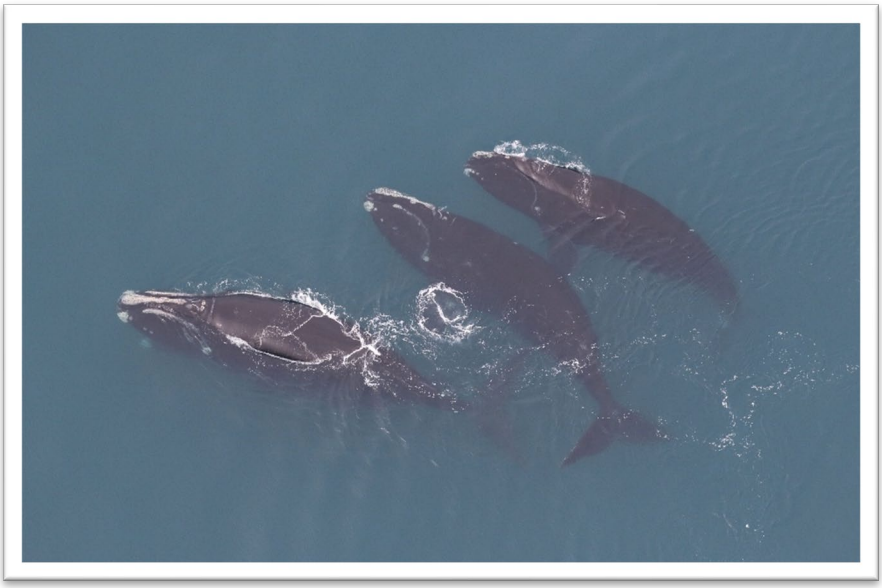
Mid-Atlantic Marine Mammal Aerial Survey Effort

2024/25

Annual Progress Report



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Cover Photo Credits:

North Atlantic right whale (*Eubalaena glacialis)* surface active group observed offshore of Virginia Beach, Virginia, in March 2025 during a tandem vessel-aerial survey, taken under National Marine Fisheries Service Scientific Research Permit Number 28184, issued to Dan Engelhaupt (HDR Inc.).

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Science ⚓ Stewardship ⚓ Protection

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Acronyms and Abbreviations

Azura	Azura Consulting LLC
Ba	*Balaenoptera acutorostrata* (minke whale)
Bp	*Balaenoptera physalus* (fin whale)
BSS	Beaufort sea state
CATS	Customized Animal Tracking Solution
CMARI	Clearwater Marine Aquarium Research Institute
DMON	Digital Acoustic Monitoring
DTAG	Digital Acoustic Recording Tag
DMA	Dynamic Management Area
Eg	*Eubalaena glacialis* (right whale)
ID	Identification Number
km	kilometer(s)
K sp.	*Kogia* sp. (dwarf or pygmy sperm whale)
m	meter(s)
Mb	*Mesoplodon bidens* (Sowerby's beaked whale)
MGEL	Marine Geospatial Ecology Lab
min	minute(s)
Mn	*Megaptera novaeangliae* (humpback whale)
nm	nautical mile(s)
NARW	North Atlantic right whale
OPAREA	Operating Area
photo-ID	photo-identification
Pm	*Physeter macrocephalus* (sperm whale)
SMA	Seasonal Management Area
UNCW	University of North Carolina Wilmington
U.S.	United States
UME	Unusual Mortality Event
VACAPES	Virginia Capes
Zc	*Ziphius cavirostris* (goose-beaked whale)

1. Introduction

The coastal and offshore waters off Virginia are regularly used by the United States (U.S.) Navy for training and testing activities, specifically the Virginia Capes (VACAPES) Operating Area (OPAREA). HDR Inc. started the Mid-Atlantic Humpback Whale Monitoring Project in 2015, which focused on monitoring the occurrence, habitat use, and behavior of humpback whales (*Megaptera novaeangliae*) within these nearshore areas, including the W-50 Mine Neutralization Exercise region, through opportunistic vessel surveys (Aschettino et al. 2026). While humpback whales were the priority species during the earlier years of the project, focus has shifted during recent years to include other baleen whale species, including critically endangered North Atlantic right (NARW; *Eubalaena glacialis*), endangered fin (*Balaenoptera physalus*), and sei (*Balaenoptera borealis*) whales, as well as minke (*Balaenoptera acutorostrata*) whales. Starting in 2020, the project evolved into the Mid-Atlantic Nearshore and Mid-Shelf Baleen Whale Monitoring Project as efforts expanded to include these additional species and extended farther into the mid-shelf waters off Virginia. Little information exists on how NARWs use the Mid-Atlantic, which was previously considered primarily a migratory corridor as the whales travel between their feeding and calving grounds. To help fill this data gap, the project has shifted priority to NARW occurrence and behavior in the Mid-Atlantic (Aschettino et al. 2023, 2024a; A. Engelhaupt et al. 2023; D. Engelhaupt et al. 2023).

During the first year of the Mid-Atlantic Humpback Whale Monitoring Project, offshore vessel surveys were also conducted focusing on outer continental shelf cetaceans, and the dedicated Offshore Cetacean Study began in 2016 (Engelhaupt et al. 2026). These surveys focus on the occurrence, habitat use, and behavior of deep-diving cetaceans within the VACAPES OPAREA, primarily sperm (*Physeter macrocephalus*) and beaked (e.g., *Ziphius cavirostris*, *Mesoplodon* spp.) whales.

