briwildlife.org

Wing Goodale
wing.goodale@briwildlife.org

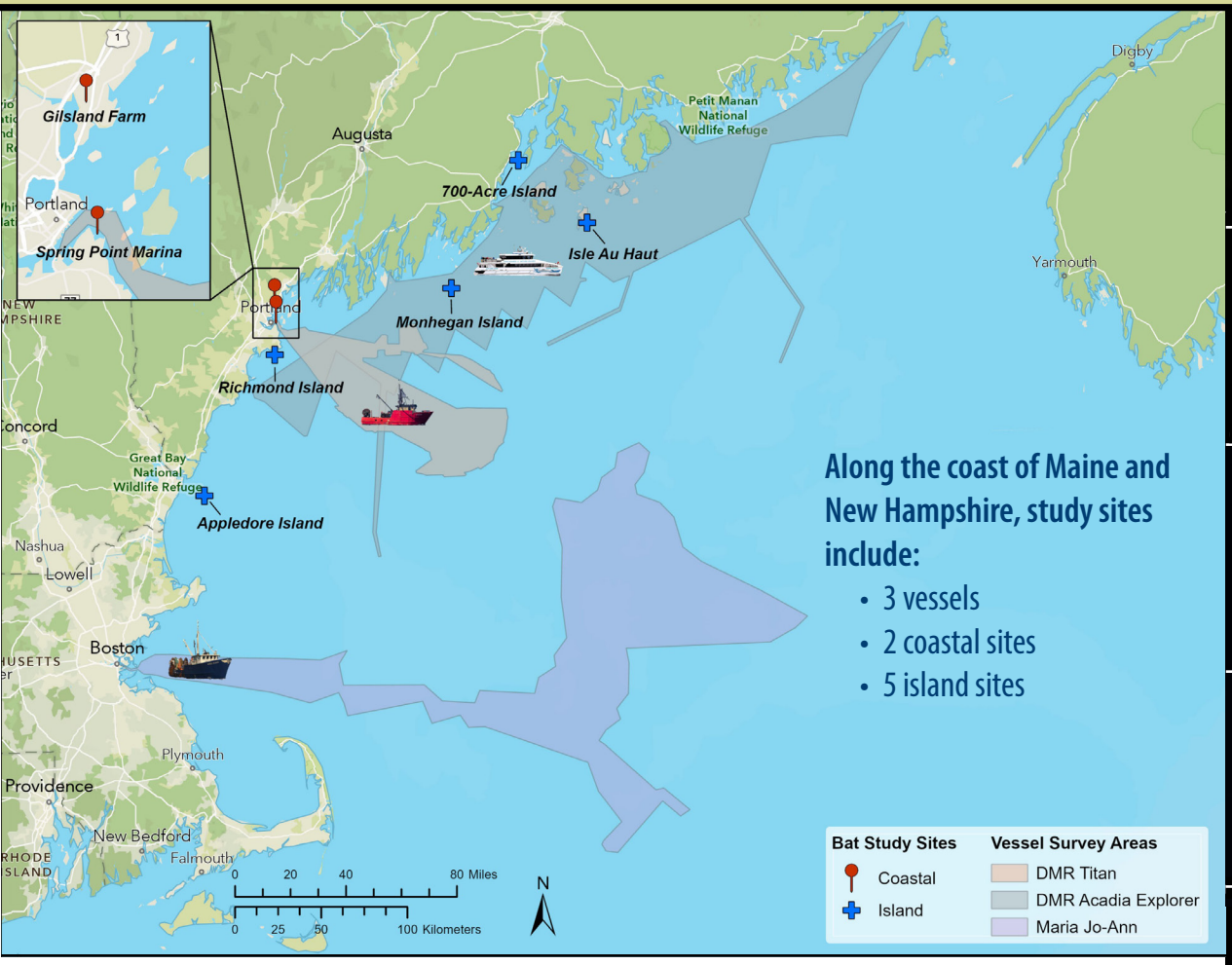
Photo credits: Front top to bottom: Big Brown Bat; Eastern Red Bat; Hoary Bat; Silver-haired Bat; Little Brown Bat; Northern Long-eared Bat; Eastern Small-footed Bat; Tricolored Bat © Merlin Tuttle Foundation. Figure 1 © BRI staff. Back: Figure 2 © BRI staff; Figure 3 © Gull Craft LLC.

MAINE DEPT. OF INLAND FISHERIES AND WILDLIFE

bri
Biodiversity Research Institute
innovative wildlife science

276 Canco Road | Portland, Maine 04103
www.briwildlife.org

Acoustic Monitoring for Bats in the Gulf of Maine



Project Approach

The Gulf of Maine is home to eight bat species: Eastern Red, Hoary, Northern Long-eared, Tricolored, Big Brown, Little Brown, Eastern Small-footed, and Silver-haired bat. Researchers from Biodiversity Research Institute and the Maine Department of Inland Fisheries and Wildlife teamed up to increase the understanding of bat activity in coastal and offshore areas in the Gulf of Maine using acoustic detectors.

Between July 2024 and October 2024, biologists deployed Wildlife Acoustics SM4 bat acoustic readers enclosed in a pelican case and microphone on pole across different sites (Figure 1). The bat detector is programmed to continuously record ultrasonic frequencies.

Figure 1. The bat detector enclosed within a pelican case.

Gilsland Farm Audubon Center

Falmouth, Maine

Summary of Findings:

- **Monitoring period: 25 July 2024 - 16 October 2024**
  - *Data has been processed from 4 Sept 2024 to 27 September 2024*
- **Percentage of monitoring nights with bats (processed data): 93%**
- **Species detected (processed data): Big Brown, Eastern Red, Hoary, Silver-haired, and Little Brown**

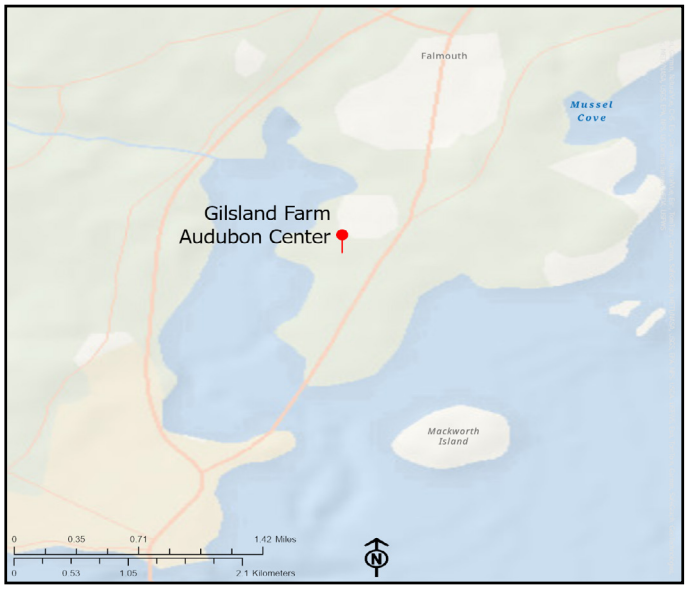


Figure 2. Zoomed in location of detector at Gilsland Farm.

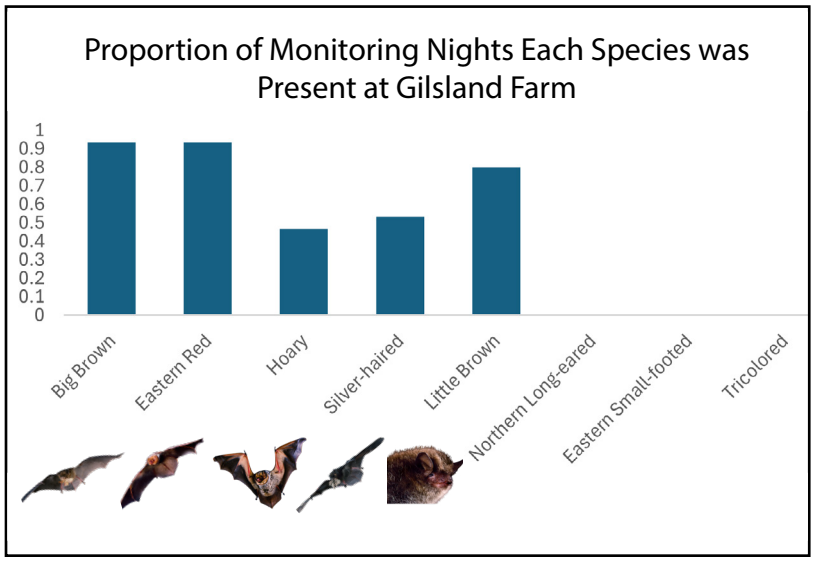


Figure 4. Proportion of monitoring nights and species detected.

