

Seal Haul-out Aerial Surveys in Virginia 2025

TECHNICAL REPORT



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Harbor seals (*Phoca vitulina*) hauled out at Little Inlet on the Eastern Shore of Virginia, photographed by Jess Ozog (HDR Inc.), 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

°N	degrees North
°W	degrees West
CBBT	Chesapeake Bay Bridge Tunnel
HO	hauled out
IW	in-water
km	kilometer(s)
m	meter(s)
min	minute(s)
Mn	<i>Megaptera novaeangliae</i>
NASA	National Aeronautics and Space Administration
Pv	<i>Phoca vitulina</i>
T sp.	<i>Tursiops</i> sp.
U.S.	United States



1. Introduction

Harbor seals (*Phoca vitulina vitulina*) are found year-round along the coast of eastern Canada and Maine as well as seasonally in the Mid-Atlantic, as far south as Cape Hatteras, North Carolina, during winter and spring ([Hayes et al. 2022](#); [Pepper et al. 2024](#)). Gray seals (*Halichoerus grypus atlantica*) range from eastern Canada to the northeastern United States (U.S.), with seasonal winter sightings occurring as far south as Virginia ([Guins and Rees 2025](#); [Hayes et al. 2024](#); [Jones 2024](#)).

The waters off southeastern Virginia and the lower Chesapeake Bay are used regularly for training and testing activities to maintain military preparedness. Seals that seasonally use these habitats may be exposed to these activities; therefore, the U.S. Navy has been studying seals within the area since 2014 to assess and mitigate any potential impacts ([Jones 2024](#)). To date, these efforts have been concentrated at the two known haul-out locations in Virginia: the Chesapeake Bay Bridge Tunnel (CBBT) rock armor islands and Little Inlet on the Eastern Shore. The CBBT has four rock armor islands positioned at the mouths of the two tunnels, and the Eastern Shore is a series of barrier islands composed of mud banks and salt marsh.

Haul-out surveys began at the CBBT islands and Eastern Shore in 2014 and 2016, respectively ([Jones 2024](#)). Beginning in 2019, time-lapse cameras were installed at both haul-out sites and have proven to be an effective, low-cost tool for daily monitoring of seal haul-out activity ([Guins and Rees 2025](#)). Additionally, satellite-linked telemetry tags were successfully deployed on harbor seals at the Eastern Shore in 2018, 2020, and 2022 to gain a better understanding of individual seal movements, habitat use, and dive behavior ([Ampela et al. 2023](#)). These efforts have demonstrated that harbor seals arrive in southeastern Virginia in late October/early November and stay within the area through late April/early May. Recent attempts to develop local abundance estimates from data collected during these efforts have highlighted the need to determine if the CBBT islands and Little Inlet are the only two locations where seals regularly haul out in Virginia.

In order to locate any undocumented seal haul-out sites in Virginia, as well as provide additional data collection at the two known haul-out sites, aerial surveys were implemented and flown along the entire Virginia coast during the winter 2025 field season.

2. Methods

Researchers from HDR Inc. and Naval Facilities Engineering Systems Command Atlantic flew a series of surveys along the Virginia coast during peak seal presence during winter 2025 and prioritized two flights per month from January through March. Some flights were extended into southern Maryland along Assateague Island National Seashore. When possible, survey flights were coordinated with baleen whale aerial surveys ([Ozog and Engelhaupt 2025](#)) to take advantage of times when an aircraft was already repositioned to the area. The survey area included the entire Virginia outer coastline, all substantial inlets, and the CBBT islands. When on the outer coastline, the aircraft was positioned at an approximately 50- to 100-meter (m) offset from the beach to avoid flying directly over seals. When on the inner portion of the barrier

islands on the Eastern Shore, the aircraft would follow major channels to avoid flying over as much land as possible to avoid any potential disturbance to seal haul-outs. These surveys were non-systematic and followed the coastline; therefore, a set of tracklines was not established. Optimal viewing conditions were Beaufort sea state of 3 or lower and 20-knot and below wind speeds. The airspace off the Virginia coast is used regularly by the U.S. Navy, as well as the National Aeronautics and Space Administration (NASA). At the southern end of the survey area, the survey plane coordinated with and when required, would deviate around Naval Air Station Oceana and restricted area R-6606. At the northern end of the survey area, the plane would often increase altitude and circle until communications could be established with NASA's Wallops Flight Facility and when required, would deviate offshore to avoid sections of restricted area R-6604.