Dedicated, systematic, marine mammal aerial surveys have previously been conducted throughout the VACAPES OPAREA. The Virginia Aquarium & Marine Science Center Foundation, Inc. and the University of North Carolina Wilmington (UNCW) conducted aerial line-transect surveys within the VACAPES OPAREA continental shelf region from 2016 to 2017 (Mallette et al. 2017). Offshore aerial line-transect surveys were flown near Norfolk Canyon by UNCW from 2015 to 2017 (McAlarney et al. 2016, 2017, 2018) and by HDR Inc. from 2018 to 2019 (Cotter 2019). HDR Inc. researchers recorded their first NARW sightings during these surveys in April 2018 (Cotter 2019). Dedicated systematic aerial survey coverage has not been conducted in the VACAPES OPAREA since these surveys ended in August 2019.

Both the Mid-Atlantic Nearshore and Mid-Shelf Baleen Whale Monitoring Project and Offshore Cetacean Study aim to provide baseline occurrence and ecological information to the U.S. Navy regarding how marine mammals use the VACAPES OPAREA. These projects aim to answer questions regarding the baseline ecology, behavior, movement patterns, and site fidelity of marine mammals that may be exposed to U.S. Navy training and testing exercises. HDR Inc. researchers use a variety of vessel-based methodologies, including photo-identification (photo-ID), biopsy sampling, drones, satellite-linked telemetry tags, and digital archival tags (Digital Acoustic Recording Tags [DTAGs] and Customized Animal Tracking Solution [CATS] tags).

To better assist the vessel team with these efforts and in locating target species, non-systematic aerial surveys were implemented beginning in March 2021 (Aschettino et al. 2023). Aerial survey efforts increased during the 2022/23 and 2023/24 seasons, with 8 (Aschettino et al. 2024b) and 13 (Ozog and Engelhaupt 2025) surveys flown, respectively. While surveys were primarily associated with locating NARWs, some aerial surveys were also flown in tandem with Offshore Cetacean Study field work. This report details the coverage and sightings from aerial surveys flown during the 2024/25 field season in coordination with vessel field work for both projects. See the individual project technical reports for more details on each (Aschettino et al. 2026, Engelhaupt et al. 2026).

2. Methods

Researchers from HDR Inc. and Naval Facilities Engineering Systems Command Atlantic flew periodic aerial surveys in association with nearshore, mid-shelf, and offshore vessel surveys Beginning in the 2024/25 season, a new set of 11 east-west tracklines was adopted to cover the primary study area (**Figure 1**). Other researchers also have intermittent coverage within this study area during peak NARW season, including Azura Consulting LLC (Azura; January to March; Whitt 2023, 2024) and Clearwater Marine Aquarium Research Institute (CMARI; November to April; CMARI 2024) (**Figure 1**). To better assist with flight planning and coordination, HDR Inc. adopted select tracklines from both the Azura and CMARI teams, including nine tracklines from Azura, one trackline from CMARI, and one independent trackline at the Virginia/North Carolina state line. Nearshore/mid-shelf tracklines typically ran from shore out to 45 nautical miles (nm), and offshore tracklines extended past the shelf break up to approximately 80 nm from shore. Occasionally, when out in deep water, the plane flew north-south tracklines following specific isobaths (e.g., 305-meter [m], 457 m). Additionally, beginning in the 2024/25 season, a set of four north-south tracklines were established that followed the general curvature of the coastline at approximately 2, 6, 10, and 14 nm from shore (**Figure 2**).

The combination of tracklines and the distance from shore covered along tracklines varied within each flight and between surveys, subject to airspace restrictions, and was primarily driven by areas with suitable weather conditions for the vessel team to operate. Optimal viewing conditions were Beaufort sea state (BSS) of 3 or lower, and tracklines were typically shortened or altered mid-flight if BSS reached 4 to 5. Near real-time acoustic detections of NARWs on the Cape Charles Digital Acoustic Monitoring (DMON) buoy within the northern portion of the study area and/or on the Norfolk DMON buoy within the southern portion of the study area were also used during survey flight planning when determining where to prioritize coverage.

Survey flights conducted by HDR Inc. primarily originated from Signature Flight Support at Norfolk International Airport in Norfolk, Virginia; however, select survey flights also departed from Chambers Field at Naval Station Norfolk, in Norfolk, and Naval Air Station Oceana in Virginia Beach, Virginia. Nimbus Aerial Solutions (Beaufort, North Carolina) and Anthem Commercial Air Services (Jacksonville, Florida) flew flights in a Cessna 337 Skymaster, and the Scientific Development Squadron (VXS) 1 – U.S. Naval Research Laboratory (Patuxent River, Maryland) flew flights in a DHC-6 Twin Otter (**Figure 3**). All aircraft used during the 2024/25 field season were equipped with photograph windows, and the Twin Otter was also equipped with bubble windows. All flights were flown with two pilots and two observers (positioned at the left and right windows in the rear seats of the aircraft). Surveys were flown at 305 m altitude and 100-knot (185 kilometer [km]/hour) speed. A Starlink Mini unit was used on most flights for plane-vessel and plane-land communications.