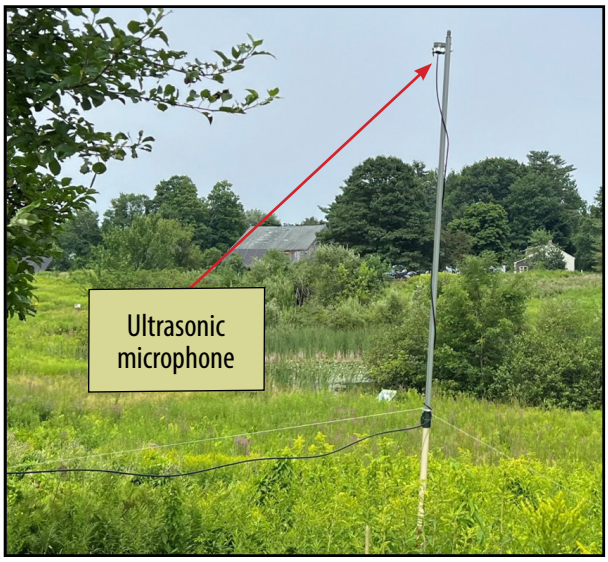


Figure 3. Photo of deployment set up at Gilsland Farm.

Scan the QR to learn more about the project.

For more information, please contact the field leads:

Merra Howe
merra.howe@briwildlife.org

Wing Goodale
wing.goodale@briwildlife.org

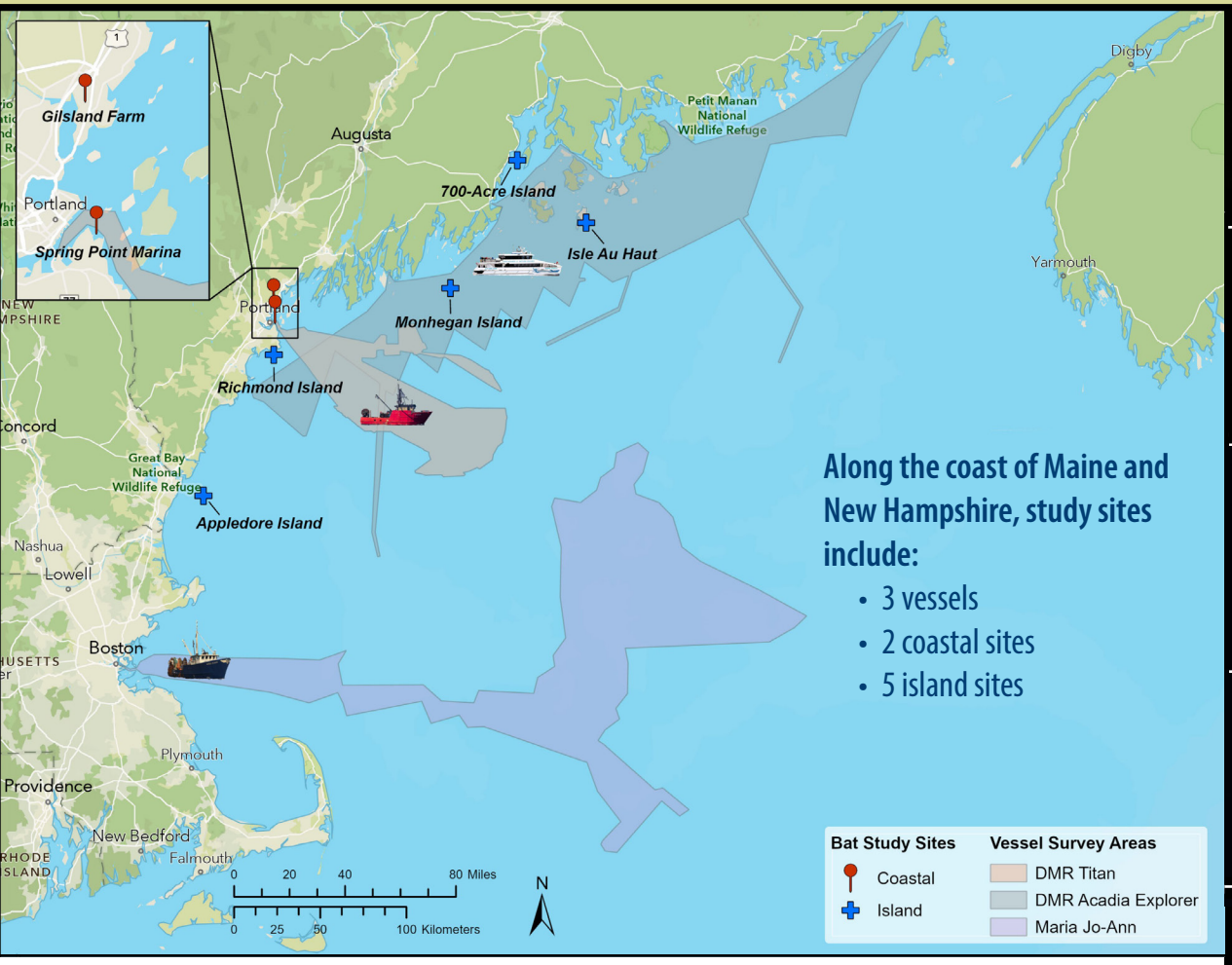
Photo credits: Front top to bottom: Big Brown Bat; Eastern Red Bat; Hoary Bat; Silver-haired Bat; Little Brown Bat; Northern Long-eared Bat; Eastern Small-footed Bat; Tricolored Bat © Merlin Tuttle Foundation. Figure 1 © BRI staff. Back: Figure 2, 3, and 4 © BRI staff.

MAINE DEPT. OF INLAND FISHERIES AND WILDLIFE

bri
Biodiversity Research Institute
innovative wildlife science

276 Canco Road | Portland, Maine 04103
www.briwildlife.org

Acoustic Monitoring for Bats in the Gulf of Maine



Along the coast of Maine and New Hampshire, study sites include:

- 3 vessels
- 2 coastal sites
- 5 island sites

Project Approach

The Gulf of Maine is home to eight bat species: Eastern Red, Hoary, Northern Long-eared, Tricolored, Big Brown, Little Brown, Eastern Small-footed, and Silver-haired bat. Researchers from Biodiversity Research Institute and the Maine Department of Inland Fisheries and Wildlife teamed up to increase the understanding of bat activity in coastal and offshore areas in the Gulf of Maine using acoustic detectors.

Between July 2024 and October 2024, biologists deployed Wildlife Acoustics SM4 bat acoustic readers enclosed in a pelican case and microphone on pole across different sites (Figure 1). The bat detector is programmed to continuously record ultrasonic frequencies.

Figure 1. The bat detector enclosed within a pelican case.

Isle au Haut

Penobscot Bay, Maine

Summary of Findings:

- **Monitoring period: 1 September 2024 to 14 September 2024**
- **Percentage of monitoring nights with bats: 100%**
- **Species detected: Eastern Red, Hoary, Silver-haired, Big Brown, and Little Brown**

Figure 2. Lighthouse on Isle au Haut.

Figure 4. Map of Isle au Haut.