Survey flights conducted by HDR Inc. departed from Signature Flight Support at Norfolk International Airport in Norfolk, Virginia. All flights were flown in a Cessna 337 Skymaster (**Figure 1**) by Nimbus Aerial Solutions (Beaufort, North Carolina) with two pilots and two observers. Surveys were flown between 213 and 244 m altitude and 100-knot (185 kilometer [km]/hour) speed. Observers continuously scanned the coastline with the naked eye, as well as image-stabilized binoculars, 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](#)). When feasible, the CBBT islands and Little Inlet were circled to allow for photographs and additional data collection of the known haul-out sites. The number of seals both hauled out and in the water was recorded for each sighting. Photographs were taken with a Canon 7D Mark II and Canon 100- to 400-millimeter zoom lens of all seal sightings and were used to verify species and count individuals. Post-survey, the number of seals at each sighting were verified from photographs and the initial sighting entry was updated accordingly in the database.



Figure 1. Primary survey aircraft (Cessna 337 Skymaster; Nimbus Aerial Solutions).

3. Results

Nine aerial surveys were flown during the winter 2025 field season, covering 2,734 km with more than 14.5 hours of survey effort (**Table 1, Figure 2**). The first aerial survey of the winter 2025 field season occurred on 03 January 2025, and the last survey occurred on 28 April 2025. Two survey flight attempts were made on 03 February 2025; however, a full survey of the Virginia coast was ultimately not conducted that day due to poor visibility and fog and Little Inlet was not surveyed. In total, 14 sightings of marine mammals occurred, including 12 harbor seal sightings composed of 223 individuals, 1 humpback whale (*Megaptera novaeangliae*) sighting composed of a single individual, and 1 deceased bottlenose dolphin (*Tursiops* sp.) sighting composed of a single individual (**Table 2, Table 3**). Photos and sighting information of the deceased dolphin were shared with the Virginia Aquarium's Stranding Response Program post-survey. No gray seals were documented during these aerial surveys. No seals were observed during the surveys on 28 March 2025 and 28 April 2025 (**Table 1, Figure 3**). Of the 12 harbor seal sightings, 6 occurred at CBBT island 4, 5 occurred at Little Inlet, and 1 occurred at CBBT island 3 (**Table 3, Figure 3**). On surveys when both the CBBT islands and Little Inlet were surveyed, a higher abundance of seals was present at Little Inlet compared to the CBBT islands (**Table 3, Figure 3**). Harbor seals were observed both hauled out and in the water during eight sightings, only hauled out at one sighting, and only in the water at three sightings (**Table 3**). The single harbor seal sighting that occurred at CBBT island 3 was of seals only in the water (**Table 3**). No seals were observed flushing or reacting to the presence of the circling aircraft. Sightings of live bottlenose dolphins occurred during most aerial surveys but were not recorded; therefore, they are not reported on further here.

Table 1. Summary of aerial survey effort off Virginia during the winter 2025 field season.

Date	# of flights	Survey time (min)	Distance surveyed (km)	Total # of sightings
1/3/2025	1	103	333	2
1/18/2025	1	159	516	3
2/3/2025 ^a	2	19	42	1
2/10/2025	1	127	392	2
2/28/2025	1	115	359	3
3/19/2025	1	114	338	2
3/28/2025	1	114	351	0
4/28/2025	1	132	403	1
Total	9	883	2,734	14

Key: # = number; km = kilometer(s); min = minute(s)

