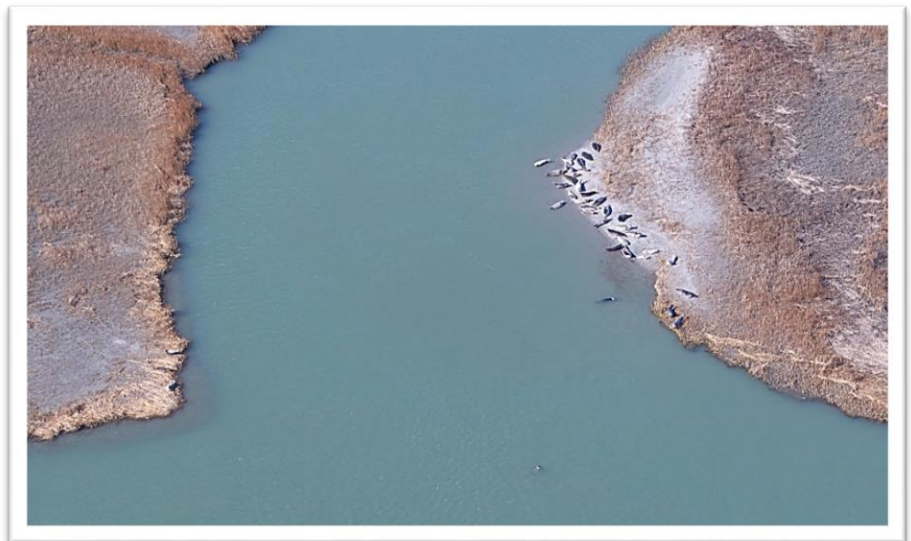


# Haul-out Counts and Photo-Identification of Pinnipeds in Chesapeake Bay and Eastern Shore, Virginia

## 2022-2024

*PROGRESS REPORT*



PREPARED BY

*Danielle V. Jones*

*Naval Facilities Engineering Systems Command Atlantic  
Norfolk, Virginia*



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Harbor seals (*Phoca vitulina vitulina*) hauled out at a survey site on the Eastern Shore, Virginia. Cover photo taken using an unmanned aircraft system (i.e., drone) by Zak Poulton, The Nature Conservancy, under NMFS General Authorization Permit #19826.

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## Acronyms and Abbreviations

ANOVA	analysis of variance
BSS	Beaufort sea state
CBBT	Chesapeake Bay Bridge Tunnel
CI	Confidence Interval
DWR	Virginia Department of Wildlife Resources
°F	degrees Fahrenheit
ft	foot or feet
GA	General Authorization for Scientific Research
ID	Identification or identifier
km	kilometer(s)
kts	knots
m	meter(s)
MLLW	Mean lower low water
mm	millimeter(s)
NAVFAC	Naval Facilities Engineering Systems Command
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
Photo-ID	Photo identification
SAR	Stock Assessment Report
TNC	The Nature Conservancy
U.S.	United States
UAS	Unmanned aircraft systems
UME	Unusual mortality event
USFF	United States Fleet Forces Command



# 1. Introduction and Background

Harbor seals (*Phoca vitulina vitulina*) are one of the world's most widely distributed pinniped species and are found in temperate to polar coastal waters of the northern hemisphere (Jefferson et al. 2015). Gray seals (*Halichoerus grypus atlantica*) are widely distributed over the continental shelf in cold temperate and sub-polar North Atlantic waters (Lesage and Hammill 2001). Both species are year-round coastal inhabitants in eastern Canada and New England, and occur seasonally in the mid-Atlantic United States (U.S.) between September and May (Hayes et al. 2022). Harbor seals move to northern areas for mating and pupping in the spring and summer, and return to southerly areas in the fall and winter. Harbor seals generally exhibit a southward movement from Maine and eastern Canada to southern New England and through the mid-Atlantic beginning in the fall (DeAngelis 2023; Rosenfeld et al. 1988). Gray seals inhabit northern areas from Massachusetts to Canada for mating and pupping in the winter, and range seasonally as far south as Virginia (Bowen et al. 2007; Hayes et al. 2022; Jones and Rees 2023).

Until 2018, National Oceanic and Atmospheric Administration (NOAA) Stock Assessment Reports (SARs) indicated that the gray seal and harbor seal populations range from Labrador to New Jersey; with scattered sightings and strandings reported as far south as North Carolina for gray seals and Florida for harbor seals (Hayes et al. 2018). Other researchers have reported that harbor and gray seal distribution along the U.S. Atlantic coast appears to be expanding or shifting (den Heyer et al. 2021; DiGiovanni et al. 2011; Johnston et al. 2015; DiGiovanni et al. 2018). In Virginia, reports from local anglers, Chesapeake Bay Bridge Tunnel (CBBT) staff, and the Virginia Aquarium & Marine Science Center indicated that seals have been using the CBBT rock armor or "islands" to haul out (i.e., rest) on for more than a decade. Additionally, pinniped stranding numbers have generally increased in Virginia since the early 1990s, with 2022 being an average year of four strandings compared to the prior 10 years, which varied from two to nine strandings (Epple et al. 2023). The range expansion of the harbor seal is not necessarily indicative of an increasing population; recent population trends and abundance estimates suggest the population is stable (Hayes et al. 2022; Sjoumney et al. 2021). Rather, it may be due to rapid growth of gray seal populations in Canada (e.g., Sable Island) and now the Northeastern U.S. (den Heyer et al. 2021; Wood et al. 2022), which could be causing the displacement of harbor seals at haul-out sites due to physical interference or competitive exclusion (Cammen et al. 2018; Pace et al. 2019; Wood et al. 2019). Substantial increases in gray seal populations in Canada and the United Kingdom have been known to negatively impact harbor seal abundance in those areas (Bowen et al. 2003; Thompson et al. 2019).

Within the last decade, harbor seals have been observed returning seasonally, from fall to spring, to haul-out locations in coastal Virginia, and gray seals are occasionally observed during the winter, but not on a consistent basis (Ampela et al. 2023; Jones and Rees 2023). More recently, NOAA SARs indicate the southern extent for the harbor seal population range is now North Carolina. However, the geographic range for the gray seal population remains the same (Hayes et al. 2022).

Since this project's commencement, there have been 10 dedicated field seasons of research from 2014-2024. During this time, we have expanded the study to include partnerships with The Nature Conservancy (TNC) and the Virginia Department of Wildlife Resources (DWR), as well as Contractor support from HDR, Inc., which allowed for an increase in survey area coverage beginning in 2016 with the addition of the Eastern Shore, Virginia.

The goal of this study is to document the presence and abundance of seals in Virginia and to gain an increased understanding of the seasonal occurrence, habitat use and haul-out patterns of seals near several important U.S. Navy installations, training and testing areas, and vessel transit routes. This report discusses the survey results for the 2022/2023 and 2023/2024 field seasons as well as the analyses conducted using data from the 2014-2024 field seasons.

Primary objectives of this project include:

- *assessing occurrence, movement, and haul-out patterns adjacent to Navy training and testing areas;*
- *the use of photo-identification methods to identify and compare individuals and assess site fidelity among haul-out site locations in the study area; and*
- *the use of mark-recapture and modeling methods to estimate local population size.*

This work is part of the U.S. Navy's Marine Species Monitoring program, supported by U.S. Fleet Forces Command, and is conducted in accordance with National Marine Fisheries Service (NMFS) General Authorizations (GA) 19826 and 25811. The data collected under this effort is being used to analyze and estimate potential impacts that U.S. Navy training and testing, installation construction (e.g. pile driving), and vessel-transiting activities may have on pinniped species and to develop mitigation options if appropriate.

## 2. Methods

### 2.1 Study Area

The study area consists of two general survey locations in southeastern Virginia (**Figure 1**): 1) in the lower Chesapeake Bay along the Chesapeake Bay Bridge Tunnel (CBBT) – from 2014 to present, and 2) the southeastern region of the Eastern Shore – from 2016 to present. The CBBT survey area is comprised of four haul-out sites (referred to as CBBT 1, CBBT 2, CBBT 3, and CBBT 4) along the bridge tunnel that span approximately 10 kilometers (km) from the most southern site (CBBT 1) to the most northern site (CBBT 4). The haul-out sites are on rock armor formations (commonly referred to as “islands”), which are intended to protect the tunnels as they go beneath the water (**Figure 2**).



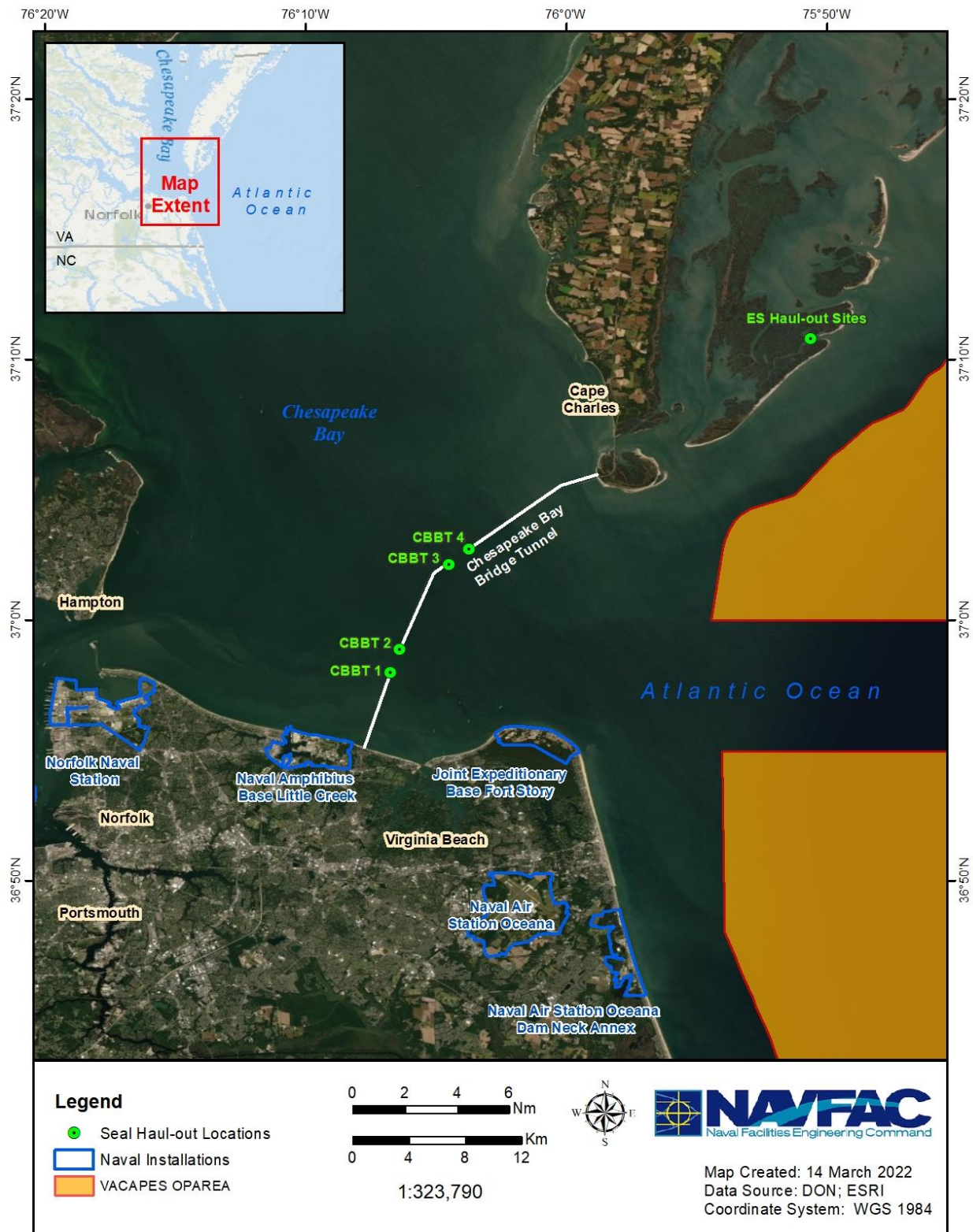


Figure 1. CBBT and Eastern Shore (ES) haul-out locations and their proximity to U.S. Naval Installations. OPAREA = Operating Area; VACAPES= Virginia Capes Range Complex.