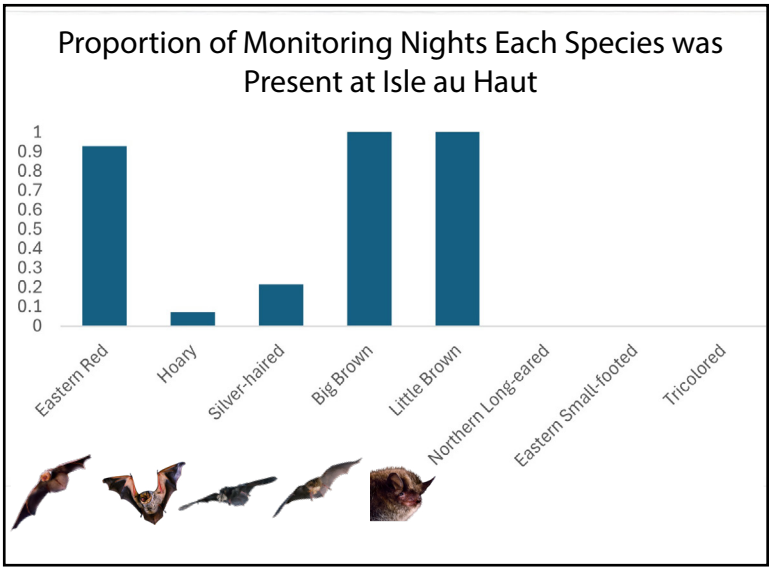


Figure 3. Proportion of monitoring nights and species detected.

Scan the QR to learn more about the project.

For more information, please contact the field leads:

Merra Howe
merra.howe@briwildlife.org

Wing Goodale
wing.goodale@briwildlife.org

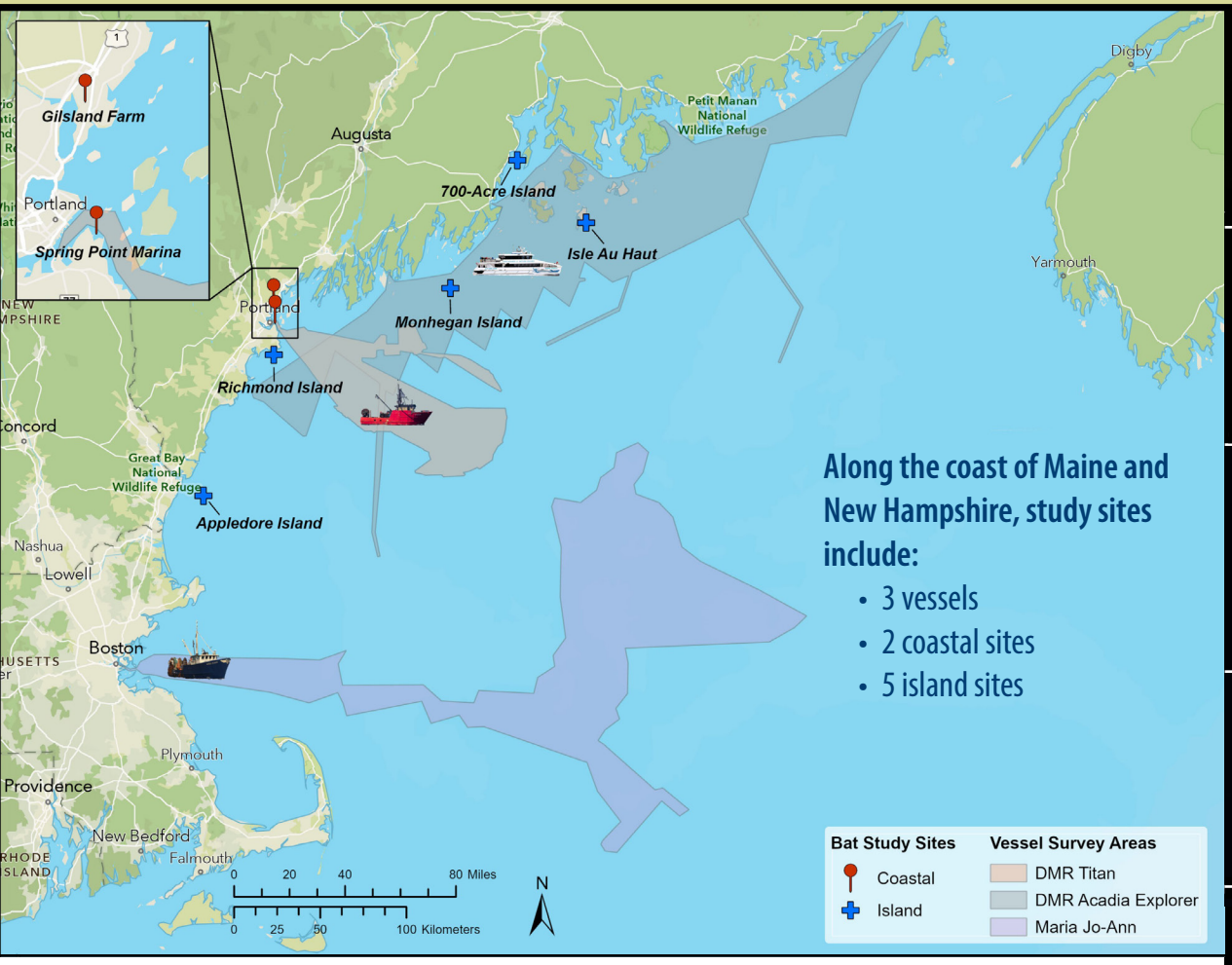
Photo credits: Front top to bottom: Big Brown Bat; Eastern Red Bat; Hoary Bat; Silver-haired Bat; Little Brown Bat; Northern Long-eared Bat; Eastern Small-footed Bat; Tricolored Bat © Merlin Tuttle Foundation. Figure 1 © BRI staff. Back: Figure 2 © Isle au Haut; Figure 3 and 4 © BRI staff.

MAINE DEPT. OF INLAND FISHERIES AND WILDLIFE

bri
Biodiversity Research Institute
innovative wildlife science

276 Canco Road | Portland, Maine 04103
www.briwildlife.org

Acoustic Monitoring for Bats in the Gulf of Maine



Along the coast of Maine and New Hampshire, study sites include:

- 3 vessels
- 2 coastal sites
- 5 island sites


Big Brown Bat


Eastern Red Bat


Hoary Bat


Silver-haired Bat


Little Brown Bat


Northern Long-eared Bat


Eastern Small-footed Bat


Tricolored Bat

Project Approach

The Gulf of Maine is home to eight bat species: Eastern Red, Hoary, Northern Long-eared, Tricolored, Big Brown, Little Brown, Eastern Small-footed, and Silver-haired bat. Researchers from Biodiversity Research Institute and the Maine Department of Inland Fisheries and Wildlife teamed up to increase the understanding of bat activity in coastal and offshore areas in the Gulf of Maine using acoustic detectors.

Between July 2024 and October 2024, biologists deployed Wildlife Acoustics SM4 bat acoustic readers enclosed in a pelican case and microphone on pole across different sites (Figure 1). The bat detector is programmed to continuously record ultrasonic frequencies.

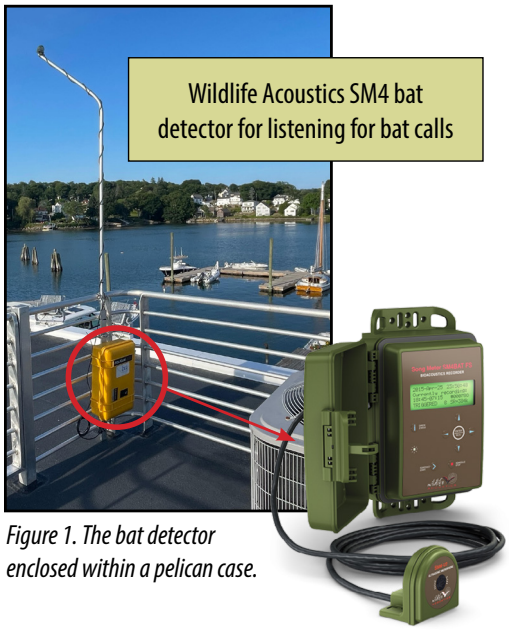


Figure 1. The bat detector enclosed within a pelican case.

