

Investigating Seasonal Patterns of Harbor Seals in the Mid-Atlantic

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INTRODUCTION

- **Project goals:** to assess seal abundance, habitat use, and haul-out patterns in relation to environmental factors, and to compare results from vessel-based and time-lapse camera surveys.
- Harbor seals exhibit a general southward movement from the Bay of Fundy to southern New England and mid-Atlantic waters in autumn and early winter [1].
- Since 2014, Navy biologists have been conducting vessel-based surveys at known seal haul-out sites in Virginia (VA) and have provided multiple years worth of baseline data on seasonal seal occurrence [2].
- Frequency and timing of vessel-based surveys is dictated by study design, weather conditions, and available resources [3].

METHODS: TIME-LAPSE CAMERAS

- Time-lapse cameras were set up at two locations in southeastern VA: along the Chesapeake Bay Bridge Tunnel (CBBT) and on the southern tip of the Eastern Shore (EASH) (Figure 1) from October to May each year.
- The cameras were programmed to capture an image every 15 minutes during daylight hours.
- At the CBBT survey site, the seals haul out on the rock armor islands that protects the underwater tunnels (Figure 2). Cameras are set up on CBBT3 and CBBT4; the other two islands are monitored by vessel surveys as they are inaccessible due to construction.
- At the EASH survey site, there are nine separate haul out sites within close proximity to one another (Figures 3 & 6). The sites are sandy banks with marsh edges and each one is monitored by a trail camera (camera trap).



Figure 2. Aerial view of a CBBT island. Photo taken by Virginia Aquarium & Marine Science Center Foundation.



Figure 3. Harbor seals hauled out at the EASH at sunrise. Photo taken under NMFS General Permit # 19826.

METHODS: DATA ANALYSIS

- Images were reviewed for the presence of seals (in the water or hauled out) and vessels using the Timelapse2 program [4].
- Counts were analyzed temporally to determine if there were patterns in haul-out activity by time of day or month.
- Counts were also compared to environmental factors to investigate if there were any haul-out patterns in relation to air temperature, wind speed, or verified tidal height.
- Data from the vessel surveys were compared to the data from the camera traps on days the vessel surveys were conducted to see if counts differed between the survey methods.

REFERENCES

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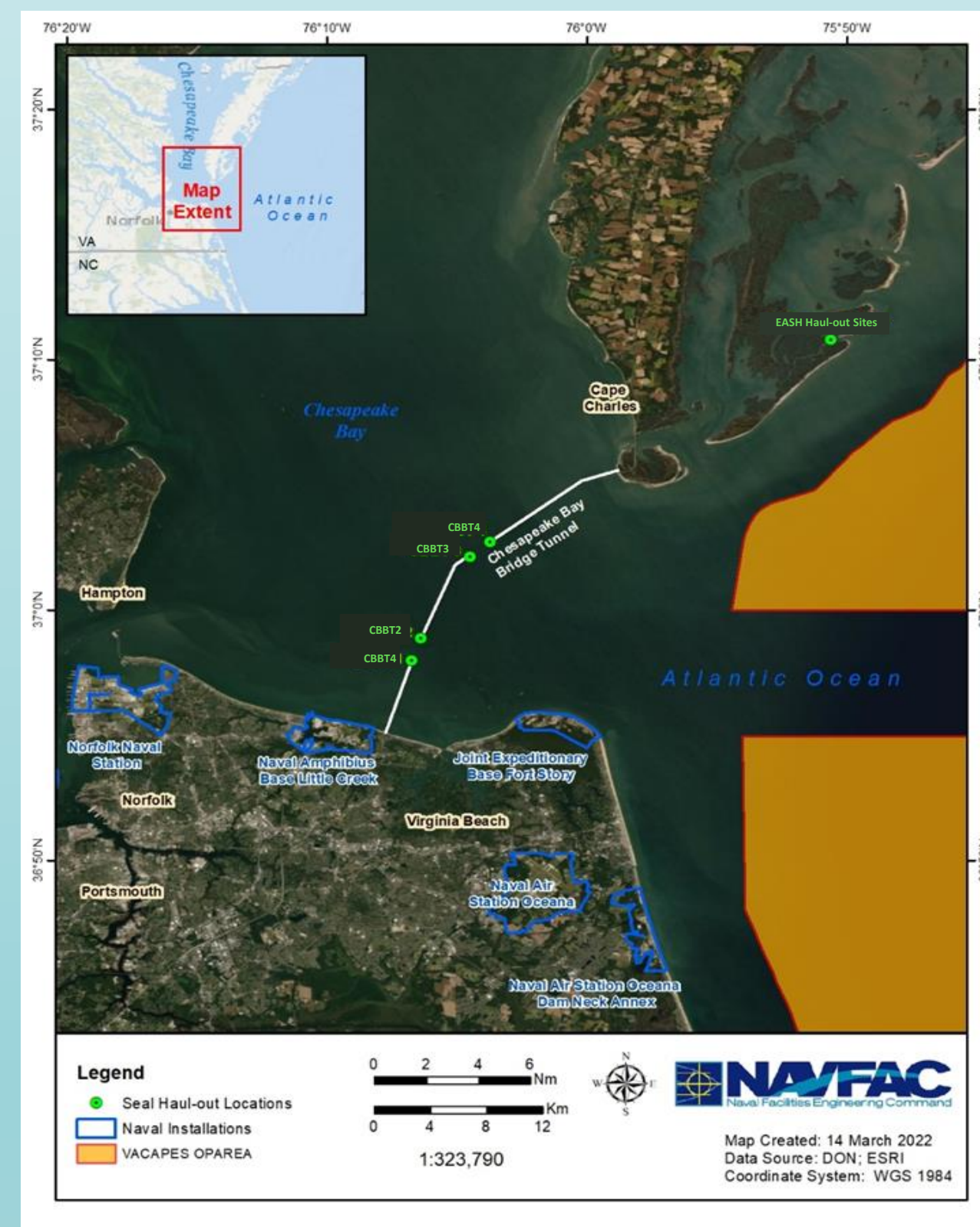