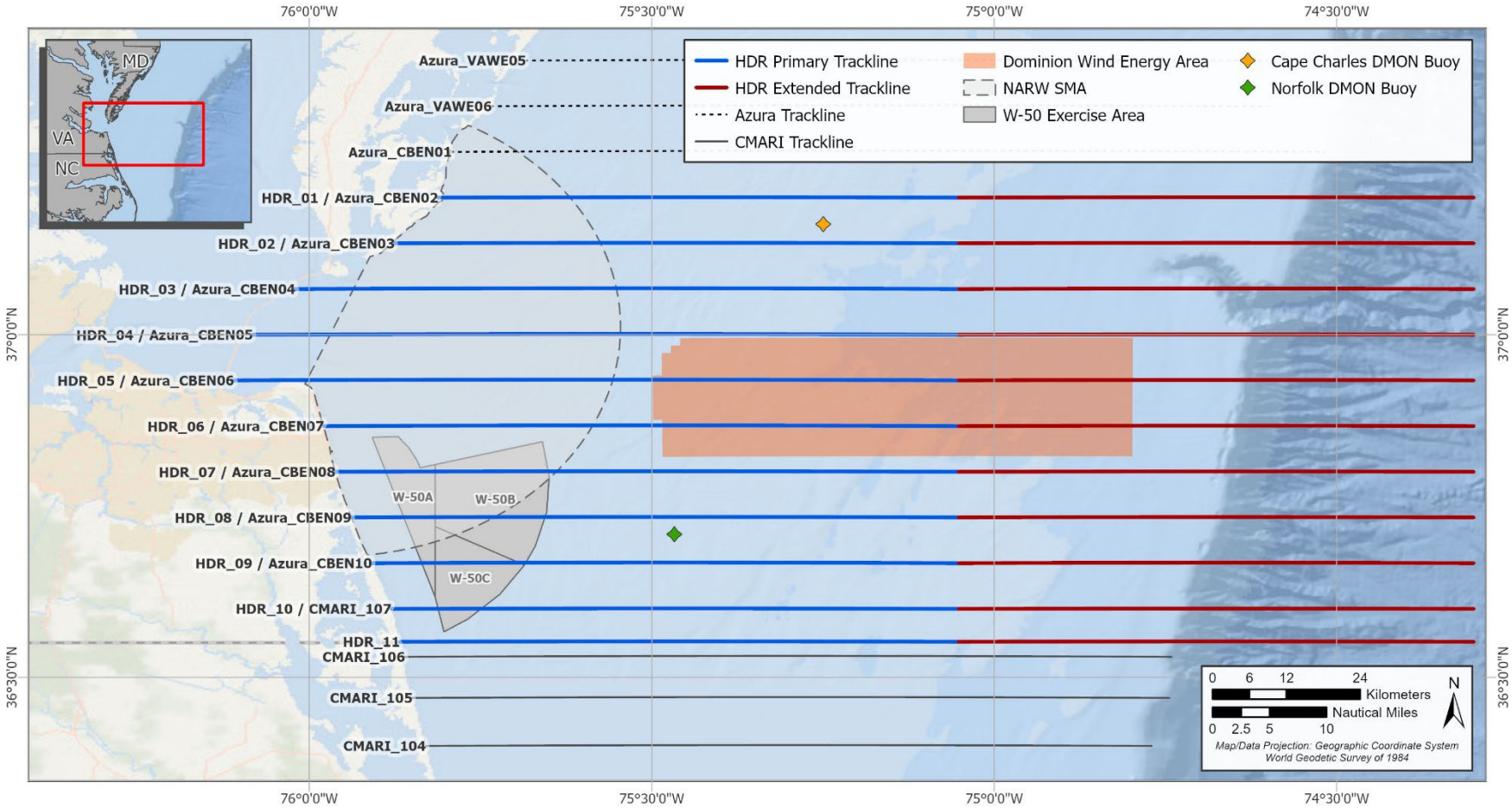

Figure 1. Aerial tracklines for HDR Inc. (blue and red), Azura (dashed), and CMARI (dark gray).

