Mid-Atlantic Baleen Whale Photo-Identification Efforts

2023/24

ANNUAL PROGRESS REPORT

June 2025

PREPARED BY

Jessica Aschettino, Dan Engelhaupt, and Jess Ozog, HDR

Amy Engelhaupt, Amy Engelhaupt Consulting

HDR

Science   ⚓   Stewardship   ⚓   Protection

Table of Contents

Figures

Tables

Appendices

Acronyms and Abbreviations

°N	degrees North
°W	degrees West
CATS	Customized Animal Tracking Solutions
GOM	Gulf of Maine
ID	identifications or identification number
km	kilometer(s)
LiDAR	Light Detection and Ranging
m	meter(s)
MAHWC	Mid-Atlantic Humpback Whale Catalog
MGEL	Marine Geospatial Ecology Lab
MINEX	Mine Neutralization Exercise
NAHWC	North Atlantic Humpback Whale Catalog
NARW	North Atlantic right whale
NAVFAC LANT	Naval Facilities Engineering Systems Command Atlantic
NDAA	National Defense Authorization Act
NEFSC	Northeast Fisheries Science Center
nm	nautical mile
OBIS-SEAMAP	Ocean Biogeographic Information System Spatial Ecological Analysis of Megavertebrate Populations
OCS	Offshore Cetacean Study
OPAREA	Operating Area
photo-ID	photo-identification
SMA	Seasonal Management Area
UME	Unusual Mortality Event
U.S.	United States
VACAPES	Virginia Capes
VAQF	Virginia Aquarium & Marine Science Center Foundation

1   Introduction and Background

Photo-identification (photo-ID) efforts on humpback whales (*Megaptera novaeangliae*) off Virginia began during the early 1990s, with shore-based counts in 1991 and vessel-based efforts in 1992 led by researchers from what is now the Virginia Aquarium & Marine Science Center Foundation (VAQF) (Swingle et al. 1993). Using fluke and dorsal fin images (Katona and Whitehead 1981), individual whales were recognized and cataloged. Photographs collected from whale-watch vessels and stranded animals comprised the majority of photo-IDs available for this area (Wiley et al. 1995, Barco et al. 2002). Images of humpback whales were compared with catalogs from other regions, and individuals were shown to match known whales from the Gulf of Maine, Gulf of St. Lawrence, and Newfoundland (Barco et al. 2002).

Beginning in January 2015, HDR Inc. has been monitoring humpback whales to assess their occurrence, habitat use, and behavior within and near United States (U.S.) Navy training and testing areas off Virginia, first via the Mid-Atlantic Humpback Whale Monitoring Project, (Aschettino et al. 2015, 2016, 2017, 2018, 2019, 2020a, 2020b, 2021, 2022) and now via the Mid-Atlantic Nearshore and Mid-shelf Baleen Whale Monitoring Project (Aschettino et al. 2023a, 2024a, 2025), which is an evolution of the initial efforts with a greater focus on mid-shelf waters and all baleen whale species. Endangered North Atlantic right whales (NARW; *Eubalaena glacialis*) and fin whales (*Balaenoptera physalus*) are priority species for this expanded effort. In addition to the nearshore and mid-shelf efforts, baleen whales are also encountered during the Mid-Atlantic Offshore Cetacean Study (OCS) (Engelhaupt et al. 2025). The baleen whale field season off Virginia Beach runs from approximately November through April, typically concentrated between December and February, with smaller numbers of sightings occurring outside this time frame.

Since the inception of the Mid-Atlantic Humpback Whale Monitoring Project, ten field seasons have occurred, with a focus on photo-ID, biopsy sampling, tagging using medium-resolution satellite tags and high-resolution suction-cup tags, and drone-based photography for length and body-condition assessments. To better assist the vessel team with these efforts and in locating target species, non-systematic aerial surveys were implemented beginning in March 2021 (Aschettino et al. 2023a). Aerial survey effort increased during the 2022/23 (Aschettino et al. 2024a) and 2023/24 seasons (Ozog and Engelhaupt 2025). This report will focus on photo-ID results of baleen whales encountered during vessel and aerial surveys in the nearshore, mid-shelf, and offshore regions. Details about tagging and biopsy sampling are provided in Aschettino et al. (2025) for the nearshore and mid-shelf effort and in Engelhaupt et al. (2025) for the offshore effort. Details from the dedicated aerial survey efforts are provided in Ozog and Engelhaupt 2025.

With the influx of photo-ID data accumulating from the Mid-Atlantic Humpback Whale Monitoring Project, multiple local whale watches operating within the area, and historical sightings and strandings data being housed in non-digital format, a need was identified to integrate and manage photo-ID data from these various sources more effectively. In 2017, the Mid-Atlantic Humpback Whale Catalog (MAHWC) was established by researchers from the VAQF with funding support from U.S. Fleet Forces Command, managed by Naval Facilities Engineering Systems Command Atlantic (NAVFAC LANT) as part of the U.S. Navy's Marine Species

Monitoring Program (Mallette and Barco 2017). VAQF maintained the role as catalog curator for more than 4 years, working closely with the Marine Geospatial Ecology Lab (MGEL) at Duke University to develop and model the catalog after the Mid-Atlantic Bottlenose Dolphin Catalog (Urian at al. 1999), which is hosted on the Ocean Biogeographic Information System Spatial Ecological Analysis of Megavertebrate Populations (OBIS-SEAMAP; http://seamap.env.duke.edu; Halpin et al. 2006, 2009; Fujioka et al. 2014) platform. Beginning in 2023, HDR Inc. and NAVFAC LANT took on the curator role for the catalog, and additional funding was provided to Duke University to convert the older 32-bit Microsoft Access database to a newer 64-bit database. Additional funding was also provided to Happywhale (Cheeseman et al. 2022) to allow for the integration of their animal identification algorithm into the database. Other baleen whale species are currently cataloged in local collections associated with the Navy's Marine Species Monitoring Program projects in the region.

During HDR Inc.'s 2023/24 field season, baleen whale sightings included humpback whales, NARWs, fin whales, minke whales (*Balaenoptera acutorostrata*), and sei whales (*Balaenoptera borealis*). This report will focus on the photo-ID results from all baleen whale sightings, photogrammetry results from the drone, and status of the MAHWC and Happywhale matching. See Aschettino et al. (2025) and Engelhaupt et al. (2025) for further information and details from the vessel survey and tagging efforts, and Ozog and Engelhaupt (2025) for details from the supporting aerial surveys.

2   Methods

The study area for the nearshore and mid-shelf project includes waters within and around the mouth of Chesapeake Bay, the W-50 Mine Neutralization Exercise (MINEX) region off Virginia Beach, and the mid-shelf region of the Virginia Capes Operating Area (VACAPES OPAREA) (**Figure 1**). The primary survey area for the OCS project includes the offshore waters (approximately 90 to 160 kilometers [km] or 50 to 85 nautical miles [nm]) off the coast of Virginia, including the outer continental shelf, shelf break, slope waters, and Norfolk and Washington Canyons (**Figure 2**). Details of overall survey methods are outlined in Aschettino et al. (2025), Engelhaupt et al. (2025), and Ozog and Engelhaupt (2025).

2.1   Photo-Identification

Photographs were collected in the field using a digital single-lens reflex camera (Canon 7D, 7D Mark II, or 1DX Mark II) or a mirrorless camera (Canon R5) with a zoom lens (Canon 100- to 400-millimeter or Canon 100- to 500-millimeter). Photographs were post-processed using ACDSee (Versions 7–9) by cropping the best image of each individual whale's dorsal fin (left and right for humpback, fin, and minke whales) and tail flukes (when obtained).

For humpback, fin, and minke whales, photographs were assembled into individual project catalogs managed by HDR Inc., in which each new whale was assigned a unique identifier using the naming convention "HDRVA," followed by the two-letter abbreviation for the scientific name of the species, followed by a numerical sequence of three numbers (e.g., HDRVAMn001, HDRVABp001). Each whale was then compared with the others. At the end of the 2014/15 field season and at the end of the 2022/23 season, images of humpback whale flukes were submitted to Allied Whale for comparison to the North Atlantic Humpback Whale Catalog (NAHWC). Prior to the 2021/22 season, images of humpback whale dorsal fins and flukes were submitted to the VAQF for comparison with the Gulf of Maine Humpback Whale Catalog (curated by the Center for Coastal Studies) and integration into the MAHWC (Mallette and Barco 2019). Subsequent seasons were integrated into the MAHWC by HDR Inc. and NAVFAC LANT curators. Images of humpback whales from all seasons were annually compared with images from local whale-watch operation Rudee Tours, and images through the 2021/22 season were compared with Gotham Whale (Brown et al. 2022). Fin whale images through 2017 were shared with the North Atlantic Fin Whale Catalog curated by the Center for Coastal Studies, and will be added to Happywhale and compared to catalog photographs from other regions that have been shared with HDR Inc.
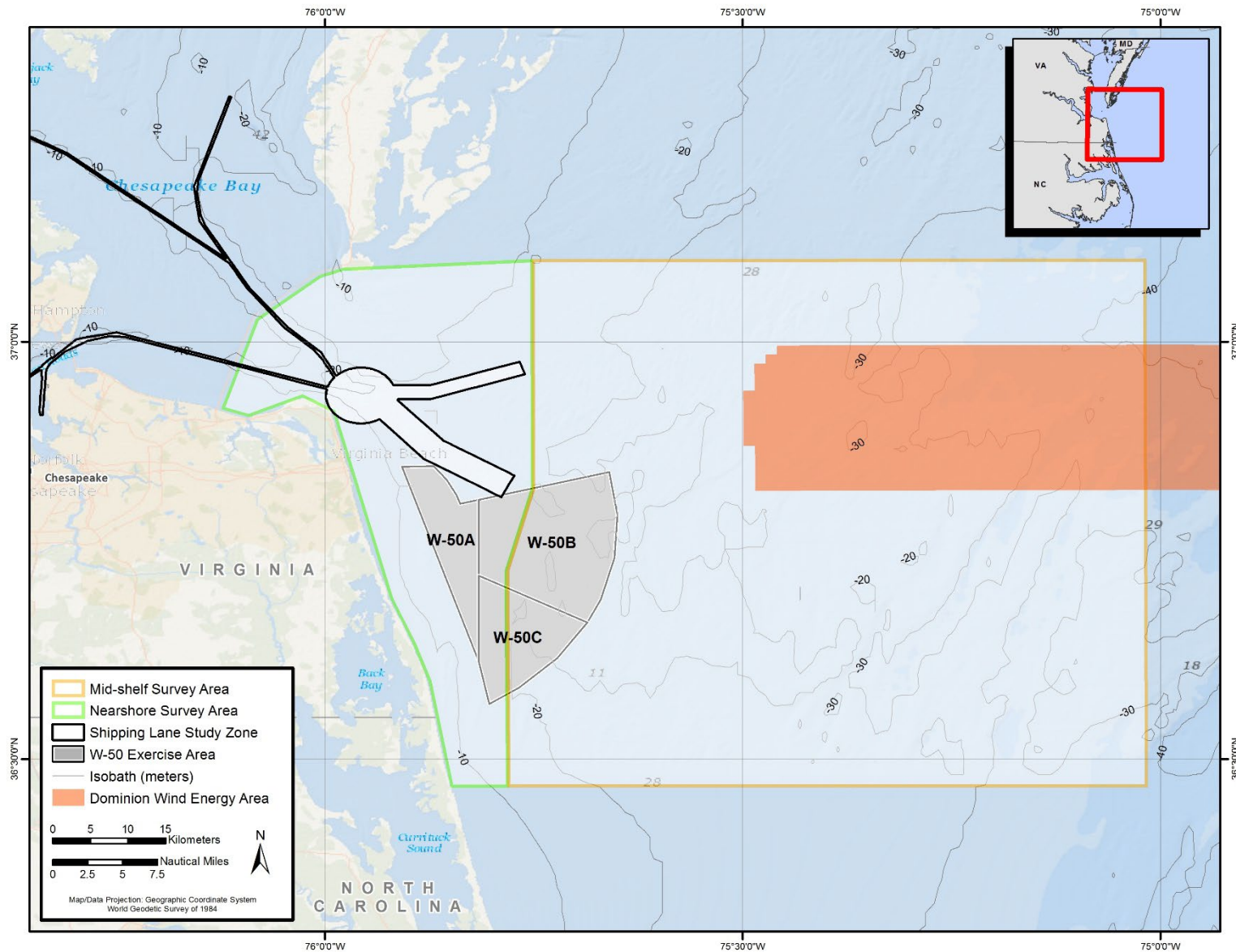
Figure 1. Map of the nearshore and mid-shelf study area, which includes waters within and around the mouth of Chesapeake Bay shipping lanes, the W-50 MINEX region off Virginia Beach, and the Dominion Wind Energy Area.
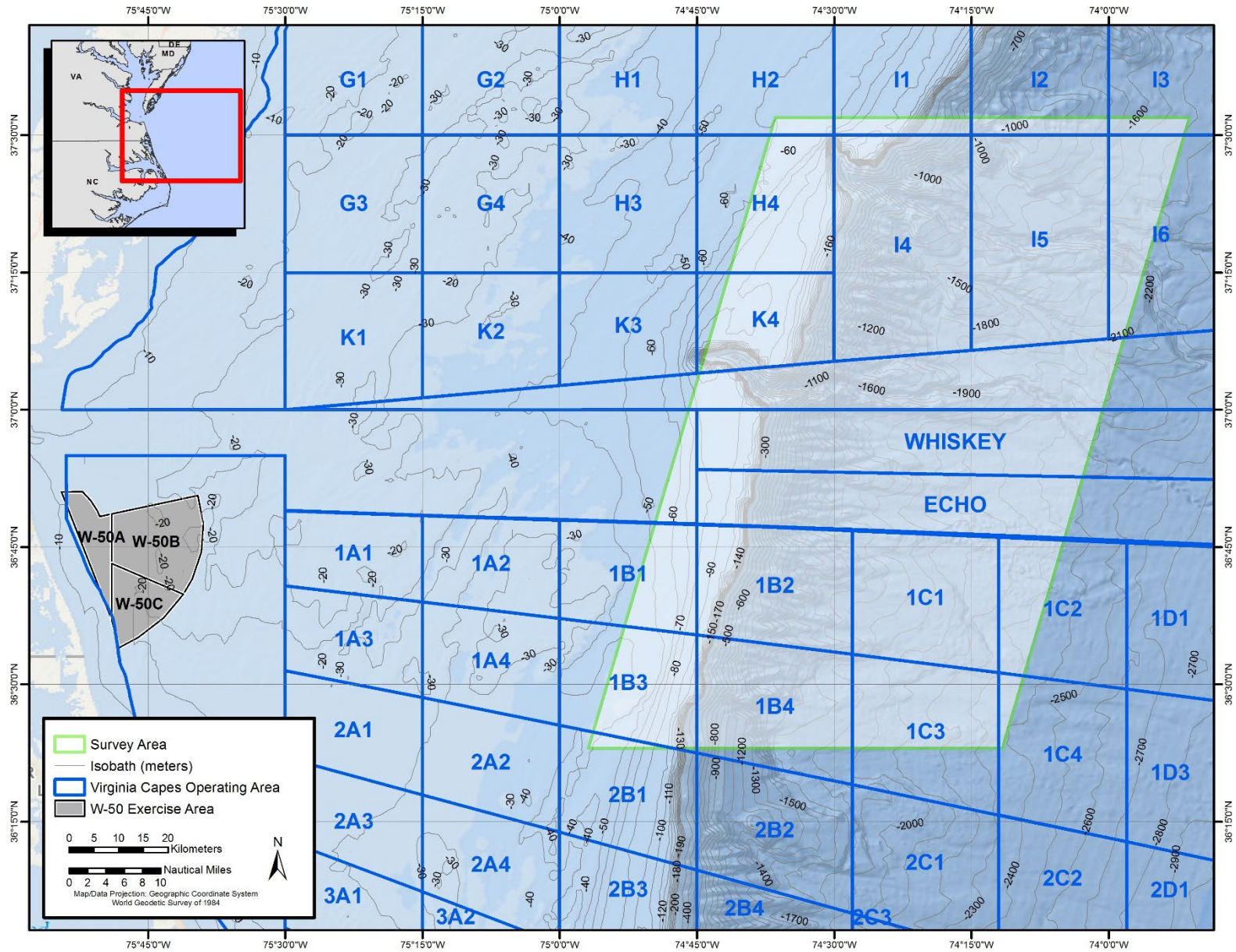
Figure 2. Map of the offshore study area off southeastern Virginia and northern North Carolina, and VACAPES training range surface grid within the region.

When sightings of NARWs were made in the field, the drone was often launched (see **Section 2.3**) to record overhead videos of all individuals. Because NARWs are best identified using callosity patterns and scarring ([Hamilton et al. 2007](#)), the resulting overhead stills were used to compare with an onboard catalog of known reproductive females. If an aerial survey happened to be in progress, they would be tasked with collecting identification photographs of all individuals. If either the vessel or aerial team was within cell-phone range, photographs of the individual NARWs were then shared with Katie Jackson (Florida Fish and Wildlife Conservation Commission) for identification assistance. If not within cell-phone range, images would be sent to Katie Jackson as well as others at the Northeast Fisheries Science Center (NEFSC) and New England Aquarium once back within range. At the end of the 2023/24 field season, all photographs and drone data collected from NARWs were submitted to the New England Aquarium for incorporation into the [North Atlantic Right Whale Catalog](#).

Photographs of sei whales were shared directly with NEFSC staff for incorporation into the existing western Atlantic catalog.

2.2   Mid-Atlantic Humpback Whale Catalog and Happywhale

The MAHWC was designed as a collaborative tool to facilitate understanding of identity, residency, site fidelity, and habitat use of humpback whales in Mid-Atlantic waters. Organizations and individuals from New York to North Carolina can contribute sighting and photographic information for inclusion in the catalog. The catalog is composed primarily of images and data collected by researchers or organizations focused on photo-ID, as well as information from stranding groups. Contributors are encouraged to provide additional data to the catalog if collected, such as biopsy status, tag status, and gender (if known).

Beginning in 2023, HDR Inc. and NAVFAC LANT took on the curator role for the MAHWC. Curator training protocols had been preliminarily developed by personnel from VAQF ([Mallette and Barco 2017](#)); however, extensive revisions were required to update the document based on recent updates to the structure and functionality of the catalog. With input from Ei Fujioka and Kim Urian of Duke University, the document was amended in 2023 and serves as a resource for future catalog curators.

To aid researchers in managing their data and images, OBIS-SEAMAP hosts an online framework for viewing fin and fluke images, mapping sighting locations, and matching individuals across projects or locations ([Halpin et al. 2009](#)). The framework is tied to a Microsoft Access database, so updates made to the database can then be pushed to the online platform where users can view the [MAHWC](#), with authorized users (i.e., those who have been assigned as contributors or collaborators) having login credentials. The curator handbook provides detailed information regarding how to enter photographs and associated metadata into the database, as well as how to work within the OBIS-SEAMAP platform. When the MAHWC was first established, it was built on a 32-bit platform; however, it was necessary to upgrade the system to a 64-bit platform to perform on most computers.

[Happywhale.com](#) is a citizen-science platform that allows any user to upload image(s) of whales to gain information on where that whale had been previously seen. An artificial-intelligence-based, automated, image-recognition algorithm was developed for humpback whale flukes,

which constitutes the majority of image types available on Happywhale. Currently, more than 112,000 individuals are in the humpback whale database, of which more than 11,000 are from the North Atlantic and Atlantic Arctic.

OBIS-SEAMAP and Happywhale have established a data exchange mechanism in which Happywhale's encounter records and associated images are imported into the OBIS-SEAMAP database at a scheduled interval (currently monthly). In order to integrate the Happywhale machine-learning, animal-identification algorithm into the MAHWC, Happywhale developed a web component containing essential features of the animal identification algorithm, and MGEL incorporated the web component into the MAHWC. Any humpback whale fluke photographs entered into the MAHWC can therefore be matched using fast, accurate, automated image recognition (Cheeseman et al. 2022) against a known set of individuals. See Aschettino et al. (2024b) for additional information on the MAHWC and Happwhale workflow. So that the known set of individuals is as useful and relevant to the MAHWC as possible, Happywhale hosts and maintains a humpback whale fluke photo-ID catalog containing representative fluke photographs of all available, known, MAHWC individuals as well as fluke images of all available North Atlantic individuals from research collaborators and citizen-science sources.

2.3   Drone and Photogrammetry

The use of a drone was incorporated into the field effort beginning in the 2018/19 field season. A DJI Phantom 4 Pro V2.0 was used to collect morphometric data and assess overall body condition. Live video was also used in the field to assist the research team during tagging attempts to maximize successful deployments. Data were typically collected at flight heights between 15 and 30 meters (m), depending upon the behavior of the focal animal during the time of the encounter. The drone collected 4K ultra-high-definition video at 30 frames per second. Initial measurements were made from data using altitude values from the drone's stock barometer, although some error is expected with this method. HDR Inc. used MorphoMetriX to calculate lengths (Torres and Bierlich 2020) and CollatriX to consolidate all length measurements (Bird and Bierlich 2020).