Maria Jo-Ann

Fishing trawler based in Boston, MA

Summary of Findings:

- **Monitoring period: 19 August 2024 - 30 September 2024**
  - *Note: Data collection from the Maria Jo-Ann did not occur during the entire monitoring period and was limited to when the vessel was offshore*
- **Percentage of monitoring nights with bats: 26%**
- **Species detected: Eastern Red, Hoary, and Silver-haired**
- **Furthest distance bat detected from shore: 84 miles**

Offshore Bat Detections

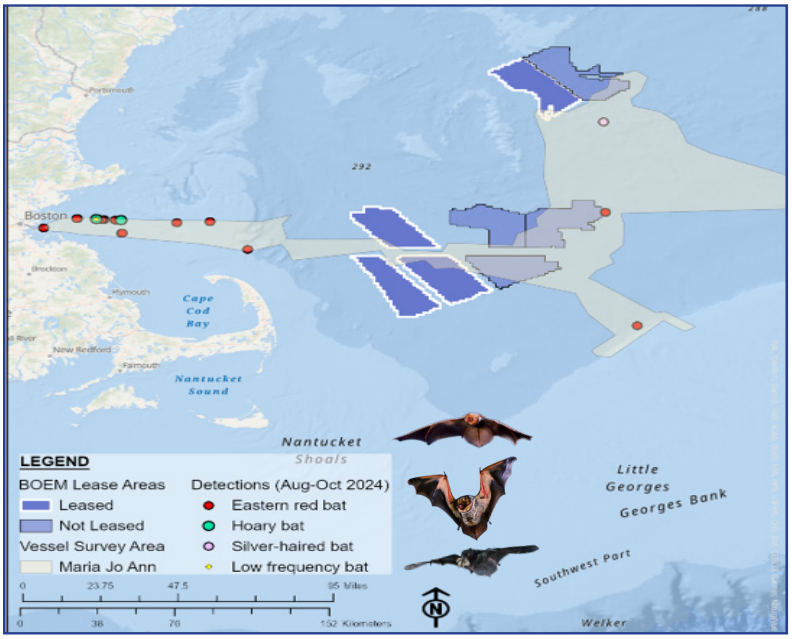


Figure 3. Map of offshore detections.

Figure 2. Photo of deployment set up.

Photo credits: Front top to bottom: Big Brown Bat; Eastern Red Bat; Hoary Bat; Silver-haired Bat; Little Brown Bat; Northern Long-eared Bat; Eastern Small-footed Bat; Tricolored Bat © Merlin Tuttle Foundation. Figure 1 © BRI staff. Back: Figure 2 and 3 © BRI staff.

Scan the QR to learn more about the project.

For more information, please contact the field leads:

Merra Howe
merra.howe@briwildlife.org

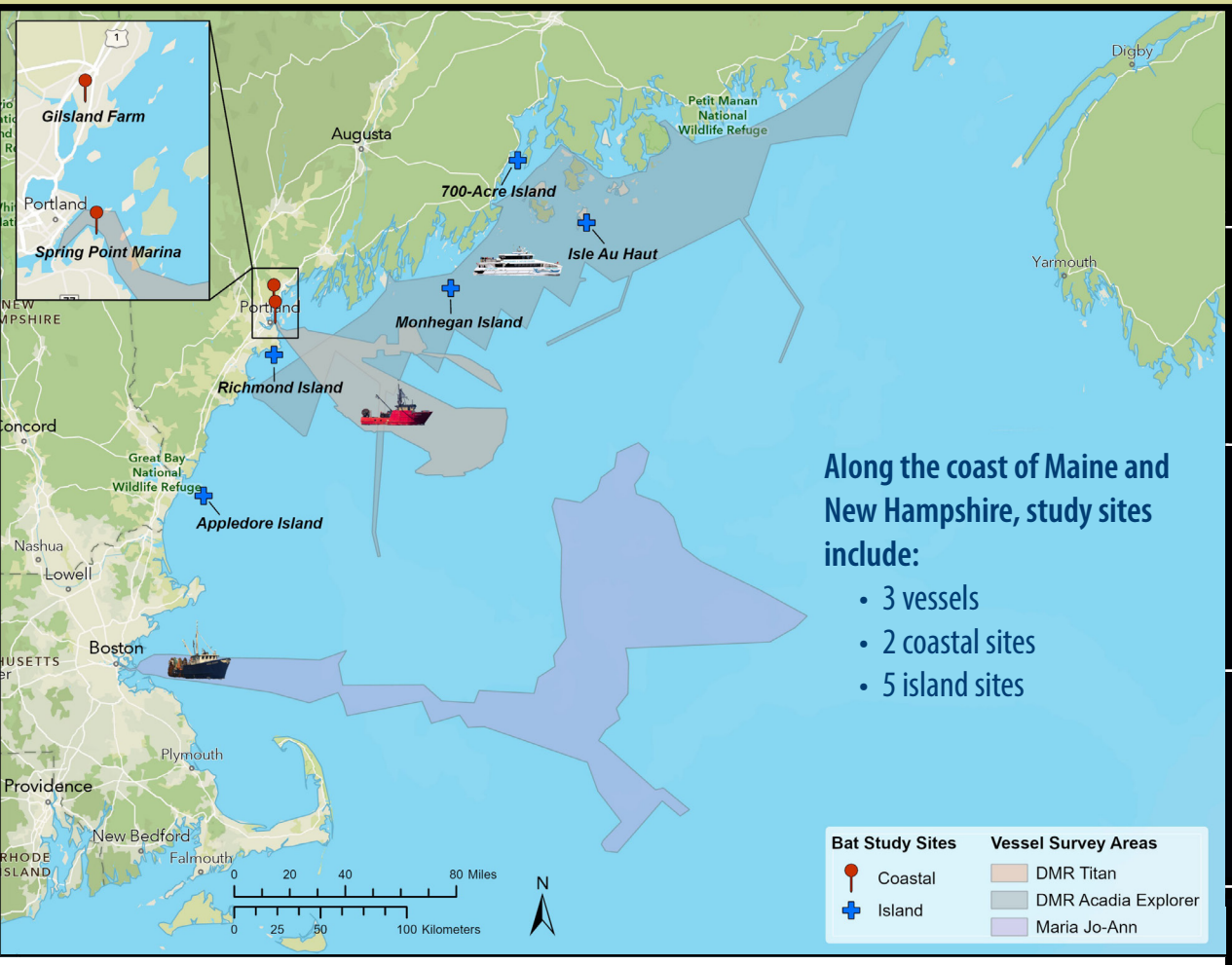
Wing Goodale
wing.goodale@briwildlife.org

MAINE DEPT. OF INLAND FISHERIES AND WILDLIFE

bri
Biodiversity Research Institute
innovative wildlife science

276 Canco Road | Portland, Maine 04103
www.briwildlife.org

Acoustic Monitoring for Bats in the Gulf of Maine



Project Approach

The Gulf of Maine is home to eight bat species: Eastern Red, Hoary, Northern Long-eared, Tricolored, Big Brown, Little Brown, Eastern Small-footed, and Silver-haired bat. Researchers from Biodiversity Research Institute and the Maine Department of Inland Fisheries and Wildlife teamed up to increase the understanding of bat activity in coastal and offshore areas in the Gulf of Maine using acoustic detectors.

Between July 2024 and October 2024, biologists deployed Wildlife Acoustics SM4 bat acoustic readers enclosed in a pelican case and microphone on pole across different sites (Figure 1). The bat detector is programmed to continuously record ultrasonic frequencies.

Figure 1. The bat detector enclosed within a pelican case.