^a Full survey aborted due to weather

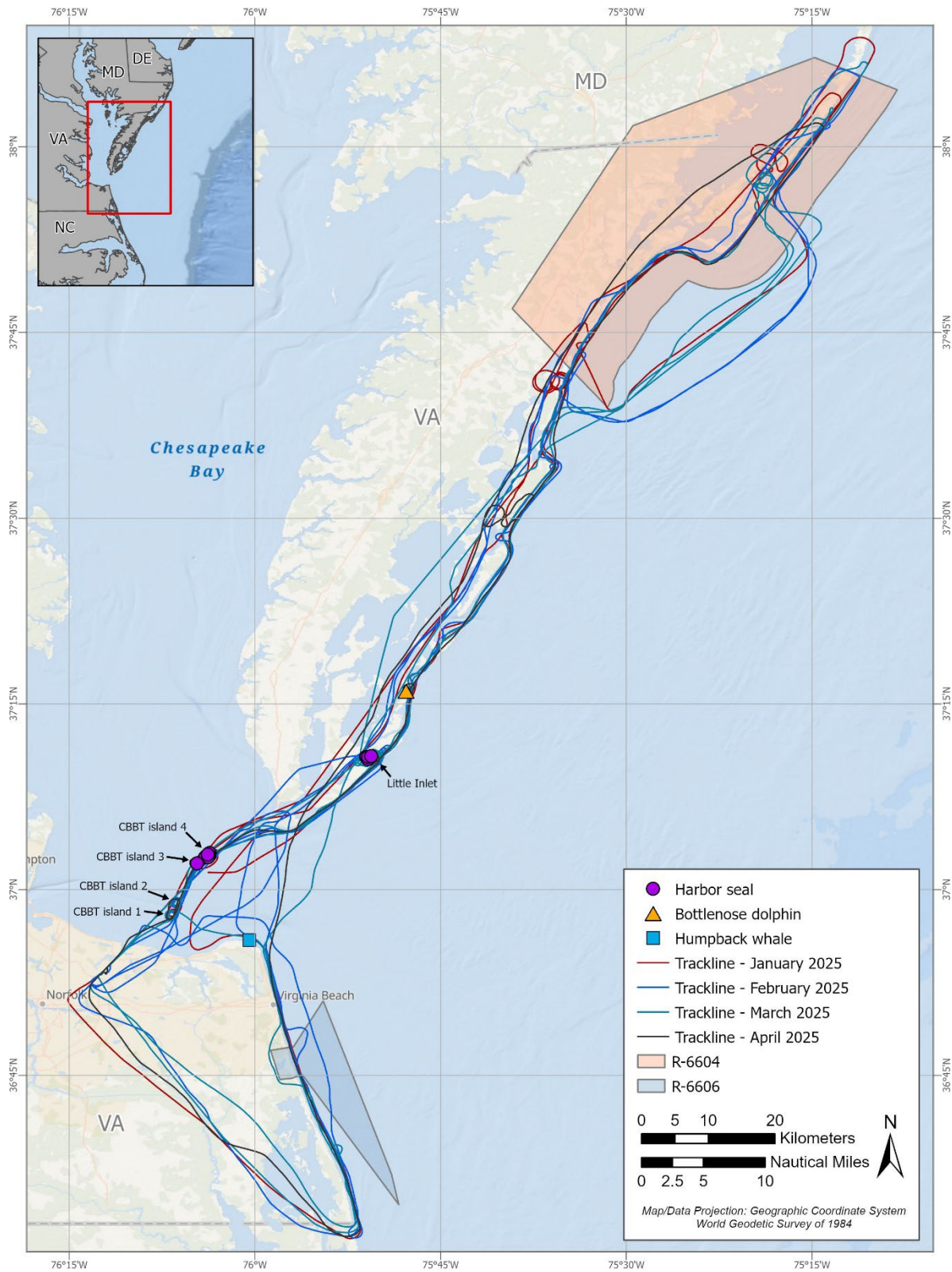


Figure 2. Aerial survey tracks with locations of all harbor seal ($n = 12$), humpback whale ($n = 1$), and deceased bottlenose dolphin ($n = 1$) sightings during the winter 2025 field season.

Table 2. Summary of marine mammal sightings off Virginia during the winter 2025 field season.