Following the methodology described in Dawson et al. (2017), the DJI Phantom 4 Pro V2.0 was retrofitted with a custom Light Detection and Ranging (LiDAR) (Lightware SF11) altimeter in 2020. This upgrade increases precision (to within 5 centimeters) and consistency of the drone altimetry measurements to minimize possible error in estimated animal lengths. Attribute-grading criteria for images, based on Christiansen et al. (2018), were used to assess drone still images for data collected beginning with the 2021/22 season and onward. Images were assessed for six of the seven attributes, including camera focus, body straightness, body roll, body arch, body pitch, and body length measurability. Each attribute was scored as either a 1 (good), 2 (medium), or 3 (poor). Any image receiving a score of 3 for any of the six attributes, or a 2 for roll/arch, roll/pitch, or arch/pitch, would be removed from analysis based on Christiansen et al. (2018). However, due to limited screen grabs from some flights/individuals, the best photograph of each whale was selected for measuring, despite the potential for exclusion from analysis based on the criteria scores.

Age classes of humpback whales were assigned based on subjective size assessments from the research vessel. The length of the HDR Inc. research vessel was often used for reference in making these subjective assessments. For example, individuals that were estimated to be approximately the length of the vessel (8.8 m) or smaller were typically classified as juveniles, whereas individuals that appeared longer than the research vessel were typically classified as sub-adults or adults. Although not precise, these estimates roughly fall in line with the estimated length at weaning of 8.0 m (Rice 1963) and length at sexual maturity starting at 11.0 m for humpback whales (Nishiwaki 1959). Furthermore, Stevick (1999) reported lengths of stranded humpback whales of known age; 16 individuals under 5 years of age measured 8.5 to 12.5 m in length (mean=10.2 m), and 7 individuals aged 7 to 17 years of age measured 12.8 to 14.2 m in length (mean=13.2 m).

3   Results

3.1   Photo-Identification

During the 2023/24 season of the nearshore and mid-shelf baleen whale monitoring project, 24 vessel surveys were conducted covering 3,379 km of trackline with more than 185 hours of effort (Aschettino et al. 2025a). The first survey occurred on 03 November 2023, and the last survey took place on 30 March 2024. There were 43 baleen whale sightings, including 33 humpback whale sightings composed of 43 individuals, 6 NARW sightings composed of 8 individuals, 3 minke whale sightings composed of 3 individuals, and 1 fin whale sighting composed of 1 individual (**Table 1**).

Fifteen offshore vessel surveys were conducted for the OCS project between March and July 2024, covering 4,510 km of trackline during more than 190 hours of effort (Engelhaupt et al. 2025). Following detection of an unusually high number of baleen whale sightings during May, an increase in survey effort was directed to the area 100 to 120 km (approximately 54 to 65 nm) from shore during the following month. Baleen whale sightings included fin whale (*n*=57), humpback whale (*n*=31), NARW (*n*=11), and sei whale (*n*=8) (**Table 1**).

Aerial survey effort was flown in coordination with either the nearshore and mid-shelf baleen whale monitoring project or with the OCS project. For the 2023/24 season, 13 aerial surveys were flown, covering 10,875 km of trackline with more than 55 hours of survey effort (Ozog and Engelhaupt 2025). The first aerial survey of the 2023/24 field season occurred on 15 December 2023, and the last survey occurred on 26 May 2024. The aerial surveys resulted in 40 sightings of baleen whales, including 8 NARW sightings composed of 13 individuals, 12 fin whale sightings composed of 17 individuals, 15 humpback whale sightings composed of 22 individuals, and 5 minke whale sightings composed of 5 individuals (**Table 1**). Photo-IDs were collected from NARWs only.

Table 1.   Summary of survey effort, sightings, and photographs collected across all three projects during the 2023/24 season.

Survey/Report	# Survey Days	# Mn sightings/ individuals	# Eg sightings/ individuals	# Bp sightings/ individuals	# Ba sightings/ individuals	# Bb sightings/ individuals	# Photos collected
Mid-Atlantic nearshore and mid-shelf baleen whale monitoring (Aschettino et al. 2025)	24	(33/43)	(6/8)	(1/1)	(3/3)	(0/0)	30,139
Offshore Cetacean Study (Engelhaupt et al. 2025)	15	(31/126)	(11/50)	(57/116)	(0/0)	(8/24)	98,399
Mid-Atlantic Marine Mammal Aerial Survey (Ozog and Engelhaupt 2025)	13	(15/22)	(8/13)	(12/17)	(5/5)	(0/0)	3,468
Totals	52	(79/205)	(25/67)	(70/133)	(8/8)	(8/23)	132,006

Key: Ba = *Balaenoptera acutorostrata* (minke whale); Bb = *Balaenoptera borealis* (sei whale); Bp = *Balaenoptera physalus* (fin whale); Eg = *Eubalaena glacialis* (right whale); Mn = *Megaptera novaeangliae* (humpback whale)

3.1.1 Humpback Whales

The 33 sightings of humpback whales observed during the 2023/24 nearshore and mid-shelf baleen whale season included 43 total individuals (Aschettino et al. 2025) and resulted in 29 unique humpback whales identified using dorsal fin and fluke images. During the offshore surveys, 31 sightings of humpback whales totaled 126 individuals (Engelhaupt et al. 2025) and resulted in 45 unique humpback whales. Humpback whales photographed from the aerial surveys (Ozog and Engelhaupt 2025) were not included in the cataloging effort. In total, 74 unique humpback whales were identified during the 2023/24 season (**Figure 3**; **Appendix A**, **Table A-1**).
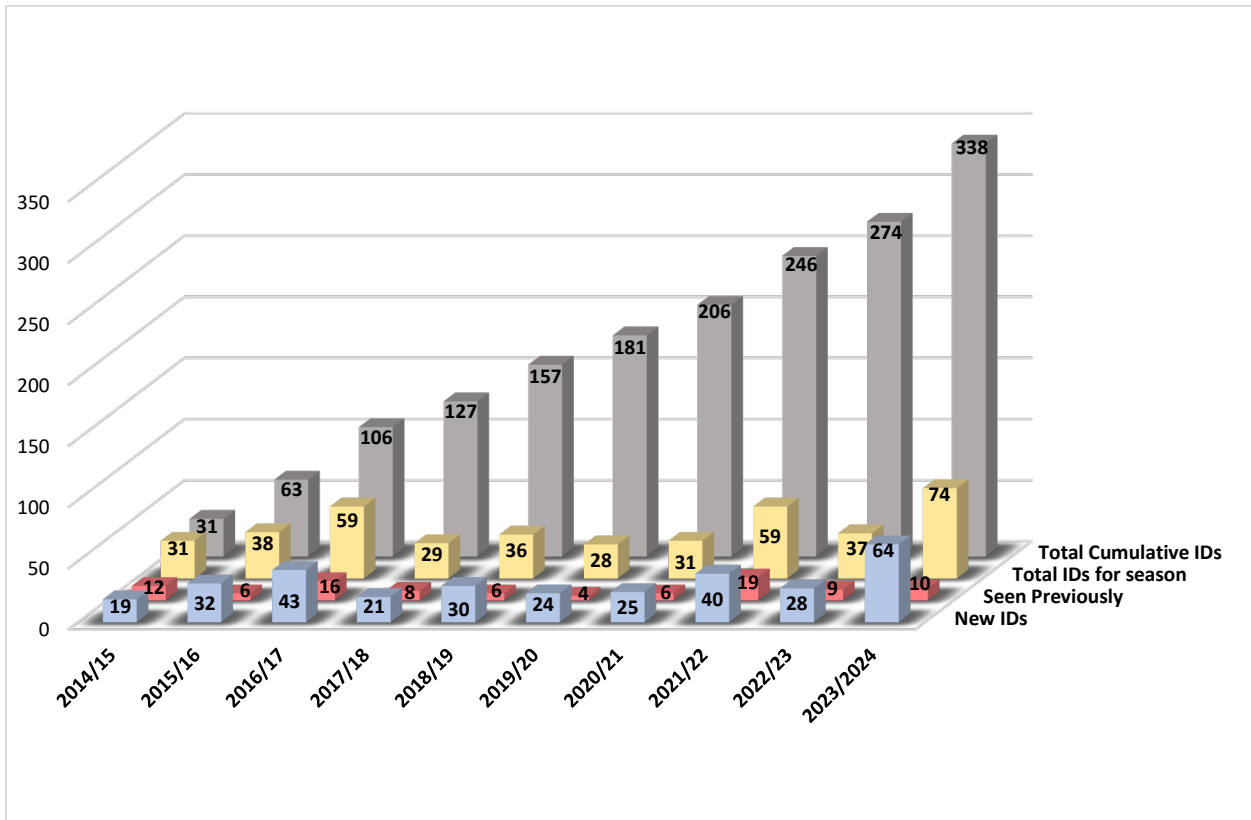
Figure 3. Humpback whale identifications (ID) over 10 field seasons within the Virginia study area (yellow bars = total number of IDs each season; red bars = number of those IDs seen in previous seasons; blue bars = number of new IDs added to catalog; and gray bars = total number of cumulative unique IDs).

Of the 74 unique humpback whales seen during the 2023/24 season, 34 (46.0 percent) were classified as adults based on their estimated size in the field, 17 (23.0 percent) were categorized as juveniles, 8 (10.8 percent) were classified as sub-adults/adults, 2 (2.7 percent) were classified as calves, and the remaining 13 (17.6 percent) were not assigned an age class. Ten (13.5 percent) of the 74 individuals were re-sights to HDR Inc.'s catalog; 1 individual had not been seen since the initial 2014/15 season (HDRVAMn017), and the remaining re-sights included individuals from six of the nine previous field seasons. The additional 64 whales were new individuals added to the growing project catalog, which, to date, has 340 unique humpback whales, inclusive of identifications added from previous bottlenose dolphin surveys (2012–2015) (Engelhaupt et al. 2016) and the Outer Continental Shelf Break/VACAPES Offshore Cetacean

Study (ongoing since 2016) [Engelhaupt et al. 2017, 2018, 2019, 2020, 2022, 2023a, 2024, 2025]) (**Figure 3**; **Appendix A**, **Table A-1**). Two individuals, HDRVAMn001 and HDRVAMn002, seen only once each in 2013 are not included in **Figure 3** or **Appendix A**, **Table A-1**.

Of the 74 unique humpback whales seen during the 2023/24 season, 27 (36.5 percent) were seen on more than 1 occasion, and 9 (12.2 percent) were seen on 3 or more occasions. Within-season re-sightings spanned 1.0 to 48.0 days apart (mean=14.5 days; median=11.9 days). This occurrence of re-sightings is similar to several previous seasons—38.6 percent during 2021/22, 42.9 percent during 2019/20, 44.7 percent during 2018/19, and 21.9 percent during 2017/18—but is less than the 2016/17 season (69.5 percent), and more than the 2020/21 (12.9 percent) and 2022/23 (13.5 percent) seasons.

For all humpback whales sighted since the beginning of this project, 174 individuals (51.2 percent) have only been seen on 1 occasion, whereas the remaining 166 individuals (48.8 percent) have been observed on 2 or more occasions (**Table 2**; **Appendix A**, **Table A-1**). The majority of humpback whales (294, 86.5 percent) were only seen during one field season (**Table 3**; **Appendix A**, **Table A-1**). However, 46 individuals (13.5 percent) were seen for two or more field seasons (**Table 2**; **Appendix A**, **Table A-1**). Including all years of data, individuals that were re-sighted within the same season (excluding same-day re-sightings) were seen 0.8 to 98.9 days from the initial sighting (mean=23.2 days; median=18.9 days).

Table 2. Frequency distribution of the number of sightings of photo-identified humpback whales since 2014.

Number of sightings	Number of individuals
1	174
2	77
3	28
4	27
5	9
6	7
7	3
8	5
9	2
11	4
14	1
17	1
18	1
21	1
Total	**340**

Table 3. Frequency distribution of the number of seasons photo-identified humpback whales were seen since 2014.

Number of seasons seen	Number of individuals
1	294
2	27
3	11
4	4
5	4
Total	**340**

Evidence of human interaction, either presumed line-entanglement scars (**Figure 4**) or propeller scars (**Figure 5**), was apparent on at least 28 of the 340 (8.2 percent) cataloged humpback whales, and 6 individuals are known to be deceased (**Appendix A**, **Table A-1**).

Figure 4. Cataloged humpback whale HDRVAMn179 with an apparent line entanglement scar in front of the leading dorsal hump.

Figure 5. Cataloged humpback whale HDRVAMn222 with apparent propeller scarring along the body's right side.

3.1.2 North Atlantic Right Whales

The six sightings of NARWs observed during the 2023/24 nearshore and mid-shelf baleen whale season included eight total individuals (Aschettino et al. 2025), and resulted in eight unique NARWs identified using callosity patterns and body scarring. During the offshore surveys, 11 sightings of NARWs totaled 50 individuals (Engelhaupt et al. 2025) and resulted in 26 unique NARWs. During the aerial surveys, 8 sightings totaled 13 individuals (Ozog and Engelhaupt 2025). In total, 35 unique NARWs were identified during the 2023/24 season (**Table 4**; **Appendix A**, **Table A-2**). One individual, #1950, was observed deceased by the aerial survey team (Ozog and Engelhaupt 2025), with the vessel team approaching for additional documentation (**Table 4**; Aschettino et al. 2025).

Researchers from the New England Aquarium maintain the publicly accessible North Atlantic Right Whale Catalog; therefore, age classes and sexes of NARWs observed during survey effort are provided here. Of the 35 unique NARWs seen during the 2023/24 season, 31 (88.5 percent) were known adults (8+ years of age), 2 (5.9 percent) were juveniles, 1 (2.8 percent) was a yearling, and 1 (2.8 percent) was a calf. Approximately half (18; 51.4 percent) were known males, 12 (34.3 percent) were known females, and sex was unknown for the remaining 5 (14.3 percent) individuals. All individuals were matched to the North Atlantic Right Whale Catalog except for one individual where only poor-quality photographs were obtained.

Unlike in previous years (Aschettino et al. 2023b; Engelhaupt et al. 2023b), no larger surface-active groups of NARWs were observed during the 2023/24 field season. However, an unusually large aggregation of baleen whales was sighted offshore near the shelf break and Norfolk Canyon during May and June 2024 (Engelhaupt et al. 2025). Sightings over this period included NARWs, sei whales, fin whales, and humpback whales, and these findings were presented at the 2024 North Atlantic Right Whale Consortium Meeting (Aschettino et al. 2024b).

HDR has now encountered 78 known individual NARWs off southern Virginia and northern North Carolina since 2018 (**Appendix A**, **Table A-2**). Seventy-one of these individuals were encountered between 2021 and 2024 during the Mid-Atlantic Nearshore and Mid-shelf Baleen Whale Monitoring and OCS projects, and the other seven individuals were encountered in 2018 during past aerial survey effort off Virginia (Cotter 2019). Individuals have represented both sexes and all age classes.

Table 4.   Summary of photo-identified NARWs from all platforms during the 2023/24 field season, sorted by sighting date and animal ID.

Animal ID / name	Age class	Sex	Group size	Behavior	Sighting date	Survey type_ sighting #	Sighting latitude (°N)	Sighting longitude (°W)	Unique sighting days
#1703 / Wolf	Adult	Female	1	Travel	15-Nov-2023	Midshelf_s1	36.5278	75.8304	1
Unknown	Unknown	Unknown	1	Travel	16-Dec-2023	Aerial_s1	36.6740	75.6493	1
Unknown	Unknown	Unknown	1	Travel	16-Dec-2023	Midshelf_s1	36.6755	75.6400	1
#2440 / Shackleton	Adult	Male	2	Travel	23-Jan-2024	Aerial_s3	36.8475	75.3491	1
#2440 / Shackleton	Adult	Male	2	Mill	23-Jan-2024	Midshelf_s1	36.8406	75.3584	1
#3623 / Bongo	Adult	Male	2	Travel	23-Jan-2024	Aerial_s3	36.8475	75.3491	1
#3623 / Bongo	Adult	Male	2	Mill	23-Jan-2024	Midshelf_s1	36.8406	75.3584	1
#1419 / Killick	Adult	Male	2	Travel	2-Feb-2024	Aerial_s1	36.7188	75.5186	1
#1419 / Killick	Adult	Male	2	Travel	2-Feb-2024	Midshelf_s1	36.7188	75.5103	1
#2470	Adult	Male	2	Travel	2-Feb-2024	Aerial_s1	36.7188	75.5186	1
#2470	Adult	Male	2	Travel	2-Feb-2024	Midshelf_s1	36.7188	75.5103	1
#3701 / Eros	Adult	Male	1	Travel	8-Feb-2024	Midshelf_s1	36.7569	75.5474	4
#1950	Adult	Female	1	Deceased	30-Mar-2024	Aerial_s1	36.6534	75.0701	1
#1950	Adult	Female	1	Deceased	30-Mar-2024	Midshelf_s1	36.6543	75.0718	1
#1047	Adult	Unknown	7	Feed	22-May-2024	OCS_s8	36.9224	74.6971	1
#1317 / Ergo	Adult	Male	7	Feed	22-May-2024	OCS_s8	36.9224	74.6971	1
#1611 / Clover	Adult	Female	7	Feed	22-May-2024	OCS_s8	36.9224	74.6971	2
#2510 / Mitosis	Adult	Male	7	Feed	22-May-2024	OCS_s8	36.9224	74.6971	1
#3297	Adult	Unknown	7	Feed	22-May-2024	OCS_s8	36.9224	74.6971	2
#3340 / Plover	Adult	Male	7	Feed	22-May-2024	OCS_s8	36.9224	74.6971	1
#4145	Adult	Male	7	Feed	22-May-2024	OCS_s8	36.9224	74.6971	2
#1050	Adult	Male	10	Feed	25-May-2024	OCS_s2	36.8065	74.6859	1
#1050	Adult	Male	4	Travel	25-May-2024	Aerial_s7	36.7898	74.6766	1
#2920	Adult	Male	1	Mill	25-May-2024	Aerial_s4	36.8570	74.7662	2
#3101 / Harmonia	Adult	Female	10	Feed	25-May-2024	OCS_s2	36.8065	74.6859	2

Animal ID / name	Age class	Sex	Group size	Behavior	Sighting date	Survey type_ sighting #	Sighting latitude (°N)	Sighting longitude (°W)	Unique sighting days
#3101 / Harmonia	Adult	Female	4	Feed	25-May-2024	Aerial_s7	36.7898	74.6766	2
#3241	Adult	Male	10	Feed	25-May-2024	OCS_s2	36.8065	74.6859	2
#3241	Adult	Male	1	Travel	25-May-2024	Aerial_s1	36.8081	74.7306	2
#3391	Adult	Male	1	Travel	25-May-2024	Aerial_s9	36.8465	74.7059	2
#3442 / Armada	Adult	Male	10	Feed	25-May-2024	OCS_s2	36.8065	74.6859	2
#3860 / Bocce	Adult	Female	10	Feed	25-May-2024	OCS_s2	36.8065	74.6859	2
#3908 / Zero	Adult	Female	10	Feed	25-May-2024	OCS_s2	36.8065	74.6859	1
#3908 / Zero	Adult	Female	4	Feed	25-May-2024	Aerial_s7	36.7898	74.6766	1
#4129 / Goldfish	Adult	Male	10	Feed	25-May-2024	OCS_s2	36.8065	74.6859	2
#4610	Adult	Female	4	Travel	25-May-2024	Aerial_s7	36.7898	74.6766	2
2023calfof#2029	Yearling	Unknown	10	Feed	25-May-2024	OCS_s2	36.8065	74.6859	3
#1047	Adult	Unknown	14	Feed	29-May-2024	OCS_s7	36.7462	74.6927	1
#1611 / Clover	Adult	Female	14	Feed	29-May-2024	OCS_s7	36.7462	74.6927	2
#2040 / Naevus	Adult	Female	14	Feed	29-May-2024	OCS_s7	36.7462	74.6927	2
#2920 / Peter Rabbit	Adult	Male	14	Feed	29-May-2024	OCS_s7	36.7462	74.6927	3
#3101 / Harmonia	Adult	Female	14	Feed	29-May-2024	OCS_s7	36.7462	74.6927	2
#3241	Adult	Male	14	Feed	29-May-2024	OCS_s7	36.7462	74.6927	2
#3297	Adult	Unknown	14	Feed	29-May-2024	OCS_s7	36.7462	74.6927	2
#3350 / Polaris	Adult	Male	14	Feed	29-May-2024	OCS_s7	36.7462	74.6927	2
#3442 / Armada	Adult	Male	14	Feed	29-May-2024	OCS_s7	36.7462	74.6927	2
#3545	Adult	Male	14	Feed	29-May-2024	OCS_s7	36.7462	74.6927	1
#3860 / Bocce	Adult	Female	14	Feed	29-May-2024	OCS_s7	36.7462	74.6927	2
#4129 / Goldfish	Adult	Male	14	Feed	29-May-2024	OCS_s7	36.7462	74.6927	2
2022CalfOf2040 (#5240)	Juvenile	Female	14	Feed	29-May-2024	OCS_s7	36.7462	74.6927	1
2023calfof#2029	Yearling	Unknown	14	Feed	29-May-2024	OCS_s7	36.7462	74.6927	3
#1317 / Ergo	Adult	Male	2	Travel	30-May-2024	OCS_s12	36.6833	74.7192	1

Animal ID / name	Age class	Sex	Group size	Behavior	Sighting date	Survey type_ sighting #	Sighting latitude (°N)	Sighting longitude (°W)	Unique sighting days
#2040 / Naevus	Adult	Female	5	Mill	30-May-2024	OCS_s15	36.6311	74.7166	2
#2520	Adult	Female	5	Mill	30-May-2024	OCS_s15	36.6311	74.7166	1
#2920	Adult	Male	2	Travel	30-May-2024	OCS_s11	36.7340	74.7395	2
#3391	Adult	Male	2	Unknown	30-May-2024	OCS_s16	36.6331	74.7517	2
#3680 / Seadragon	Adult	Male	5	Mill	30-May-2024	OCS_s15	36.6311	74.7166	1
#4145	Adult	Male	5	Mill	30-May-2024	OCS_s15	36.6311	74.7166	2
#4310 / Prickly Pear	Adult	Female	5	Mill	30-May-2024	OCS_s15	36.6311	74.7166	1
2023calfof#2029	Yearling	Unknown	2	Mill	30-May-2024	OCS_s1	36.7507	74.7925	3
#3270 / Pico	Adult	Female	2	Mill	1-Jun-2024	OCS_s8	36.5697	74.7352	1
2024Calfof#3270	Calf	Unknown	2	Mill	1-Jun-2024	OCS_s8	36.5697	74.7352	1

Key: °N = degrees North; °W = degrees West; ID = Identification Number

3.1.3 Fin Whales

One sighting of one individual fin whale was made during the 2023/24 nearshore and mid-shelf baleen whale season (Aschettino et al. 2025). During the offshore surveys, 57 sightings of fin whales totaled 116 individuals (Engelhaupt et al. 2025) and resulted in 53 uniquely identified fin whales. Fin whales photographed from the aerial surveys (Ozog and Engelhaupt 2025) were not included in the cataloging effort. In total, 54 unique fin whales were identified during the 2023/24 season (**Appendix A**, **Table A-3**).