**Figure 2.** Aerial view of a CBBT haul-out site. Seals generally haul out on the tip of the rock armor farthest from the road. Photo by Virginia Aquarium & Marine Science Center Foundation

The survey area on the Eastern Shore of Virginia was added to the project in the fall of 2016 in collaboration with TNC. The Eastern Shore survey area has several haul-out sites (about five main locations: A, B, C, D, and E) where seals have been observed (**Figure 3**). The haul-out sites are within a tidal salt marsh habitat, and are mainly comprised of mud banks with vegetation (**Figure 4**).



**Figure 3.** The five main seal haul-out locations on the Eastern Shore of Virginia



**Figure 4. Eastern Shore survey area with harbor seals hauled out on a mud bank. Photo by Danielle Jones, NAVFAC Atlantic under NMFS GA Permit #19826**

The straight line distance from the northernmost (i.e., the closest) CBBT haul-out site, CBBT 4, to the Eastern Shore survey area is approximately 27 km. Both survey areas are in close proximity (<100 km) to several major U.S. Navy installations (e.g., Norfolk Naval Station, Naval Amphibious Base-Little Creek, Joint Expeditionary Base-Fort Story, Naval Air Station Oceana, and Naval Air Station Oceana Dam Neck Annex) (**Figure 1**).

## 2.2 Survey Protocol

Based on sightings/stranding data, seals generally begin to arrive in Virginia in November, and depart the area by May, at the latest. Therefore, for each field season we started dedicated seal haul-out surveys in the fall (October/November) and ended in the spring (April/May), , conducting at least one additional survey at each survey area, when possible, after the first recorded absence of seals. This allowed for the documentation of the arrival and departure time period for the season.

For the 2022/2023 and 2023/2024 field seasons, systematic vessel-based counts were conducted with support from HDR, Inc. for the CBBT survey area and with TNC for the Eastern Shore survey area. The vessel surveys at the CBBT survey area were conducted using a 30-foot (ft) center console Sea Hunt boat, and the vessel surveys at the Eastern Shore survey area were conducted using a 19, 23, or 24-ft Carolina skiff (**Figure 5**). The survey crew consisted of one to two marine mammal observers, one data recorder, and one boat captain.



**Figure 5. Observers used a Carolina skiff (vessel) for the Eastern Shore haul-out counts. Photo by NAVFAC Atlantic**

We aimed to conduct vessel surveys at the CBBT and Eastern Shore survey areas at least two times per month during the field season. The number of survey days were dependent on weather, tides, and staff/survey vessel availability. Surveys were not conducted at either of the CBBT or Eastern Shore survey areas during inclement weather such as precipitation or high winds. Vessel-based counts at the CBBT and Eastern Shore survey areas were not conducted in Beaufort sea states higher than 3. With vessel access to the Eastern Shore survey area being restricted by tides, we were only able to conduct surveys during tidal heights of 0.1 ft (Mean Lower Low Water [MLLW]) or higher at that location.

Seals were recorded at each haul-out site using point sampling techniques (Raposa and Dapp 2009). The survey period consisted of three separate 2-minute counts (10 minutes apart) at each site to account for seals moving between the water and the haul-out sites or diving during a previous count. Counts were conducted using hand held binoculars (Fujinon 7x50 MTRC-SX or Canon 10x30 IS II Image Stabilizer). During each sampling period, the data recorder documented the survey start and end times, each count start time, the number of seals present, the species present, photo numbers, standardized animal behaviors and the presence of vessels at the site. The best estimate of seals in the water and hauled out was recorded separately during each count. For analysis purposes, the best total estimate (i.e., the highest count from all three counts) for the overall number of seals sighted (both in the water and hauled out) was used, consistent with similar studies by Grellier et al. (1996) and Pauli and Terhune (1987). Unless otherwise specified, seal count data should be interpreted as the best total estimate of seals present during the survey period.

During the 8-minute between-count breaks, one of the observers obtained images of the seals. A master photo capturing all of the seals on a haul-out was taken, along with photos of individual seals. A digital single-lens reflect camera (Nikon D7100 or Canon EOS R7) with a

zoom lens (ranging in size from 18-600 millimeter [mm]) was used to capture photos. Image frame numbers were recorded in order to be used later for photo-identification (photo-ID). Multiple photos of different views (head/neck region, dorsal, lateral, and ventral) of each seal were taken when possible in order to obtain quality photos of pelage (fur) patterns.

In the 2018/2019 season, we added the use of an unmanned aircraft system (UAS), i.e., drone, for the Eastern Shore survey area to help improve count data collected during vessel-based point counts. Depending on the haul-out site at this survey area, animals may be obscured to observers during vessel-based counts by creek banks, marsh vegetation and other animals, especially as the number of animals present in the survey area increases throughout the winter. The UAS provides a better visual perspective from which to capture photos and video as it allows for visual detection of all animals on a haul-out site during point counts (animals are less likely to be obscured if viewed from above), which should increase the accuracy of counts.

The UAS, a DJI Matrice 300 quadcopter with a Zenmuse X5 camera and Olympus 14-44mm zoom lens, was piloted by a certified UAS operator from TNC. The UAS was launched from the marsh or survey vessel, which was either idle on the water or anchored on a marsh bank, at about 800 meters (m) away from the haul-out survey area. The UAS was flown at an altitude of 60-120 m above ground level and at least 100 m away from a haul-out site. One UAS flight was comparable to a 2-minute count, since the UAS hovered over the haul-out sites and the camera was able to capture the same survey area as the observer team during a count. The UAS was only used in good weather conditions (e.g., no precipitation and winds less than 15 knots [kts]). For surveys where weather conditions were favorable, a count using the UAS was conducted by the pilot first followed by a vessel-based count by the observers. The animal count from the UAS footage was recorded after the vessel-based count in order to prevent bias in the data. For analysis purposes, the number of seals recorded during a drone count was compared to the counts recorded by the observers during the vessel surveys and considered for determining the best total estimate of the overall number of seals sighted (both in the water and hauled out) during a survey.

Environmental data was recorded prior to the start of each survey at each of the haul-out sites and later downloaded from the National Oceanic and Atmospheric Association's (NOAA) Tides & Currents page (<https://tidesandcurrents.noaa.gov/>). Data were collected on the following environmental variables: air temperature (°F), water temperature (°F), wind speed (kts), wind direction (cardinal and degrees), wind gusts (kts), visibility, tidal height (ft) (MLLW), Beaufort sea state (BSS), glare (%), and cloud cover (%).

Similar to previous field seasons, environmental data, with the exception of visibility, BSS, cloud cover, and glare were acquired from several NOAA weather stations for the 2022-2024 seasons. For the CBBT survey area, environmental data (with the exception of water temperature) were collected from NOAA weather station (ID 8638901) - CBBT, Chesapeake Channel, located at 37.032 N, 76.083 W. Water temperature for the CBBT survey area was collected from NOAA weather station (ID 8632200) - Kiptopeke, Virginia, located at 37.165 N, 75.988 W, or directly from the survey vessel's transponder, due to the water sensor from the CBBT, Chesapeake Channel station being disabled. Looking at the average monthly water

temperatures for the previous field seasons (2014-2017), the averages at the Kiptopeke station differed by only 1-2 degrees compared to the CBBT, Chesapeake Channel station, and so data was representative of the CBBT survey area. For the Eastern Shore survey area, environmental data were collected from the Kiptopeke and CBBT, Chesapeake Channel stations as well as NOAA weather station (ID 8631874) - Smith Island (Coast Guard Station), Virginia (via <https://tides4fishing.com>), located at 37.117 N, 75.917 W. Environmental data may be used to investigate relationships between seal presence and environmental variables in future reports.

## 2.3 Photo Identification (Photo-ID)

Upon returning from the field, images were cropped and graded based on photographic quality and distinctiveness of the pelage pattern (**Table 1**). Image criteria was based on image grading methods used by Balmer et al. (2008) and Forcada and Aguilar (2000). In order to standardize methods for photo-ID across similar projects, and attempt to uniquely identify more individual seals, the photo-ID criteria (see below) was updated after the 2015/2016 progress report (Rees et al. 2016). All photos have been reassessed using these new criteria, and consequently images from the 2014/2015 field season were not included as they did not meet the quality standards of the updated methods. Therefore, individuals from this study were not identified until the 2015/2016 field season. In addition, images were obtained for the years 2010-2015 from Brian Lockwood, Jet Ski Fishing & Adventures. Many seals in these mostly earlier images have been matched to individuals identified in this study, providing valuable historical occurrence and site fidelity information. The Lockwood photos were not utilized in our analyses, as they were not collected under similar standardized survey protocols.

**Table 1. Image criteria and grading for photo identification**

Image Grade	Criteria
<b>Quality</b>	
Q1	Excellent photo, sharp focus, no glare, animal perpendicular to camera, majority ( $\geq 75\%$ of) of side of seal captured, and/or fully wet pelage
Q2	Good photo, minimal glare, minor bending of animal, 50-75% of seal captured, and/or mostly wet pelage
Q3	Marginal photo, mediocre focus, moderate glare and bending of animal, 25-50% of seal captured, and/or partially dry pelage
Q4	Poor photo, limited focus, substantial glare, shading, or bending, $<25\%$ of animal captured, and/or fully dry pelage
<b>Distinctiveness</b>	
D1	Very distinct, large and numerous marks, visible scars, and/or 3+ very characteristic marks apparent even in poor quality photos
D2	Moderately distinct, 1-2 characteristic marks or some, but limited, distinctive patterning
D3	Indistinct, uniform pelage and no distinct markings

The photographic quality rating (Q1-Q4) focused on clarity, image resolution, glare/lighting, distortion, angle of the animal from the camera, the posture of the animal, and the proportion of the animal's body captured within the image. A Q1 signified an excellent photo fully suitable for manual or computer aided photo identification, whereas, a Q4 represented a photo with a quality too poor to reliably conduct photo-ID using either computer software or through manual matching. The distinctiveness rating (D1-D3) focused on the distinctiveness of pelage patterns and/or unique markings/scarring of an animal.

Using the quality and distinctiveness grades for images, a catalog of uniquely identified seals was compiled. Photos with a Q1-Q3 grade, along with a distinctiveness grade of D1-D2, were given a unique ID number (e.g., CB001) and added to a Microsoft Excel catalog and seal ID database for the study area. The resulting uniquely identified individuals were used to determine population abundance of harbor seals within the study area (Section 2.4.2 [Abundance Estimation]). For each photo included in the catalog, standardized descriptions were applied for pelage color patterns (i.e., color phase), which allowed for greater ease in manual matching by creating documented categories of images from which to match. The color phases in which the photos were categorized were the following: light (light background with no to a few/faint spots), intermediate (light background with dark spots), dark (dark background with many light-colored spots/rings), light/intermediate (seal pelage with two distinct light and intermediate color phases), and dark/light (seal pelage with two distinct light and dark color phases).

Fields included within the database are survey date, location, original photo image name, unique seal ID, file name, species, quality rating, distinctiveness rating, aspect (portion of seal's body that was captured), color phase, notable markings, and additional comments. The catalog allows for the sorting and processing of seal photos in order to compare and identify individual seals, using visual matching, for the mark-recapture portion of the study. Photos were reviewed through the use of this catalog and captured (i.e., marked) and re-captured (i.e., re-sighted) seals were identified and recorded in the seal identification database. Movement of some of the identified seals has been observed between the CBBT and Eastern Shore survey areas. Therefore, mark-recapture data from both survey areas were included to estimate a minimum population size for the region.