Figure 1. EASH and CBBT haul-out sites and nearby U.S. naval installations. VACAPES OPAREA= Virginia Capes Range Complex Operating Area

RESULTS

- During each season, seals were observed from October/ November to April/ May.
- Seals were hauled out in highest numbers in February (Figures 4 and 5).
- The highest total and maximum count for the CBBT survey site was during the 2022/2023 season; for the EASH survey site, it was during the 2021/2022 season (Table 1).
- The majority of seals documented have been harbor seals, although there have been 14 instances of gray seals captured in photos (Figure 6).
- Harbor seals were more likely to be hauled-out in the following environmental conditions
 - Tidal height: (2-25 ft. at EASH, 0.5-1 ft. at CBBT)
 - Wind Speed: (5-10 kn. at both EASH and CBBT)
 - Air Temperature: (35-55°F at EASH and CBBT)
- More in-water seals were counted during vessel surveys than camera surveys.
- More hauled-out seals were counted during camera surveys than vessel surveys.

Season	Site	Total Count	Maximum Count
2019/2020	EASH	48,784	72
	CBBT	5,690	17
2020/2021	EASH	54,066	71
	CBBT	10,555	20
2021/2022	EASH	60,963	73
	CBBT	14,144	23
2022/2023	EASH	59,551	63
	CBBT	15,461	27

Table 1. Total count (every time a seal was seen in an image) and maximum count (the highest count in one image) results for each site and season.

DISCUSSION

- Camera traps were proven as an effective method to monitor seals in all conditions during daylight hours, compared to vessel surveys, which are limited by weather conditions.
- Seals in the water are more likely to be observed during vessel surveys than camera surveys due to vessel surveys being conducted over a continuous time frame while camera surveys only take one photo every 15 minutes. If a seal is not above water the exact moment a photo is taken, it would be missed.
- This analysis demonstrates the consistent use of the haul-out sites from November-April at both the EASH and CBBT.
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- The addition of infrared imaging cameras would help to observe seal activity in the absence of daylight. Previous data shows that seals spend more time hauled out at night rather than during the day, so current counts may be underestimating seals using the haul-out sites [5].
- The addition of aerial surveys would help determine if there are additional haul-out sites in the region.
- The addition of artificial intelligence (AI) models for counting seals in images would help eliminate the hours dedicated to this labor-intensive part of the project. Currently, there is limited research on the use of these AI tools and harbor seal monitoring efforts.