Of the 54 unique fin whales seen during the 2023/24 season, 47 (87.0 percent) were classified as adults or sub-adults based on their estimated size in the field, and 7 (13.0 percent) were categorized as juveniles or sub-adult/juveniles. Six (11.1 percent) of the 54 individuals were re-sights to HDR Inc.'s catalog, 2 individuals had not been seen since 2017 (HDRVABp021, HDRVABp028), 3 individuals had not been seen since 2018 (HDRVABp042, HDRVABp051, HDRVABp054), and HDRVABp093 was seen previously in 2021 and 2023. The additional 48 whales were new individuals added to the growing project catalog, which, to date, has 164 unique fin whales (**Appendix A**, **Table A-3**).

Of the 54 unique fin whales seen during the 2023/24 season, 4 (7.4 percent) were seen on more than 1 occasion, and 1 (1.9 percent) was seen on 3 occasions. Within-season re-sightings spanned 6.3 to 15.0 days apart (mean=9.5 days; median=12.2 days).

For all fin whales included in the catalog dating back to 2015, 136 individuals (82.9 percent) have only been seen on 1 occasion, whereas the remaining 28 individuals (17.1 percent) have been observed on 2 or more occasions (**Table 5**; **Appendix A**, **Table A-3**). The majority of fin whales (143, 87.2 percent) were only seen during one field season (**Table 6**; **Appendix A**, **Table A-3**). However, 21 individuals (12.8 percent) were seen for two or more field seasons (**Table 6**; **Appendix A**, **Table A-3**). Including all years of data, individuals that were re-sighted within the same season (excluding same-day re-sightings) were seen between 3 and 100 days from the initial sighting (mean=18.2 days; median=9.4 days).

Table 5. Frequency distribution of the number of sightings of photo-identified fin whales since 2015.

Number of sightings	Number of individuals
1	136
2	15
3	9
4	3
5	-
6	1
Total	**164**

Table 6. **Frequency distribution of the number of seasons photo-identified fin whales were seen since 2015.**

Number of seasons seen	Number of individuals
1	143
2	13
3	7
4	1
Total	**164**

3.1.4 Minke Whales

Minke whales are occasionally encountered in the study area; however, minimal effort is spent trying to work with or photograph them given they are not a priority species for these projects. Across all years and projects, the minke whale catalog currently contains 16 individuals. No re-sights between years have been made, although HDRVABa015 was encountered on two occasions during the 2023/24 season when it was satellite tagged and tagged with a Customized Animal Tracking Solutions (CATS) tag six days later (**Appendix A**, **Table A-4**).

3.1.5 Sei Whales

Sei whales are infrequently encountered in the study area, with only one sighting previously recorded from vessel surveys in January 2017 (Engelhaupt et al. 2018) and three sightings from aerial surveys in April 2018 (Cotter 2019). A catalog of two individuals exists for the pair of whales observed in January 2017. In March and May 2024, sei whales were observed on 5 occasions, representing an estimated 24 individuals (Engelhaupt et al. 2025). The 4,889 photographs collected of sei whales were shared directly with Pete Duley at the NEFSC, and matching to their catalogs is currently under way. At the time of this report, no matches between the sites had been made.

3.2   Mid-Atlantic Humpback Whale Catalog Development and Happywhale Results

During the study year, HDR Inc. and NAVFAC LANT continued working on updating the curator-training protocols as well as learning the Microsoft Access database and the OBIS-SEAMAP portion of the MAHWC.

In the initial development stages of the MAHWC, a stakeholder workshop was held in June 2017, which focused on submission and data access protocols, establishing workflows, collaboration between Mid-Atlantic organizations, and discussions with already established catalog curators (Gulf of Maine Humpback Whale Catalog [GOM] and NAHWC) (Mallette et al. 2017). Building upon this previous meeting, HDR Inc. and NAVFAC LANT coordinated and hosted an in-person MAHWC stakeholder meeting in Virginia Beach, Virginia, on 26 June 2024 (**Appendix B**). Research groups and organizations that had participated in the initial stakeholder meeting and contributed to the MAHWC during earlier years, as well as those that expressed new interest in contributing, participated in the meeting. In total, representatives of nine organizations from North Carolina to New York attended (**Figure 6**), including:

- HDR Inc. and NAVFAC LANT (Virginia)
- Rudee Tours (Virginia)
- Virginia Aquarium Stranding Response Program (Virginia)
- North Carolina Stranding Network (North Carolina)
- Duke University Marine Lab (Virginia and North Carolina)
- Cape May Whale Watch and Research Center (Delaware and New Jersey)
- Wildlife Conservation Society (New Jersey and New York)
- Coastal Research & Education Society of Long Island (New York)
- Gotham Whale (New Jersey and New York)

The main objective of the workshop was to present and demonstrate the updates made to the MAHWC since 2023, primarily the incorporation of the Happywhale algorithm into OBIS-SEAMAP. Additionally, the meeting was intended to gauge continued stakeholder interest in contributing to the MAHWC and inform further catalog developments (**Appendix B**).

To introduce new organizations, as well as reintroduce previous contributors, all groups gave short overview presentations on their operations and data-collection methods (**Appendix B**). MAHWC curators gave an overview of the status of the catalog and highlighted the recent progress made. A demonstration of the entire data-submission process was conducted. This included a review of the required contributor data-submission protocols, which comprised a set of images as well as an accompanying metadata spreadsheet and consent form. The backend of the Microsoft Access database was shown, as well as the process the curator follows when uploading a new submission to the catalog database, uploading a new submission to OBIS-SEAMAP, and syncing match updates between OBIS-SEAMAP and the database. The Happywhale matching workflow in OBIS-SEAMAP was also demonstrated, which was of high interest to all stakeholders.

Figure 6. In-person participants at the MAHWC stakeholder workshop in Virginia Beach, Virginia, June 2024. From left to right, back row: Carlee Dunn and Melissa Laurino (Cape May Whale Watch and Research Center), Danielle Brown (Gotham Whale/Rutgers University), Marianne McNamara (Coastal Research & Ecology Society of Long Island), Jessica Aschettino (HDR Inc.), Jackie Bort and Joel Bell (NAVFAC LANT), Dan Engelhaupt (HDR Inc.), Ally McNaughton (Virginia Aquarium & Marine Science Center), Alexis Rabon (Rudee Tours), Karen Clark (North Carolina Wildlife Resource Commission), Amy Engelhaupt (Amy Engelhaupt Consulting), Carissa King-Nolan (Wildlife Conservation Society); front row: Jess Ozog (HDR Inc.), Alexandra Epple (Virginia Aquarium & Marine Science Center), Kristin Rayfield (Rudee Tours).

Overall, this stakeholder workshop was productive by allowing all groups to re-engage and discuss continued collaboration and the importance of a catalog specific to the Mid-Atlantic. All stakeholders were supportive of the continuation of the MAHWC despite the existence of publicly accessible sites such as Happywhale and Flukebook. Post-meeting, MAHWC curators revised all contributor documents, which are primarily based on the Mid-Atlantic Bottlenose Dolphin Catalog and the North Atlantic Right Whale Consortium. This included documents for (see **Appendix B**):

- Protocol for Data Access
- Authorship Criteria
- Submission Protocols and Workflow
- Photo-ID Submission Template
- Submission Consent Form
- Fin and Fluke Attribute Guide (modified from GOM and NAHWC)

Updated, draft versions of all documents were distributed to all stakeholders and after their review and feedback, all documents were finalized and redistributed. MAHWC curators also met with researchers from the Thorne Lab at Stony Brook University (NY) to discuss their interest in contributing to the catalog.

The MAHWC was updated with all HDR Inc.'s sighting records and humpback whale images through the end of the 2023/24 winter season, which currently contains 299 individuals (**Table 7**). Images included the best dorsal fin and fluke image, comprehensive of every sighting of a given whale. Additionally, the Duke University Marine Lab catalog was updated with images provided by Kim Urian and contains 42 individuals (**Table 7**). A new contributor catalog was created with a submission by Melissa Laurino from Cape May Whale Watch and Research Center and now contains 232 individuals (**Table 7**). Matching between catalogs is ongoing.

Table 7. All catalogs created and/or updated within the MAHWC during 2024, including the years of data collection and number of unique individuals.

Organization/ research team	Location	Point(s) of Contact	Years	Number of individuals
HDR Inc.	Virginia	Jessica Aschettino, Jess Ozog	2013–2024	340
Duke University Marine Lab	Virginia, North Carolina	Kim Urian	2017; 2019–2022; 2024	42
Cape May Whale Watch and Research Center	Delaware, New Jersey	Melissa Laurino	2011–2023	232

Additionally, during the study year, all fluke images within the HDR Inc. catalog were compiled and submitted to the NAHWC for matching, and results are pending.

The best fluke image available for each of HDR Inc.'s cataloged whales and associated metadata were also uploaded separately to Happywhale in order to make publicly available all of the whales sighted during survey efforts. Happywhale developed an additional dorsal fin matching algorithm and dorsal fins images collected during the 2021/22 season onward were also uploaded.

The HDR Inc. Happywhale catalog was updated with individuals and images from the 2023/24 winter field season. In total, HDR Inc.'s Happywhale humpback whale catalog contains 240 individuals, and 142 of these individuals yielded match records (**Appendix A**, **Table A-1**). Whales were matched to feeding grounds in waters off the northeastern U.S., Canada, Iceland, and Svalbard, and were also matched to breeding grounds off the Dominican Republic as well as the Turks and Caicos Islands (**Figure 7**). Matches within the Mid-Atlantic, including Virginia, Delaware, New Jersey, and New York, were also made; in fact, some whales were only matched within Virginia and not to outside areas.

Both the GOM and NAHWC recently began a partnership with Happywhale, and comparisons of individuals between Happywhale and both catalogs are ongoing (**Table 8**). If an individual has a sighting history in one or both catalogs and is also currently in Happywhale, identification information was added to the individual's page for the respective catalog. The GOM has a long-standing naming process and 54 humpback whales in HDR Inc.'s Happywhale catalog have been named to date. **Table 8** includes matches to other maintained catalogs; however, this table does not include sightings added by individuals (rather than organizations), such as photographs collected on a whale-watch tour by a customer.
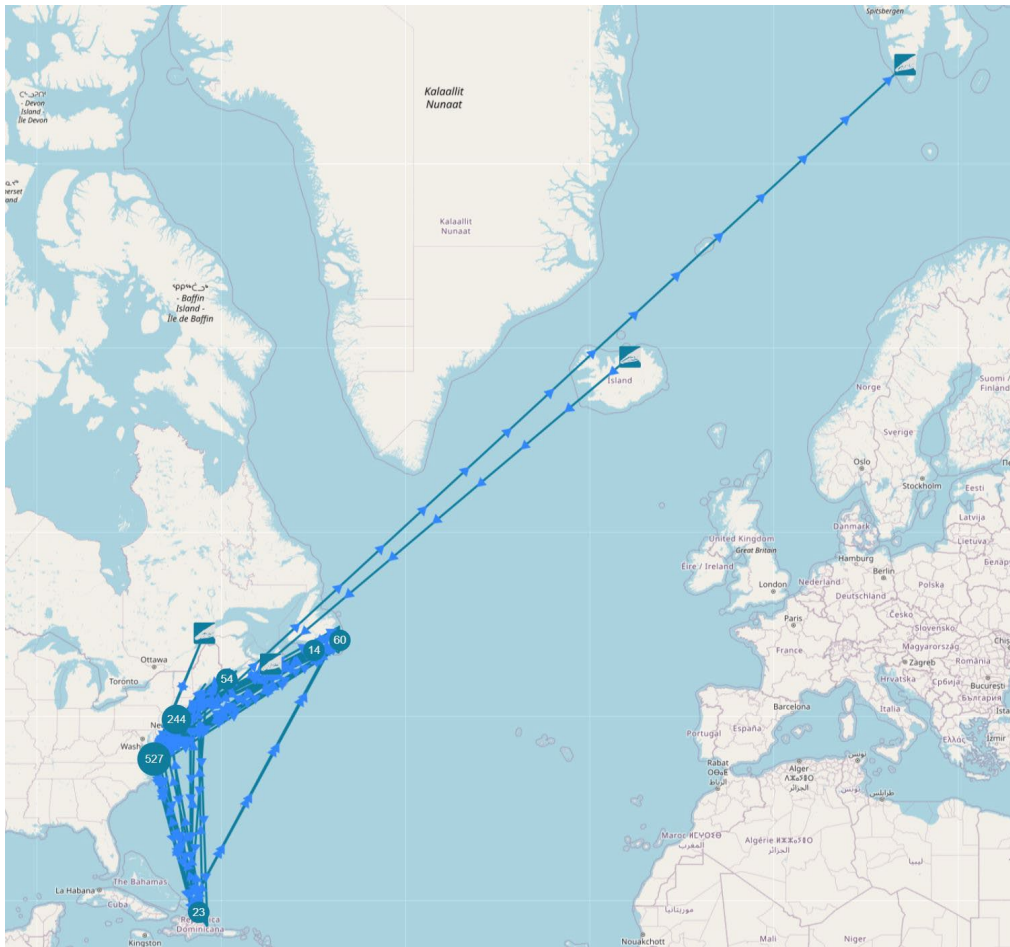
Figure 7. Happywhale connections of all humpback whales observed during HDR Inc.'s surveys. Note sightings to feeding and breeding grounds, as far northeast as Svalbard.

Table 8. HDR Inc. humpback whale matches to other organizations within Happywhale.

Organization	Number of matches
Rudee Flipper Dolphin and Whale Watching Tours	96
GOM Catalog	59
Gotham Whale New York City	56
NAHWC	44
Witless Bay Reserve Humpback Whale Catalog	9
Coastal Research & Education Society of Long Island	8
Turks and Caicos Islands Whale Project	8
Saint Pierre and Miquelon	8
Trinity Bay Newfoundland – Kris Prince	3
Marine and Coastal Ecology Research Center	2
Husavik Research Centre	1
Mingan Island Cetacean Study	1

Within Happywhale, all users maintain rights to their data; however, the data are openly accessible to view and explore. Within the HDR homepage on Happywhale, all individual humpback whales observed during HDR Inc. surveys are viewable. The user can click on any given whale to see whether that individual has been seen within other areas. An individual of interest is HDRVAMn246, who had previously only been documented in Happywhale off the coast of Virginia Beach, Virginia, by HDR Inc. and Rudee Flipper Dolphin and Whale Watching Tours during winter 2022. This whale was most recently documented off the coast of Svalbard in July 2024 (Oceanwide Expeditions, Michelle van Dijk and Cristina Amanda Tur) (**Figure 8**), which is the northernmost sighting in the HDR Inc. Happywhale catalog. Another individual of interest is HDRVAMn005 – 'Mojo', whose first record in Happywhale was from January 2014 off the coast of Virginia Beach, Virginia (Rudee Flipper Dolphin and Whale Watching Tours, Kristin Rayfield). The most recent sighting was in February 2025 in the Dominican Republic (Conscious Breath Adventures, Deb Stewart and Jeff Friedman) (**Figure 9**). 'Mojo' currently has 20 documented sightings in Happywhale, of which 2 were off eastern Canada, 7 were off New Jersey/Delaware, 8 were off Virginia, and 3 were in the Caribbean (**Figure 9**).
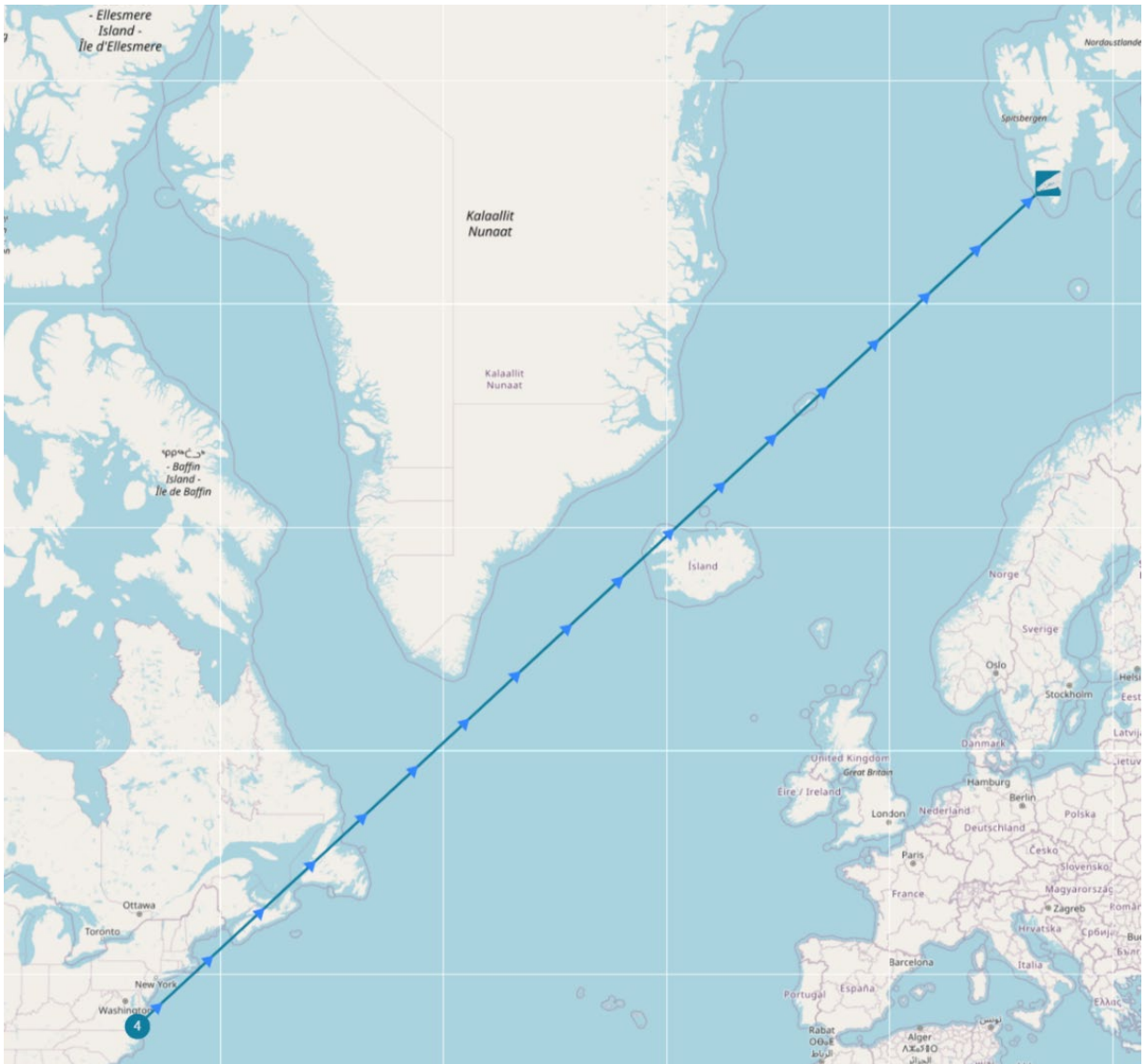
Figure 8. Sighting history of individual humpback whale HDRVAMn246, seen four times off the coast of Virginia, U.S. and once off Svalbard.
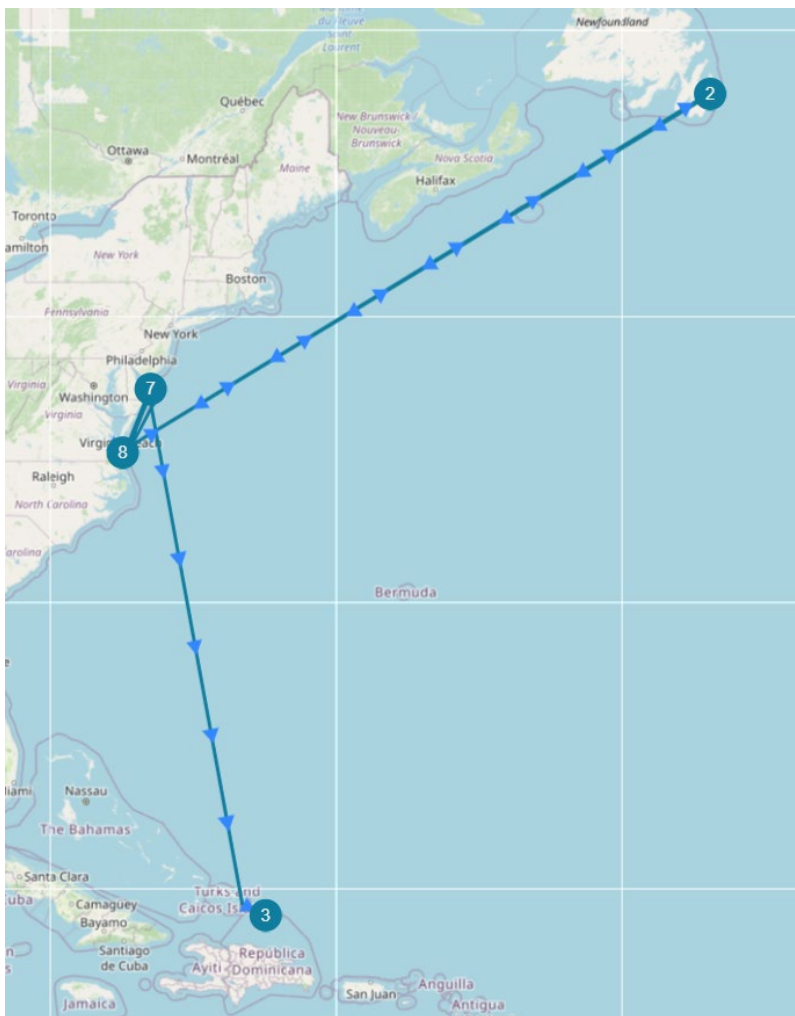
Figure 9. **Sighting history of individual humpback whale HDRVAMn005 – 'Mojo', seen off Newfoundland and Labrador, Canada; New Jersey, Delaware, and Virginia, U.S.; Salt Cay, Turks and Caicos; and Cofresi, Dominican Republic.**