## 2.4 Analytical Methods

### 2.4.1 Analysis of Seal Presence

Mean seal count was compared between 10 field seasons from 2014-2024 for the CBBT survey area using a one-way analysis of variance (ANOVA). Mean seal count was also compared between eight field seasons from 2016-2024 for the Eastern Shore survey area using a one-way ANOVA. If a significant difference ( $p$ -value  $\leq 0.05$ ) was found between the mean seal counts for the CBBT and Eastern Shore survey areas, then a Tukey/Kramer multiple comparison test was performed in order to see which of the mean counts across the individual field seasons were significantly different from each other. Determining the differences between the respective seasonal mean counts was done by calculating the critical value of  $Q$  ( $Q_{cv}$ ) as well as the  $Q$  statistic ( $Q_{stat}$ ) for each possible pairwise comparison of the mean counts. The  $Q$  statistic was

compared to the critical value for each pair of mean counts; if the  $Q$  statistic was larger than the critical value, the mean counts for the two separate seasons were statistically different.

#### 2.4.2 Abundance Estimation

To estimate the population abundance ( $N$ ) of harbor seals for the study area, including both the CBBT and Eastern Shore survey areas, we used the mark-recapture data from the photo-ID portion of the study to fit a Lincoln-Petersen mark-resight model (see Section 2.4.2.1 [Mark-recapture Approach]). The Lincoln-Petersen mark-resight model was fit for each individual season (2015/2016, 2016/2017, 2017/2018, 2018/2019, 2019/2020, 2020/2021, 2021/2022, and 2022/2023), as well as for the eight seasons combined. Abundance has not been estimated for the 2023/2024 season as data collected for that season is still being analyzed. The telemetry correction factor approach (Refer to Jones and Rees [2023] for more information) was not used to estimate abundance after the 2021/2022 season, as no harbor seals were satellite tagged during this season and the pinniped tagging project for Virginia has concluded.

The Lincoln-Petersen mark-resight model was selected based on the protocol for the photo-ID portion of the study, as this model assumes 1) a closed population (i.e., no recruitment [birth or immigration] or losses [death or emigration] during the study period), 2) all individuals have the same probability of being caught, 3) capture and marking do not impact catchability, 4) samples are random, 5) marks are not lost between sampling events, and 6) all marks are correctly recorded and reported when recovered in sample two.

$$N = ((m_1 * n_2)/m_2), \text{ where}$$

$m_1$  = total # of marked animals/captures;  
 $n_2$  = total # of marked/unmarked animals;  
and  $m_2$  = # of total re-sightings/re-captures

In this study,  $m_1$  was the total number of marked (i.e., uniquely identified) seals with an ID number (e.g., CB001) in the seal catalog. Only identified seals with a quality grade of Q1-Q3 and a distinctiveness grade of D1 and D2 were used in order to not violate the model's assumption that all individuals have the same probability of being caught. A distinctiveness grade of D3, as previously discussed in Section 2.3 (Photo Identification [Photo-ID]), represented seals with uniform pelage and no distinct markings. Therefore, the probability of "capturing" or identifying seals given a D3 in comparison to those with unique markings (grades of D1 or D2) would be far lower, and thus not equal. For the purpose of this study, we interpreted  $n_2$  as meaning that all catchable animals are marked, therefore  $m_1$  and  $n_2$  are equal. The number of times each uniquely identified seal was re-captured, i.e. re-sighted, is represented as  $m_2$ . Due to the small sample size, all re-sightings were counted, as opposed to just one re-sighting per individual.



## 3. Results

### 3.1 Haul-out Counts

#### 3.1.1 The 2022/2023 Field Season

Haul-out counts commenced in November 2022 for the ninth field season at the CBBT survey area. Counts were conducted over the course of 12 survey days between 4 November 2022 and 24 April 2023 (**Table 2**). Once seals were sighted in the survey area, animals were recorded on a consistent basis (10 out of 12 [83.3%] survey days) until departure. Overall, a total (combined in water and hauled out) of 110 seals were sighted across the four CBBT haul-out locations for the season (**Table 2**). Seals were observed more at CBBT 3 than the other CBBT haul-out sites, similar to previous field seasons. Of the 110 seals sighted, 64 (58%) were recorded at CBBT 3 and 44 (40%) were recorded at CBBT 4. The total daily number of seals counted ranged from 0-31 seals per survey day. The majority of seals observed were identified as harbor seals; two gray seals were observed on 2 and 21 February 2023.

**Table 2. Summary of the number of seals sighted for the 2022/2023 field season for the CBBT survey area**

Date	Number of Individuals Pv	Number of Individuals Hg
4-Nov-22	0	0
22-Nov-22	1	0
5-Dec-22	4	0
20-Dec-22	6	0
3-Jan-23	15	0
18-Jan-23	25	0
2-Feb-23	30	1
21-Feb-23	16	1
6-Mar-23	5	0
20-Mar-23	5	0
3-Apr-23	1	0
24-Apr-23	0	0
<b>Total</b>	<b>108</b>	<b>2</b>

Key: Pv = *Phoca vitulina vitulina* (harbor seal); Hg = *Halichoerus grypus atlantica* (gray seal)

Haul-out counts commenced in November 2022 for the seventh field season at the Eastern Shore survey area. Counts were conducted over the course of 11 survey days, between 2 November 2022 and 11 April 2023 (**Table 3**). Once seals were sighted in the survey area,

animals were recorded on a consistent basis (9 out of 11 [82%] survey days) until departure. Seals were observed hauled out at four of the five main haul-out sites; A, B, C and E (**Figure 3**); and seals did not appear to establish any new haul-out sites. Over the entire season, a total (combined in water and hauled out) of 187 seals were sighted (**Table 3**). The total daily number of seals counted ranged from 0-68 individuals per survey day. The majority of seals observed were identified as harbor seals; two gray seals were sighted on 3 January 2023 and 16 March 2023.

**Table 3. Summary of the number of seals sighted for the 2022/2023 field season at the Eastern Shore survey area**

Date	Number of Individuals Pv	Number of Individuals Hg
2-Nov-22	2	0
18-Nov-22	6	0
2-Dec-22	7	0
14-Dec-22	38	0
3-Jan-23	8	1
24-Jan-23	68	0
21-Feb-23	30	0
28-Feb-23	19	0
16-Mar-23	7	1
29-Mar-23	0	0
11-Apr-23	0	0
<b>Total</b>	<b>185</b>	<b>2</b>

Key: Pv = *Phoca vitulina vitulina* (harbor seal); Hg = *Halichoerus grypus atlantica* (gray seal)

The UAS (i.e., drone) was used to conduct nine counts during the 2022/2023 season, specifically from November 2022 to March 2023 (**Table 4**). The UAS was unable to be used during several surveys throughout the season due to high winds and limited availability of UAS operator. The observers recorded more seals (differential ranged from 3-4 animals) from the vessel-based counts compared to the UAS counts during three of the nine survey days; the counts recorded from the UAS and observers were the same for the remaining six survey days. There was no significant difference between the mean counts for the UAS compared to the observers ( $t_{\text{stat}} = -0.12$ ,  $p = 0.91$ ).

**Table 4. Comparison of counts recorded from the UAS and observer during vessel-based surveys for the 2022/2023 season at the Eastern Shore survey area**

Date	Seal Count from UAS	Seal Count from Observer
2-Nov-22	2	2
18-Nov-22	2	6
14-Dec-22	38	38
3-Jan-23	9	9
24-Jan-23	68	68
21-Feb-23	30	30
28-Feb-23	15	19
16-Mar-23	5	8
29-Mar-23	0	0

### 3.1.2 The 2023/2024 Field Season

Haul-out counts commenced in November 2023 for the tenth field season at the CBBT survey area. Counts were conducted over the course of 11 survey days between 3 November 2023 and 8 April 2024 (**Table 5**). Once seals were sighted in the survey area, animals were recorded on a fairly consistent basis (7 out of 11 [64%] survey days) until departure. Overall, a total (combined in water and hauled out) of 92 seals were sighted across the four CBBT haul-out locations for the season (**Table 5**). Historically, seals have been observed more at CBBT 3 than the other CBBT haul-out sites. However, more seals were sighted at CBBT 4 than CBBT 3 this season compared to previous seasons. Of the 92 seals sighted, 40 (44%) were recorded at CBBT 3 and 50 (54%) were recorded at CBBT 4. The total daily number of seals counted ranged from 0-38 seals per survey day. Only harbor seals were identified at the CBBT during this season.

**Table 5. Summary of the number of seals sighted for the 2023/2024 field season at the CBBT survey area**

Date	Number of Individuals Pv	Number of Individuals Hg
3-Nov-23	0	0
15-Nov-23	0	0
4-Dec-23	6	0
15-Dec-23	5	0
3-Jan-24	13	0
22-Jan-24	38	0
9-Feb-24	9	0
26-Feb-24	9	0
12-Mar-24	12	0
21-Mar-24	0	0
8-Apr-24	0	0
<b>Total</b>	<b>92</b>	<b>0</b>

Key: Pv = *Phoca vitulina vitulina* (harbor seal); Hg = *Halichoerus grypus atlantica* (gray seal)

Haul-out counts commenced in November 2023 for the eighth field season at the Eastern Shore survey area. Counts were conducted over the course of 12 survey days, between 2 November 2023 and 15 April 2024 (**Table 6**). Once seals were sighted in the survey area, animals were recorded on a consistent basis (9 out of 12 [75%] survey days) until departure. Seals were only observed hauled out at site E, which has a marsh bank and a sandy beach on both sides of the creek (**Figure 3**). Seals did not appear to establish any new haul-out sites during this season. Over the entire season, a total (combined in water and hauled out) of 185 seals were sighted (**Table 6**). The total daily number of seals counted ranged from 0-45 individuals per survey day. The majority of seals observed were identified as harbor seals; two gray seals were sighted on 8 February 2024 and 4 March 2024.

Table 6. Summary of the number of seals sighted for the 2023/2024 field season at the Eastern Shore survey area

Date	Number of Individuals Pv	Number of Individuals Hg
2-Nov-23	0	0
15-Nov-23	3	0
1-Dec-23	12	0
12-Dec-23	17	0
3-Jan-24	7	0
22-Jan-24	23	0
8-Feb-24	38	1
22-Feb-24	38	0
4-Mar-24	44	1
26-Mar-24	1	0
5-Apr-24	0	0
15-Apr-24	0	0
<b>Total</b>	<b>183</b>	<b>2</b>

Key: Pv = *Phoca vitulina vitulina* (harbor seal); Hg = *Halichoerus grypus atlantica* (gray seal)

The UAS (i.e., drone) was used to conduct seven counts during the 2023/2024 season, specifically from November 2023 to February 2024 (**Table 7**). The UAS was unable to be used during several surveys throughout the season due to high winds and limited availability of UAS operator. A higher seal count was recorded from the UAS (compared to observers on the vessel) during three of the seven survey days, with the count differential ranging from 7-23 animals. However, during the surveys on 8 February 2024 and 22 February 2024, the hauled out seals flushed due to the presence and sounds from the vessel and UAS, respectively. This resulted in a lower count recorded by the observers for both of those survey days. The observers recorded more seals from the vessel-based counts compared to the UAS counts during three of the seven survey days, with the count differential ranging from 1-4 animals. There was no significant difference between the mean counts for the UAS compared to the observer ( $t_{\text{stat}} = 0.75$ ,  $p = 0.47$ ).