Monhegan Island

Islesboro, Maine

Summary of Findings:

- **Monitoring period: 14 August 2024 to 13 September 2024**
- **Percentage of monitoring nights with bats: 100%**
- **Species detected: Big Brown, Eastern Red, Hoary, and Silver-haired**

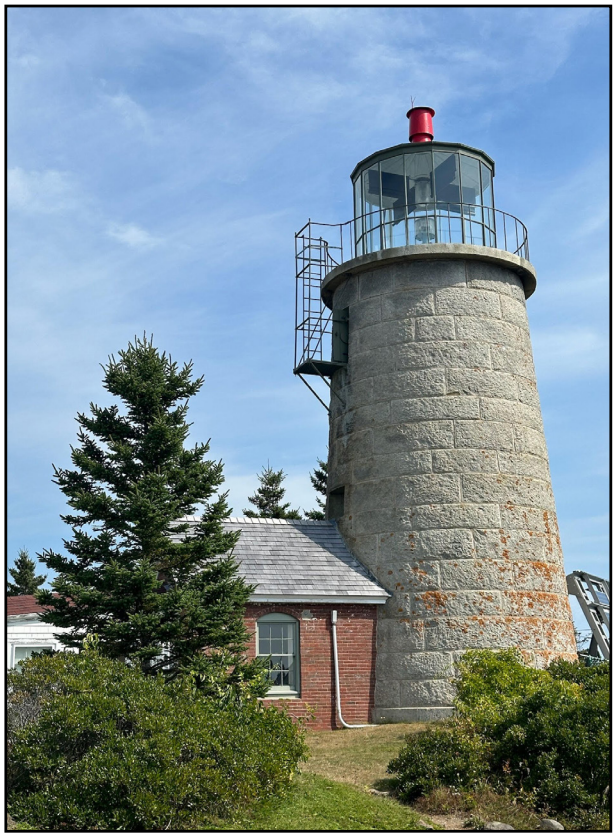


Figure 3. Lighthouse at Monhegan Island.

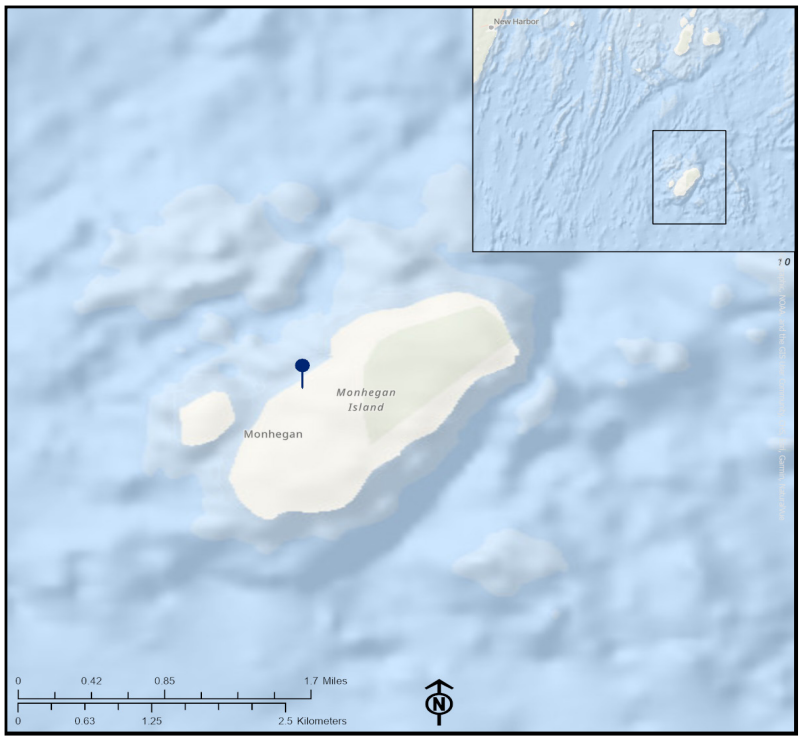


Figure 2. Map of Monhegan Island.

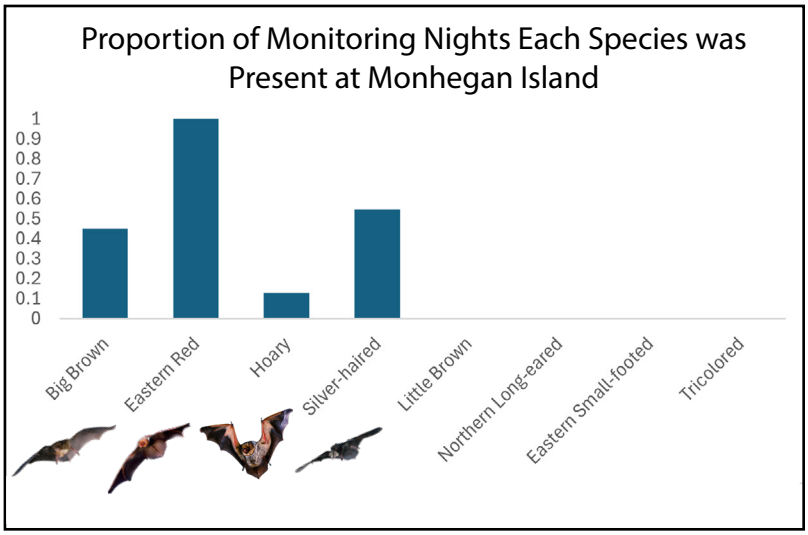


Figure 4. Proportion of monitoring nights and species detected.

Scan the QR to learn more about the project.

For more information, please contact the field leads:

Merra Howe
merra.howe@briwildlife.org

Wing Goodale
wing.goodale@briwildlife.org

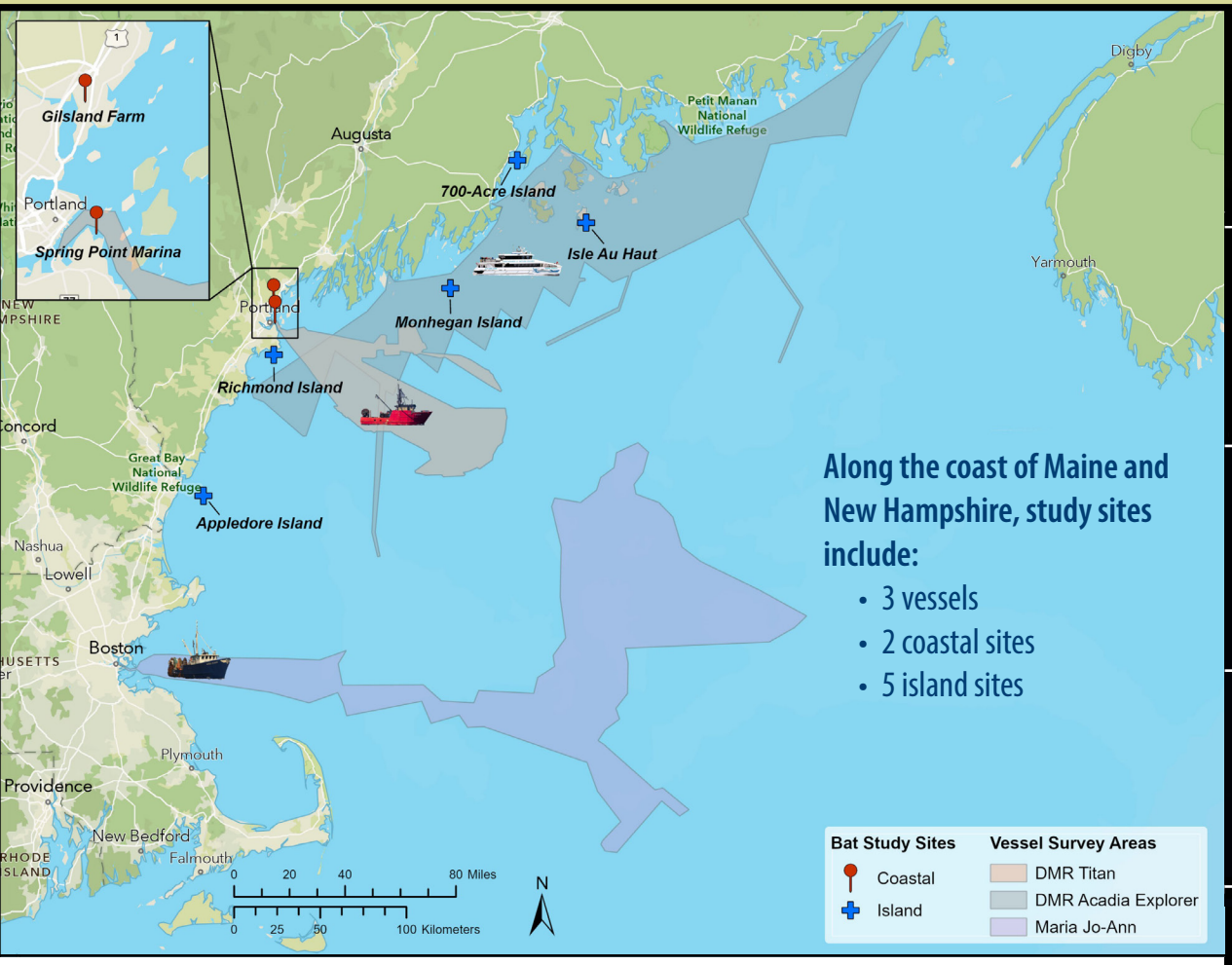
Photo credits: Front top to bottom: Big Brown Bat; Eastern Red Bat; Hoary Bat; Silver-haired Bat; Little Brown Bat; Northern Long-eared Bat; Eastern Small-footed Bat; Tricolored Bat © Merlin Tuttle Foundation. Figure 1 © BRI staff. Back: Figure 2, 3, and 4 © BRI staff.