3.3 Drone Photogrammetry Results

Drone video was collected on multiple humpback whales and was used to observe behaviors, look for potential entanglements or injuries that would not be apparent from the vessel, assist with tagging approaches, and record video that could then be used to measure body length. The lengths of 82 individuals have been calculated to date (data from January 2019 through December 2023) (see Aschettino et al. 2023a, 2024a for body length measurements from previous seasons; **Table 9**; **Figure 9**). Each of these whales has a unique identifier in the catalog. Between November and December 2023, five individuals were measured for the first time, and the body lengths for two individuals that were previously measured were measured for a second time (**Table 9**). Updated grading criteria methodology was implemented on drone images captured from November 2021 onward, so caution should be taken when making comparisons to measurements from earlier field seasons. **Table 9** reports the measurements from the best images for all seven individuals with drone video between November and December 2023. Individuals whose best image does not meet all grading criteria from Christiansen et al. (2018) have been included in **Table 9** for reference to individual, age-class

field estimates; however, they have been excluded from the following descriptive statistics calculations. The five measured humpback whales that met the grading criteria ranged in size from 10.3 to 13.23 m in total length, with a mean length of 12.16 m and a median length of 12.58 m. One whale measured under 11.0 m, and the remaining four whales measured longer than 11.0 m. Since water clarity improves farther from shore, whales measured farther from shore were more likely to meet the grading criteria, whereas whales closer to shore were more likely not to meet the criteria.

Table 9. **Overall lengths of all humpback whales measured between November and December 2023 using drone photogrammetry, sorted from smallest to largest.**

Humpback whale ID	Length based on photogrammetry (m)	Total unique measurement days	Age-class assigned based on initial visual assessment
HDRVAMn294	10.3	1	Juvenile
HDRVAMn220	11.91[a]	2	Adult[b]
HDRVAMn017	12.18[c]	1	Adult
HDRVAMn260	12.58[a]	2	Adult[b]
HDRVAMn225	12.78	1	Adult
HDRVAMn005	13.23	2[d]	Adult
HDRVAMn287	13.44[c]	1	Adult

Key: ID = identification number
[a] Measurement longer than previous years
[b] Most recent assessment; assigned a different age class in previous years
[c] Measurement excluded from descriptive statistics calculations based on image grading criteria
[d] Measured on two different days during same season

Figure 10. **Total length measurement being taken in MorphoMetriX using a still video grab from drone-collected data for humpback whale HDRVAMn208.**

Each whale had been assigned an age-class in the field based on subjective size assessments from the research vessel (**Table 9**). The smallest field-assigned age class was a whale (HDRVAMn294) that appeared to be juvenile-sized and measured 10.3 m. All whales that measured over 11.0 m were assigned to the adult age class. Similar to previous field seasons, whales that measured larger were more likely to be assigned an age class corresponding to larger size; however, smaller whales, or those of intermediate length, were more difficult to accurately assign an age class to (Aschettino et al. 2024b).

After the November and December 2023 flights, the drone experienced technical difficulties, ultimately precluding additional drone data collection for the remainder of the season. HDR has purchased a National Defense Authorization Act (NDAA)-compliant Freefly Astro that is currently being outfitted to allow suction-cup tag deployments to be used for the 2025/26 field season.

4   Discussion

Photo-ID studies take years, even decades, to produce meaningful results. While data analyses from this multi-year project are ongoing, each field season builds a more comprehensive picture of humpback whale presence and use of the waters within and around the mouth of Chesapeake Bay and the surrounding area. Shipping channels, W-50 MINEX, U.S. Navy OPAREAS, and wind energy development areas all overlap with the habitat that baleen whales use seasonally.

The number of humpback whale identifications has grown over the course of this study. When assessing all 10 seasons, 3 "peaks" of individual identifications are evident—the 2016/17 season, the 2021/22 season, and the current 2023/24 season, with 59, 58, and 74 individuals seen per season, respectively (**Figure 3**). All other seasons have ranged between 28 and 38 individuals identified. Because these surveys are not designed to support density or abundance estimates, trends in sightings across study years cannot be evaluated statistically; however, some subjective inferences may be made. Future effort will look at whether there were any meteorological or oceanographic trends for the years with peak whale occurrence within the region. Further analysis of water-temperature data collected from conductivity, temperature, and depth measurements; buoy data; and tag data collected during this study may provide a better understanding of thresholds that result in humpback whales (and presumably their prey) remaining in or moving outside the nearshore area. This past 2023/24 season, the large number of humpback whales can be attributed to the unusually large aggregation of baleen whales seen during May and June on the OCS surveys (Engelhaupt et al. 2025). Just from that period, 41 individual humpback whales were added to the catalog. Interestingly, none of those humpbacks matched to any others in the HDR Inc. catalog, and only seven individuals had matches within Happywhale. Excluding those 41 individuals from the overall identifications for the season would bring the total number of identifications down to 33, which is more in line with the other 7 survey seasons.

The aggregation of baleen whales also included NARWs, fin whales, and sei whales, the latter being a species that is not frequently encountered during project surveys. Prior to this field season, sei whales were only observed on one other occasion from the vessel effort in January 2017 (Engelhaupt et al. 2018) and 3 sightings from aerial surveys in April 2018 (Cotter 2019). Both NARWs and sei whales are copepod feeders, which suggests that they may have been feeding on prey aggregations within the area. All four species are also krill feeders, so aggregations of either prey type is possible. A more detailed look at the oceanographic conditions that were present during this time frame relative to the sightings of baleen whales was presented at the NARW consortium meeting in October 2024 (Aschettino et al. 2024b).

Of the 340 humpback whales identified in the study area since 2013, the majority (294, 86.5 percent) were only seen during one field season; the remaining 46 individuals (13.5 percent) were seen for two or more field seasons (**Table 3**; **Appendix A**, **Table A-1**). Approximately half of all cataloged whales were seen on two or more occasions. When re-sighted within the same season, individuals were seen between 0.8 to 98.9 days from the initial sighting (mean=23.2 days; median=18.9 days). These data help shed light on the numbers of humpback whales using the waters at the mouth of Chesapeake Bay and provide insight into

how long they remain within the area. Based on these results, there are likely a small number of whales that are at an increased risk for anthropogenic activities during the time they remain within the study region.

Part of the increase in the number of identifications over the first three seasons is likely due to effort—the 2016/17 and 2017/18 field seasons began 2 months earlier than the 2014/15 season and 1 month earlier than the 2015/16 field season. Also, during the 2014/15 season, effort was focused on collecting focal follows of individual whales, so priority was given to staying with one whale over a longer period rather than collecting as many photo-IDs of animals within the surrounding areas as possible. Overall effort on the water, both in terms of survey days and hours, also increased during the first three field seasons, partially accounting for the increase in sighting information during the 2016/17 field season. In more recent years, effort has also expanded to the mid-shelf area, so less coverage is focused on nearshore waters, but additional opportunities are available for sightings of whales farther from shore. During the baleen whale aggregation in spring 2024, effort was increased to focus on locating NARWs, but ultimately also increased the overall number of sightings and individual humpback and fin whales.

Approximately two-thirds of the humpback whales identified during the 10 years of survey effort on this project appear to be juveniles that are spending more time within the nearshore study area than larger animals, presumed to be adults, and may be at greater risk for injury. Sightings of sub-adult-sized humpback whales are highest early in the field season or farther from shore within the mid-shelf region. Those individuals are often re-sighted less frequently, suggesting that sightings early in the season may be whales passing through the area rather than whales remaining within the nearshore study area for longer durations. The large percentage of juveniles observed in this study matches both historical stranding (e.g., Wiley et al. 1995) and observational (e.g., Swingle et al. 1993) data for the area.

Interactions with vessels, both large and small, are a significant cause for concern for baleen whales within the study area, particularly humpback whales and NARWs. In April 2017, the National Marine Fisheries Service declared an Unusual Mortality Event (UME) for humpback whales within the Atlantic Ocean, from Maine to North Carolina, based on elevated mortalities of this species since January 2016 (NOAA 2025a). At the time of this report, 255 humpback whales are included in this UME, and 74 (27.8 percent) of those have occurred along the shore or in waters off the coast of Virginia or North Carolina (NOAA 2025a).

Given this designation, the UME working group, which is a group of subject matter experts, will further investigate what is causing or contributing to the increased number of humpback whale deaths within this area. Some of the whales examined thus far have exhibited evidence of peri-mortem vessel strike, but the UME investigation process remains ongoing. Evidence of human interaction, either presumed line-entanglement scars (**Figure 4**) or propeller scars (**Figure 5**), was apparent on approximately 8 percent of all cataloged humpback whales throughout this study, which is an alarmingly high rate of occurrence, although orders of magnitude less than that of NARWs. Additionally, six cataloged humpback whales are known to be deceased (**Appendix A**, **Table A-1**): four deaths occurred within the primary study area; a fifth death occurred south of the primary study area, off North Carolina; and a sixth death occurred off Massachusetts. Results from necropsies concluded that three of the four whales killed within the study area showed injuries consistent with peri-mortem vessel interactions (Marine Mammal

Health and Stranding Response Program; Virgina Aquarium & Marine Science Center). Vessel strikes pose a significant risk to humpback and NARWs, and previous analysis of tagging data from this study show a high level of occurrence by humpback whales within shipping lanes at the mouth of Chesapeake Bay (Aschettino et al 2020b).

A current UME also exists for the critically endangered NARW; at the time of this report, 157 individuals are included in this UME (NOAA 2025b). In 2023, an adult male NARW, Eg #3343, washed up dead on a beach in Virginia Beach. This individual had not been observed previously during survey effort off Virginia Beach in aggregations of NARWs that persisted around the same timeframe. Results from the examination concluded that he "suffered a catastrophic blunt force traumatic injury, which impacted a large portion of the spinal column. The injuries are consistent with a vessel strike" (NOAA 2025c). During this past season, on 30 March 2024, the aerial survey team came across a deceased adult female NARW at sea. Eg #1950 was a new mother, and had most recently been seen with her calf off Florida 42 days prior (NOAA 2025d). This sighting prompted an elaborate response, first by the vessel team to deploy a satellite tag on the carcass, followed by the towing of the carcass to shore to be examined. Preliminary results from this necropsy concluded that "findings included catastrophic injuries with a dislocation of the whale's spine and fractures to all vertebrae in the lower back. These findings are consistent with blunt force trauma from a vessel strike prior to death" (NOAA 2025d). Unfortunately, because the young calf was a dependent, it was also presumed dead.

From November through April, a ship-speed reduction rule is in effect at the mouth of Chesapeake Bay as part of the Seasonal Management Area (SMA) set up to protect Endangered Species Act-listed NARWs. These speed restrictions require all vessels 65 feet (19.8 m) or longer to travel at 10 knots (18.5 km/hour) or less, and a proposed rule to extend these restrictions to smaller vessels within a wider area is under review. One problem with the current SMA is that the areas where NARWs and humpback whales frequently occur are not within these boundaries. For instance, no NARW sightings and only approximately half of the nearshore/mid-shelf humpback whale sightings during the 2023/24 season occurred within the SMA boundaries (see Figure 5 and Figure 6; Aschettino et al. 2025).

Matching of HDR Inc.'s cataloged humpback whales to other regions is ongoing. Currently, all humpback whales with fluke images observed during these survey efforts are available on Happywhale, and matches have been found to feeding grounds in waters off the northeastern U.S., Canada, Iceland, and Svalbard as well as breeding grounds off the Dominican Republic and the Turks and Caicos Islands (**Figure 7**). Matches within the Mid-Atlantic, including Virginia, New York, and New Jersey, were also made; in fact, some whales were only matched within Virginia and not to outside areas. Humpback whales of the West Indies Distinct Population Segment (Bettridge et al. 2015) are known to migrate from six northern feeding grounds in the Gulf of Maine, the Gulf of St. Lawrence, Newfoundland/Labrador, western Greenland, Iceland, and Norway to Caribbean Sea waters during winter months (Katona and Beard 1990; Christensen et al. 1992; Palsbøll et al 1997). Matches to these areas are therefore to be expected, but the sighting histories and timelines that can be gained from incorporating these details into a platform such as Happywhale are invaluable.

Integration of the drone component to the study, beginning in 2018, has allowed for additional opportunities to examine body condition and estimate length. The drone also proved valuable in assisting with tag deployments, observing unique behavior (e.g., bubble-net feeding), and collecting follow-up images from tagged whales. The study team retrofitted the drone and installed a custom LiDAR altimeter, which increases the precision and consistency of the drone altimetry measurements to minimize possible error in measured animal lengths. HDR Inc. has acquired a new American-made drone to be NDAA-compliant with improved capabilities such as LiDAR sensors, longer flight times, a higher-resolution camera, and the capacity to also deploy suction cup tags. This drone will be available for use beginning in the later part of 2025.

Efforts for the 2024/25 field season continue to focus on pushing farther into mid-shelf waters, as well as continuing photo-ID efforts within nearshore waters. Happywhale will be updated with dorsal fin images of humpback whales (for those not already loaded) to help improve future animal identification algorithms. At the end of the 2024/25 season, all humpback whale identifications will be added and incorporated into the MAHWC and Happywhale, and all photographs and videos collected from NARW sightings will be shared with the New England Aquarium.

5   References

Aschettino, J., A. Engelhaupt, and D. Engelhaupt. 2015. *Mid-Atlantic Humpback Whale Monitoring, Virginia Beach, VA: 2014/15 Annual Progress Report*. Final Report. Prepared for U.S. Fleet Forces Command. Submitted to Naval Facilities Engineering Command Atlantic, Norfolk, Virginia, under Contract No. N62470-10-3011, Task Order 054, issued to HDR Inc., Virginia Beach, Virginia. June 2015.

Aschettino, J.M., D. Engelhaupt, A. Engelhaupt, and M. Richlen. 2016. *Mid-Atlantic Humpback Whale Monitoring, Virginia Beach, Virginia: 2015/16 Annual Progress Report*. Prepared for U.S. Fleet Forces Command. Submitted to Naval Facilities Engineering Command Atlantic, Norfolk, Virginia, under Contract Nos. N62470-10-3011, Task Orders 03 and 54, and N62470-15-8006, Task Order 13, issued to HDR Inc., Virginia Beach, Virginia. August 2016.

Aschettino, J.M., D. Engelhaupt, A. Engelhaupt, and M. Richlen. 2017. *Mid-Atlantic Humpback Whale Monitoring, Virginia Beach, Virginia: 2016/17 Annual Progress Report.* Prepared for U.S. Fleet Forces Command. Submitted to Naval Facilities Engineering Command Atlantic, Norfolk, Virginia, under Contract N62470-15-8006, Task Order 33, issued to HDR Inc., Virginia Beach, Virginia. August 2017.

Aschettino, J.M., D. Engelhaupt, A. Engelhaupt, M. Richlen, and A. DiMatteo. 2018. *Mid-Atlantic Humpback Whale Monitoring, Virginia Beach, Virginia: 2017/18 Annual Progress Report.* Final Report. Prepared for U.S. Fleet Forces Command. Submitted to Naval Facilities Engineering Command Atlantic, Norfolk, Virginia, under Contract N62470-15-8006, Task Order 17F4013, issued to HDR Inc., Virginia Beach, Virginia. June 2018.

Aschettino, J.M., D. Engelhaupt, A. Engelhaupt, M. Richlen, and M. Cotter. 2019. *Mid-Atlantic Humpback Whale Monitoring, Virginia Beach, Virginia: 2018/19 Annual Progress Report*. Prepared for U.S. Fleet Forces Command. Submitted to Naval Facilities Engineering Command Atlantic, Norfolk, Virginia, under Contract N62470-15-8006, Task Order 19F4005, issued to HDR Inc., Virginia Beach, Virginia. July 2019.

Aschettino, J.M., D. Engelhaupt, A. Engelhaupt, M. Richlen, and M. Cotter. 2020a. *Mid-Atlantic Humpback Whale Monitoring, Virginia Beach, Virginia: 2019/20 Annual Progress Report*. Prepared for U.S. Fleet Forces Command. Submitted to Naval Facilities Engineering Command Atlantic, Norfolk, Virginia, under Contract N62470-15-8006, Task Order 20F4011, issued to HDR Inc., Virginia Beach, Virginia. May 2020.

Aschettino, J.M., D.T. Engelhaupt, A.G. Engelhaupt, A. DiMatteo, T. Pusser, M.F. Richlen, and J.T. Bell. 2020b. Satellite telemetry reveals spatial overlap between vessel high-traffic areas and humpback whales (*Megaptera novaeangliae*) near the mouth of the Chesapeake Bay. *Frontiers in Marine Science* 7:121. DOI 10.3389/fmars2020.00121.

Aschettino, J.M., D. Engelhaupt, A. Engelhaupt, M. Richlen, and M. Cotter. 2021. *Mid-Atlantic Humpback Whale Monitoring, Virginia Beach, Virginia: 2019/20 Annual Progress Report*. Prepared for U.S. Fleet Forces Command. Submitted to Naval Facilities Engineering Systems Command Atlantic, Norfolk, Virginia, under Contract N62470-15-8006, Task Order 20F4011, issued to HDR Inc., Virginia Beach, Virginia. May 2021.

Aschettino, J.M., D. Engelhaupt, A. Engelhaupt, M. Cotter, and M. Richlen. 2022. *Mid-Atlantic Humpback Whale Monitoring, Virginia Beach, Virginia: 2020/21 Annual Progress Report.* Prepared for U.S. Fleet Forces Command. Submitted to Naval Facilities Engineering Systems Command Atlantic, Norfolk, Virginia, under Contract N62470-20-0016, Task Order 21F4005, issued to HDR Inc., Virginia Beach, Virginia. June 2022.

Aschettino, J.M., D. Engelhaupt, and A. Engelhaupt. 2023a. *Mid-Atlantic Nearshore and Mid-Shelf Baleen Whale Monitoring, Virginia Beach, Virginia: 2021/22 Annual Progress Report*. Prepared for U.S. Fleet Forces Command. Submitted to Naval Facilities Engineering Systems Command Atlantic, Norfolk, Virginia, under Contract N62470-20-0016, Task Order 21F4005, issued to HDR Inc., Virginia Beach, Virginia. July 2023.

Aschettino, J., D. Engelhaupt, A. Engelhaupt, T. Pusser, M. Cotter, M. Richlen, J. Bort Thornton, K. Jackson, and J. Bell. 2023b. North Atlantic Right Whale Sightings and Group Composition in the VA/NC Mid-Atlantic: 2018–2023. Poster, North Atlantic Right Whale Consortium Meeting, Halifax, Nova Scotia, Canada, October 2023.

Aschettino, J.M., D. Engelhaupt, and A. Engelhaupt. 2024a. *Mid-Atlantic Nearshore and Mid-Shelf Baleen Whale Monitoring, Virginia Beach, Virginia: 2022/23 Annual Progress Report*. Prepared for U.S. Fleet Forces Command. Submitted to Naval Facilities Engineering Systems Command Atlantic, Norfolk, Virginia, under Contract N62470-20-0016, Task Order 23F4020, issued to HDR Inc., Virginia Beach, Virginia. February 2024.