**Table 7. Comparison of counts recorded from the UAS and observer during vessel-based surveys for the 2023/2024 season at the Eastern Shore survey area**

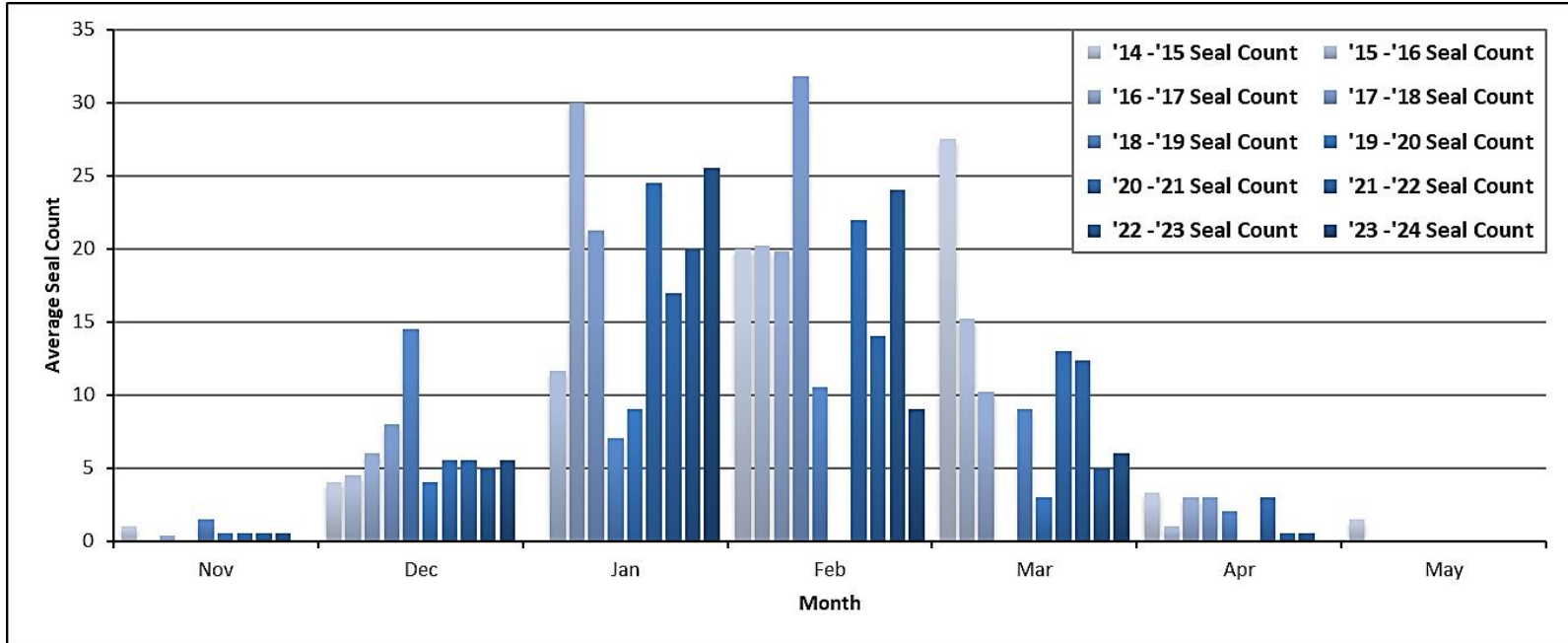
Date	Seal Count from UAS	Seal Count from Observer
2-Nov-23	0	0
15-Nov-23	1	3
12-Dec-23	16	17
3-Jan-24	3	7
22-Jan-24	23	16
8-Feb-24	39	24
22-Feb-24	38	15

## 3.2 Seal Presence Analysis Results

### 3.2.1 CBBT Survey Area

A total of 145 survey days have been conducted across 10 field seasons (see Section 2.4.1 [Analysis of Seal Presence]) at the CBBT survey area. Seals have been consistently recorded from mid-November to early April across field seasons (**Figure 6**). Most sightings (75.4%) occurred at the CBBT 3 haul-out site during the 10 field seasons combined followed by 21.3% of sightings at CBBT 4 and 3.3% for CBBT 1 and 2 combined. These percentages should be interpreted with caution due to the variation in survey effort across field seasons at the CBBT survey area.

Once seals arrived in the CBBT survey area, animals were recorded on a consistent basis (114 out of 117 [97.4%] survey days) until departure. Based on this and similar observations for the Eastern Shore survey area, we termed the number of survey days between and including the first and last seal observation as “in season” survey effort and included only “in season” data in our analyses for both survey areas (unless otherwise specified). Over 10 field seasons, there has been a fluctuation in seal presence for the CBBT survey area. For the first four field seasons (2014-2018), there was an increasing trend in the total count (sum of all the seals sighted in a season), average number of seals observed per survey day, and maximum count for a single survey day in a season (**Table 8**), followed by a decrease from 2018 to 2020. For the 2020/2021 season, seal presence appeared to rebound with an increase in average seal count as well as maximum seal count for a single survey day. A slight decrease in average and maximum seal count was observed for the 2021/2022 and 2022/2023 seasons, followed by an increase in these summary statistics for the 2023/2024 season.



**Figure 6. Average seal count by month using “in season” effort for the CBBT survey area. Surveys were only conducted in October for the 2015-2017 seasons (with no seal sightings) and in May for the 2014-2016 and 2021/2022 seasons. Surveys were not conducted in January 2015, March 2018, or February 2020.**

The difference between the mean counts across the 10 field seasons was statistically significant ( $F_{stat}=2.17$ ,  $p=0.030$ ), with the Tukey/Kramer test results ( $Q_{cv}=4.56$  for  $df=106$ ) indicating that the mean counts for the 2017/2018 and 2018/2019 seasons ( $Q_{stat}=4.64$ ) as well as the 2017/2018 and 2019/2020 seasons ( $Q_{stat}=4.83$ ) were statistically different. This between-season comparison, however, does not take into account the sampling bias for some of the field seasons. For example, the average count (23 seals) and maximum count (45 seals) for the 2017/2018 season are higher than the other seasons, which may be due to a change in sampling methodology (counts being vessel-based instead of land-based). In addition, there was inconsistent survey effort across months for the 2017/2018 season as well as the 2019/2020 season (e.g., no surveys in March 2018 and February 2020, and concentrated survey effort from January-February 2018). With no statistically significant difference amongst the meant counts for the more recent field seasons (2020-2024 seasons), this could indicate that the local population is relatively stable.

**Table 8. "In season" survey effort (number of survey days), total seal count (best estimate), effort-normalized average (number of seals observed per survey day), and maximum seal count on a single survey day at the CBBT survey area**

Field Season	"In Season" Survey Effort (days)	Seal Counts		
		Total	Average	Maximum
2014-2015	11	113	10	33
2015-2016	14	187	13	39
2016-2017	22	308	14	40
2017-2018*	15	340	23	45
2018-2019	10	82	8	17
2019-2020	6	29	5	9
2020-2021	11	137	12	32
2021-2022	10	98	10	25
2022-2023	11	110	10	31
2023-2024	7	92	13	38

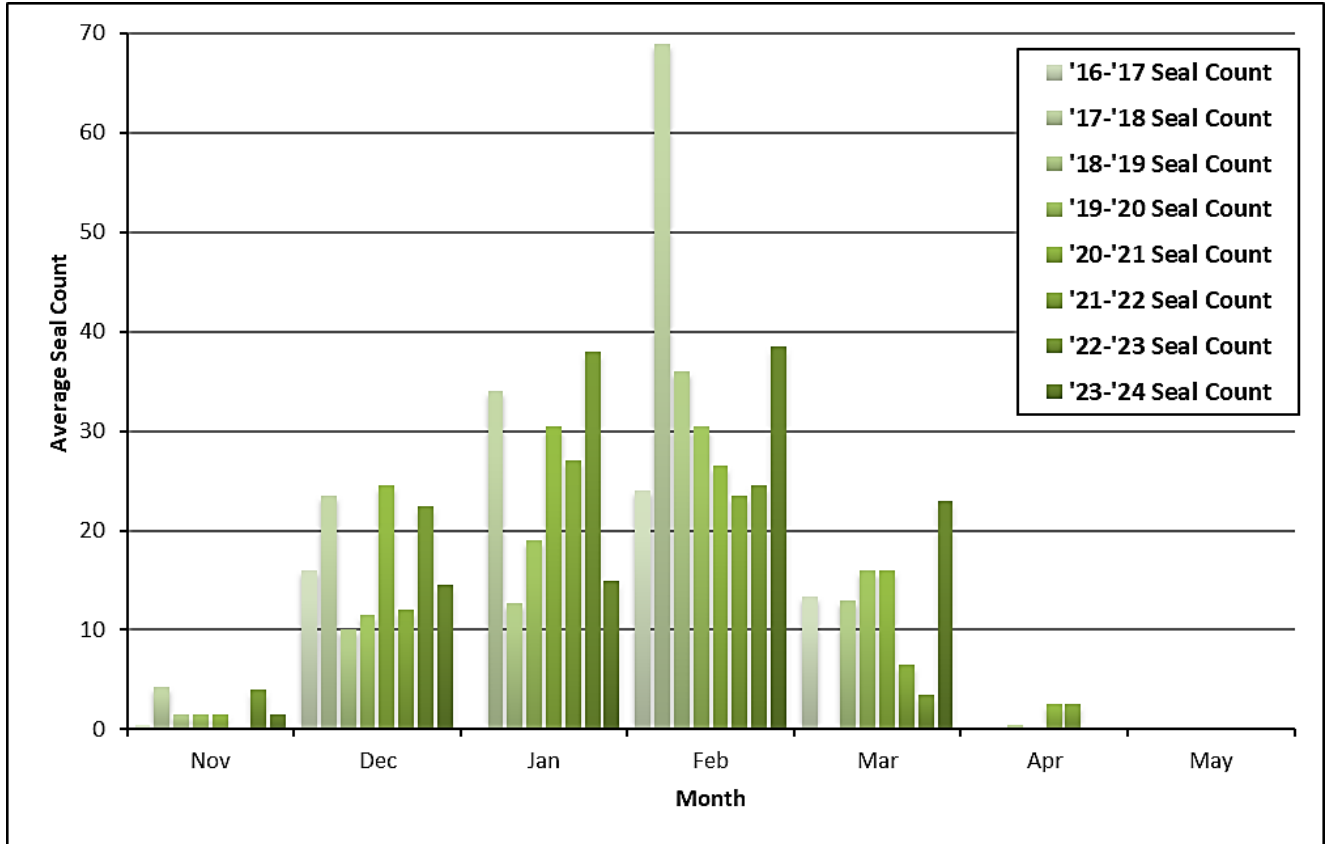
\* Surveys for the CBBT survey area switched from land-based to vessel-based

### 3.2.2 Eastern Shore Survey Area

A total of 94 surveys have been conducted across eight field seasons at the Eastern Shore survey area. Seals have been consistently recorded from early November to early April (**Figure 7**).

Similar to the CBBT, animals were recorded consistently once they arrived at the Eastern Shore survey area (74 out of 74 [100%] survey days) until departure. Over eight field seasons, there has been a fluctuation in seal presence, similar to what was observed for the CBBT survey area. The total count and maximum count for a single survey increased from the 2016-2018 field seasons and again for the 2020-2023 seasons (**Table 9**), followed by a decrease for both summary statistics for the 2023/2024 season. The average number of seals observed per survey day increased from 2016-2018, but decreased to 15 seals for the 2018/2019 season. Average seal count started to increase again for the 2019/2020 season with some fluctuation over the 2020/2021 and 2021/2022 seasons. Average count remained the same at 21 seals for the 2022/2023 and 2023/2024 seasons. The difference between the mean counts across the eight field seasons was not statistically significant ( $F_{stat}=0.35$ ,  $p=0.93$ ), which could indicate that the local population is relatively stable. This between-season comparison, however, does not take into account the sampling bias for the first two seasons (2016-2018), which consisted of inconsistent survey effort across months (e.g., no surveys conducted in January 2017 and March-April 2018).