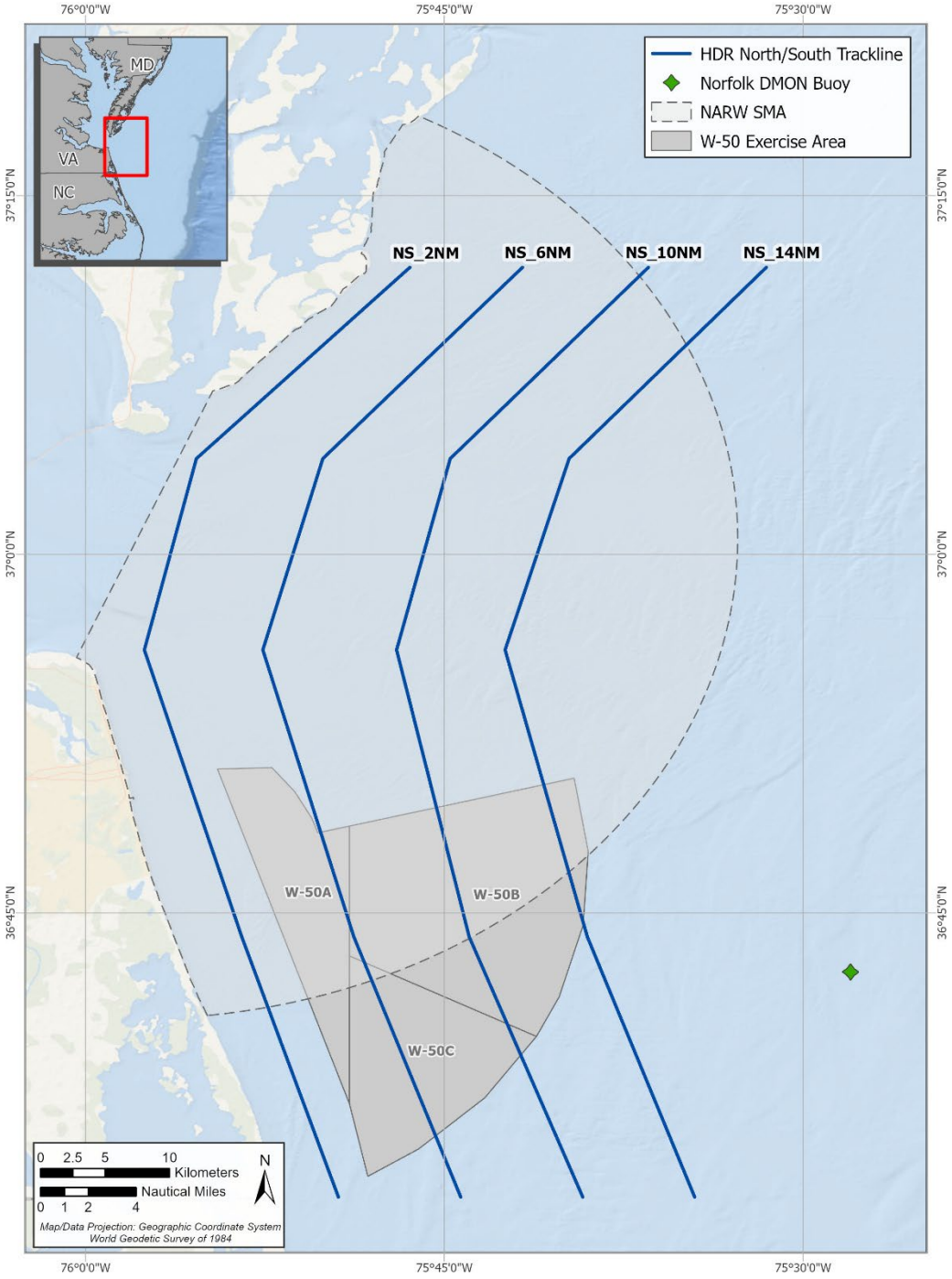

Figure 2. HDR Inc. aerial north-south tracklines at 2, 6, 10, and 14 nm from shore.