Aschettino, J.M., D. Engelhaupt, A. Engelhaupt, J. Ozog, J. Bort Thornton, J. Bell, and K. Jackson. 2024b. A Closer Look at an Unusual Late-Spring Aggregation of North Atlantic Right Whales off Virginia Using Tag and Environmental Data. Presentation, North Atlantic Right Whale Consortium Meeting, Providence, Rhode Island, October 2024.

Aschettino, J., D. Engelhaupt, A. Engelhaupt, and J. Ozog. 2025. *Mid-Atlantic Nearshore and Mid-Shelf Baleen Whale Monitoring, Virginia Beach, Virginia: 2023/24 Annual Progress Report*. Prepared for U.S. Fleet Forces Command. Submitted to Naval Facilities Engineering Systems Command Atlantic, Norfolk, Virginia, under Contract N62470-20-0016, Task Order 23F4020, issued to HDR Inc., Virginia Beach, Virginia. May 2025.

Barco, S.G., W.A. McLellan, J.M. Allen, R.A. Asmutis-Silvia, D Mallon-Day, E.M. Meagher, D.A. Pabst, J. Robbins, R.E. Seton, W.M. Swingle, M.T. Weinrich, and P.J. Clapham. 2002. Population identity of humpback whales (*Megaptera novaeangliae*) in the waters of the US mid-Atlantic states. *Journal of Cetacean Research and Management* 4:135–141.

Bettridge, S., C.S. Baker, J. Barlow, P.J. Clapham, M. Ford, D. Gouveia, D. Mattila, R.M. Pace III, P.E. Rosel, G.K. Silber, and P.R. Wade. 2015. *Status Review of the Humpback Whale (*Megaptera novaeangliae*) Under the Endangered Species Act*. NOAA Technical Memorandum NMFS-SWFSC-540. National Marine Fisheries Service, La Jolla, California.

Bird, C., and K.C. Bierlich. 2020. CollatriX: A GUI to collate MorphoMetriX outputs. *Journal of Open Source Software* 5(51):2323–2328.

Brown, D.M, J. Robbins, P.L. Sieswerda, C. Ackerman, J.M. Aschettino, S. Barco, T. Boye, R. A. DiGiovanni, K. Durham, A. Engelhaupt, A. Hill, L. Howes, K. F. Johnson, L. Jones, C. D. King, A. H. Kopelman, M. Laurino, S. Lonergan, S. D. Mallette, M. Pepe, C. Ramp, K. Rayfield, M. Rekdahl, H.C. Rosenbaum, R. Schoelkopf, D. Schulte, R. Sears, J.E.F. Stepanuk, J.E. Tackaberry, M. Weinrich, E.C.M. Parsons, and J. Wiedenmann. 2022. Site fidelity, population identity and demographic characteristics of humpback whales in the New York Bight apex. *Journal of the Marine Biological Association of the United Kingdom* 102(1-2):157–165. doi:10.1017/S0025315422000388.

Cheeseman T, K. Southerland, J. Park, M. Olio, K. Flynn, J. Calambokidis, L. Jones, C. Garrigue, A. Frisch Jordán, A. Howard, W. Reade, J. Neilson, C. Gabriele, and P. Clapham. 2022. Advanced image recognition: a fully automated, high-accuracy photo-identification matching system for humpback whales. *Mammalian Biology* 102:915–929. doi:10.1007/S42991-021-00180-9.

Christiansen, F., F. Vivier, C. Charlton, R. Ward, A. Amerson, S. Burnell, and L. Bejder. 2018. Maternal body size and condition determine calf growth rates in southern right whales. *Marine Ecology Progress Series* 592:267–281. doi.org/10.3354/meps12522.

Christensen, I., T. Haug, and N. Øien. 1992. Seasonal distribution, exploitation and present abundance of stocks of large baleen whales (Mysticeti) and sperm whales (*Physeter macrocephalus*) in Norwegian and adjacent waters. *ICES Journal of Marine Science* 49:341–355.

Cotter, M.P. 2019. *Aerial Surveys for Protected Marine Species in the Norfolk Canyon Region: 2018–2019 - Final Report*. Prepared for U.S. Fleet Forces Command. Submitted to Naval Facilities Engineering Command Atlantic, Norfolk, Virginia, under Contract No. N62470-15-D8006 Task Order 18F4019, issued to HDR Inc., Virginia Beach, Virginia. November 2019.

Dawson, S.M., M.H. Bowman, E. Leunissen, and P. Sirguey. 2017. Inexpensive aerial photogrammetry for studies of whales and large marine animals. *Frontiers in Marine Science* 4:366. doi:10.3389/fmars.2017.00366.

Engelhaupt, A., J. Aschettino, T.A. Jefferson, D. Engelhaupt, and M. Richlen. 2016. *Occurrence, Distribution, and Density of Marine Mammals Near Naval Station Norfolk and Virginia Beach, Virginia: 2016 Final Report*. Prepared for U.S. Fleet Forces Command. Submitted to Naval Facilities Engineering Command Atlantic, Norfolk, Virginia, under Contract No. N62470-10-3011, Task Orders 03 and 043, issued to HDR Inc., Virginia Beach, Virginia. 12 October 2016.

Engelhaupt, A., J.M. Aschettino, and D. Engelhaupt. 2017. *VACAPES Outer Continental Shelf Cetacean Study, Virginia Beach, Virginia: 2016 Annual Progress Report.* Prepared for U.S. Fleet Forces Command. Submitted to Naval Facilities Engineering Command Atlantic, Norfolk, Virginia, under Contract Nos. N62470-10-3011, Task Orders 03 and 54, and N62470-15-8006, Task Order 35, issued to HDR Inc., Virginia Beach, Virginia. 31 August 2017.

Engelhaupt, A., J.M. Aschettino, and D. Engelhaupt. 2018. *VACAPES Outer Continental Shelf Cetacean Study, Virginia Beach, Virginia: 2017 Annual Progress Report.* Prepared for U.S. Fleet Forces Command. Submitted to Naval Facilities Engineering Command Atlantic, Norfolk, Virginia, under Contract No. N62470-15-8006, Task Order 35, issued to HDR Inc., Virginia Beach, Virginia. May 2018.

Engelhaupt, A., J.M. Aschettino, D. Engelhaupt, A. DiMatteo, M. Richlen, and M. Cotter. 2019. *VACAPES Outer Continental Shelf Cetacean Study, Virginia Beach, Virginia: 2018 Annual Progress Report.* Prepared for U.S. Fleet Forces Command. Submitted to Naval Facilities Engineering Command Atlantic, Norfolk, Virginia, under Contract No. N62470-15-8006, Task Order 18F4082, issued to HDR Inc., Virginia Beach, Virginia. July 2019.

Engelhaupt, A., J.M. Aschettino, D. Engelhaupt, M. Richlen, and M. Cotter. 2020. *VACAPES Outer Continental Shelf Cetacean Study, Virginia Beach, Virginia: 2019 Annual Progress Report*. Prepared for U.S. Fleet Forces Command. Submitted to Naval Facilities Engineering Command Atlantic, Norfolk, Virginia, under Contract No. N62470-15-8006, Task Orders 18F4082 and 19F4068, issued to HDR Inc., Virginia Beach, Virginia. April 2020.

Engelhaupt, A., J.M. Aschettino, D. Engelhaupt, M. Richlen, and M. Cotter. 2022. *VACAPES Outer Continental Shelf Cetacean Study, Virginia Beach, Virginia: 2021 Annual Progress Report*. Prepared for U.S. Fleet Forces Command. Submitted to Naval Facilities Engineering Systems Command Atlantic, Norfolk, Virginia, under Contract No. N62470-15-8006, Task Order 20F4031, issued to HDR Inc., Virginia Beach, Virginia. June 2022.

Engelhaupt, A., J.M. Aschettino, D. Engelhaupt, M. Richlen, and M. Cotter. 2023a. *VACAPES Outer Continental Shelf Cetacean Study, Virginia Beach, Virginia: 2022 Annual Progress Report*. Prepared for U.S. Fleet Forces Command. Submitted to Naval Facilities Engineering Command Atlantic, Norfolk, Virginia, under Contract No. N62470-20-0016, Task Order 20F4031, issued to HDR Inc., Virginia Beach, Virginia. June 2023.

Engelhaupt, A., J. Aschettino, D. Engelhaupt, T. Pusser, J. Bort Thornton, and J. Bell. 2023b. More than Just a Migration Corridor: Important North Atlantic Right Whale Surface-Active Behaviors Observed in the Western Mid-Atlantic. Presentation, North Atlantic Right Whale Consortium Meeting, Halifax, Nova Scotia, Canada, October 2023.

Engelhaupt, A., J.M. Aschettino, and D. Engelhaupt. 2024. *VACAPES Outer Continental Shelf Cetacean Study, Virginia Beach, Virginia: 2023 Annual Progress Report.* Prepared for U.S. Fleet Forces Command. Submitted to Naval Facilities Engineering Command Atlantic, Norfolk, Virginia, under Contract No. N62470-20-0016, Task Order 20F4031, issued to HDR Inc., Virginia Beach, Virginia. February 2024.

Engelhaupt, A., J.M. Aschettino, and D. Engelhaupt. 2025. *VACAPES Offshore Cetacean Study, Virginia Beach, Virginia: 2024 Annual Progress Report.* Prepared for U.S. Fleet Forces Command. Submitted to Naval Facilities Engineering Systems Command Atlantic, Norfolk, Virginia, under Contract No. N62470-15-8006, Task Order 20F4031, issued to HDR Inc., Virginia Beach, Virginia. May 2025.

Fujioka, E., C.Y. Kot, B.P. Wallace, B.D. Best, J. Moxley, J. Cleary, B. Donnelly, and P.N. Halpin. 2014. Data integration for conservation: Leveraging multiple data types to advance ecological assessments and habitat modeling for marine megavertebrates using OBIS-SEAMAP. *Ecological Informatics* 20:13–26.

Halpin, P.N., A.J. Read, B.D. Best, K.D. Hyrenbach, E. Fujioka, M.S. Coyne, L.B. Crowder, S.A. Freeman, and C. Spoerri. 2006. OBIS-SEAMAP: developing a biogeographic research data commons for the ecological studies of marine mammals, seabirds, and sea turtles. *Marine Ecological Progress Series* 316:239–246. DOI:10.3354/meps316239.

Halpin, P.N., A.J. Read, E. Fujioka, B.D. Best, B. Donnelly, L.J. Hazen, and C. Kot. 2009. OBIS-SEAMAP: The world data center for marine mammal, sea bird, and sea turtle distributions. *Oceanography* 22(2):104–115.

Hamilton, P.K., A.R. Knowlton, and M.K. Marx. 2007. Right whales tell their own stories: The photo-identification catalog. In *The Urban Whale: North Atlantic Right Whales at the Crossroads*, edited by S.D. Kraus and R.M. Rolland, pp. 75–104. Harvard University Press, Cambridge, Massachusetts.

Katona, S.K., and H.P. Whitehead. 1981. Identifying humpback whales using their natural markings. *Polar Record* 20:439–344.

Katona, S.K. and J.A. Beard. 1990. Population size, migrations, and feeding aggregations of the humpback whale (*Megaptera novaeangliae*) in the western North Atlantic Ocean. *Reports of the International Whaling Commission, Special Issue* 12:295–306.

Mallette, S.D., and S. Barco. 2017. *Development of a Web-based Mid-Atlantic Humpback Whale Catalog: 2016 Annual Progress Report.* Prepared for U.S. Fleet Forces Command. Submitted to Naval Facilities Engineering Command Atlantic, Norfolk, Virginia, under Contract No. N62470- 15-8006, Task Order 27, issued to HDR Inc., Virginia Beach, Virginia. 19 July 2017.

Mallette, S.D., and S.G. Barco. 2019. *Mid-Atlantic and Southeast Humpback Whale Photo-ID Catalog: 2018 Annual Progress Report.* Prepared for U.S. Fleet Forces Command. Submitted to Naval Facilities Engineering Command Atlantic, Norfolk, Virginia, under Contract No. N62470-15-8006, Task Order 18F4032, issued to HDR Inc., Virginia Beach, Virginia. June 2019.

Mallette, S., Urian, K., Fujioka, E., Mathias, N., and Barco, S. 2017. *An Introduction to the Mid-Atlantic Humpback Whale Catalog (MAHWC): A Workshop Report*. Prepared for U.S. Fleet Forces Command. Submitted to Naval Facilities Engineering Command Atlantic, Norfolk, Virginia, under Contract No. N62470-15-8006, Task Order 27, issued to HDR Inc., Virginia Beach, Virginia. 31 August 2017.

Nishiwaki, M. 1959. Humpback whales in Ryukyuan waters. *Scientific Reports of the Whales Research Institute, Tokyo* 14:49–86.

NOAA (National Oceanic and Atmospheric Administration). 2025a. 2016–2025 Humpback Whale Unusual Mortality Event Along the Atlantic Coast. Accessed May 2025.

NOAA (National Oceanic and Atmospheric Administration). 2025b. *2017–2025 North Atlantic Right Whale Unusual Mortality Event*. Accessed May 2025.

NOAA (National Oceanic and Atmospheric Administration). 2025c. *North Atlantic Right Whale Updates 2023*. Accessed May 2025.

NOAA (National Oceanic and Atmospheric Administration). 2025d. *North Atlantic Right Whale Updates*. Accessed May 2025.

Ozog, J., and D. Engelhaupt. 2025. Mid-Atlantic Marine Mammal Aerial Survey Effort: 20232024 Annual Progress Report. Prepared for U.S. Fleet Forces Command. Submitted to Naval Facilities Engineering Systems Command Atlantic, Norfolk, Virginia, under Contract N62470-15D-8006, Task Order 20F4031 and Contract N62470-20-0016, Task Order 23F4020, issued to HDR Inc., Virginia Beach, Virginia. April 2025

Palsbøll, P.J., J. Allen, M. Bérubé, P. Clapham, T. Feddersen, P. Hammond, R. Hudson, H. Jørgensen, S. Katona, A.H. Larsen, F. Larsen, J. Lien, D. Mattila, J. Sigurjónsson, R. Sears, T. Smith, R. Sponer, P. Stevick, and N. Øien. 1997. Genetic tagging of humpback whales. *Nature* 388:767–769.

Rice, D.W. 1963. Progress report on biological studies of the larger cetaceans in the waters off California. *Norsk Hvalfangst-Tidende* 52:181–187.

Stevik, P.T. 1999. Age-length relationships in humpback whales: a comparison of strandings in the western North Atlantic with commercial catches. *Marine Mammal Science* 15(3):725–737.

Swingle, W.M., S.G. Barco, and T.D. Pitchford. 1993. Appearance of juvenile humpback whales feeding in the nearshore waters of Virginia. *Marine Mammal Science* 9(3):309–315.

Torres, W.I., and K. Bierlich. 2020. MorphoMetriX: a photogrammetric measurement GUI for morphometric analysis of megafauna. *Journal of Open Source Software* 5(45):1825. doi:10.21105/joss.01825.

Urian, K.W., A.A. Hohn, and L.J. Hansen. 1999. *Status of the Photo-identification Catalog of Coastal Bottlenose Dolphins of the Western North Atlantic: Report of a Workshop of Catalog Contributors.* NOAA Administrative Report NMFS-SEFSC-425. National Marine Fisheries Service, Miami, Florida.

Wiley, D.N., R.A. Asmutis, T.D. Pitchford, and D.P. Gannon. 1995. Stranding and mortality of humpback whales, *Megaptera novaeangliae*, in the mid-Atlantic and southeast United States, 1985–1992. *Fishery Bulletin* 93:196–205.

Appendix A.
Sighting History Tables

Table A-1. Sighting history (number of days seen per season) and additional information for all photo-identified humpback whales off Virginia Beach, Virginia: December 2014–June 2024.

HDR Catalog ID	Season 1 Dec 2014–Apr 2015	Season 2 Oct 2015–May 2016	Season 3 Nov 2016–Mar 2017	Season 4 Oct 2017–Mar 2018	Season 5 July 2018–May 2019	Season 6 Dec 2019–Mar 2020	Season 7 Nov 2020–Apr 2021	Season 8 Nov 2021–Mar 2022	Season 9 Nov 2022–Mar 2023	Season 10 Nov 2023–Jun 2024	Total No. Days Seen	Total No. Seasons Seen	Biopsied? (Y/N)/ Gender (M/F/U)	Satellite Tagged? (Y/N)	D-/CATS Tagged? (Y/N)	Estimated Age Class (A/SA/J/Ye/C)	Propeller Scars or Injuries? (Y/N/P)	Total No. Focal Follows	Drone (Y/N);	Happywhale match? (Y/N)	Total No. Focal Follow Minutes
HDRVAMn003	1						1	2			4	3	N/U	N	N	A	N	0	Y	Y	—
HDRVAMn004	1								2		3	2	N/U	N	N	A	N	0	Y	Y	—
HDRVAMn005	2		5							4	11	3	Y/F	Y	N	A	N	1	Y	Y	64
HDRVAMn006	2										2	1	N/U	N	N	J	N	1	N	Y	69
HDRVAMn007	4	1	7		8	1					21	5	Y/F	Y	N	J	N	1	Y	Y	60
HDRVAMn008	5						2				7	2	N/U	N	N	J; SA/A	N	3	Y	Y	215
HDRVAMn009	4										4	1	Y/F	N	N	J	N	2	N	Y	112
HDRVAMn010	1	2		1							4	3	Y/M	Y (2)	N	J	N	1	N	Y	76
HDRVAMn011	4		1								5	2	Y/F	N	N	J	N	1	N	Y	60
HDRVAMn012	3	2	6	2	3		2				18	6	Y/F	Y (3)	Y	J; SA/A	N	3	Y	Y	47
HDRVAMn013	10										10	1	Y/F	N	N	J	N	4	N	Y	357
HDRVAMn014	5	1	1	1							8	4	Y/F	N	N	J	N	1	N	Y	60
HDRVAMn015	2		1								3	2	Y/F	N	N	J	N	1	N	Y	58
HDRVAMn016	1										1	1	N/U	N	N	U	N	0	N	Y	—
HDRVAMn017	1									1	2	2	N/U	N	N	U	N	0	Y	Y	—
HDRVAMn018	1										1	1	N/U	N	N	U	Y	0	N	Y	—
HDRVAMn019	1										1	1	N/U	N	N	U	N	0	N	Y	—
HDRVAMn020	1										1	1	N/U	N	N	U	N	0	N	Y	—
HDRVAMn021	2		3	2	6	1					14	5	N/U	N	N	SA	N	1	Y	Y	78
HDRVAMn022	2										2	1	N/U	N	N	J	N	1	N	Y	85
HDRVAMn023	1		3ª	—	—	—	—	—	—	—	4	2	Y/M	Y	N	J	N	1	N	Y	80

Key: ID = Identification Number; No. = Number; Y = yes; N = no; M = Male; F = Female; U = Unknown; A = adult; SA = sub-adult; J = juvenile; Ye = yearling; C = calf; P = possible; D-Tag = Digital Acoustic Recording Tag; CATS Tag = Customized Animal Tracking Solutions Tag

ª Deceased
ᵇ Sighting occurred on offshore survey

HDR Catalog ID	Season 1 Dec 2014–Apr 2015	Season 2 Oct 2015–May 2016	Season 3 Nov 2016–Mar 2017	Season 4 Oct 2017–Mar 2018	Season 5 July 2018–May 2019	Season 6 Dec 2019–Mar 2020	Season 7 Nov 2020–Apr 2021	Season 8 Nov 2021–Mar 2022	Season 9 Nov 2022–Mar 2023	Season 10 Nov 2023–Jun 2024	Total No. Days Seen	Total No. Seasons Seen	Biopsied? (Y/N)/ Gender (M/F/U)	Satellite Tagged? (Y/N)	D-/CATS Tagged? (Y/N)	Estimated Age Class (A/SA/J/Ye/C)	Propeller Scars or Injuries? (Y/N/P)	Total No. Focal Follows	Drone (Y/N);	Happywhale match? (Y/N)	Total No. Focal Follow Minutes
HDRVAMn024	2										2	1	Y/M	N	N	A	P	1	N	Y	60
HDRVAMn025	1						1				2	2	Y/M	N	N	SA/A	N	1	Y	Y	62
HDRVAMn027	2	3	1	1ᵇ							7	4	Y/F	N	N	J	N	1	N	Y	61
HDRVAMn028	1										1	1	N/U	N	N	J	N	0	N	Y	—
HDRVAMn029	1										1	1	Y/M	N	N	J	P	1	N	Y	63
HDRVAMn030	1	1									2	2	N/U	N	N	A	N	1	N	Y	62
HDRVAMn031	1		1	1							3	3	Y/M	Y	N	J	N	0	N	Y	—
HDRVAMn032	1										1	1	N/U	N	N	SA	N	1	N	Y	—
HDRVAMn033	1										1	1	N/U	N	N	J	N	0	N	Y	63
HDRVAMn034	1										1	1	N/U	N	N	J	N	0	N	Y	—
HDRVAMn035		2									2	1	N/U	N	N	J	N	0	N	Y	—
HDRVAMn036		2									2	1	N/U	N	N	J	N	0	N	Y	—
HDRVAMn037		3									3	1	N/U	N	N	J	N	0	N	Y	—
HDRVAMn039		1									1	1	Y/M	Y	N	J	N	0	N	Y	—
HDRVAMn041		1									1	1	Y/M	Y	N	J	N	0	N	Y	—
HDRVAMn042		6									6	1	N/U	N	N	J	N	0	N	Y	—
HDRVAMn043		1									1	1	N/U	N	N	J	N	0	N	N	—
HDRVAMn044		1									1	1	Y/F	Y	N	J	Y	0	N	Y	—
HDRVAMn045		6									6	1	Y/M	Y	N	J	Y	0	N	Y	—
HDRVAMn046		4									4	1	N/U	N	N	J	N	0	N	Y	—
HDRVAMn047		1									1	1	N/U	N	N	J	N/A	0	N	N	—
HDRVAMn048		2	1								3	2	Y/M	Y	N	SA/A	N	0	N	Y	—
HDRVAMn049		2	6	1, 1ᵇ				1		1	12	5	Y/F	Y (2)	N	SA/A	N	0	Y	Y	—