**Figure 7. Average seal count by month using “in season” effort for the Eastern Shore survey area. No surveys were conducted in October for all eight seasons. May surveys were only conducted during the 2020-2022 seasons. Surveys were not conducted in January 2017 and from March to April 2018. One survey was conducted in February 2018.**

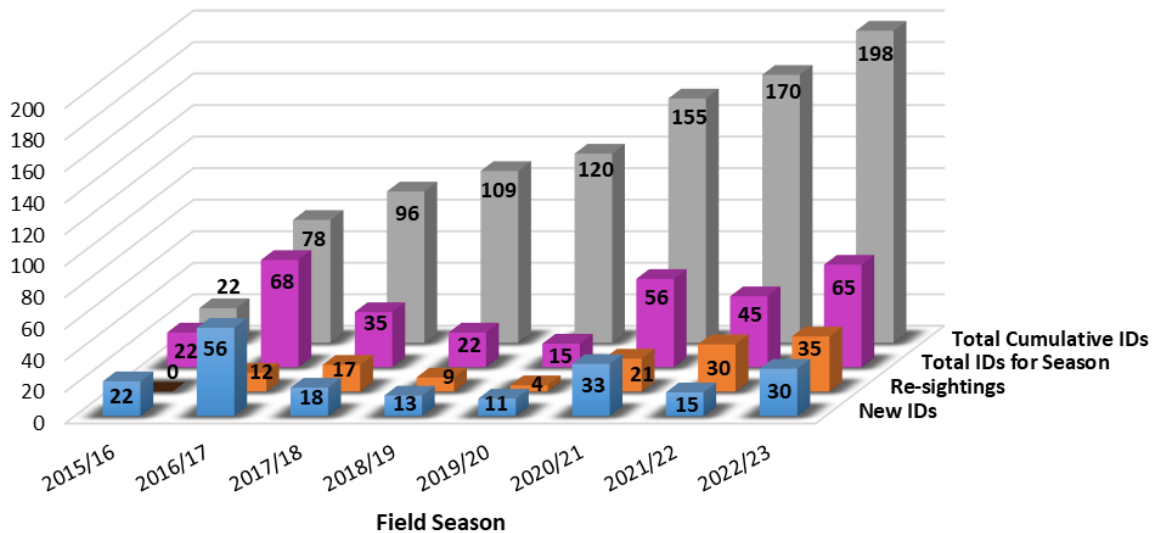
**Table 9. “In season” survey effort (number of survey days), total seal count (best estimate), effort-normalized average (number of seals observed per survey day), and maximum seal count on a single survey day at the Eastern Shore survey area**

Field Season	"In Season" Survey Effort (days)	Seal Counts		
		Total	Average	Maximum
2016-2017	7	105	15	24
2017-2018	8	197	25	69
2018-2019	11	160	15	66
2019-2020	9	157	17	39
2020-2021	12	219	18	44
2021-2022	9	143	16	45
2022-2023	9	187	21	68
2023-2024	9	185	21	45

### 3.3 Photo Identification

For the 2022/2023 field season, 65 harbor seals and 3 gray seals were uniquely identified based upon image grading criteria (**Table 1, Table A-1**). The last images used for photo-ID analysis were collected on 30 March 2023. None of the images collected on 3 April 2023 (the last day of sightings for the 2022/2023 season) met the quality standards for the study. Of the 65 harbor seals, 30 (46%) were new individuals to the catalog and 35 (54%) were re-sightings of individuals that were identified from previous field seasons (**Figure 8**). The highest number of individual re-sights (n=35) for harbor seals were recorded for this season compared to previous field seasons. Identified harbor seals were sighted at the CBBT and Eastern Shore survey areas, with 37 seals sighted at only the CBBT survey area and 21 seals sighted at only the Eastern Shore survey area (**Table A-1**). Seven harbor seals were sighted at both the CBBT and Eastern Shore survey areas during the season. In addition, one (CB181) of the 35 identified seals sighted at the CBBT survey area was also sighted at the Eastern Shore survey area during the 2020/2021 field season. Of the three gray seals, two (CB240 and CB250) were new individuals to the catalog and one (CB188) was a re-sighting of an individual that was first identified during the 2020/2021 field season. CB188 and CB250 were sighted at the Eastern Shore survey area and CB240 was sighted at the CBBT survey area for the 2022/2023 field season (**Table A-1**).

After reviewing all images from the 2015-2023 field seasons, 198 harbor seals and 4 gray seals have been uniquely identified based upon image grading criteria (**Table A-1, Figure 8**). As previously mentioned, images from the 2014/2015 season did not meet the quality standards for the study. The 2019/2020 field season marked the first time a gray seal (CB168) could be uniquely identified (Jones and Rees 2021) and added to the catalog. This animal was sighted at the Eastern Shore survey area in February 2020.



**Figure 8. Harbor seal identifications over eight field seasons (2015-2023).** The purple bars indicate the total number of IDs for a season, orange bars indicate the number of re-sightings, i.e., those IDs that were seen in previous seasons, and blue bars indicate the number of new IDs added to the catalog. The gray bars indicate the total number of cumulative unique IDs.

Of the 198 uniquely identified harbor seals, 96 (48%) were observed only once and 102 (52%) were determined to be present in the study area on more than one occasion from 2015-2023. In an individual season, the maximum number of sightings of a uniquely identified seal was nine (CB069) during the 2016/2017 field season.

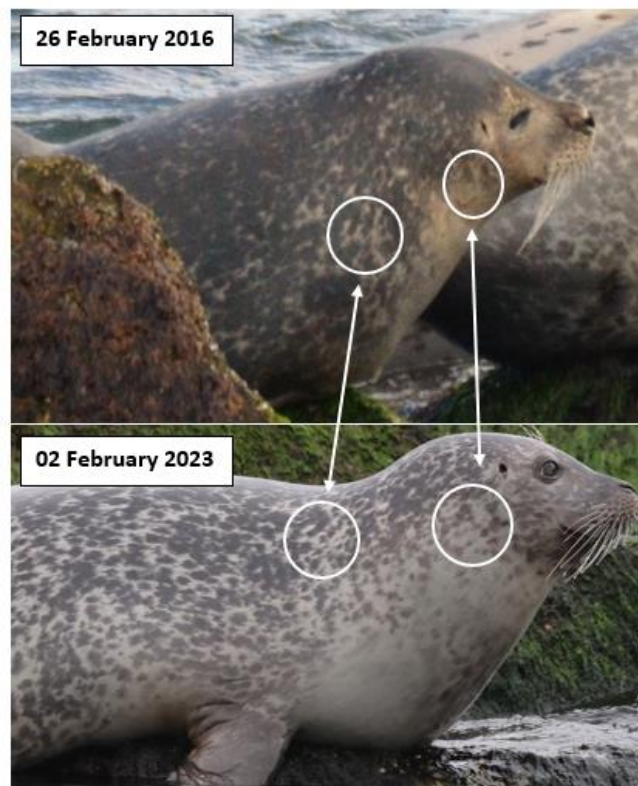
Between December 2015 and March 2023, the minimum number of days for an identifiable re-sighting (or re-capture) of an individual was 5 days (CB121, 15 March 2017 and the last sighting being on 21 March 2017) and the maximum number of days was 2,631 days (CB053, 9 December 2015 and the last sighting being on 21 February 2023), which is about 7.2 years. Across the study period, 56 individuals were observed on two different survey days and 46 individuals were observed on three or more different survey days, with the maximum number of encounters being 20 for one individual (CB053).

Photo-ID data from eight field seasons have provided additional information pertaining to habitat use patterns and site fidelity for seals, particularly harbor seals. Some seals have been sighted across multiple seasons. Of the 102 individual harbor seals identified to be present on more than one occasion, 23 were re-sighted within one season, 50 were sighted across two different field seasons, 17 were sighted across three different field seasons, six were sighted across four different field seasons (e.g., CB022 and CB066), four were sighted across five different field seasons (e.g., CB006 and CB090), and one seal was sighted across six (CB047) and seven (CB053) different field seasons. For example, CB047 was first sighted on 26 February 2016 and then re-sighted multiple times (e.g., on 2 February 2023) during the 2016-2023 seasons (**Figure 9**). For the first time, an identified gray seal was re-sighted during the 2022/2023 season;

CB188 was first identified at the Eastern Shore survey area on 17 February 2021 and then re-sighted at the Eastern Shore survey area again on 3 January 2023.

Not only have individual harbor seals been sighted on more than one occasion whether that is within a season or across seasons, but some individuals have been sighted and re-sighted together. For example, CB047 and CB064 were first sighted together at the same haul-out site (CBBT 3) on 26 February 2016 and then re-sighted together on multiple survey days at that same haul-out site, with the last re-sighting of them recorded on 2 February 2023, which amounts to a 2,533-day span (about 7 years) between sightings.

About half of the identified harbor seals ( $n=105$ ) have been sighted at only the CBBT survey area, with some ( $n=72$ ) being sighted at only the Eastern Shore survey area. Surveys have been conducted at the CBBT for more seasons compared to the Eastern Shore, which may account for this difference in number of identified seals across survey areas. The remaining 21 identified seals have been sighted at both survey areas on separate survey days. Nine seals (e.g., CB020, CB053, and CB2224) were sighted at both survey areas during the same season, whereas, the other 12 seals (e.g., CB021) were sighted at each survey area across different seasons.



**Figure 9. Harbor seal, CB047, sighted on 26 February 2016 at the CBBT 3 haul-out site (above) and re-sighted on 2 February 2023 at CBBT 4 (below). Photo by NAVFAC Atlantic under NMFS GA Permits #19826 and #25811**

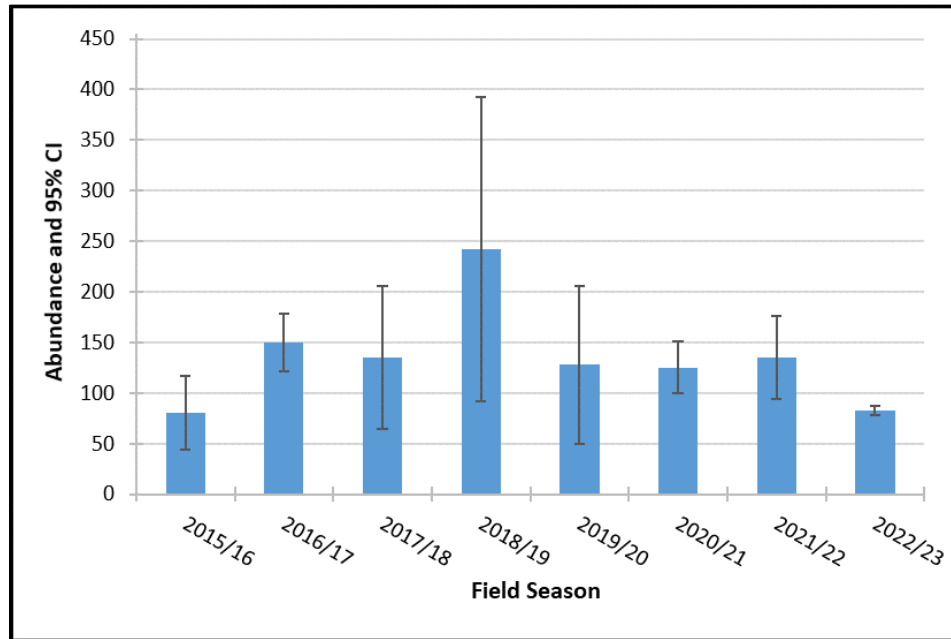
The images from the 2023/2024 field season are being assessed and photo-ID analysis results will be incorporated into the next progress report.