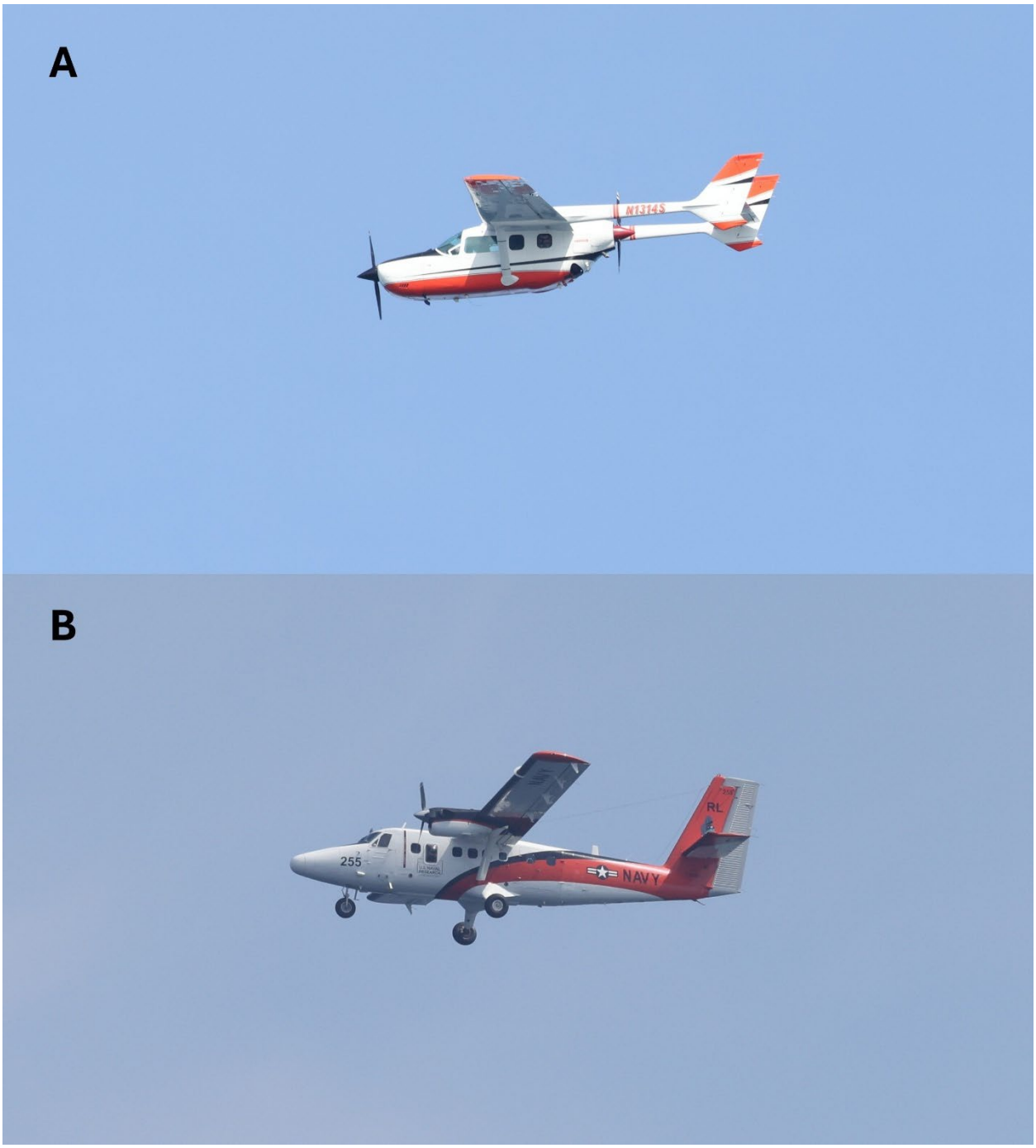

Figure 3. Primary survey aircraft: (A) Cessna 337 Skymaster; Nimbus Aerial Solutions; (B) DHC-6 Twin Otter; Scientific Development Squadron (VXS) 1 – U.S. Naval Research Laboratory.

Observers continuously scanned the trackline and used an inclinometer to obtain a vertical angle to a sighting when a detection was made within the observer's field of view. Survey data were collected on an Apple® iPad using COMPASS (Richlen et al. 2019). The plane would break from the trackline when a sighting of interest was made to allow for photographs and additional data collection. Photographs were taken with a Canon 7D Mark II and Canon 100- to 400-millimeter zoom lens of all baleen whale sightings when feasible and were used to verify species and identify individual NARWs. The camera was equipped with a Canon Wi-Fi Adapter W-E1 card, which allowed observers to connect a phone to the camera via the Canon Camera Connect app and to download high-resolution photographs in near real-time for sharing and identification purposes.

Photographs of NARWs were provided to Florida Fish and Wildlife Conservation Commission colleagues for near real-time photo-ID assistance to determine if an individual NARW was a tagging candidate for the vessel field team. All baleen whale sightings were relayed to the vessel team in real time; when a NARW was observed, the plane would stay with the sighting and circle until the vessel team was on site. Once the vessel team was on site, the plane would circle a larger area around the original sighting to see if other NARWs were present before resuming tracklines. HDR Inc. researchers leveraged sightings from both the Azura and CMARI aerial survey teams whenever possible. Post-survey, all surveyed tracklines and NARW sightings were uploaded and shared on WhaleMap (Johnson et al. 2021).

3. Results

Twenty-four aerial surveys were flown during the 2024/25 field season, covering 21,292 km of trackline with more than 100 hours of survey effort (**Table 1**, **Figure 4**). The first aerial survey of the 2024/25 field season occurred on 19 November 2024, and the last survey occurred on 23 September 2025. In total, 67 sightings of baleen whales occurred, including 8 NARW sightings totaling 23 individuals, 11 fin whale sightings totaling 17 individuals, 45 humpback whale sightings totaling 67 individuals, and 3 minke whale sightings totaling 3 individuals (**Table 2**) (see Aschettino et al. 2026 for additional details on baleen whale sightings and photo-ID). Of these sightings, one was recorded as multi-species and was composed of fin and humpback whales. The NARW sighting on 18 December 2024 was the first documentation of adult female #4540/Cavatappi with her first known calf (**Table 2**; NOAA 2026a). Previously entangled adult male NARW #3301/Neptune was seen gear-free on 25 January 2025 in Virginia, after being documented with an entanglement in Canada in August 2024 (**Table 2**; NOAA 2026b).

In total, 12 sightings of deep-diving whales were recorded, including 8 sperm whale sightings totaling 14 individuals, 2 goose-beaked whale (*Ziphius cavirostris*) sightings totaling 4 individuals, 1 Sowerby's beaked whale (*Mesoplodon bidens*) sighting of 2 individuals, and 1 *Kogia* sp. sighting of 2 individuals, during aerial surveys that extended out to deeper waters beyond the shelf break (**Table 3**) (see Engelhaupt et al. 2026 for additional details on sperm whale sightings and photo-ID). Additionally, one deceased short-finned pilot whale (*Globicephala macrorhynchus*) was observed with an entanglement on 8 May 2025. Sighting information and photographs of the individual were shared with the Virginia Aquarium Stranding Response Program post-survey.

Sightings of dolphins, including bottlenose (*Tursiops* sp.), common (*Delphinus delphis*), striped (*Stenella coeruleoalba*), Atlantic spotted (*Stenella frontalis*), and Risso's (*Grampus griseus)* dolphins, as well as pilot whales (*Globicephala* sp.), harbor porpoise (*Phocoena phocoena*), great white sharks (*Carcharodon carcharias*), basking sharks (*Cetorhinus maximus*), and ocean sunfish (*Mola mola*) occurred during aerial surveys but were not always recorded; therefore, these are not reported on further herein.

Table 1. Summary of aerial survey effort off Virginia Beach, Virginia, for the 2024/25 field season.