Key: ID = Identification Number; No. = Number; Y = yes; N = no; M = Male; F = Female; U = Unknown; A = adult; SA = sub-adult; J = juvenile; Ye = yearling; C = calf; P = possible;
D-Tag = Digital Acoustic Recording Tag; CATS Tag = Customized Animal Tracking Solutions Tag
ᵃ Deceased
ᵇ Sighting occurred on offshore survey

HDR Catalog ID	Season 1 Dec 2014–Apr 2015	Season 2 Oct 2015–May 2016	Season 3 Nov 2016–Mar 2017	Season 4 Oct 2017–Mar 2018	Season 5 July 2018–May 2019	Season 6 Dec 2019–Mar 2020	Season 7 Nov 2020–Apr 2021	Season 8 Nov 2021–Mar 2022	Season 9 Nov 2022–Mar 2023	Season 10 Nov 2023-Jun 2024	Total No. Days Seen	Total No. Seasons Seen	Biopsied? (Y/N)/ Gender (M/F/U)	Satellite Tagged? (Y/N)	D-/CATS Tagged? (Y/N)	Estimated Age Class (A/SA/J/Ye/C)	Propeller Scars or Injuries? (Y/N/P)	Total No. Focal Follows	Drone (Y/N);	Happywhale match? (Y/N)	Total No. Focal Follow Minutes
HDRVAMn050		4									4	1	Y/M	N	N	J	N	0	N	Y	—
HDRVAMn051		9									9	1	Y/M	N	N	J	Y	0	N	Y	—
HDRVAMn052		3									3	1	Y/F	N	N	J	N	0	N	Y	—
HDRVAMn053		2									2	1	N/U	N	N	J	Y	0	N	Y	—
HDRVAMn054		7									7	1	Y/M	Y	N	J	N	0	N	Y	—
HDRVAMn055		2									2	1	N/U	N	N	J	N	0	N	Y	—
HDRVAMn056		2									2	1	N/U	N	N	J	N	0	N	Y	—
HDRVAMn057		1									1	1	N/U	N	N	J	N	0	N	Y	—
HDRVAMn058		1						3			4	2	N/U	N	N	J/SA; SA/A	Y	0	Y	Y	—
HDRVAMn059	1	2									3	2	Y/M	Y	N	SA	N	0	N	N	—
HDRVAMn060		1									1	1	N/U	N	N	J	N/A	0	N	N	—
HDRVAMn061		3									3	1	Y/M	Y	N	J	N	0	N	Y	—
HDRVAMn062		3									3	1	N/U	N	N	J	N	0	N	Y	—
HDRVAMn063		4									4	1	Y/M	Y	N	J	N	1	N	Y	120
HDRVAMn064	2	12	2	3	2						21	5	Y/F	Y (2)	N	J	N	0	Y	Y	—
HDRVAMn065		1	3								4	2	N/U	N	N	J	N	0	N	Y	—
HDRVAMn066		2	2								4	2	Y/M	Y	N	J	N	0	N	Y	—
HDRVAMn067		1[b]									1	1	N/U	N	N	J	N	0	N	N	—
HDRVAMn068		1									1	1	N/U	N	N	J	N	0	N	Y	—
HDRVAMn069			1								1	1	Y/F	Y	N	SA	N	0	N	Y	—
HDRVAMn071		2									2	1	Y/M	Y	N	SA	N	0	N	Y	—
HDRVAMn072			1								1	1	N/U	N	N	J	N	0	N	N	—

Key: ID = Identification Number; No. = Number; Y = yes; N = no; M = Male; F = Female; U = Unknown; A = adult; SA = sub-adult; J = juvenile; Ye = yearling; C = calf; P = possible; D-Tag = Digital Acoustic Recording Tag; CATS Tag = Customized Animal Tracking Solutions Tag
[a] Deceased
[b] Sighting occurred on offshore survey

HDR Catalog ID	Season 1 Dec 2014–Apr 2015	Season 2 Oct 2015–May 2016	Season 3 Nov 2016–Mar 2017	Season 4 Oct 2017–Mar 2018	Season 5 July 2018–May 2019	Season 6 Dec 2019–Mar 2020	Season 7 Nov 2020–Apr 2021	Season 8 Nov 2021–Mar 2022	Season 9 Nov 2022–Mar 2023	Season 10 Nov 2023–Jun 2024	Total No. Days Seen	Total No. Seasons Seen	Biopsied? (Y/N)/Gender (M/F/U)	Satellite Tagged? (Y/N)	D-/CATS Tagged? (Y/N)	Estimated Age Class (A/SA/J/Ye/C)	Propeller Scars or Injuries? (Y/N/P)	Total No. Focal Follows	Drone (Y/N);	Happywhale match? (Y/N)	Total No. Focal Follow Minutes
HDRVAMn073			1					1,1[b]	1		4	3	N/U	N	N	SA; A	N	0	Y	Y	—
HDRVAMn074			1								1	1	N/U	N	N	J	N/A	0	N	N	—
HDRVAMn075			1								1	1	N/U	N	N	SA	N/A	0	N	N	—
HDRVAMn076			1								1	1	N/U	N	N	SA	N	0	N	Y	—
HDRVAMn077			1								1	1	N/U	N	N	SA	N	0	N	Y	—
HDRVAMn078			1[a]	—	—	—	—	—	—	—	1	1	N/U	N	N	J	N	0	N	Y	—
HDRVAMn079			3								3	1	N/U	N	N	J	N	0	N	Y	—
HDRVAMn080			1								1	1	N/U	N	N	J	N	0	N	Y	—
HDRVAMn081			9								9	1	Y/F	Y	N	J	N	0	N	Y	—
HDRVAMn082			4	—[a]	—	—	—	—	—	—	3	1	Y/F	Y	N	J	N	0	N	Y	—
HDRVAMn083			2								2	1	N/U	Y	N	J	N	0	N	Y	—
HDRVAMn084			11								11	1	Y/F	Y	N	J	N	0	N	Y	—
HDRVAMn085			8								8	1	N/U	N	N	J	Y	0	N	Y	—
HDRVAMn086			1					1			2	2	N/U	N	N	J; SA	N	0	N	N	—
HDRVAMn087			3								3	1	N/U	N	N	J	N	0	N	N	—
HDRVAMn088			6								6	1	Y/M	Y	N	J	N	0	N	Y	—
HDRVAMn089			1								1	1	N/U	N	N	J	N	0	N	Y	—
HDRVAMn090			4[a]	—	—	—	—	—	—	—	4	1	Y/M	Y	N	J	Y	0	N	Y	—
HDRVAMn091			5[a]	—	—	—	—	—	—	—	5	1	Y/M	N	N	SA	Y	0	N	Y	—
HDRVAMn092			6								6	1	Y/F	Y	N	J	N	0	N	Y	—
HDRVAMn093			6		4	1					11	3	Y/F	Y (3)	N	J	N	0	Y	Y	—
HDRVAMn094			1								1	1	N/U	N	N	J	N	0	N	N	—
HDRVAMn095			2								2	1	Y/M	Y	N	J	N	0	N	Y	—

Key: ID = Identification Number; No. = Number; Y = yes; N = no; M = Male; F = Female; U = Unknown; A = adult; SA = sub-adult; J = juvenile; Ye = yearling; C = calf; P = possible; D-Tag = Digital Acoustic Recording Tag; CATS Tag = Customized Animal Tracking Solutions Tag
[a] Deceased
[b] Sighting occurred on offshore survey

HDR Catalog ID	Season 1 Dec 2014–Apr 2015	Season 2 Oct 2015–May 2016	Season 3 Nov 2016–Mar 2017	Season 4 Oct 2017–Mar 2018	Season 5 July 2018–May 2019	Season 6 Dec 2019–Mar 2020	Season 7 Nov 2020–Apr 2021	Season 8 Nov 2021–Mar 2022	Season 9 Nov 2022–Mar 2023	Season 10 Nov 2023-Jun 2024	Total No. Days Seen	Total No. Seasons Seen	Biopsied? (Y/N)/ Gender (M/F/U)	Satellite Tagged? (Y/N)	D-/CATS Tagged? (Y/N)	Estimated Age Class (A/SA/J/Ye/C)	Propeller Scars or Injuries? (Y/N/P)	Total No. Focal Follows	Drone (Y/N);	Happywhale match? (Y/N)	Total No. Focal Follow Minutes
HDRVAMn096			5								5	1	Y/M	N	N	J	N	0	N	Y	—
HDRVAMn097			1					2		1	4	3	N/U	Y	N	J; SA; A	N	0	Y	Y	—
HDRVAMn098			8								8	1	Y/F	N	N	J	N	0	N	Y	—
HDRVAMn099			6								6	1	Y/F	Y	N	J	N	0	N	Y	—
HDRVAMn100			1ᵃ	—	—	—	—	—	—		1	1	N/U	N	N	J	N	0	N	Y	—
HDRVAMn101			1								1	1	Y/M	Y	N	J	N	0	N	N	—
HDRVAMn102			7								7	1	Y/M	Y	N	J	N	0	N	Y	—
HDRVAMn103			4								4	1	N/U	N	N	J	N	0	N	Y	—
HDRVAMn104			4								4	1	Y/F	Y	N	J	N	0	N	Y	—
HDRVAMn105			3								3	1	Y/F	Y	N	J	N	0	N	Y	—
HDRVAMn106			3								3	1	N/U	N	N	J	P	0	N	Y	—
HDRVAMn107			2								2	1	N/U	N	N	J	N	0	N	Y	—
HDRVAMn108			2								2	1	N/U	N	N	J	N	0	N	Y	—
HDRVAMn109			3								3	1	Y/M	N	N	J	N	0	N	Y	—
HDRVAMn110			2								2	1	N/U	N	N	J	N	0	N	Y	—
HDRVAMn111			1								1	1	Y/F	N	N	SA/A	N	0	N	Y	—
HDRVAMn112			1								1	1	Y/M	N	N	J	P	0	N	N	—
HDRVAMn113				1							1	1	N/U	N	N	J	N	0	N	Y	—
HDRVAMn114				2							2	1	N/U	N	N	J	N	0	N	N	—
HDRVAMn115				2							2	1	N/U	N	N	J	N	0	N	Y	—
HDRVAMn116				1							1	1	N/U	N	N	J	N	0	N	Y	—
HDRVAMn117				1							1	1	N/U	N	N	J	N	0	N	N	—
HDRVAMn118				1							1	1	N/U	N	N	J	N	0	N	N	—

Key: ID = Identification Number; No. = Number; Y = yes; N = no; M = Male; F = Female; U = Unknown; A = adult; SA = sub-adult; J = juvenile; Ye = yearling; C = calf; P = possible; D-Tag = Digital Acoustic Recording Tag; CATS Tag = Customized Animal Tracking Solutions Tag
ᵃ Deceased
ᵇ Sighting occurred on offshore survey

HDR Catalog ID	Season 1 Dec 2014–Apr 2015	Season 2 Oct 2015–May 2016	Season 3 Nov 2016–Mar 2017	Season 4 Oct 2017–Mar 2018	Season 5 July 2018–May 2019	Season 6 Dec 2019–Mar 2020	Season 7 Nov 2020–Apr 2021	Season 8 Nov 2021–Mar 2022	Season 9 Nov 2022–Mar 2023	Season 10 Nov 2023–Jun 2024	Total No. Days Seen	Total No. Seasons Seen	Biopsied? (Y/N)/ Gender (M/F/U)	Satellite Tagged? (Y/N)	D-/CATS Tagged? (Y/N)	Estimated Age Class (A/SA/J/Ye/C)	Propeller Scars or Injuries? (Y/N/P)	Total No. Focal Follows	Drone (Y/N);	Happywhale match? (Y/N)	Total No. Focal Follow Minutes
HDRVAMn119				2							2	1	N/U	N	N	J	N	0	N	Y	—
HDRVAMn120				1							1	1	Y/M	Y	N	J	N	0	N	Y	—
HDRVAMn121				1							1	1	N/U	N	N	J	N	0	N	N	—
HDRVAMn122				3							3	1	Y/M	N	N	J	N	0	N	N	—
HDRVAMn123				1	1[b]			2			4	3	N/U	N	N	J; SA/A	N	0	N	Y	N
HDRVAMn124				1							1	1	N/U	N	N	J	N	0	N	Y	—
HDRVAMn125				2							2	1	N/U	N	N	J	Y	0	N	N	—
HDRVAMn126				1[b]							1	1	Y/M	Y	N	SA/A	N	0	N	Y	—
HDRVAMn127				1[b]							1	1	N/U	N	N	J	N	0	N	N	—
HDRVAMn128				1[b]							1	1	N/U	N	N	A	N	0	N	N	—
HDRVAMn129				1[b]							1	1	N/U	N	N	A	N/A	0	N	N	—
HDRVAMn130				1[b]							1	1	N/U	N	N	J/SA	N	0	N	N	—
HDRVAMn131				1[b]							1	1	N/U	N	N	U	N	0	N	Y	—
HDRVAMn132					1		1	2			4	3	Y/F	Y	N	J; SA/A	N	0	Y	Y	—
HDRVAMn133					1[b]						1	1	N/U	N	N	J	N	0	N	Y	—
HDRVAMn135					2						2	1	N/U	N	N	J	N	0	N	N	—
HDRVAMn136					1						1	1	N/U	Y	N	J	N	0	N	Y	—
HDRVAMn137					2						2	1	N/U	N	N	J	N	0	N	Y	—
HDRVAMn138					1						1	1	N/U	N	N	J	N/A	0	N	N	—
HDRVAMn139					1						1	1	N/U	N	N	J	N/A	0	N	N	—
HDRVAMn140					1						1	1	N/U	N	N	U	N	0	N	Y	—
HDRVAMn142					4						4	1	N/U	N	N	J	N/A	0	N	N	—
HDRVAMn143					2						2	1	N/U	N	N	J/SA	N	0	N	Y	—

Key: ID = Identification Number; No. = Number; Y = yes; N = no; M = Male; F = Female; U = Unknown; A = adult; SA = sub-adult; J = juvenile; Ye = yearling; C = calf; P = possible;
     D-Tag = Digital Acoustic Recording Tag; CATS Tag = Customized Animal Tracking Solutions Tag
[a] Deceased
[b] Sighting occurred on offshore survey

HDR Catalog ID	Season 1 Dec 2014–Apr 2015	Season 2 Oct 2015–May 2016	Season 3 Nov 2016–Mar 2017	Season 4 Oct 2017–Mar 2018	Season 5 July 2018–May 2019	Season 6 Dec 2019–Mar 2020	Season 7 Nov 2020–Apr 2021	Season 8 Nov 2021–Mar 2022	Season 9 Nov 2022–Mar 2023	Season 10 Nov 2023–Jun 2024	Total No. Days Seen	Total No. Seasons Seen	Biopsied? (Y/N)/ Gender (M/F/U)	Satellite Tagged? (Y/N)	D-/CATS Tagged? (Y/N)	Estimated Age Class (A/SA/J/Ye/C)	Propeller Scars or Injuries? (Y/N/P)	Total No. Focal Follows	Drone (Y/N);	Happywhale match? (Y/N)	Total No. Focal Follow Minutes
HDRVAMn144					1						1	1	N/U	N	N	J	N	0	N	N	—
HDRVAMn145					2						2	1	N/U	N	N	J	N	0	N	Y	—
HDRVAMn146					1[b]						1	1	Y/M	Y	N	J	N	0	N	Y	—
HDRVAMn147					1						1	1	N/U	N	N	J	Y	0	Y	Y	—
HDRVAMn148					3						3	1	N/U	N	N	J	N	0	N	N	—
HDRVAMn149					4						4	1	N/U	N	N	SA/A	N	0	N	Y	—
HDRVAMn150					1						1	1	N/U	N	N	SA/A	N	0	N	N	—
HDRVAMn151					2[a]	—	—	—	—	—	2	1	Y/F	Y	N	J	N	0	Y	Y	—
HDRVAMn152					3						3	1	Y/M	Y	N	J	N	0	Y	N	—
HDRVAMn153					2						2	1	Y/F	Y	N	J	N	0	Y	N	—
HDRVAMn154					1						1	1	Y/F	Y	N	J	N	0	Y	N	—
HDRVAMn153					2						2	1	Y/F	Y	N	J	N	0	Y	N	—
HDRVAMn154					1						1	1	Y/F	Y	N	J	N	0	Y	N	—
HDRVAMn155				1[b]							1	1	N/U	N	N	J	N	0	N	N	—
HDRVAMn156					2						2	1	Y/F	N	N	SA/A	N	0	N	Y	—
HDRVAMn157					1						1	1	N/U	N	N	SA/A	N	0	N	Y	—
HDRVAMn158					1						1	1	N/U	N	N	J	N/A	0	N	N	—
HDRVAMn159					1						1	1	N/U	N	N	J	N/A	0	N	Y	—
HDRVAMn160					1						1	1	N/U	N	N	A	N	0	N	Y	—
HDRVAMn161					1						1	1	N/U	N	N	J	N	0	N	Y	—
HDRVAMn162					1						1	1	N/U	Y	N	J	N/A	0	N	Y	—
HDRVAMn163					2			2			4	2	Y/F	Y (2)	N	J	N	0	Y	N	—
HDRVAMn164					1						1	1	N/U	N	N	J	N	0	N	N	—

Key: ID = Identification Number; No. = Number; Y = yes; N = no; M = Male; F = Female; U = Unknown; A = adult; SA = sub-adult; J = juvenile; Ye = yearling; C = calf; P = possible; D-Tag = Digital Acoustic Recording Tag; CATS Tag = Customized Animal Tracking Solutions Tag

[a] Deceased

[b] Sighting occurred on offshore survey

HDR Catalog ID	Season 1 Dec 2014–Apr 2015	Season 2 Oct 2015–May 2016	Season 3 Nov 2016–Mar 2017	Season 4 Oct 2017–Mar 2018	Season 5 July 2018–May 2019	Season 6 Dec 2019–Mar 2020	Season 7 Nov 2020–Apr 2021	Season 8 Nov 2021–Mar 2022	Season 9 Nov 2022–Mar 2023	Season 10 Nov 2023-Jun 2024	Total No. Days Seen	Total No. Seasons Seen	Biopsied? (Y/N)/ Gender (M/F/U)	Satellite Tagged? (Y/N)	D-/CATS Tagged? (Y/N)	Estimated Age Class (A/SA/J/Ye/C)	Propeller Scars or Injuries? (Y/N/P)	Total No. Focal Follows	Drone (Y/N);	Happywhale match? (Y/N)	Total No. Focal Follow Minutes
HDRVAMn165					1						1	1	N/U	N	N	J	N/A	0	N	Y	—
HDRVAMn166						3					3	1	Y/U	Y	N	J	N	0	Y	Y	—
HDRVAMn167						1					1	1	N/U	N	N	J	Y	0	N	N	—
HDRVAMn168						1					1	1	N/U	N	N	SA/A	N	0	N	Y	—
HDRVAMn169						1					1	1	N/U	N	N	J	N/A	0	N	N	—
HDRVAMn170						2					2	1	N/U	N	N	SA/A	N	0	Y	N	—
HDRVAMn171						1		1			2	2	N/U	N	N	J	N	0	N	Y	—
HDRVAMn172						3	1	1			5	3	Y/U	Y (2)	N	SA/A; A	N	0	Y	Y	—
HDRVAMn173						4					4	1	Y/U	Y	N	J	N	0	Y	Y	—
HDRVAMn174						3	3				6	2	N/U	Y	N	J	Y	0	Y	Y	—
HDRVAMn175						1	1	1			3	3	Y/U	Y	N	J; J/SA	N	0	Y	Y	—
HDRVAMn176						1					1	1	N/U	N	N	J	N	0	N	Y	—
HDRVAMn177						4					4	1	N/U	Y	N	J	N	0	Y	Y	—
HDRVAMn178						1					1	1	N/U	N	N	J	N	0	N	Y	—
HDRVAMn179						1	1				2	2	N/U	N	N	J	Y	0	N	Y	—
HDRVAMn180						1					1	1	N/U	N	N	J	N	0	Y	Y	—
HDRVAMn181						1		1			2	2	N/U	N	N	J; SA/A	N	0	Y	Y	—
HDRVAMn182						2					2	1	Y/U	N	N	SA	N	0	N	Y	—
HDRVAMn183						1					1	1	N/U	N	N	SA	N/A	0	N	N	—
HDRVAMn184						4				1	5	2	Y/U	Y	N	J; A	N	0	Y	Y	—
HDRVAMn185						1					1	1	N/U	N	N	SA	N	0	Y	Y	—
HDRVAMn186						2		1			3	2	Y/U	Y	N	SA	N	0	Y	Y	—
HDRVAMn187						2				1	3	2	N/U	Y	N	SA; A	N	0	Y	Y	—