### 3.4 Abundance Estimates

The abundance estimates and 95% confidence intervals (CI) calculated from the Lincoln-Peterson model for the 2015-2023 field seasons ranged from 81 (95% CI: 44.14-117.19) to 242 (95% CI: 91.35-392.65) individual harbor seals (

**Figure 10).** As previously mentioned in Section 3.3 (Photo Identification), uniquely identified harbor seals were sighted at the CBBT and Eastern Shore survey areas, therefore, capture and re-capture data across both survey areas were used for the abundance estimate calculations. Abundance estimates show a fluctuation across seasons. There was an overall increase from the 2015/2016 to 2018/2019 field seasons, with the exception of the 2017/2018 season, in which a decrease in abundance (N=135 individuals) was observed. After the 2018/2019 season, abundance decreased but seemed to remain relatively stable from the 2019/2020 through 2021/2022 seasons, with estimates ranging from 125 to 135 individuals. For the 2022/2023 season, abundance decreased even more to 85 individuals. The lowest abundance estimates occurred during the 2015/2016 season (N=81 individuals) and 2022/2023 season (N=85 individuals). For the 2015/2016 season, a low number of captures (n=22) were recorded, which produced a lower abundance estimate, and this was most likely due to a lower amount of survey effort and not a large enough zoom lens ( $\leq 400$  mm) given the distance from the observer to the seals. In addition, surveys were only conducted at the CBBT during this season, which means that a smaller closed population (in terms of area) was used for this abundance estimate, whereas, a larger closed population (in terms of area) was used for the other seven seasons' abundance estimates since capture and re-capture data were used from both the CBBT and Eastern Shore survey areas. The abundance estimate for the 2022/2023 season was also low compared to the other seasons, and this was due to some of the highest number of captures (n=65) and re-captures (n=51) being recorded for this season. The 2018/2019 season had the highest estimate of 242 individuals, however, the 95% CI for this season's estimate is larger compared to the other seasons, indicating that this estimate may not be the most accurate representation of the number of individuals utilizing both survey areas for this season. This may be due to the low proportion of re-captures (n=2) compared to the number of captures (n=22) that were recorded for a single season. A regression analysis was conducted for the seasonal abundance estimates to see if there is a potential population trend for the study area. Results indicated that the slope was not statistically significant ( $p=0.79$ ), therefore, there does not appear to be a trend in the seasonal abundance of the local population.

With the abundance showing a fluctuation across seasons, especially from 2015-2019 and no discernable trend, a mean abundance estimate was calculated. The abundance estimate for the eight seasons (2015-2023) yielded an estimate of 150 individuals (95% CI: 144.41-156.01). Given the narrow range of the CI, this estimate may be a reliable representation of the number of harbor seals using both the CBBT and Eastern Shore survey areas.



**Figure 10. Total abundance estimates (blue bars) and 95% confidence intervals (CIs) for the CBBT and Eastern Shore survey areas combined during each of the field seasons from 2015-2023.**

The photo-ID and mark-recapture analyses for the 2023/2024 season are currently being conducted. The abundance estimate for the 2023/2024 season as well as the mean abundance for the 2015-2024 seasons will be incorporated into the next progress report.

## 4. Discussion

The results from this study to date indicate that seals, specifically harbor seals, regularly occur in southeastern Virginia from the fall to the spring. Harbor seals have been consistently recorded at the CBBT and Eastern Shore survey areas from November to April. This finding is reflected in the count data collected across 10 field seasons. An ongoing, complimentary project is investigating seal occurrence and haul-out patterns using time-lapse remote cameras at both the CBBT and Eastern Shore survey areas (Guins and Rees 2024). The camera surveys demonstrated that harbor seals were present in the study area from fall to spring, with peak numbers from January-March, similar to the haul-out survey results presented in this report. Seals were also recorded on the cameras at both of the survey areas until May for the 2020/2021 through 2023/2024 seasons (Guins and Rees 2024). Seals have not been recorded in May during the vessel-based surveys since 2015. Results from the camera surveys show that this type of monitoring is an effective means at collecting count data throughout the day and across the field season, thereby providing a more robust investigation of seal occurrence in Virginia.

Since the start of the study, there has been a fluctuation in seal presence for the CBBT survey area. From 2014 to 2018, there was an increasing trend in the average seal count per survey day and maximum seal count for a single survey day, followed by a decrease from 2018 to 2020, and then an increase for the 2020/2021 season. A slight decrease in these summary statistics was observed for the 2021/2022 to 2022/2023 seasons, followed by an increase for the 2023/2024 season. A similar fluctuation in seal presence was observed for the Eastern Shore survey area, with an increase in average and maximum seal count for the first two field seasons (2016-2018) and again for the 2019 to 2023 seasons. Average seal count remained the same for the 2023/2024 season. Some of the lowest total, maximum, and average seal counts for the CBBT and Eastern Shore survey areas were reported for the 2018 to 2020 as well as 2021/2022 seasons. In addition, there was a statistically significant difference between the average seal counts across the 10 field seasons for the CBBT survey area. The drop in maximum and average seal count for the Eastern Shore survey area was not as substantial compared to the CBBT survey area for these seasons, and the difference between average seal counts across the eight field seasons (2016-2024) for this survey area was not statistically different.

The observed fluctuation in seal presence for maximum and average seal count as well as overall seal sightings may be due to several factors including two unusual mortality events (UMEs) along the U.S. east coast during the study, seasonal differences (e.g., pupping season) in haul-out behavior, sampling bias in survey effort, and/or changes in habitat use in terms of haul-out site preference,.

A Northeast U.S. Pinniped UME was declared from 2018 to 2020 based on elevated harbor and gray seal stranding numbers (mainly across Maine, New Hampshire, and Massachusetts) as well as seals testing positive for pathogens such as phocine distemper virus and avian influenza virus. Clinical signs were observed in seals that stranded as far south as Virginia, therefore, the UME encompassed all seal strandings from Maine to Virginia (NOAA 2020). Three harbor seals captured and tagged on the Eastern Shore during the 2017/2018 field season tested positive for the avian influenza virus (Costidis et al. 2019). This UME is no longer active and the closure of it is currently pending (NOAA 2022). However, another Northeast U.S. Pinniped UME was declared from June-July 2022 based on elevated numbers of sick harbor and gray seals that were testing positive for avian influenza along the Maine coast; this UME is now closed (NOAA 2024). Several of the harbor seals tagged at the Eastern Shore survey area from 2018-2022 displayed northward movements to Maine in the spring (Ampela et al. 2023). Therefore, both of these UMEs could be a potential reason for the observed fluctuation in count numbers across the study area from 2018 to 2024, as impacts from UMEs (e.g., mortality of individuals from Virginia's seasonal population) could persist after summer 2022.

The lower seal counts recorded for the 2018 to 2020 as well as 2021/2022 seasons could also be a result of harbor seals spending less time hauled out and more time at sea, resting or foraging, during surveys. Russel et al. (2015) found that outside of the molting and pupping seasons, the amount of time that harbor seals spend hauled out is reduced and variable, resulting at more time spent at sea. The probabilities of resting on land were estimated to be

about 0.10-0.33 for harbor seals that were satellite tagged in Britain (Russel et al. 2015). Harbor seals migrate to Virginia in the fall from New England after the molting and pupping seasons. Similar to the probabilities reported by Russel et al. (2015), harbor seals tagged in 2018, 2020 and 2022 were found to spend a mean proportion of 0.18 of daylight hours resting on land (i.e., hauled out) while in Virginia.

For both the CBBT and Eastern Shore survey areas, the number of “in season” survey days conducted has varied each season and has varied by month within a season. Caution needs to be taken when comparing these numbers across seasons and when drawing conclusions due to a change in sampling methodology (e.g., vessel-based counts vs. land-based counts) for the CBBT survey area and variable survey effort across the 2014-2024 seasons for both survey areas, leading to sampling bias. In addition, the incorporation of the UAS with the vessel-based counts on the Eastern Shore may help to improve counts, especially if seals frequently exhibit movement from the haul-out site into the water as vessels approach closer to the haul-out locations for counts and photographs. This in turn could improve the analysis of the local population to see if there is an increasing or decreasing trend in numbers over the course of this study.

The fluctuation in seal presence that has been observed in more recent field seasons could also be due to a change in the seals’ habitat use patterns within the study area. Based on the count data from this study, the average seal count per survey day for the study area (i.e., combining the CBBT and Eastern Shore survey areas) has not varied much between the 2019-2024 seasons, with the average count ranging from 13-17 seals. However, looking at the count summary statistics for each of the survey areas, the average seal count and maximum seal count for a single survey day has been consistently higher than 15 and 40 seals, respectively, since 2020 for the Eastern Shore (**Table 9**). Whereas, both average and maximum seal count for the CBBT have been below those values since 2019 (**Table 8**). Looking at the count data from the camera surveys, results also show a higher monthly seal count average at the Eastern Shore survey area compared to the CBBT for the 2019-2024 seasons (Guins and Rees 2024). However, the count data from these surveys is mostly of hauled out seals, therefore, some caution needs to be taken when comparing the averages between survey areas. For the vessel surveys, the number of seals hauled out and in the water are recorded. In addition, the abundance estimates calculated for this study were relatively stable from 2019-2022 (

**Figure 10**). Therefore, there may have been a shift in habitat use amongst the survey areas in recent seasons, with more seals utilizing the Eastern Shore for haul-out habitat. This potential increase in habitat use of the Eastern Shore could be due to this area being only accessible by vessel and more remote compared to the CBBT, which means there is less vessel traffic, and therefore, less human disturbance, occurring in this area.

Another potential factor to be considered in the future is the construction activity for the CBBT expansion project. Construction, including pile driving, has been taking place since 2017 at CBBT 1 and 2, where few seals (about 3.3% of total sightings) have been observed in previous seasons. Looking at the months where certain in-water activities related to construction were conducted, especially once construction takes place at CBBT 3 and 4, and if that overlaps with



the timeframe that seals are present in the study area, will aid in determining if construction activity may be influencing seal occurrence.

More surveys, whether these are conducted via vessels or remote cameras, are recommended for both the CBBT and Eastern Shore survey areas in order to investigate whether or not there is a potential increase or decrease in seal occurrence in the region or if this may be a normal fluctuation for this local seasonal population. More data is needed before drawing firm conclusions as to what may be the factor(s) for the observed fluctuation in the number of seals present in the study area.

Prior to this pinniped haul-out study, there was no seasonal population abundance estimate for harbor seals in southeastern Virginia. For this study, a population abundance was estimated for the lower Chesapeake Bay and coastal Virginia waters using mark-recapture data. A total of 150 individuals were estimated as the average seasonal abundance across all eight seasons (2015-2023). Abundance estimates were also calculated for each annual field season from 2015-2023 using the mark-recapture data. A fluctuation in abundance estimates occurred across seasons, with estimates ranging from 81 (2015/2016 season) to 242 (2018/2019 season) individual harbor seals. The 2022/2023 season had the second lowest abundance estimate with 85 individuals. Inferences about population trends in the region cannot be accurately made due to this fluctuation in abundance across seasons. Regression analysis results indicate that there is not a statistically significant trend in population abundance. Therefore, there is reason to believe that the population of animals utilizing the lower Chesapeake Bay and Eastern Shore of Virginia may be relatively stable. Results from the seal presence analysis (Section 3.2) also support the possibility of this local population being stable as there has been no significant difference among mean counts for both the CBBT and Eastern Shore survey areas since the 2019/2020 field season. Other harbor seal populations in New England are also considered stable. Seasonal counts of harbor seals hauled out throughout Narragansett Bay, Rhode Island have fluctuated from year to year since 2009, but the count data has demonstrated that the population is mostly stable (Save The Bay 2024). The harbor seal population in Maine is also considered stable due to the minor changes in abundance that were observed between 2012 and 2018 (Hayes et al. 2022; Sigourney et al. 2021). It is difficult to draw further conclusions until additional data is collected and a more robust dataset (for the mark-recapture and haul-out and camera survey data) is developed that will allow us to determine if the population in Virginia is, in fact, stable and/or if harbor seal site fidelity at this southeastern Virginia study area is potentially increasing.