Date	# sightings Pv	# individuals Pv	# sightings Mn	# individuals Mn	# sightings T sp.	# individuals T sp.
1/3/2025	2	57	0	0	0	0
1/18/2025	2	47	1	1	0	0
2/3/2025	1	16	0	0	0	0
2/10/2025	2	38	0	0	0	0
2/28/2025	3	58	0	0	0	0
3/19/2025	2	7	0	0	0	0
3/28/2025	0	0	0	0	0	0
4/28/2025	0	0	0	0	1	1 ^a
Total	12	223	1	1	1	1

Key: # = number; Mn = *Megaptera novaeangliae* (humpback whale); Pv = *Phoca vitulina* (harbor seal); T sp. = *Tursiops* sp. (bottlenose dolphin)

^a Deceased

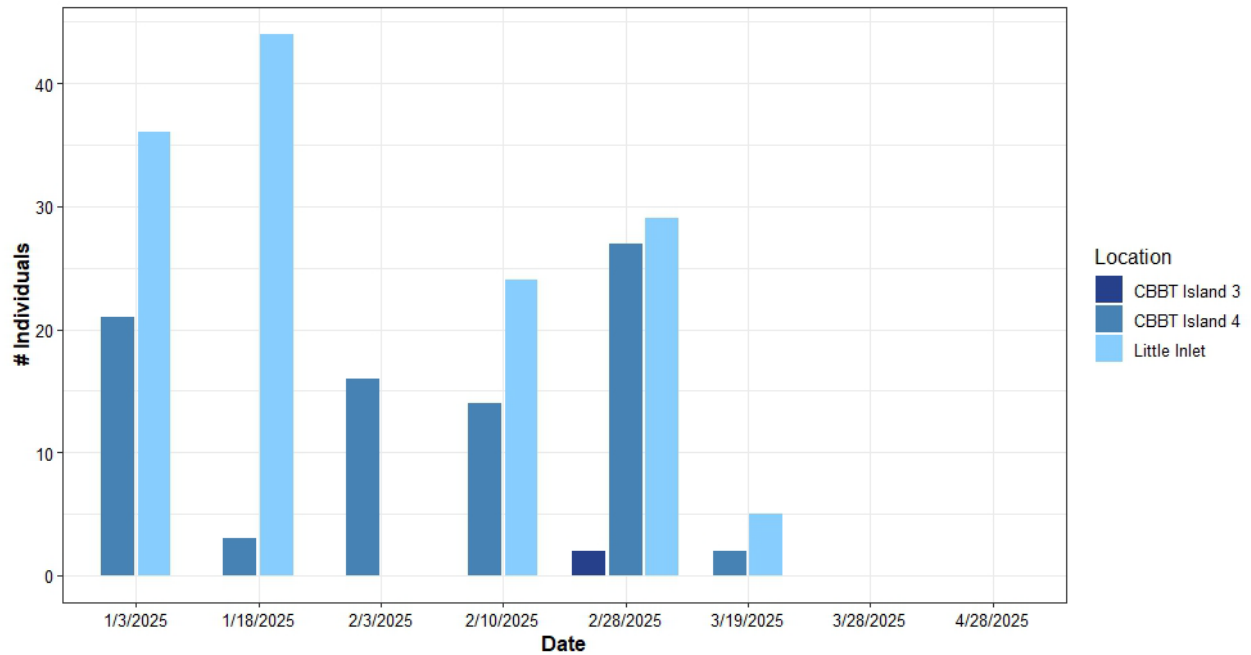


Figure 3. Number of seals hauled out by location by date throughout winter 2025. Little Inlet was not surveyed on 2/3/2025 due to weather. No seals were observed on 3/28/2025 or 4/28/2025.

Table 3. Marine mammal sightings off Virginia during the winter 2025 field season.