MAINE DEPT. OF INLAND FISHERIES AND WILDLIFE

bri
Biodiversity Research Institute
innovative wildlife science

276 Canco Road | Portland, Maine 04103
www.briwildlife.org

Acoustic Monitoring for Bats in the Gulf of Maine



Along the coast of Maine and New Hampshire, study sites include:

- 3 vessels
- 2 coastal sites
- 5 island sites

Project Approach

The Gulf of Maine is home to eight bat species: Eastern Red, Hoary, Northern Long-eared, Tricolored, Big Brown, Little Brown, Eastern Small-footed, and Silver-haired bat. Researchers from Biodiversity Research Institute and the Maine Department of Inland Fisheries and Wildlife teamed up to increase the understanding of bat activity in coastal and offshore areas in the Gulf of Maine using acoustic detectors.

Between July 2024 and October 2024, biologists deployed Wildlife Acoustics SM4 bat acoustic readers enclosed in a pelican case and microphone on pole across different sites (Figure 1). The bat detector is programmed to continuously record ultrasonic frequencies.

Figure 1. The bat detector enclosed within a pelican case.

Isle of Shoals
Appledore Island

Summary of Findings:

- **Monitoring period: 16 September 2024 to 16 October 2024**
- **Percentage of monitoring nights with bats: 77%**
- **Species detected: Eastern Red, Big Brown, Little Brown Hoary, and Silver-haired**

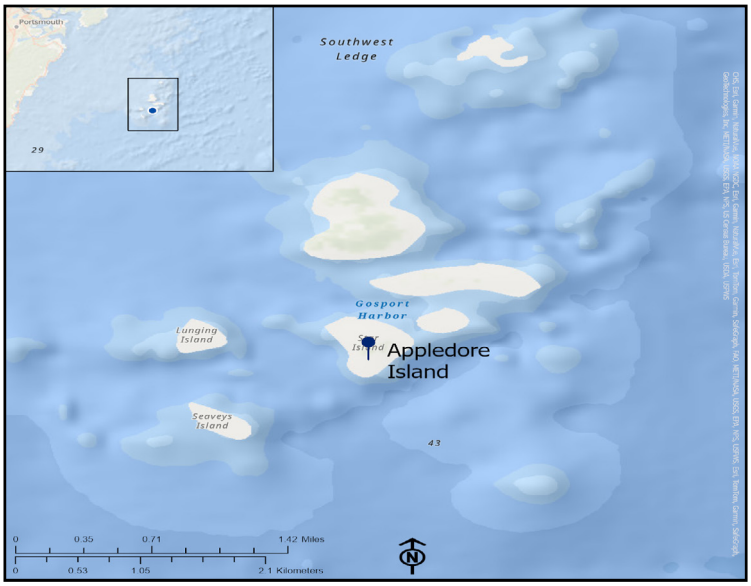


Figure 2. Zoomed in location of detector on Appledore Island.

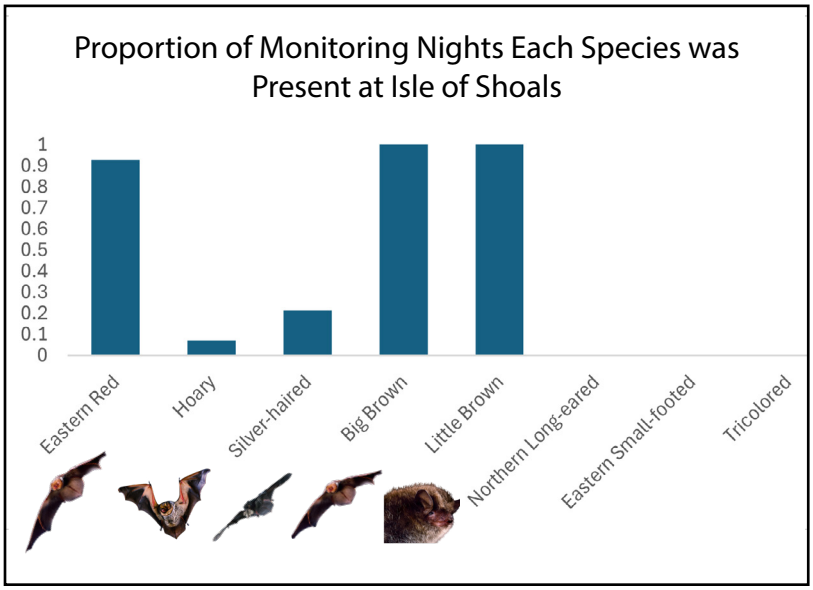


Figure 4. Proportion of monitoring nights and species detected.

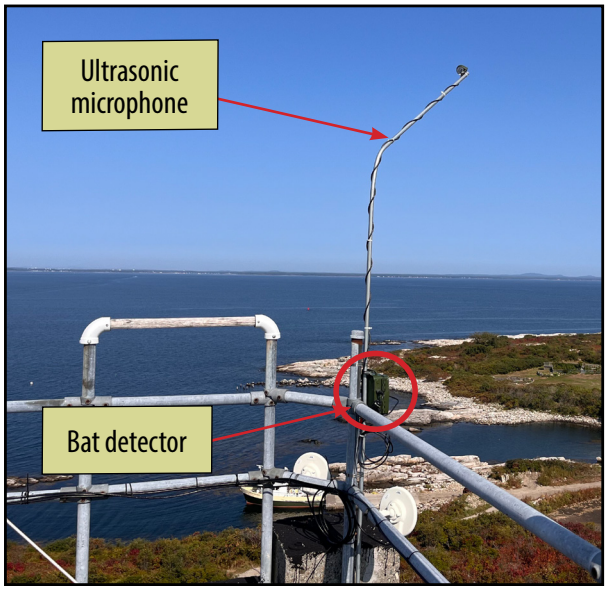


Figure 3. Photo of deployment set up.

Scan the QR to learn more about the project.