Based on the photo-ID analysis, results indicate that some harbor seals are returning to the same southerly haul-out locations in Virginia across multiple seasons. Photo-ID conducted via visual matching for the 2015-2023 field seasons has shown that some individuals (102 out of 198 uniquely identified seals) sighted at the study area have been re-sighted within a season and across seasons, indicating a degree of site fidelity within the lower Chesapeake Bay and coastal Virginia waters. For example, 12 identified seals have now been sighted across four or more seasons since 2015. Identifiable re-sightings across the study period have spanned as far as about 87 months, and some of these identified harbor seals have utilized the CBBT haul-out

sites for longer than our study period (based on images taken in years prior to 2014 and provided by B. Lockwood). Based on these contributed citizen photographs, we have been able to determine that some of the individuals have been occurring seasonally in the region since 2011 (CB004, CB005, and CB006) and 2015 (CB020 and CB022). These findings further prove that this region serves as an important resource for harbor seals by providing regular, seasonal haul-out sites for these animals within the lower Chesapeake Bay and Eastern Shore of Virginia.

Using photo-ID, we have also been able to gather more information on movement and habitat preference within the region. More than half of the identified harbor seals (53%) have been sighted at only the CBBT survey area, with some (36%) being sighted at only the Eastern Shore survey area. However, 21 individuals were re-sighted at both survey areas on separate survey days within a season and across seasons. These results indicate that harbor seals make localized movements throughout the region during their seasonal occupancy and that while some seals may be utilizing a particular haul-out site within a given season, others may utilize multiple haul-out sites within a season. The pinniped tracking study for southeastern Virginia confirms that seals make localized movements throughout the region (Ampela et al. 2021 and 2023). Nine of the 14 harbor seals captured and tagged at haul-out sites in the Eastern Shore survey area from February 2018 to February 2022 displayed movements between the Eastern Shore and CBBT survey areas before departing Virginia to head north towards New England.

Although the majority of seals observed within the study area have been harbor seals, occasional sightings of gray seals have been recorded at both the CBBT and Eastern Shore survey areas between December and March. Gray seal sightings have not been recorded consecutively between field seasons for the CBBT survey area since the start of the study. However, 1-2 gray seal sightings have been consistently recorded for the Eastern Shore survey area since the 2017/2018 season. To date, one identified gray seal (CB188) has been re-sighted within a different season at the Eastern Shore. Additional surveys would be required in order to verify that gray seals regularly occur in southeastern Virginia or if this species is starting to expand its distribution farther south.

Results from this study document that a small population does occur seasonally within southeastern Virginia, and contributed towards the geographic range for harbor seals of the Western North Atlantic stock being updated in the NOAA SAR (Hayes et al. 2022). Both the harbor and gray seal previously formed large colonies (prior to subsistence hunts and government-supported bounties) from Labrador, Canada to Cape Hatteras, North Carolina (Johnston et al. 2015). The observed fluctuation in seal count numbers across the study period as well as the Virginia abundance estimates calculated for this study reflect claims made by Johnston et al. (2015), who believe that harbor seals are now beginning to re-occupy substantial portions of their previous range. Several researchers report that harbor and gray seal distribution along the U.S. Atlantic coast appears to be expanding or shifting (den Heyer et al. 2021; DiGiovanni et al. 2011; DiGiovanni et al. 2018; Johnston et al. 2015; Pepper et al. 2024), which could explain the fluctuation observed in seal occurrence at the CBBT and Eastern Shore survey areas since this study began in 2014. A large southward shift in pup production had occurred by 2016, with more than 90% of production occurring south of the Gulf of St. Lawrence

in Canada, and some parts of the Gulf of Maine have seen as much as a 26% increase in gray seal populations (den Heyer et al. 2021; Wood et al. 2019 and 2022). An increase in gray seal pupping (Wood et al. 2019 and 2022) and overall, abundance, in the Northeastern U.S. (Pace et al. 2019) could create interspecific competition for the two species, whether that is for habitat and/or prey resources, thus leading to changes in species distribution. In some areas of the U.S. east coast where gray and harbor seals overlap such as southeastern Massachusetts, harbor seal counts have declined since 2009, and gray seals appear to have displaced harbor seals from some haul-out locations that they formerly used (Pace et al. 2019). Trends in sighting data for New York indicate that the Western New York Bight harbor seal population may eventually experience displacement by the influx of gray seals, which would result in more of a southern expansion of harbor seals along the east coast (Sieswerda and Kopelman 2018). Over the past couple of decades, harbor seals have been regularly observed along the Outer Banks of North Carolina, particularly in Oregon Inlet (North Carolina Division of Parks and Recreation 2023 and Pepper et al. 2024). Haul-out surveys have been conducted at Oregon Inlet since 2010, and the data indicate harbor seals are only present in the area from December and April. The largest single group count recorded during a survey was 35 harbor seals (Pepper et al. 2024).

## 5. Conclusions and Recommendations

Our research continues to document a regular, seasonal presence of harbor seals and occasional sightings of gray seals within the lower Chesapeake Bay and Eastern Shore, Virginia. Patterns of seasonal residency and a baseline for population abundance for harbor seals within the region have started to emerge. However, more research is necessary to determine the level of site fidelity and whether or not harbor seal abundance is potentially increasing, decreasing, or is stable within the study area, and as to what may be the factors for the observed fluctuation in counts and overall, abundance. Data will continue to be collected and examined for any emerging patterns of habitat utilization and residency time, as well as population trends. The results from this project will not only provide additional information on the distribution of pinniped species along the U.S. east coast, but also provide information critical to the development of effective protective measures during naval training and testing activities, which will help the Navy with ongoing environmental compliance and conservation efforts.

While the study provides an essential basis towards determining the occurrence and habitat use of harbor and gray seals within the lower Chesapeake Bay and coastal waters of Virginia, recommendations to enhance the project are below:

- 1. Experiment with using satellite telemetry data for abundance estimation.**

Fourteen harbor seals were successfully tagged within the study area from 2018-2022 with satellite tags. The satellite telemetry data for the tagged seals is available on MoveBank.org as well as the Animal Telemetry Network. The final report summarizing tagging efforts for the 2021/2022 season as well as analysis results from the 2018-2022

seasons has been completed (Ampela et al. 2023). The additional data from this study will provide a more robust suite of information pertaining to the distribution, migratory routes, haul-out patterns, and diving behavior of seals in this area. If additional tagging and tracking efforts are planned for future field seasons along the U.S. east coast, especially Virginia, a more robust approach involving a generalized linear mixed model framework by Sharples et al. (2009) to estimate seasonal absolute abundance using haul-out counts and information from satellite telemetry data may be possible to improve abundance estimation efforts for the region.

**2. Investigate the use of improved automated photo identification tools and seal recognition software.**

New computer-assisted pattern and facial recognition software (e.g., Hotspotter, Seal Codex, or SealNet) have been developed and improved upon to assist in seal pelage pattern and facial recognition and matching individuals (Birenbaum et al. 2022; Langley et al. 2021), which in the future may be used to enhance the photographic mark-recapture potential of the study. Automated matching may improve the frequency of matches as well as improve photo-matching time and abundance estimation.

**3. Submit data to OBIS-SEAMAP.**

Documentation of seal presence for Virginia is currently lacking in sightings databases and the published literature. We will be inquiring with Duke University to have these data incorporated into OBIS-SEAMAP, which will allow the data to be archived and accessible for use by future researchers and promote collaboration with organizations in order to augment our understanding of the distribution and ecology of pinnipeds in the Mid-Atlantic region.

**4. Integrate remote time-lapse camera data with the haul-out survey analysis.**

The use of time-lapse remote camera surveys provides additional and near continuous monitoring data during daylight hours at the Eastern Shore and CBBT survey areas. These data are an important supplement to what is being collected by the vessel survey team, providing a much larger sample size for the count estimates. The integration of the data from these projects will likely allow us to better assess seal presence and abundance in Virginia.

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## **Appendix A**

### Sighting History Tables



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Table A-1. Sighting history (by number of days seen per season) of uniquely identified harbor and gray seals at the Chesapeake Bay Bridge Tunnel (CBBT) and Eastern Shore (ES): December 2015-March 2023

NAVFAC Catalogue ID	Season 2 Dec 2015-Mar 2016	Season 3 Dec 2016-Apr 2017	Season 4 Nov 2017-Feb 2018	Season 5 Dec 2018-Mar 2019	Season 6 Dec 2019-Mar 2020	Season 7 Dec 2020-Apr 2021	Season 8 Nov 2021-Apr 2022	Season 9 Nov 2022-Mar 2023	Location	Total No. Days Seen	Total No. Seasons Seen	Max No. Days Seen within a Season
<b>Harbor Seals</b>												
CB004		1	1						CBBT 3	2	2	1
CB005	1	3	2						CBBT 3	6	3	3
CB006	1	3	2			3		3	CBBT 3	12	5	3
CB017	1	1							CBBT 3	2	2	1
CB020	1	1	1				1	3	CBBT 3 & ES	7	5	3
CB021	1				1				CBBT 3 & ES	2	2	1
CB022		3	1			1	1		CBBT 3/4	6	4	3
CB023	1	2							CBBT 3	3	2	2
CB035	2								CBBT 3	2	1	2
CB036	1	1						3	CBBT 3/4	5	3	3
CB037	1								CBBT 3	1	1	1
CB038	2								CBBT 4	2	1	2
CB041	1								CBBT 3	1	1	1
CB042	1								CBBT 4	1	1	1
CB043	1								CBBT 4	1	1	1
CB044	1	1							CBBT 3/4	2	2	1
CB045	1	1							CBBT 3	2	2	1
CB046	1	1				2	2	1	CBBT 3	7	5	2
CB047	2	1		1		3	4	4	CBBT 3/4	15	6	4
CB048	1	1							CBBT 3	2	2	1
CB051	1								CBBT 3	1	1	1

NAVFAC Catalogue ID	Season 2 Dec 2015-Mar 2016	Season 3 Dec 2016-Apr 2017	Season 4 Nov 2017-Feb 2018	Season 5 Dec 2018-Mar 2019	Season 6 Dec 2019-Mar 2020	Season 7 Dec 2020-Apr 2021	Season 8 Nov 2021-Apr 2022	Season 9 Nov 2022-Mar 2023	Location	Total No. Days Seen	Total No. Seasons Seen	Max No. Days Seen within a Season
<b>Harbor Seals (continued)</b>												
CB053	4	2	2	1		1	6	4	CBBT 1/3 & ES	20	7	6
CB056				1	1	1			CBBT 3	3	3	1
CB057		1	1						CBBT 3 & ES	2	2	1
CB062	1		1	1			1		CBBT 3/4	4	4	1
CB064	1						1	1	CBBT 3/4	3	3	1
CB066		1				1	4	3	CBBT 3 & ES	9	4	4
CB067		1							CBBT 3	1	1	1
CB069		9	1						CBBT 3/4	10	2	9
CB071		4						2	CBBT 3	6	2	4
CB072		1							CBBT 3	1	1	1
CB073		1							CBBT 3	1	1	1
CB074		1							CBBT 3	1	1	1
CB076		1				2	1	2	CBBT 3/4	6	4	2
CB078		1							CBBT 3	1	1	1
CB079		1							CBBT 3	1	1	1
CB080		1				1			CBBT 3 & ES	2	2	1
CB081		1							CBBT 3	1	1	1
CB083		2	1						CBBT 3	3	2	2
CB084		1							CBBT 3	1	1	1
CB085		2							CBBT 3	2	1	2
CB086		3				1			CBBT 3 & ES	4	2	3