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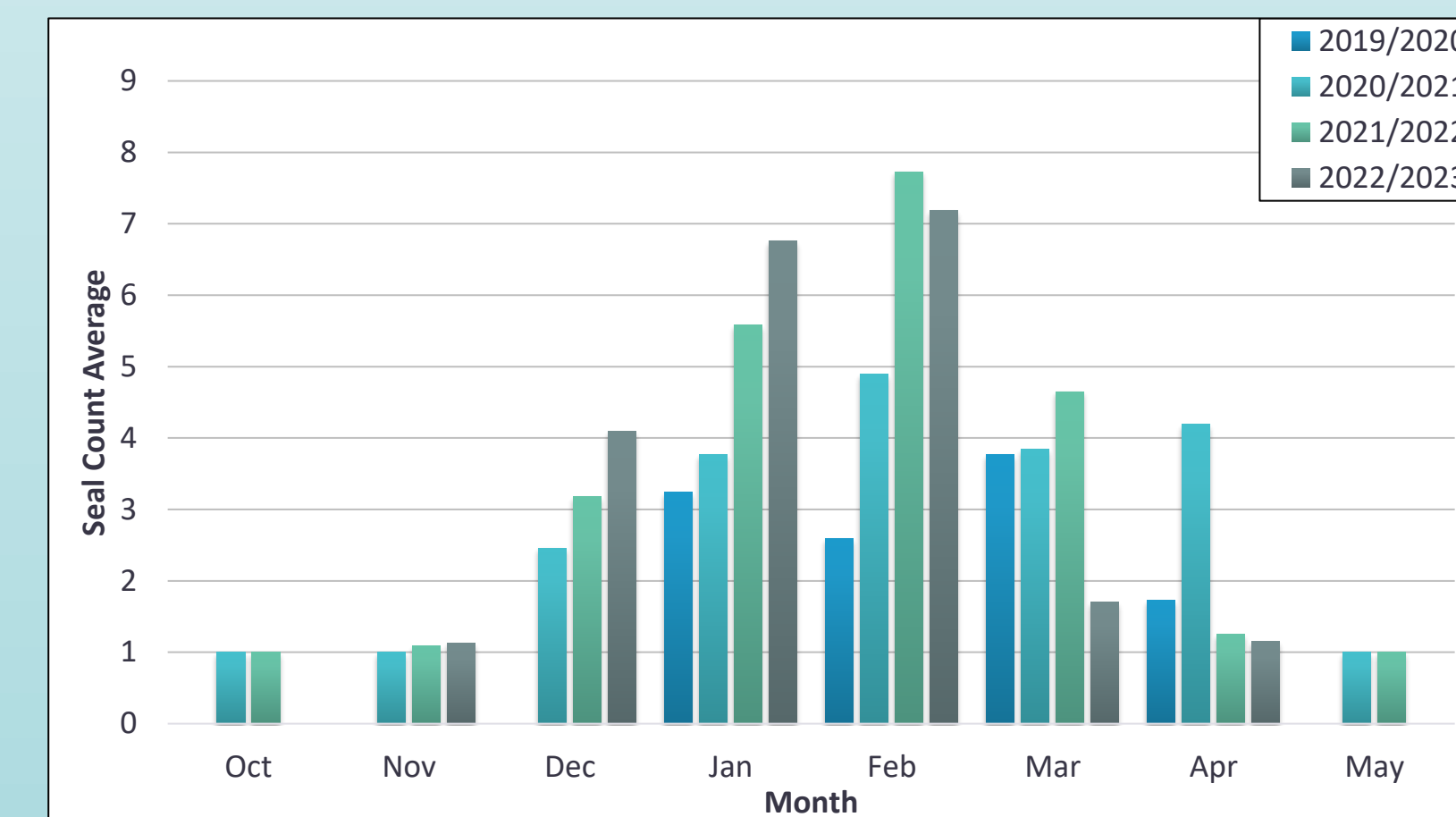


Figure 4. Average count of seals hauled out during each month of each season at the CBBT survey site from October to May.