Date	Aircraft Type	# of Flights	Survey Time (min)	Survey Distance (km)	Survey Area	Total # of Sightings	Total # of Individuals
11/19/2024	Skymaster	1	315	1,033	Nearshore/Mid-shelf	0	0
11/25/2024	Skymaster	1	361	1,164	Nearshore/Mid-shelf	7	9
12/7/2024	Skymaster	1	299	953	Nearshore	4	4
12/10/2024	Skymaster	1	252	838	Nearshore/Mid-shelf	1	1
12/18/2024	Skymaster	1	278	934	Nearshore/Mid-shelf/Offshore	2	4
12/27/2024	Skymaster	2	305	1,022	Nearshore/Mid-shelf	2	3
1/3/2025	Skymaster	1	108	352	Nearshore/Mid-shelf	0	0
1/17/2025	Skymaster	1	293	966	Nearshore/Mid-shelf	3	4
1/25/2025	Skymaster	1	249	853	Nearshore/Mid-shelf	5	14
1/27/2025	Skymaster	1	274	925	Nearshore/Mid-shelf	7	10
1/30/2025	Skymaster	1	331	1,086	Nearshore/Mid-shelf/Offshore	6	16
2/18/2025	Skymaster	1	362	1,183	Nearshore/Mid-shelf	1	1
2/23/2025	Skymaster	1	377	1,213	Nearshore/Mid-shelf/Offshore	4	4
2/25/2025	Twin Otter	1	239	784	Nearshore/Mid-shelf	2	3
2/26/2025	Twin Otter	1	272	885	Nearshore/Mid-shelf/Offshore	1	3
3/3/2025	Twin Otter	1	302	975	Nearshore/Mid-shelf	4	4
3/10/2025	Skymaster	1	301	984	Nearshore/Mid-shelf/Offshore	1	6
3/19/2025	Skymaster	1	319	1,010	Nearshore/Mid-shelf/Offshore	12	20
5/8/2025	Twin Otter	1	293	979	Mid-shelf/Offshore	3	5
6/3/2025	Skymaster	1	232	913	Mid-shelf/Offshore	6	10
7/14/2025	Twin Otter	1	241	792	Mid-shelf/Offshore	6	8
9/19/2025	Twin Otter	1	174	589	Offshore	1	1
9/23/2025	Twin Otter	1	250	859	Mid-shelf/Offshore	1	2
Totals	—	**24**	**6,427**	**21,292**	**—**	**79**	**132**

Key: min = minute(s)