For more information, please contact the field leads:

Merra Howe
merra.howe@briwildlife.org

Wing Goodale
wing.goodale@briwildlife.org

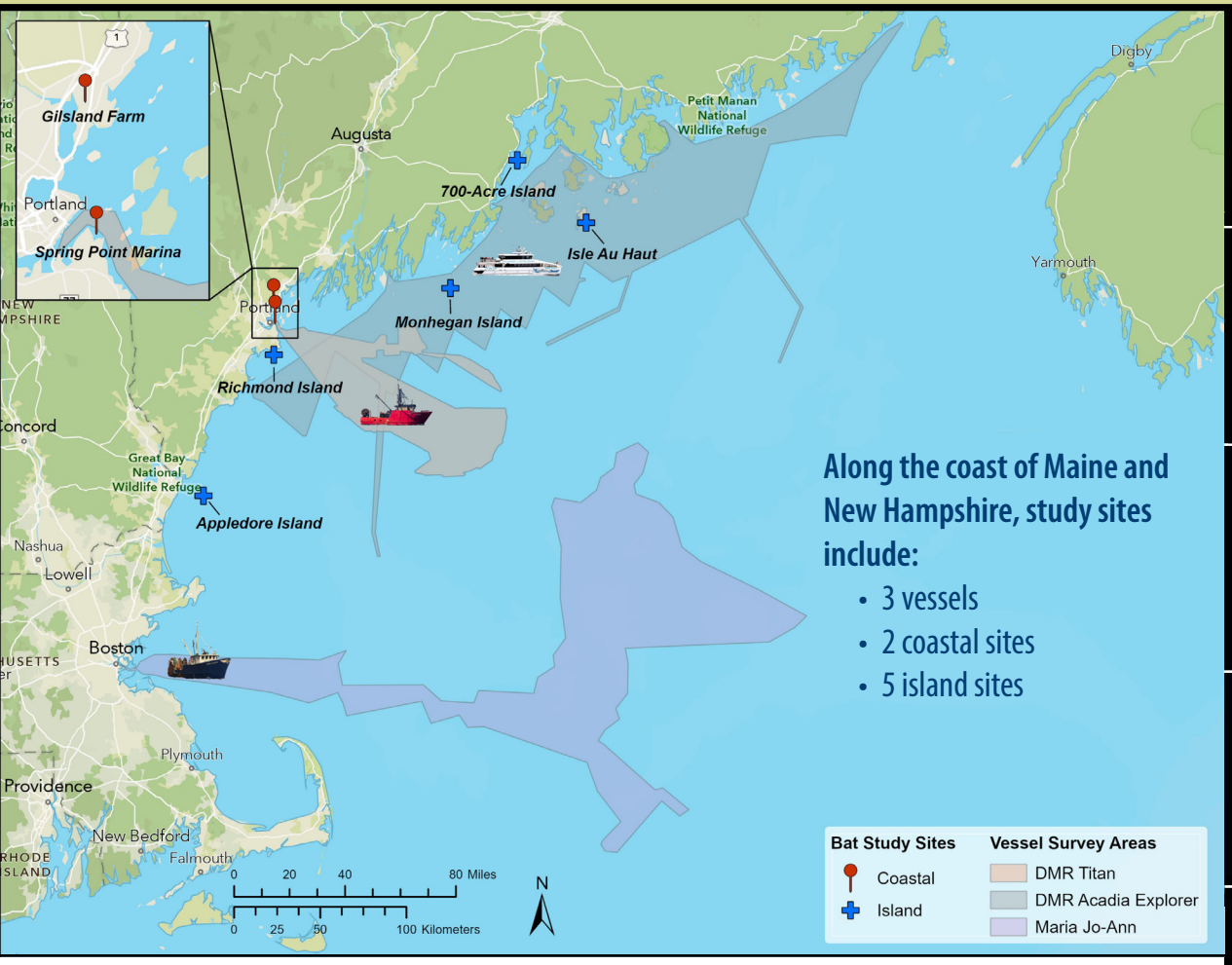
Photo credits: Front top to bottom: Big Brown Bat; Eastern Red Bat; Hoary Bat; Silver-haired Bat; Little Brown Bat; Northern Long-eared Bat; Eastern Small-footed Bat; Tricolored Bat © Merlin Tuttle Foundation. Figure 1 © BRI staff. Back: Figure 2, 3, and 4 © BRI staff.

MAINE DEPT. OF INLAND FISHERIES AND WILDLIFE

bri
Biodiversity Research Institute
innovative wildlife science

276 Canco Road | Portland, Maine 04103
www.briwildlife.org

Acoustic Monitoring for Bats in the Gulf of Maine



Along the coast of Maine and New Hampshire, study sites include:

- 3 vessels
- 2 coastal sites
- 5 island sites

Project Approach

The Gulf of Maine is home to eight bat species: Eastern Red, Hoary, Northern Long-eared, Tricolored, Big Brown, Little Brown, Eastern Small-footed, and Silver-haired bat. Researchers from Biodiversity Research Institute and the Maine Department of Inland Fisheries and Wildlife teamed up to increase the understanding of bat activity in coastal and offshore areas in the Gulf of Maine using acoustic detectors.

Between July 2024 and October 2024, biologists deployed Wildlife Acoustics SM4 bat acoustic readers enclosed in a pelican case and microphone on pole across different sites (Figure 1). The bat detector is programmed to continuously record ultrasonic frequencies.

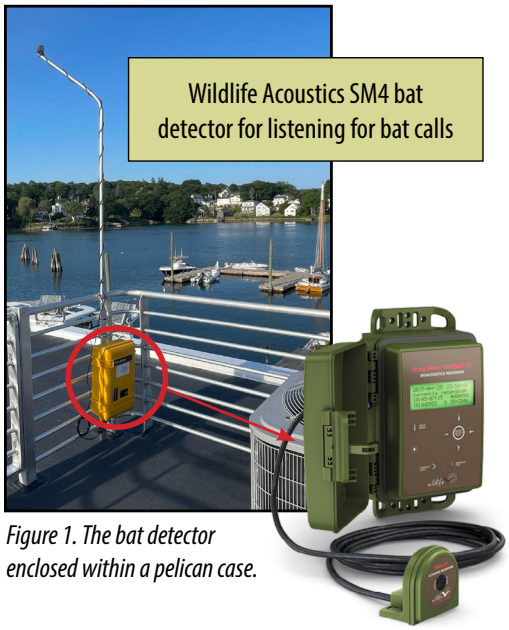


Figure 1. The bat detector enclosed within a pelican case.

Spring Point Marina

South Portland, Maine

Summary of Findings:

- **Monitoring period: 8 August 2024 to 15 October 2024**
  - *Data has been processed from 13 September 2024 to 15 October 2024*
- **Percentage of monitoring nights with bats: 82%**
- **Species detected: Eastern Red, Hoary, Silver-haired, and Big Brown**

Figure 2. Zoomed in location of detector at Spring Point Marina.

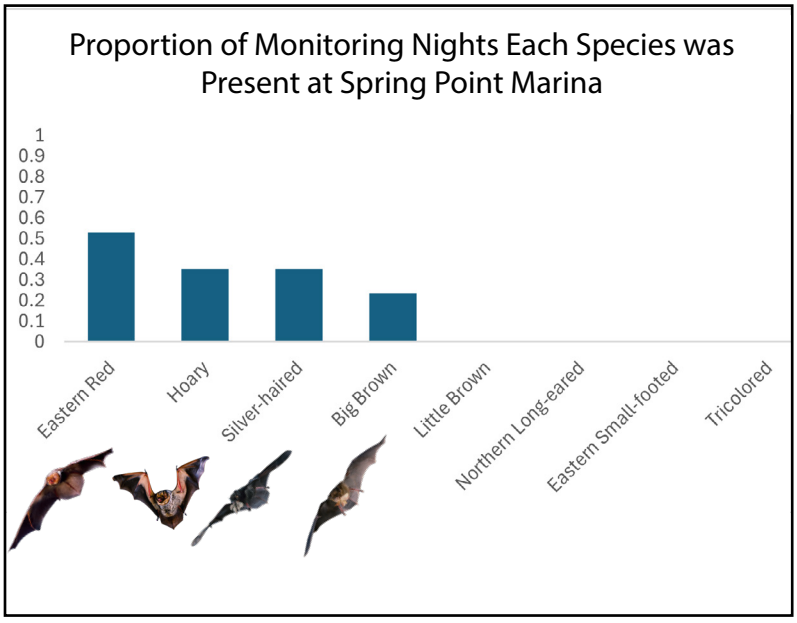


Figure 4. Proportion of monitoring nights and species detected.

Figure 3. Photo of deployment set up at Spring Point Marina with Double-crested Cormorants (Nannopterum auritum) in the background.

Scan the QR to learn more about the project.