Key: ID = Identification Number; No. = Number; Y = yes; N = no; M = Male; F = Female; U = Unknown; A = adult; SA = sub-adult; J = juvenile; Ye = yearling; C = calf; P = possible; D-Tag = Digital Acoustic Recording Tag; CATS Tag = Customized Animal Tracking Solutions Tag

[a] Deceased

[b] Sighting occurred on offshore survey

HDR Catalog ID	Season 1 Dec 2014–Apr 2015	Season 2 Oct 2015–May 2016	Season 3 Nov 2016–Mar 2017	Season 4 Oct 2017–Mar 2018	Season 5 July 2018–May 2019	Season 6 Dec 2019–Mar 2020	Season 7 Nov 2020–Apr 2021	Season 8 Nov 2021–Mar 2022	Season 9 Nov 2022–Mar 2023	Season 10 Nov 2023-Jun 2024	Total No. Days Seen	Total No. Seasons Seen	Biopsied? (Y/N)/ Gender (M/F/U)	Satellite Tagged? (Y/N)	D-/CATS Tagged? (Y/N)	Estimated Age Class (A/SA/J/Ye/C)	Propeller Scars or Injuries? (Y/N/P)	Total No. Focal Follows	Drone (Y/N);	Happywhale match? (Y/N)	Total No. Focal Follow Minutes
HDRVAMn188						1					1	1	N/U	N	N	SA	N	0	N	Y	—
HDRVAMn189						1					1	1	N/U	N	N	J	N	0	Y	Y	—
HDRVAMn190							1				1	1	Y/U	N	Y	J	N	1	Y	Y	313
HDRVAMn191							1		1		2	2	N/U	N	N	J; SA	N	0	Y	Y	—
HDRVAMn192							1				1	1	N/U	N	N	SA/A	N	0	Y	N	—
HDRVAMn193							2				2	1	Y/U	Y	N	J	N	0	Y	Y	—
HDRVAMn194							1				1	1	N/U	N	N	J	N	0	N	Y	—
HDRVAMn195							1				1	1	N/U	N	N	J	N	0	N	Y	—
HDRVAMn196							1				1	1	Y/U	Y	N	SA/A	N	0	Y	Y	—
HDRVAMn197							2				2	1	N/U	N	N	SA/A	N	0	N	N	—
HDRVAMn198							1	3			4	2	N/U	N	N	A	N	0	Y	Y	—
HDRVAMn199							1				1	1	N/U	N	N	SA/A	N	0	N	Y	—
HDRVAMn200							2				2	1	N/U	N	N	SA/A	N	0	Y	Y	—
HDRVAMn201							1		1		2	2	N/U	N	N	SA/A	N	0	Y	Y	—
HDRVAMn202							1				1	1	Y/U	Y	N	SA/A	N	0	Y	Y	—
HDRVAMn203							1	1			2	2	N/U	N	N	SA/A	N	0	Y	N	—
HDRVAMn204							2				2	1	Y/U	Y	N	J	N	0	Y	Y	—
HDRVAMn205							2				2	1	N/U	N	N	J	N	0	N	N	—
HDRVAMn206							1	1			2	2	N/U	N	N	J	N	0	Y	Y	—
HDRVAMn207							1				1	1	N/U	N	N	J	N	0	N	N/A	—
HDRVAMn208							1				1	1	N/U	N	Y	J	N	1	Y	N	—
HDRVAMn209							1				1	1	N/U	N	N	A	N	0	N	N	—
HDRVAMn210							1[b]				1	1	N/U	N	N	A	N	0	N	N	—

Key: ID = Identification Number; No. = Number; Y = yes; N = no; M = Male; F = Female; U = Unknown; A = adult; SA = sub-adult; J = juvenile; Ye = yearling; C = calf; P = possible; D-Tag = Digital Acoustic Recording Tag; CATS Tag = Customized Animal Tracking Solutions Tag

[a] Deceased

[b] Sighting occurred on offshore survey

HDR Catalog ID	Season 1 Dec 2014–Apr 2015	Season 2 Oct 2015–May 2016	Season 3 Nov 2016–Mar 2017	Season 4 Oct 2017–Mar 2018	Season 5 July 2018–May 2019	Season 6 Dec 2019–Mar 2020	Season 7 Nov 2020–Apr 2021	Season 8 Nov 2021–Mar 2022	Season 9 Nov 2022–Mar 2023	Season 10 Nov 2023–Jun 2024	Total No. Days Seen	Total No. Seasons Seen	Biopsied? (Y/N)/ Gender (M/F/U)	Satellite Tagged? (Y/N)	D-/CATS Tagged? (Y/N)	Estimated Age Class (A/SA/J/Ye/C)	Propeller Scars or Injuries? (Y/N/P)	Total No. Focal Follows	Drone (Y/N);	Happywhale match? (Y/N)	Total No. Focal Follow Minutes
HDRVAMn211							1[b]	1			2	2	N/U	N	N	JA	N	0	N	Y	—
HDRVAMn212							1[b]				1	1	N/U	N	N	J	N	0	N	N/A	—
HDRVAMn213							1[b]				1	1	N/F	N	N	A	N	0	N	N/A	—
HDRVAMn214							1[b]				1	1	N/U	N	N	C	N	0	N	N/A	—
HDRVAMn215								1			1	1	N/U	N	N	SA/A	N	0	Y	Y	—
HDRVAMn216								1			1	1	N/U	N	N	J	N	0	Y	Y	—
HDRVAMn217								1[b]			1	1	N/U	N	N	SA/A	N	0	N	Y	—
HDRVAMn218								2		1[b]	3	2	N/M	N	N	SA/A; A	N	0	Y	Y	—
HDRVAMn219								1			1	1	Y/U	Y	Y	SA/A	N	1	N	Y	307
HDRVAMn220								1		1	2	2	N/U	N	N	SA/A; A	Y	0	Y	Y	—
HDRVAMn221								1	1		2	2	N/U	N	N	SA/A	Y	0	N	Y	—
HDRVAMn222								1			1	1	N/U	N	N	SA/A	Y	0	N	N	—
HDRVAMn223								2			2	1	Y/U	Y	N	SA/A	N	0	Y	N	—
HDRVAMn224								1			1	1	N/U	N	N	J	N	0	N	Y	—
HDRVAMn225								1		1	2	2	Y/U	Y	N	SA/A; A	N	0	Y	Y	—
HDRVAMn226								1			1	1	N/F	N	N	A	N	0	Y	Y	—
HDRVAMn227								1			1	1	N/U	N	N	C	N	0	Y	Y	—
HDRVAMn228								1			1	1	N/U	N	N	A	N	0	Y	Y	—
HDRVAMn229								1			1	1	N/U	N	N	SA/A	N	0	N	Y	—
HDRVAMn230								2			2	1	N/U	N	N	SA/A	N	0	Y	N	—
HDRVAMn231								2	1		3	2	N/U	N	N	SA/A	N	0	Y	Y	—
HDRVAMn232								2			2	1	N/U	N	N	SA/A	N	0	Y	N	—
HDRVAMn233								1			1	1	Y/U	Y	N	SA/A	N	0	Y	Y	—

Key: ID = Identification Number; No. = Number; Y = yes; N = no; M = Male; F = Female; U = Unknown; A = adult; SA = sub-adult; J = juvenile; Ye = yearling; C = calf; P = possible;
D-Tag = Digital Acoustic Recording Tag; CATS Tag = Customized Animal Tracking Solutions Tag
[a] Deceased
[b] Sighting occurred on offshore survey

HDR Catalog ID	Season 1 Dec 2014–Apr 2015	Season 2 Oct 2015–May 2016	Season 3 Nov 2016–Mar 2017	Season 4 Oct 2017–Mar 2018	Season 5 July 2018–May 2019	Season 6 Dec 2019–Mar 2020	Season 7 Nov 2020–Apr 2021	Season 8 Nov 2021–Mar 2022	Season 9 Nov 2022–Mar 2023	Season 10 Nov 2023–Jun 2024	Total No. Days Seen	Total No. Seasons Seen	Biopsied? (Y/N)/ Gender (M/F/U)	Satellite Tagged? (Y/N)	D-/CATS Tagged? (Y/N)	Estimated Age Class (A/SA/J/Ye/C)	Propeller Scars or Injuries? (Y/N/P)	Total No. Focal Follows	Drone (Y/N);	Happywhale match? (Y/N)	Total No. Focal Follow Minutes
HDRVAMn234								2			2	1	N/U	N	N	J	Y	0	N	Y	—
HDRVAMn235								1			1	1	N/U	N	N	A	N	0	Y	Y	—
HDRVAMn236								1			1	1	N/U	N	N	J	N	0	Y	Y	—
HDRVAMn237								1			1	1	N/U	N	N	SA/A	N	0	N	Y	—
HDRVAMn238								1			1	1	N/U	N	N	SA/A	N	0	N	N	—
HDRVAMn240								1[b]			1	1	N/U	N	N	A	N	0	Y	Y	—
HDRVAMn241								1[b]			1	1	N/U	N	N	J	N	0	Y	N	—
HDRVAMn242								1[b]			1	1	N/U	N	N	J	Y	0	N	Y	—
HDRVAMn243								1			1	1	N/U	Y	N	SA	N	0	N	N	—
HDRVAMn244								2			2	1	N/U	N	N	SA/A	N	0	N	Y	—
HDRVAMn245								2			2	1	N/U	N	N	J	N	0	Y	Y	—
HDRVAMn246								4			4	1	Y/U	Y	N	J	N	0	Y	Y	—
HDRVAMn247								3	1		4	2	N/U	N	N	J	N	0	Y	Y	—
HDRVAMn248								4			4	1	N/U	N	N	J	N	0	Y	Y	—
HDRVAMn249								1			1	1	N/U	N	N	J	N	0	N	Y	—
HDRVAMn250								1			1	1	N/U	N	N	SA/A	N	0	Y	Y	—
HDRVAMn251								1			1	1	Y/U	Y	N	J	N	0	Y	N	—
HDRVAMn252								1			1	1	N/U	N	N	J	N	0	Y	Y	—
HDRVAMn253								1	1		2	2	N/U	N	N	A; J	N	0	N	Y	—
HDRVAMn254									1		1	1	N/U	N	N	A	N	0	N	N	—
HDRVAMn255									2		2	1	N/U	N	N	A	N	0	Y	N	—
HDRVAMn256									2		2	1	N/U	N	N	SA/A	N	0	Y	Y	—
HDRVAMn257									1		1	1	N/U	N	N	SA/A	N	0	Y	Y	—

Key: ID = Identification Number; No. = Number; Y = yes; N = no; M = Male; F = Female; U = Unknown; A = adult; SA = sub-adult; J = juvenile; Ye = yearling; C = calf; P = possible;
D-Tag = Digital Acoustic Recording Tag; CATS Tag = Customized Animal Tracking Solutions Tag
[a] Deceased
[b] Sighting occurred on offshore survey

HDR Catalog ID	Season 1 Dec 2014–Apr 2015	Season 2 Oct 2015–May 2016	Season 3 Nov 2016–Mar 2017	Season 4 Oct 2017–Mar 2018	Season 5 July 2018–May 2019	Season 6 Dec 2019–Mar 2020	Season 7 Nov 2020–Apr 2021	Season 8 Nov 2021–Mar 2022	Season 9 Nov 2022–Mar 2023	Season 10 Nov 2023–Jun 2024	Total No. Days Seen	Total No. Seasons Seen	Biopsied? (Y/N)/ Gender (M/F/U)	Satellite Tagged? (Y/N)	D-/CATS Tagged? (Y/N)	Estimated Age Class (A/SA/J/Ye/C)	Propeller Scars or Injuries? (Y/N/P)	Total No. Focal Follows	Drone (Y/N);	Happywhale match? (Y/N)	Total No. Focal Follow Minutes
HDRVAMn258									1		1	1	N/U	N	N	SA/A	N	0	Y	N	—
HDRVAMn259									1		1	1	N/U	N	N	SA/A	N	0	Y	Y	—
HDRVAMn260									1	1	2	2	N/U	N	N	A	N	0	Y	Y	—
HDRVAMn261									2		2	1	N/U	N	N	A	N	0	Y	Y	—
HDRVAMn262									1[b]		1	1	N/U	N	N	J	Y	0	Y	N	—
HDRVAMn263									1		1	1	N/U	N	N	SA/A	N	0	Y	N	—
HDRVAMn264									1		1	1	N/U	N	N	A	N	0	Y	Y	—
HDRVAMn265									1		1	1	N/U	N	N	A	N	0	Y	Y	—
HDRVAMn266									1		1	1	N/U	N	N	J	N	0	N	Y	—
HDRVAMn267									1		1	1	—	N	N	A	Y	0	N	Y	—
HDRVAMn268									2		2	1	Y/U	Y	Y	SA	N	0	Y	Y	—
HDRVAMn269									2		2	1	N/U	N	N	SA	N	0	N	N	—
HDRVAMn270									1		1	1	N/U	N	N	SA	N	0	N	N	—
HDRVAMn271									1		1	1	N/U	N	N	A	N	0	N	N	—
HDRVAMn272									1		1	1	N/U	N	N	A	N	0	N	Y	—
HDRVAMn273									3		3	1	N/U	N	N	J	N	0	N	Y	—
HDRVAMn274									1		1	1	N/U	N	N	J	N	0	N	N	—
HDRVAMn275									1		1	1	N/U	N	N	J	N	0	N	Y	—
HDRVAMn276									1		1	1	N/U	N	N	SA	N	0	N	Y	—
HDRVAMn277									1		1	1	N/U	N	N	SA	N	0	N	Y	—
HDRVAMn278									1		1	1	N/U	Y	Y	J	N	0	Y	Y	—
HDRVAMn279									1		1	1	N/U	N	N	J	N	0	N	N	—
HDRVAMn280									1		1	1	N/U	N	N	J	N	0	N	N	—

Key: ID = Identification Number; No. = Number; Y = yes; N = no; M = Male; F = Female; U = Unknown; A = adult; SA = sub-adult; J = juvenile; Ye = yearling; C = calf; P = possible;
D-Tag = Digital Acoustic Recording Tag; CATS Tag = Customized Animal Tracking Solutions Tag
[a] Deceased
[b] Sighting occurred on offshore survey

HDR Catalog ID	Season 1 Dec 2014–Apr 2015	Season 2 Oct 2015–May 2016	Season 3 Nov 2016–Mar 2017	Season 4 Oct 2017–Mar 2018	Season 5 July 2018–May 2019	Season 6 Dec 2019–Mar 2020	Season 7 Nov 2020–Apr 2021	Season 8 Nov 2021–Mar 2022	Season 9 Nov 2022–Mar 2023	Season 10 Nov 2023-Jun 2024	Total No. Days Seen	Total No. Seasons Seen	Biopsied? (Y/N)/ Gender (M/F/U)	Satellite Tagged? (Y/N)	D-/CATS Tagged? (Y/N)	Estimated Age Class (A/SA/J/Ye/C)	Propeller Scars or Injuries? (Y/N/P)	Total No. Focal Follows	Drone (Y/N);	Happywhale match? (Y/N)	Total No. Focal Follow Minutes
HDRVAMn281									1		1	1	N/U	N	N	SA/A	N	0	N	N	—
HDRVAMn282									1		1	1	N/U	N	N	J	N	0	N	N	—
HDRVAMn283									1		1	1	N/U	N	N	A	N	0	N	N	—
HDRVAMn284										1	1	1	N/U	N	N	A	N	0	N	N	—
HDRVAMn285										1	1	1	N/U	N	N	J	N	0	N	N	—
HDRVAMn286										2	2	1	N/U	N	N	J	N	0	N	N	—
HDRVAMn287										1	1	1	N/U	N	N	A	N	0	Y	N	—
HDRVAMn288										1	1	1	N/U	N	N	A	N	0	N	Y	—
HDRVAMn289										1	1	1	N/U	N	N	U	N	0	N	N	—
HDRVAMn290										1	1	1	N/U	N	N	J	N	0	N	N	—
HDRVAMn291										1	1	1	N/U	N	N	J	N	0	N	N	—
HDRVAMn292										1	1	1	N/U	N	N	J	N	0	N	N	—
HDRVAMn293										1[b]	1	1	N/U	N	N	J	N	0	N	N	—
HDRVAMn294										1	1	1	N/U	N	Y	J	N	0	Y	N	—
HDRVAMn295										2	2	1	N/U	N	N	A	N	0	Y	N	—
HDRVAMn296										1	1	1	N/U	N	N	J	N	0	N	N	—
HDRVAMn297										1	1	1	N/U	N	N	J	N	0	N	N	—
HDRVAMn298										1	1	1	N/U	N	N	J	N	0	N	N	—
HDRVAMn299										1	1	1	N/U	N	N	U	N	0	N	N	—
HDRVAMn300										4	4	1	N/U	N	N	J	N	0	N	N	—
HDRVAMn301										2	2	1	N/U	N	N	J	N	0	N	N	—
HDRVAMn302										2[a]	2	1	N/U	N	N	J	N	0	N	N	—
HDRVAMn303										1[a]	1	1	N/U	N	N	J	N	0	Y	N	—

Key: ID = Identification Number; No. = Number; Y = yes; N = no; M = Male; F = Female; U = Unknown; A = adult; SA = sub-adult; J = juvenile; Ye = yearling; C = calf; P = possible; D-Tag = Digital Acoustic Recording Tag; CATS Tag = Customized Animal Tracking Solutions Tag
[a] Deceased
[b] Sighting occurred on offshore survey

HDR Catalog ID	Season 1 Dec 2014–Apr 2015	Season 2 Oct 2015–May 2016	Season 3 Nov 2016–Mar 2017	Season 4 Oct 2017–Mar 2018	Season 5 July 2018–May 2019	Season 6 Dec 2019–Mar 2020	Season 7 Nov 2020–Apr 2021	Season 8 Nov 2021–Mar 2022	Season 9 Nov 2022–Mar 2023	Season 10 Nov 2023–Jun 2024	Total No. Days Seen	Total No. Seasons Seen	Biopsied? (Y/N)/ Gender (M/F/U)	Satellite Tagged? (Y/N)	D-/CATS Tagged? (Y/N)	Estimated Age Class (A/SA/J/Ye/C)	Propeller Scars or Injuries? (Y/N/P)	Total No. Focal Follows	Drone (Y/N);	Happywhale match? (Y/N)	Total No. Focal Follow Minutes
HDRVAMn304										1	1	1	N/U	N	N	J	N	0	N	N	—
HDRVAMn305										1	1	1	N/U	N	N	A	N	0	N	Y	—
HDRVAMn306										1b	1	1	N/U	N	N	A	N	0	N	N	—
HDRVAMn307										2b	2	1	N/U	N	N	A	N	0	N	N	—
HDRVAMn308										3b	3	1	N/U	N	N	A	N	0	N	N	—
HDRVAMn309										1b	1	1	N/F	N	N	A	N	0	N	N	—
HDRVAMn310										1b	1	1	N/U	N	N	C	N	0	N	N	—
HDRVAMn311										3b	3	1	Y/U	Y	N	A	N	0	N	N	—
HDRVAMn312										2b	2	1	N/U	Y	N	A	N	0	N	N	—
HDRVAMn313										1b	1	1	N/U	N	N	U	N	0	N	Y	—
HDRVAMn314										2b	2	1	N/U	N	N	U	N	0	N	N	—
HDRVAMn315										3b	3	1	N/F	N	N	A	N	0	N	Y	—
HDRVAMn316										3b	3	1	N/U	N	N	C	N	0	N	N	—
HDRVAMn317										1b	1	1	N/U	N	N	U	N	0	N	N	—
HDRVAMn318										1b	1	1	N/U	N	N	U	N	0	N	N	—
HDRVAMn319										2b	2	1	N/U	N	N	A	N	0	N	Y	—
HDRVAMn320										2b	2	1	N/U	N	N	A	N	0	N	N	—
HDRVAMn321										6b	6	1	N/U	N	N	A	N	0	N	N	—
HDRVAMn322										3b	3	1	N/U	N	N	SA	N	0	N	N	—
HDRVAMn323										2b	2	1	N/U	N	N	A	N	0	N	N	—
HDRVAMn324										1b	1	1	N/U	N	N	A	N	0	N	N	—
HDRVAMn325										1b	1	1	N/U	N	N	A	N	0	N	Y	—
HDRVAMn326										2b	2	1	N/U	N	N	A	N	0	N	N	—

Key: ID = Identification Number; No. = Number; Y = yes; N = no; M = Male; F = Female; U = Unknown; A = adult; SA = sub-adult; J = juvenile; Ye = yearling; C = calf; P = possible; D-Tag = Digital Acoustic Recording Tag; CATS Tag = Customized Animal Tracking Solutions Tag
[a] Deceased
[b] Sighting occurred on offshore survey

HDR Catalog ID	Season 1 Dec 2014–Apr 2015	Season 2 Oct 2015–May 2016	Season 3 Nov 2016–Mar 2017	Season 4 Oct 2017–Mar 2018	Season 5 July 2018–May 2019	Season 6 Dec 2019–Mar 2020	Season 7 Nov 2020–Apr 2021	Season 8 Nov 2021–Mar 2022	Season 9 Nov 2022–Mar 2023	Season 10 Nov 2023-Jun 2024	Total No. Days Seen	Total No. Seasons Seen	Biopsied? (Y/N)/ Gender (M/F/U)	Satellite Tagged? (Y/N)	D-/CATS Tagged? (Y/N)	Estimated Age Class (A/SA/J/Ye/C)	Propeller Scars or Injuries? (Y/N/P)	Total No. Focal Follows	Drone (Y/N);	Happywhale match? (Y/N)	Total No. Focal Follow Minutes
HDRVAMn327										3b	3	1	N/U	N	N	A	N	0	N	N	—
HDRVAMn328										1b	1	1	N/U	N	N	A	N	0	N	N	—
HDRVAMn329										2b	2	1	N/U	N	N	U	N	0	N	N	—
HDRVAMn330										1b	1	1	N/U	N	N	A	N	0	N	N	—
HDRVAMn331										1[b]	1	1	N/U	N	N	J	N	0	N	Y	—
HDRVAMn332										1[b]	1	1	N/U	N	N	U	N	0	N	N	—
HDRVAMn333										1[b]	1	1	N/U	N	N	U	N	0	N	N	—
HDRVAMn334										2[b]	2	1	N/U	N	N	A/SA	N	0	N	N	—
HDRVAMn335										3[b]	3	1	N/U	N	N	A/SA	N	0	N	N	—
HDRVAMn336										1[b]	1	1	N/U	N	N	SA	N	0	N	N	—
HDRVAMn337										1[b]	1	1	N/U	N	N	SA	N	0	N	N	—
HDRVAMn338										2[b]	2	1	N/U	N	N	SA/A	N	0	N	N	—
HDRVAMn339										1[b]	1	1	N/U	N	N	U	N	0	N	N	—
HDRVAMn340										1[b]	1	1	N/U	N	N	SA/A	N	0	N	N	—
HDRVAMn341										1[b]	1	1	N/U	N	N	SA/A	N	0	N	N	—
HDRVAMn342										1[b]	1	1	N/U	N	N	SA/A	N	0	N	N	—
HDRVAMn343										2[b]	2	1	N/U	N	N	J	N	0	N	N	—
HDRVAMn344										1[b]	1	1	N/U	N	N	SA/A	N	0	N	N	—
HDRVAMn345										1[b]	1	1	N/U	N	N	A	N	0	N	N	—
HDRVAMn346										2[b]	2	1	N/U	N	N	A	N	0	N	N	—
HDRVAMn347										1[b]	1	1	N/U	N	N	SA/A	N	0	N	N	—
Totals	31	38	59	29	36	28	32	58	45	68			71	64 / 7	4			28	32		2,571

Key: ID = Identification Number; No. = Number; Y = yes; N = no; M = Male; F = Female; U = Unknown; A = adult; SA = sub-adult; J = juvenile; Ye = yearling; C = calf; P = possible;
D-Tag = Digital Acoustic Recording Tag; CATS Tag = Customized Animal Tracking Solutions Tag
[a] Deceased
[b] Sighting occurred on offshore survey

Table A-22. Sighting history (number of days seen per season) and additional information for all photo-identified North Atlantic right whales off Virginia Beach, Virginia: 2017–2018 and 2021–2024.