Date	Sighting Time (local)	Scientific Name	Common Name	# Individuals	Latitude (°N)	Longitude (°W)	Location	Behavior (HO/IW)
1/3/2025	11:08	<i>Phoca vitulina</i>	Harbor seal	36	37.1783	75.8478	Little Inlet	HO/IW
1/3/2025	12:33	<i>Phoca vitulina</i>	Harbor seal	21	37.0438	76.0674	CBBT island 4	HO
1/18/2025	8:35	<i>Megaptera novaeangliae</i>	Humpback whale	1	36.9320	76.0076	Cape Henry	—
1/18/2025	8:52	<i>Phoca vitulina</i>	Harbor seal	44	37.1790	75.8501	Little Inlet	HO/IW
1/18/2025	10:47	<i>Phoca vitulina</i>	Harbor seal	3	37.0464	76.0626	CBBT island 4	IW
2/3/2025	13:32	<i>Phoca vitulina</i>	Harbor seal	16	37.0491	76.0610	CBBT island 4	HO/IW
2/10/2025	13:10	<i>Phoca vitulina</i>	Harbor seal	14	37.0459	76.0616	CBBT island 4	HO/IW
2/10/2025	13:23	<i>Phoca vitulina</i>	Harbor seal	24	37.1754	75.8480	Little Inlet	HO/IW
2/28/2025	13:13	<i>Phoca vitulina</i>	Harbor seal	2	37.0354	76.0778	CBBT island 3	IW
2/28/2025	13:14	<i>Phoca vitulina</i>	Harbor seal	27	37.0438	76.0629	CBBT island 4	HO/IW
2/28/2025	13:30	<i>Phoca vitulina</i>	Harbor seal	29	37.1785	75.8476	Little Inlet	HO/IW
3/19/2025	15:32	<i>Phoca vitulina</i>	Harbor seal	2	37.0474	76.0636	CBBT island 4	HO/IW
3/19/2025	15:50	<i>Phoca vitulina</i>	Harbor seal	5	37.1797	75.8434	Little Inlet	IW
4/28/2025	8:52	<i>Tursiops</i> sp.	Bottlenose dolphin	1 ^a	37.2684	75.7966	Wreck Island	—

Key: CBBT = Chesapeake Bay Bridge Tunnel; HO = hauled out; °N = degrees North; °W = degrees West; IW = in-water

^a Deceased

4. Discussion

Results of these surveys further support the presence of two known haul-out sites in Virginia. No new haul-out sites were identified along the Virginia coast during winter 2025. Previous haul-out surveys and camera trap efforts primarily consisted of harbor seal sightings, with only occasional gray seal sightings ([Guins and Rees 2025](#); [Jones 2024](#)). Similarly, harbor seals were the only pinniped observed and recorded during these aerial surveys. Harbor seals have regularly been documented flushing in response to nearby and/or transiting vessels at both the CBBT and Little Inlet ([Guins and Rees 2025](#)). The time for seals to haul out again after disturbance has varied based on haul-out location, as well as varied from season to season, but on average, it takes multiple hours ([Guins and Rees 2025](#)). One sighting at CBBT island 4 and one sighting at Little Inlet consisted of low numbers of seals only in the water, which may have been due to flushing caused by vessel activity or disturbance earlier in the day. Seals did not react to the presence of the aircraft during these surveys. Additionally, the aerial perspective provided an unobstructed view for accurate seal counts. For all sightings, photographs were subsequently reviewed, and seal counts were higher in photographs compared to initial observations recorded in the field. The number of observed seals from the plane was similar to counts previously documented at the CBBT and Little Inlet, with generally a higher abundance of seals present at Little Inlet compared to the CBBT ([Guins and Rees 2025](#); [Jones 2024](#)).

Continued monitoring of these two haul-out sites will provide further information on site fidelity, behavior, and habitat use of pinnipeds in southeast Virginia and will continue to support U.S. Navy compliance and mitigation efforts within the area. Haul-out surveys have shown a higher number of seals using Little Inlet during recent seasons ([Jones 2024](#)), which could potentially be due to ongoing [tunnel expansion construction efforts](#) at CBBT islands 1 and 2. These local impacts should continue to be monitored, especially as construction efforts expand to CBBT islands 3 and 4 in the future. Additionally, rebounding gray seal populations in Canada may be causing the displacement of harbor seals in northern areas, potentially leading to an increase of their southward expansion into the Mid-Atlantic ([den Heyer et al. 2021](#); [Pace et al. 2019](#)). Future efforts to re-survey the entire Virginia coastline for seal haul-out sites may be warranted based on gray and harbor seal population trends.

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