NAVFAC Catalogue ID	Season 2 Dec 2015-Mar 2016	Season 3 Dec 2016-Apr 2017	Season 4 Nov 2017-Feb 2018	Season 5 Dec 2018-Mar 2019	Season 6 Dec 2019-Mar 2020	Season 7 Dec 2020-Apr 2021	Season 8 Nov 2021-Apr 2022	Season 9 Nov 2022-Mar 2023	Location	Total No. Days Seen	Total No. Seasons Seen	Max No. Days Seen within a Season
<b>Harbor Seals (continued)</b>												
CB087		1	1						CBBT 3 & ES	2	2	1
CB088		1							CBBT 3	1	1	1
CB089		1							CBBT 3	1	1	1
CB090		2		1		1	1	4	CBBT 3/4	9	5	4
CB091		1					1		CBBT 3 & ES	2	2	1
CB092		2							CBBT 3	2	1	2
CB095		1						1	CBBT 3	2	2	1
CB096		1				1			CBBT 3	2	2	1
CB097		1							CBBT 3	1	1	1
CB098		1		1					CBBT 3	2	2	1
CB099		1	1						CBBT 3	2	2	1
CB100		3	2						CBBT 3	5	2	3
CB101		1		2				4	CBBT 3/4	7	3	4
CB102		1							CBBT 3	1	1	1
CB103		1							ES	1	1	1
CB104		2	2			1			ES	5	3	2
CB105		1							ES	1	1	1
CB106		1		1		2	2		ES	6	4	2
CB107		1							ES	1	1	1
CB110		1							CBBT 3	1	1	1
CB111		1							CBBT 3	1	1	1



NAVFAC Catalogue ID	Season 2 Dec 2015-Mar 2016	Season 3 Dec 2016-Apr 2017	Season 4 Nov 2017-Feb 2018	Season 5 Dec 2018-Mar 2019	Season 6 Dec 2019-Mar 2020	Season 7 Dec 2020-Apr 2021	Season 8 Nov 2021-Apr 2022	Season 9 Nov 2022-Mar 2023	Location	Total No. Days Seen	Total No. Seasons Seen	Max No. Days Seen within a Season
<b>Harbor Seals (continued)</b>												
CB112		1		1					CBBT 3 & ES	2	2	1
CB113		1							ES	1	1	1
CB114		1	1						ES	2	2	1
CB115		1							ES	1	1	1
CB116		2							ES	2	1	2
CB117		1							ES	1	1	1
CB118		1							CBBT 3	1	1	1
CB119		1							CBBT 3	1	1	1
CB120		1		1					CBBT 3 & ES	2	2	1
CB121		2							CBBT 3 & ES	2	1	2
CB122		1							ES	1	1	1
CB123		1	1						ES	2	2	1
CB124		1							ES	1	1	1
CB125		1							ES	1	1	1
CB126		1	1						ES	2	2	1
CB127		1				1			ES	2	2	1
CB128*			1						ES	1	1	1
CB129			1				1	3	CBBT 3 & ES	5	3	3
CB130			1						CBBT 3	1	1	1
CB132			1			3		2	CBBT 3/4	6	3	3
CB133			1						CBBT 3	1	1	1

\*CB128 found stranded/dead at the Eastern Shore survey area on 9 April 2019

NAVFAC Catalogue ID	Season 2 Dec 2015-Mar 2016	Season 3 Dec 2016-Apr 2017	Season 4 Nov 2017-Feb 2018	Season 5 Dec 2018-Mar 2019	Season 6 Dec 2019-Mar 2020	Season 7 Dec 2020-Apr 2021	Season 8 Nov 2021-Apr 2022	Season 9 Nov 2022-Mar 2023	Location	Total No. Days Seen	Total No. Seasons Seen	Max No. Days Seen within a Season
<b>Harbor Seals (continued)</b>												
CB134			1						CBBT 3	1	1	1
CB135			1						CBBT 3	1	1	1
CB136			1						CBBT 3	1	1	1
CB137			1						CBBT 3	1	1	1
CB138			1						ES	1	1	1
CB139			1			1			ES	2	2	1
CB140			1						ES	1	1	1
CB141			1						ES	1	1	1
CB143			1						ES	1	1	1
CB144			1						ES	1	1	1
CB145			1						ES	1	1	1
CB146			1						ES	1	1	1
CB147			1						ES	1	1	1
CB148				1					ES	1	1	1
CB149				1				1	ES	2	2	1
CB150				1	1	2	1		CBBT 3 & ES	5	4	2
CB151				1					CBBT 3	1	1	1
CB152				1					CBBT 3	1	1	1
CB153				1				2	CBBT 3 & ES	4	3	3
CB154				2			1		CBBT 4 & ES	3	2	2
CB156				1					ES	1	1	1

NAVFAC Catalogue ID	Season 2 Dec 2015-Mar 2016	Season 3 Dec 2016-Apr 2017	Season 4 Nov 2017-Feb 2018	Season 5 Dec 2018-Mar 2019	Season 6 Dec 2019-Mar 2020	Season 7 Dec 2020-Apr 2021	Season 8 Nov 2021-Apr 2022	Season 9 Nov 2022-Mar 2023	Location	Total No. Days Seen	Total No. Seasons Seen	Max No. Days Seen within a Season
<b>Harbor Seals (continued)</b>												
CB157				1	1				ES	2	2	1
CB158				1			1	1	ES	3	3	1
CB159				1					ES	1	1	1
CB160				1					CBBT 2	1	1	1
CB161					2				ES	2	1	2
CB162					1		1		ES	2	2	1
CB163					1	1			ES	2	2	1
CB164					1		1		ES	2	2	1
CB165					1				ES	1	1	1
CB166					1				ES	1	1	1
CB167					1				ES	1	1	1
CB169					1				ES	1	1	1
CB170					2	1			ES	3	2	2
CB171					1	1		1	CBBT 4	3	3	1
CB172					1				CBBT 4	1	1	1
CB173						3			CBBT 3	3	1	3
CB174						2			ES	2	1	2
CB175						1			ES	1	1	1
CB176						2			ES	2	1	2
CB177						2	1	2	CBBT 3/4	5	3	2
CB178						2			CBBT 3/4	2	1	2

NAVFAC Catalogue ID	Season 2 Dec 2015-Mar 2016	Season 3 Dec 2016-Apr 2017	Season 4 Nov 2017-Feb 2018	Season 5 Dec 2018-Mar 2019	Season 6 Dec 2019-Mar 2020	Season 7 Dec 2020-Apr 2021	Season 8 Nov 2021-Apr 2022	Season 9 Nov 2022-Mar 2023	Location	Total No. Days Seen	Total No. Seasons Seen	Max No. Days Seen within a Season
<b>Harbor Seals (continued)</b>												
CB179						3	1	3	CBBT 3/4	7	3	3
CB180						1	1		CBBT 3	2	2	1
CB181						1		1	CBBT 3 & ES	2	2	1
CB182						2	1	1	CBBT 3	4	3	2
CB183						1	1		CBBT 3/4	2	2	1
CB184						2		1	CBBT 3	3	2	2
CB185						1			CBBT 3	1	1	1
CB186						1	1	2	CBBT 3/4	4	3	2
CB187						2	2	4	CBBT 3/4	8	3	4
CB189						1		2	CBBT 3/4	3	2	2
CB190						1		2	CBBT 3 & ES	3	2	2
CB192						1		2	CBBT 3	3	2	2
CB193						1	1	1	ES	3	3	1
CB194						1		1	ES	2	2	1
CB195						1			CBBT 4	1	1	1
CB196						2			CBBT 3	2	1	2
CB197						1	1		ES	2	2	1
CB198						1	1		CBBT 4	2	2	1
CB199						2			CBBT 4	2	1	2
CB200						1			CBBT 3	1	1	1
CB201						1	1		ES	2	2	1

NAVFAC Catalogue ID	Season 2 Dec 2015-Mar 2016	Season 3 Dec 2016-Apr 2017	Season 4 Nov 2017-Feb 2018	Season 5 Dec 2018-Mar 2019	Season 6 Dec 2019-Mar 2020	Season 7 Dec 2020-Apr 2021	Season 8 Nov 2021-Apr 2022	Season 9 Nov 2022-Mar 2023	Location	Total No. Days Seen	Total No. Seasons Seen	Max No. Days Seen within a Season
<b>Harbor Seals (continued)</b>												
CB202						1			ES	1	1	1
CB203						1	1		CBBT 4	2	2	1
CB204						1			CBBT 2	1	1	1
CB205						1			CBBT 2	1	1	1
CB206						2			CBBT 4 & ES	2	1	2
CB207						1			ES	1	1	1
CB208							1	1	CBBT 3	2	2	1
CB209							1	1	CBBT 3/4	2	2	1
CB210							1	2	CBBT 4	3	2	2
CB211							1		ES	1	1	1
CB212							1		ES	1	1	1
CB213							1		CBBT 4	1	1	1
CB214							1		CBBT 2	1	1	1
CB215							1	1	ES	2	2	1
CB216							2		CBBT 4 & ES	2	1	2
CB217							1		CBBT 4	1	1	1
CB218							1		CBBT 2	1	1	1
CB219							1		ES	1	1	1
CB220							1		ES	1	1	1
CB221							1		ES	1	1	1
CB222							1		ES	1	1	1

NAVFAC Catalogue ID	Season 2 Dec 2015-Mar 2016	Season 3 Dec 2016-Apr 2017	Season 4 Nov 2017-Feb 2018	Season 5 Dec 2018-Mar 2019	Season 6 Dec 2019-Mar 2020	Season 7 Dec 2020-Apr 2021	Season 8 Nov 2021-Apr 2022	Season 9 Nov 2022-Mar 2023	Location	Total No. Days Seen	Total No. Seasons Seen	Max No. Days Seen within a Season
<b>Harbor Seals (continued)</b>												
CB223								3	ES	3	1	3
CB224								4	CBBT 3/4 & ES	4	1	4
CB225								1	ES	1	1	1
CB226								2	CBBT 3	2	1	2
CB227								1	CBBT 4	1	1	1
CB228								2	CBBT 3	2	1	2
CB229								1	ES	1	1	1
CB230								1	ES	1	1	1
CB231								5	CBBT 4	5	1	5
CB232								2	CBBT 3/4	2	1	2
CB233								2	CBBT 3/4	2	1	2
CB234								1	CBBT 3	1	1	1
CB235								1	ES	1	1	1
CB236								1	ES	1	1	1
CB237								1	ES	1	1	1
CB238								1	ES	1	1	1
CB239								1	ES	1	1	1
CB241								1	CBBT 4	1	1	1
CB242								1	CBBT 3	1	1	1
CB243								1	CBBT 3	1	1	1
CB244								1	ES	1	1	1

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<b>Harbor Seals (continued)</b>												
CB245								1	ES	1	1	1
CB246								1	ES	1	1	1
CB247								1	ES	1	1	1
CB248								1	ES	1	1	1
CB249								1	CBBT 4	1	1	1
CB251								1	CBBT 3	1	1	1
CB252								2	CBBT 4	2	1	2
CB253								1	CBBT 2	1	1	1
CB254								1	ES	1	1	1
<b>Totals</b>	<b>28</b>	<b>98</b>	<b>40</b>	<b>24</b>	<b>17</b>	<b>79</b>	<b>60</b>	<b>116</b>				
<b>Gray Seals</b>												
CB168					1				ES	1	1	1
CB188						1		1	ES	2	2	1
CB240								1	CBBT 4	1	1	1
CB250								1	ES	1	1	1
<b>Totals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>3</b>				