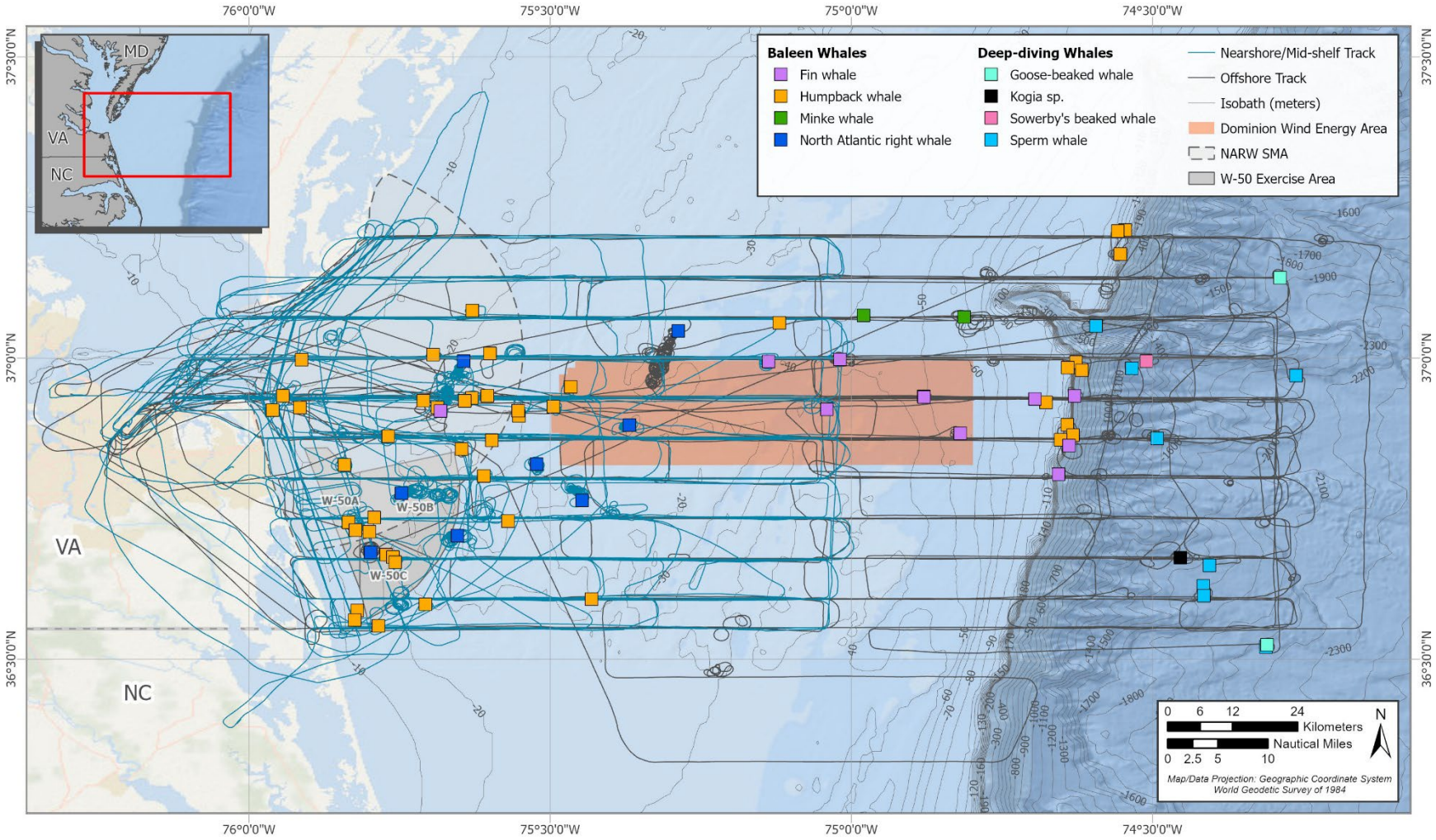

Figure 4. **Aerial survey tracks (teal and gray), with locations of all fin (*n*=11), humpback (*n*=45), minke (*n*=3), North Atlantic right (*n*=8), goose-beaked (*n*=2), *Kogia* sp. (*n*=1), Sowerby's beaked (*n*=1), and sperm (*n*=8) whale sightings for the 2024/25 field season.**

Table 2. Summary of baleen whale sightings off Virgina Beach, Virginia, for the 2024/25 field season.

Date	# Eg Sightings	# Eg Individuals	Eg ID #/Name	# Bp Sightings	# Bp Individuals	# Mn Sightings	# Mn Individuals	# Ba Sightings	# Ba Individuals
11/25/2024	—	—	—	—	—	7	9	—	—
12/7/2024	1[a]	1	#3950	—	—	3	3	—	—
12/10/2024	—	—	—	—	—	1	1	—	—
12/18/2024	1	2	#4540/Cavatappi; 2025CalfOf4540	—	—	—	—	—	—
12/27/2024	1	1	2024CalfOf3320	—	—	1	2	—	—
1/17/2025	1	1	2024CalfOf3320	—	—	2	3	—	—
1/25/2025	1[a]	3	#1706/Pencil; #3934; #4146	1	2	2	2	—	—
	1	7	#3301/Neptune; #3821/Zigzag; #4360/Musketeer; #4523/Beaker; #5104/Wall-E; #5190; #5311(2023CalfOf1711)						
1/27/2025	1	2	#3903/Taffy; #4980/Coral	—	—	6	8	—	—
1/30/2025	—	—	—	1	3	5	13	—	—
2/18/2025	—	—	—	—	—	1	1	—	—
2/23/2025	—	—	—	1	1	2	2	—	—
2/25/2025	—	—	—	1	2	1	1	—	—
2/26/2025	—	—	—	1	3		—	—	—
3/3/2025	—	—	—	—	—	4	4	—	—
3/10/2025	1	6	#2406/Hammer; #2795; #3232/Lobster; #3423/Epic; #3545; #4220/Kermit	—	—	—	—	—	—
3/19/2025	—	—	—	1	1	9	17	2	2
6/3/2025	—	—	—	2	2	1	1	—	—
7/14/2025	—	—	—	3	3	—	—	1	1
Totals	**8**	**23**	**—**	**11**	**17**	**45**	**67**	**3**	**3**

Key: Ba = *Balaenoptera acutorostrata* (minke whale); Bp = *Balaenoptera physalus* (fin whale); Eg = *Eubalaena glacialis* (right whale); ID = Identification Number; Mn = *Megaptera novaeangliae* (humpback whale)

[a] Sighting cued by Azura aerial team

Table 3. Summary of deep-diving whale sightings off Virgina Beach, Virginia, for the 2024/25 field season.

Date	# Pm Sightings	# Pm Individuals	# Zc Sightings	# Zc Individuals	# Mb Sightings	# Mb Individuals	# K sp. Sightings	# K sp. Individuals
12/18/2024	1	2	—	—	—	—	—	—
2/23/2025	1	1	—	—	—	—	—	—
5/8/2025	2	3	1	2	—	—	—	—
6/3/2025	3	7	—	—	—	—	—	—
7/14/2025	—	—	1	2	1	2	—	—
9/19/2025	1	1	—	—	—	—	—	—
9/23/2025	—	—	—	—	—	—	1	2
Totals	**8**	**14**	**2**	**4**	**1**	**2**	**1**	**2**

Key: K sp. = *Kogia* sp. (dwarf or pygmy sperm whale); Mb = *Mesoplodon bidens* (Sowerby's beaked whale); Pm = *Physeter macrocephalus* (sperm whale); Zc = *Ziphius cavirostris* (goose-beaked whale)