For more information, please contact the field leads:

Merra Howe
merra.howe@briwildlife.org

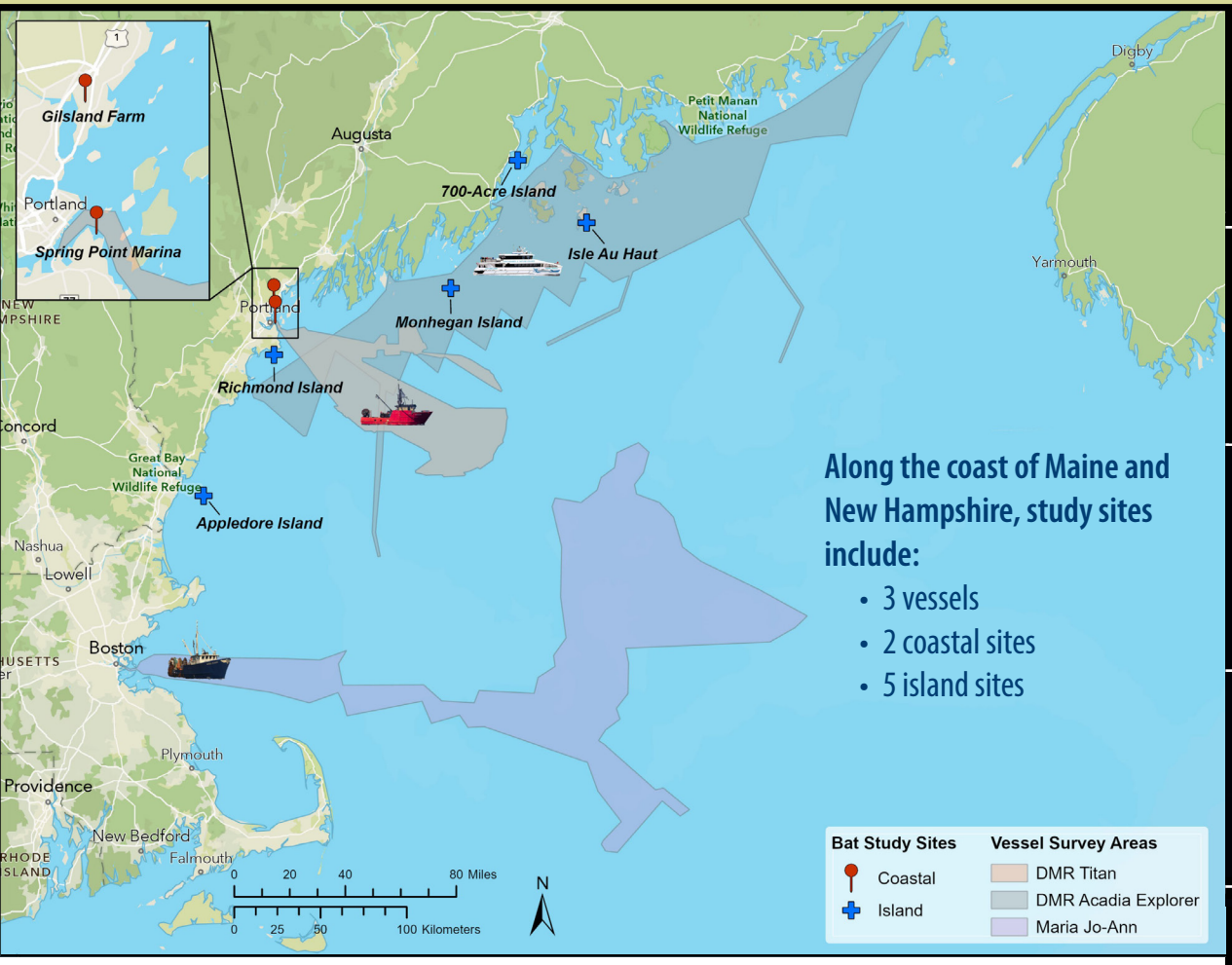
Wing Goodale
wing.goodale@briwildlife.org

MAINE DEPT. OF INLAND FISHERIES AND WILDLIFE

bri
Biodiversity Research Institute
innovative wildlife science

276 Canco Road | Portland, Maine 04103
www.briwildlife.org

Acoustic Monitoring for Bats in the Gulf of Maine



Project Approach

The Gulf of Maine is home to eight bat species: Eastern Red, Hoary, Northern Long-eared, Tricolored, Big Brown, Little Brown, Eastern Small-footed, and Silver-haired bat. Researchers from Biodiversity Research Institute and the Maine Department of Inland Fisheries and Wildlife teamed up to increase the understanding of bat activity in coastal and offshore areas in the Gulf of Maine using acoustic detectors.

Between July 2024 and October 2024, biologists deployed Wildlife Acoustics SM4 bat acoustic readers enclosed in a pelican case and microphone on pole across different sites (Figure 1). The bat detector is programmed to continuously record ultrasonic frequencies.

Figure 1. The bat detector enclosed within a pelican case.

F/V Titan*

Maine DMR offshore mapping vessel based out of Portland, ME

Summary of Findings:

- **Monitoring period: 31 July 2024 to 21 October 2024**
  - *Note: Data collection from the F/V Titan did not occur during the entire monitoring period and was limited to when the vessel was offshore*
- **Percentage of monitoring nights with bats: 26%**
- **Species detected: Big Brown, Eastern Red, and Silver-haired**
- **Furthest distance bat detected from shore: 35 miles**
  - *Data included a possible example of bat following the vessel*

Offshore Bat Detections

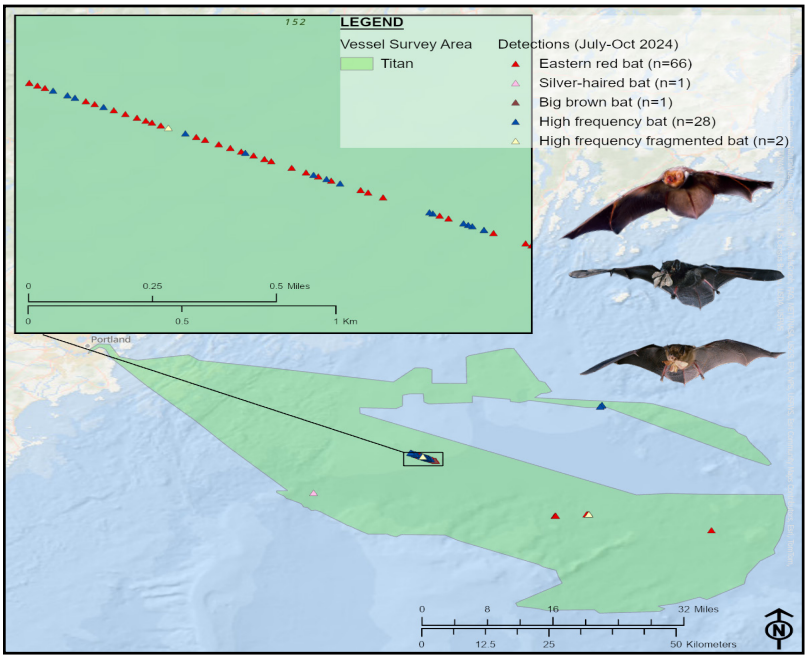


Figure 3. Map of offshore detections with zoomed in bat detections.

Figure 2. Photo of deployment set up.

Photo credits: Front top to bottom: Big Brown Bat; Eastern Red Bat; Hoary Bat; Silver-haired Bat; Little Brown Bat; Northern Long-eared Bat; Eastern Small-footed Bat; Tricolored Bat © Merlin Tuttle Foundation. Figure 1 © BRI staff. Back: Figure 2 and 3 © BRI staff.

Scan the QR to learn more about the project.

For more information, please contact the field leads:

Merra Howe
merra.howe@briwildlife.org

Wing Goodale
wing.goodale@briwildlife.org

*Funding for the F/V Titan survey effort provided by the Maine Offshore Wind Research Consortium

MAINE DEPT. OF INLAND FISHERIES AND WILDLIFE

bri
Biodiversity Research Institute
innovative wildlife science

276 Canco Road | Portland, Maine 04103
www.briwildlife.org