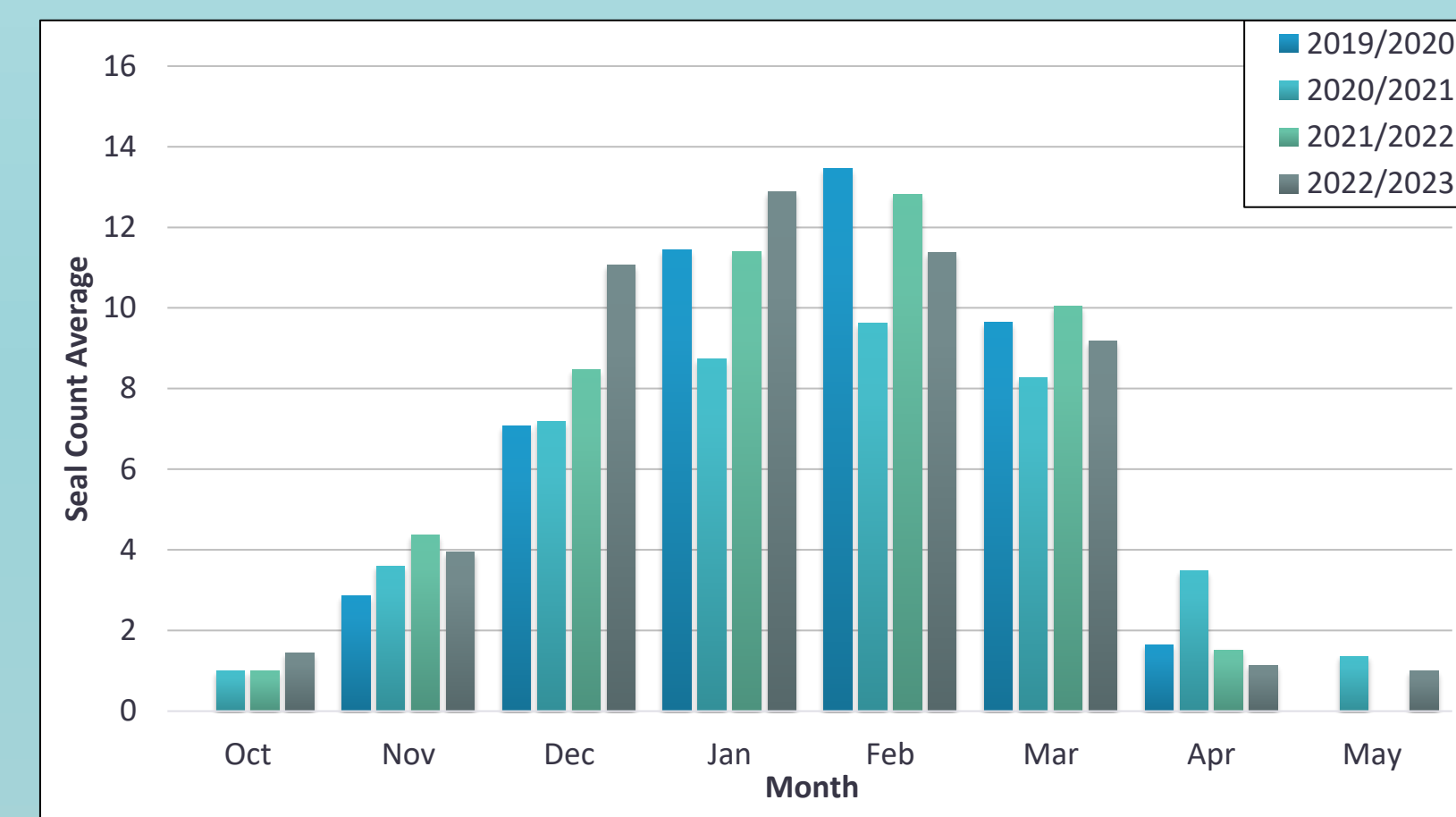


Figure 5. Average count of seals hauled out during each month of each season at the EASH survey site from October to May.



Figure 6. Gray seal photographed at EASH site, shown in the yellow box. Photo taken under NMFS General Permit # 19826.