4. Discussion

The addition of aerial surveys to complement vessel field work for the Mid-Atlantic Baleen Whale Monitoring Project and Offshore Cetacean Study have proven extremely beneficial by (1) providing greater coverage of the study area; (2) locating and identifying individuals and aggregations of critically endangered NARWs; and (3) working with the vessel team to maximize sighting opportunities and photo-ID, photogrammetry, and tagging efforts. The plane's ability to survey the wider area in the vicinity of an initial NARW sighting, as well as the greater study area as a whole, has yielded additional sightings when the vessel team's efforts become focused on a target sighting. Aerial photographs of NARWs are beneficial for identification purposes and are useful for colleagues that provide near real-time photo-ID assistance, which in turn helps determine if an individual NARW is a tagging candidate and ultimately directs the vessel team's efforts. The incorporation of a Starlink Mini unit and the Canon Camera Connect app during the 2024/25 field season allowed for near-real time sharing of high-quality photographs, which greatly improved photo-ID and tagging coordination efforts in the field. Additionally, the aerial team's perspective allows for NARW behavioral observations that may not be obvious from the vessel, such as subsurface and social behaviors. During recent field seasons, sightings of NARWs ranged from singles to groups of 14 individuals, including whales of both genders and all age classes, engaged in various behaviors, including traveling, socializing, and feeding (Aschettino et al. 2023, 2024a, 2024b, 2025a, 2026; A. Engelhaupt et al. 2023, 2025; Ozog and Engelhaupt 2025). Overall, these efforts have begun to fill critical data gaps in NARW habitat use and distribution and to highlight the importance of the Mid-Atlantic as more than just a migratory corridor.

The waters off Virginia and the mouth of the Chesapeake Bay are used extensively for commercial shipping, recreational and commercial fishing, wind energy development, and U.S. Navy training exercises. From 1 November to 30 April, a NARW Seasonal Management Area (SMA) is in place from the mouth of the Chesapeake Bay out to 37 km from shore (NOAA 2026c). Within the SMA, a 10-knot vessel speed restriction is in place for vessels of 65 feet (19.8 m) or longer. However, the majority of NARW sightings during the 2022/23 season (Aschettino et al. 2024b), all during the 2023/24 season (Aschettino et al. 2025b; Ozog and Engelhaupt 2025), and the majority during the 2024/25 season occurred outside the SMA, indicating that current conservation measures do not offer sufficient protection within the region (**Figure 4**).

When a group of three or more NARWs is visually detected, a Dynamic Management Area (DMA) is created (NOAA 2026c). Within a DMA, mariners are encouraged to reduce speed to 10 knots while transiting through the area or to avoid the area altogether. However, unlike SMAs, DMA speed restrictions are voluntary and do not guarantee additional protection to whales within the area. During the 2024/25 field season, one HDR Inc. aerial sighting of six NARWs triggered a DMA offshore of Virginia near the Dominion Wind Energy Area. One HDR Inc. aerial sighting of seven individuals occurred within the SMA. Additionally, HDR Inc. responded to a sighting of three NARWs originally sighted by Azura within the Dominion Wind Energy Area, which did trigger a DMA.

Since 2017, an Unusual Mortality Event (UME) has been ongoing for NARWs due to increased cases of mortality, serious injury, and morbidity, of which most are attributed to fishing gear entanglements or vessel strikes (NOAA 2026d). In February 2023, the carcass of adult male NARW #3343 washed up on a beach near the Chesapeake Bay Bridge Tunnel in Virginia Beach, and necropsy results indicated he "suffered a catastrophic blunt force traumatic injury, which impacted a large portion of the spinal column. The injuries are consistent with a vessel strike" (NOAA 2026e). In March 2024, the HDR Inc. aerial team first documented the carcass of adult female NARW #1950, which was a significant finding for the UME. It is estimated that only approximately 70 reproductively active females remain in the NARW population (Linden 2024), and the loss of one has significant impacts on population recovery. Additionally, NARW #1950 was a mother from the 2024 calving season and had a dependent calf, which was not relocated near the carcass. The calf was last seen in February 2024 on the calving grounds (NOAA 2026f). NOAA released a statement on the necropsy indicating that "preliminary findings included catastrophic injuries with a dislocation of the whale's spine and fractures to all vertebrae in the lower back. These findings are consistent with blunt force trauma from a vessel strike prior to death" (NOAA 2026f). These necropsy results, coupled with most NARW sightings from HDR Inc. aerial and vessel surveys over the past three field seasons occurring outside the SMA (Aschettino et al. 2024b, 2025b, 2026; Engelhaupt et al. 2025; Ozog and Engelhaupt 2025), further emphasize the vulnerability of NARWs to vessel strikes in the Mid-Atlantic.

Aerial surveys during the 2025/26 field season will continue to coordinate efforts with the vessel team to maximize additional opportunities to deploy satellite-linked telemetry and digital archival tags on baleen and deep-diving whales within the VACAPES OPAREA. For additional details on the Mid-Atlantic Nearshore and Mid-Shelf Baleen Whale Monitoring Project, see Aschettino et al. (2026); and on the Offshore Cetacean Study, see Engelhaupt et al. (2026).

Additionally, prior to the start of aerial surveys for the 2025/26 field season, HDR Inc. will coordinate with modelers from the Duke University Marine Geospatial Ecology Lab (MGEL). MGEL has previously produced a series of habitat-based marine mammal density models for over 30 species and multi-species guilds for the U.S. East Coast and the U.S. Navy's Atlantic Fleet Training and Testing area (Roberts et al. 2016, 2023), ultimately supporting the U.S. Navy's environmental compliance efforts. These models are built upon data collected during systematic aerial and vessel-based surveys and will be updated in the coming years to include new and more recent data sources. While the current HDR Inc. aerial surveys are not strictly systematic in design, HDR Inc. will work with MGEL to discuss survey and data collection protocols to ensure the data collected during these surveys can be used to the maximum extent possible for future density model updates.

5. References

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