NARW Catalog ID	Name	2017–2018	2021–2022	2022–2023	2023–2024	Total No. Days Seen	Total No. Seasons Seen	Gender (M/F/U)	Satellite Tagged? (Y/N)	D-/CATS Tagged? (Y/N)	Age Class (A/SA/J/Ye/C)	Drone? (Y/N)
#3343		1				1	1	M	N	N	A	N
#3350		1			1	2	2	M	N	N	A	N
#3611		1				1	1	M	N	N	A	N
#3714	Sawtooth	2				2	1	M	N	N	A	N
#4120		1				1	1	F	N	N	J	N
#2602	Marble	1				1	1	M	N	N	A	N
#3360	Horton	1	1			2	2	F	N	N	A	Y
#3821	ZigZag		2			2	2	M	N	N	A	Y
#2142	Rhino		1			1	1	M	N	N	A	Y
#4523	Beaker		1		3	4	2	M	N	N	J; SA; A	Y
calf of 2642 (#5042)			1			1	1	F	Y	DTAG	Ye	Y
calf of 1612 (#5012)			1			1	1	M	Y	DTAG	Ye	N
#1245	Slalom			1		1	1	F	N	N	A	Y
2021Calfof#1245	Slalom's 2021 calf			1		1	1	U	N	N	C	Y
2021CalfOf3232 (#5132)	Lobster's 2021 calf			1		1	1	M	Y	N	Ye	Y
#4180	Dyad			1		1	1	F	N	N	A	Y
2022Calfof#4180				1		1	1	U	N	N	C	Y
#1017	Batman			1		1	1	M	N	N	A	N
#3040	Aviator			1		1	1	M	N	N	A	N
#3832				1		1	1	M	N	N	A	N
#2605	Smoke			1	1	2	2	F	N	CATS	A	N
#3503	Caterpillar			1		1	1	F	N	N	A	N
2022Calfof#2753 (#5253)				1		1	1	U	N	N	C	Y
#1934	Sagamore			1		1	1	F	N	N	A	N

Key: a = deceased; ID = Identification Number; No. = Number; Y = yes; N = no; M = Male; F = Female; U = Unknown; A = adult; SA = sub-adult; J = juvenile; Ye = yearling; C = calf; D-Tag = Digital Acoustic Recording Tag; CATS Tag = Customized Animal Tracking Solutions Tag

NARW Catalog ID	Name	2017–2018	2021–2022	2022–2023	2023–2024	Total No. Days Seen	Total No. Seasons Seen	Gender (M/F/U)	Satellite Tagged? (Y/N)	D-/CATS Tagged? (Y/N)	Age Class (A/SA/J/Ye/C)	Drone? (Y/N)
#3640				1		1	1	M	N	N	A	N
#3810				3		3	1	M	N	CATS	A	Y
#4610				1	1	2	2	F	N	N	J	N
#3120	Oakley			2		2	2	M	N	N	A	N
#3701	Eros			3	1	4	2	M	N	N	A	Y
#4612				1		1	1	F	N	N	J	N
#4540				1		1	1	F	N	N	SA	Y
#3541				1		1	1	F	N	N	A	Y
#3301	Neptune			1		1	1	M	N	N	A	Y
#3579				1		1	1	M	N	N	A	Y
#3460	Havana			1		1	1	M	N	N	A	Y
#4991				2		2	1	F	N	N	J	Y
#4457	Seamount			1		1	1	M	N	N	SA	Y
#4020	Nymph			1		1	1	F	N	N	A	Y
#4130				2		2	1	M	N	N	A	Y
#4191				1		1	1	F	N	N	A	N
#4720				1		1	1	U	N	N	J	N
#3845	Mogul			1		1	1	M	N	N	A	N
#4330				1		1	1	M	N	N	SA	N
#3997				1		1	1	M	N	N	A	N
#1423	Old Blunt Tips			1		1	1	U	N	N	A	Y
2022calfof#2605	Smoke's 2022 calf			1		1	1	U	N	N	C	N
#1703	Wolf				1	1	1	F	N	N	A	N
TBD					1	1	1	U	N	N	U	N
#2440	Shackleton				1	1	1	M	N	N	A	N
#3623	Bongo				1	1	1	M	N	N	A	N
#1419	Killick				1	1	1	M	N	N	A	N
#2470					1	1	1	M	N	N	A	N

Key: a = deceased; ID = Identification Number; No. = Number; Y = yes; N = no; M = Male; F = Female; U = Unknown; A = adult; SA = sub-adult; J = juvenile; Ye = yearling; C = calf; D-Tag = Digital Acoustic Recording Tag; CATS Tag = Customized Animal Tracking Solutions Tag

NARW Catalog ID	Name	2017–2018	2021–2022	2022–2023	2023–2024	Total No. Days Seen	Total No. Seasons Seen	Gender (M/F/U)	Satellite Tagged? (Y/N)	D-/CATS Tagged? (Y/N)	Age Class (A/SA/J/Ye/C)	Drone? (Y/N)
#1950					1a	1	1	F	N	N	A	N
#1317	Ergo				2	1	2	M	N	N	A	N
#1047					2	2	1	U	N	N	A	N
#3297					2	2	1	U	N	N	A	N
#1611	Clover				2	2	1	F	N	N	A	N
#4145					2	2	1	M	N	N	A	N
#2510	Mitosis				1	1	1	M	N	N	A	N
#3340	Plover				1	1	1	M	N	N	A	N
#4129	Goldfish				2	2	1	M	N	N	A	N
#1050					1	1	1	M	N	DTAG	A	N
#3101	Harmonia				2	2	1	F	N	N	A	N
#3241					2	2	1	M	N	CATS	A	N
#3442	Armada				2	2	1	M	N	N	A	N
#3860	Bocce				2	2	1	F	N	N	A	N
#3908	Zero				1	1	1	F	N	N	A	N
2023calfof#2029					3	3	1	U	N	N	Ye	N
#2920					3	3	1	M	N	N	A	N
#3391					3	3	1	M	N	CATS	A	N
2022CalfOf2040 (#5240)					1	1	1	F	N	N	J	N
#2040	Naevus				2	2	1	F	N	N	A	N
#3545					1	1	1	M	N	N	A	N
#2520					1	1	1	F	N	N	A	N
#3680	Seadragon				1	1	1	M	N	N	A	N
#4310	Prickly Pear				1	1	1	F	N	N	A	N
#3270	Pico				1	1	1	F	N	N	A	N

Key: a = deceased; ID = Identification Number; No. = Number; Y = yes; N = no; M = Male; F = Female; U = Unknown; A = adult; SA = sub-adult; J = juvenile; Ye = yearling; C = calf; D-Tag = Digital Acoustic Recording Tag; CATS Tag = Customized Animal Tracking Solutions Tag

NARW Catalog ID	Name	2017–2018	2021–2022	2022–2023	2023–2024	Total No. Days Seen	Total No. Seasons Seen	Gender (M/F/U)	Satellite Tagged? (Y/N)	D-/CATS Tagged? (Y/N)	Age Class (A/SA/J/Ye/C)	Drone? (Y/N)
2024Calfof#3270					1	1	1	U	N	N	C	N
Totals		**7**	**6**	**34**	**37**				**3**	**3-DTAG; 4-CATS**		**23**

Key: a = deceased; ID = Identification Number; No. = Number; Y = yes; N = no; M = Male; F = Female; U = Unknown; A = adult; SA = sub-adult; J = juvenile; Ye = yearling; C = calf; D-Tag = Digital Acoustic Recording Tag; CATS Tag = Customized Animal Tracking Solutions Tag

Table A-3. Sighting history (number of days seen per calendar year) and additional information for all photo-identified fin whales off Virginia Beach, Virginia: 2015–2024.

HDR Catalog ID	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total No. Days Seen	Total No. Years Seen	Biopsied? (Y/N)/ Gender (M/F/U)	Satellite Tagged? (Y/N)	D-/CATS Tagged? (Y/N)	Estimated Age Class (A/SA/J/ C)	Propeller or Entanglement Scars or Injuries? (Y/N/P/E/I)	Total No. Focal Follows	Total No. Focal Follow Minutes
HDRVABp001	1ª										1	1	N/F	N	N	A	N	0	—
HDRVABp002	1ª										1	1	N/U	N	N	C	N	0	—
HDRVABp003	1ª										1	1	N/U	N	N	A	N	1	61
HDRVABp004	1										1	1	N/U	N	N	A	N	1	32
HDRVABp005	1										1	1	Y/M	N	N	SA/A	Y (P)	0	—
HDRVABp006	1										1	1	N/F	N	N	A	N	0	—
HDRVABp007	1										1	1	N/U	N	N	C	N	0	—
HDRVABp008	1										1	1	N/U	N	N	SA/A	N	0	—
HDRVABp009		2ª							1ª		3	2	N/U	N	N	SA/A	N	0	—
HDRVABp010		2ª					1ª	1ª	2ª		6	4	N/U	N	N	SA/A	N	0	—
HDRVABp011		1ª									1	1	N/U	N	N	A	N	0	—
HDRVABp012		1									1	1	N/U	Y	N	SA/A	Y (P)	0	—
HDRVABp013		1									1	1	N/U	N	N	SA	N	0	—
HDRVABp014			1								1	1	N/U	N	N	A	N	0	—
HDRVABp015			1								1	1	N/U	N	N	A	N	0	—
HDRVABp016			1	1ª							2	2	N/U	Y	N	SA/A	N	0	—
HDRVABp017			1								1	1	N/U	Y	N	SA/A	N	0	—
HDRVABp018			1	2							3	2	N/U	Y	N	SA/A	N	0	—
HDRVABp019			1	1							2	2	Y/F	Y	N	SA/A	Y (I)	0	—
HDRVABp020			1	2ª				1ª			4	3	N/U	Y	N	SA/A	N	0	—
HDRVABp021			1							1	2	2	N/U	N	N	SA/A	Y (E)	0	—

Key: a = deceased; ID = Identification Number; No. = Number; Y = yes; N = no; M = Male; F = Female; U = Unknown; A = adult; SA = sub-adult; J = juvenile; C = calf; P = prop; E = entangled; I = injury; D-Tag = Digital Acoustic Recording Tag; CATS Tag = Customized Animal Tracking Solutions Tag
ª nearshore or mid-shelf sighting
ᵇ aerial sighting

HDR Catalog ID	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total No. Days Seen	Total No. Years Seen	Biopsied? (Y/N)/ Gender (M/F/U)	Satellite Tagged? (Y/N)	D-/CATS Tagged? (Y/N)	Estimated Age Class (A/SA/J/ C)	Propeller or Entanglement Scars or Injuries? (Y/N/P/E/I)	Total No. Focal Follows	Total No. Focal Follow Minutes
HDRVABp022			1								1	1	N/U	N	N	SA/A	N	0	—
HDRVABp023			2	1							3	2	N/U	N	N	A	N	0	—
HDRVABp024			1								1	1	N/U	N	N	J	N	0	—
HDRVABp025			1								1	1	N/U	Y	N	SA/A	N	0	—
HDRVABp026			1								1	1	N/M	Y	N	SA/A	N	0	—
HDRVABp027			1				1[a]		1[a]		3	3	N/M	Y	N	SA/A	N	0	—
HDRVABp028			1							1	2	2	N/U	N	N	SA/A	N	0	—
HDRVABp029			1	2							3	2	N/U	N	N	SA/A	N	0	—
HDRVABp030			1	1			1[a]				3	3	N/U	Y	N	SA/A	N	0	—
HDRVABp031			1								1	1	N/U	N	N	SA/A	N	0	—
HDRVABp032			1								1	1	N/U	N	N	SA/A	N	0	—
HDRVABp033			1								1	1	N/U	N	N	SA/A	N	0	—
HDRVABp034			1				1[a]				2	2	N/U	N	N	SA/A	N	0	—
HDRVABp035			1a[a]								1	1	N/U	N	N	J	N	0	—
HDRVABp037				1[a]							1	1	N/U	N	N	J	N	0	—
HDRVABp038				1[a]							1	1	N/U	N	N	Unk	N	0	—
HDRVABp040				1; 1[a]							2	2	N/U	N	N	SA	N	0	—
HDRVABp041				1[a]							1	1	N/U	Y	N	SA/A	N	0	—
HDRVABp042				1[a]						1	2	2	N/U	N	N	SA/A	N	0	—
HDRVABp043				1							1	1	N/U	N	N	SA/A	N	0	—
HDRVABp044				1							1	1	N/U	N	N	SA/A	N	0	—
HDRVABp045				1							1	1	N/U	N	N	J/SA	N	0	—
HDRVABp046				1							1	1	Y/M	Y	N	SA/A	N	0	—

Key: a = deceased; ID = Identification Number; No. = Number; Y = yes; N = no; M = Male; F = Female; U = Unknown; A = adult; SA = sub-adult; J = juvenile; C = calf; P = prop; E = entangled; I = injury; D-Tag = Digital Acoustic Recording Tag; CATS Tag = Customized Animal Tracking Solutions Tag

[a] nearshore or mid-shelf sighting

[b] aerial sighting

HDR Catalog ID	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total No. Days Seen	Total No. Years Seen	Biopsied? (Y/N)/ Gender (M/F/U)	Satellite Tagged? (Y/N)	D-/CATS Tagged? (Y/N)	Estimated Age Class (A/SA/J/ C)	Propeller or Entanglement Scars or Injuries? (Y/N/P/E/I)	Total No. Focal Follows	Total No. Focal Follow Minutes
HDRVABp047				1							1	1	N/U	Y	N	SA/A	N	0	—
HDRVABp048				1							1	1	N/U	Y	N	SA/A	N	0	—
HDRVABp049				1							1	1	Y/M	N	N	SA/A	N	0	—
HDRVABp050				2							2	1	Y/M	Y	N	SA/A	N	0	—
HDRVABp051				1						1	2	2	N/F	N	N	SA/A	N	0	—
HDRVABp052				1							1	1	N/U	N	N	A	N	0	—
HDRVABp053				1							1	1	N/U	N	N	C	N	0	—
HDRVABp054				1						1	2	2	N/U	N	N	SA/A	N	0	—
HDRVABp055				1							1	1	N/U	N	N	SA/A	N	0	—
HDRVABp056				1							1	1	N/U	N	N	SA/A	N	0	—
HDRVABp057				1							1	1	N/U	N	N	SA/A	N	0	—
HDRVABp058				1							1	1	N/U	N	N	SA/A	N	0	—
HDRVABp059				2							2	1	N/U	N	N	SA/A	N	0	—
HDRVABp060				2							2	1	N/U	Y	N	SA/A	N	0	—
HDRVABp061				1							1	1	N/U	N	N	SA/A	N	0	—
HDRVABp062				1[b]							1	1	N/U	N	N	Unk	N	0	—
HDRVABp063				1							1	1	N/U	N	N	J	N	0	—
HDRVABp064				1							1	1	N/U	N	N	J	N	0	—
HDRVABp065				1							1	1	N/U	N	N	SA/A	Y (E)	0	—
HDRVABp066				1							1	1	N/U	N	N	SA/A	N	0	—
HDRVABp067				1							1	1	N/U	N	N	SA/A	N	0	—
HDRVABp068				1							1	1	N/U	N	N	SA/A	N	0	—
HDRVABp069				1							1	1	N/U	N	N	SA/A	N	0	—

Key: a = deceased; ID = Identification Number; No. = Number; Y = yes; N = no; M = Male; F = Female; U = Unknown; A = adult; SA = sub-adult; J = juvenile; C = calf; P = prop; E = entangled; I = injury; D-Tag = Digital Acoustic Recording Tag; CATS Tag = Customized Animal Tracking Solutions Tag

[a] nearshore or mid-shelf sighting

[b] aerial sighting

HDR Catalog ID	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total No. Days Seen	Total No. Years Seen	Biopsied? (Y/N)/ Gender (M/F/U)	Satellite Tagged? (Y/N)	D-/CATS Tagged? (Y/N)	Estimated Age Class (A/SA/J/ C)	Propeller or Entanglement Scars or Injuries? (Y/N/P/E/I)	Total No. Focal Follows	Total No. Focal Follow Minutes
HDRVABp070				1							1	1	N/U	N	N	SA/A	N	0	—
HDRVABp071				1							1	1	N/U	N	N	SA/A	N	0	—
HDRVABp072				1							1	1	N/U	N	N	J	N	0	—
HDRVABp073				1							1	1	N/U	N	N	SA/A	N	0	—
HDRVABp074				1							1	1	N/U	N	N	C	N	0	—
HDRVABp075				1							1	1	N/U	N	N	SA/A	N	0	—
HDRVABp076				1							1	1	N/U	N	N	SA/A	N	0	—
HDRVABp077					1						1	1	N/U	N	N	SA/A	N	0	—
HDRVABp078					1						1	1	N/U	N	N	SA/A	N	0	—
HDRVABp079					1						1	1	N/U	N	N	J	N	0	—
HDRVABp080					1						1	1	N/U	N	N	SA/A	N	0	—
HDRVABp081					1						1	1	N/U	N	N	J/SA	N	0	—
HDRVABp082					1						1	1	N/U	N	N	SA/A	N	0	—
HDRVABp083					1						1	1	N/U	N	N	J	N	0	—
HDRVABp084					1						1	1	N/U	N	N	J	N	0	—
HDRVABp085					1						1	1	N/U	N	N	SA/A	N	0	—
HDRVABp086						1[a]					1	1	Y/U	Y	N	SA/A	N	0	—
HDRVABp087						1					1	1	N/U	N	N	J	N	0	—
HDRVABp088						1					1	1	N/U	N	N	SA/A	Y (E)	0	—
HDRVABp089						1					1	1	N/U	N	N	SA/A	N	0	—
HDRVABp090						1					1	1	N/U	N	N	J	N	0	—
HDRVABp091						1					1	1	N/U	N	N	SA/A	N	0	—
HDRVABp092							1	2[a]	1[a]		4	3	N/U	N	N	SA/A	Y (I)	0	—

Key: a = deceased; ID = Identification Number; No. = Number; Y = yes; N = no; M = Male; F = Female; U = Unknown; A = adult; SA = sub-adult; J = juvenile; C = calf; P = prop; E = entangled; I = injury; D-Tag = Digital Acoustic Recording Tag; CATS Tag = Customized Animal Tracking Solutions Tag
[a] nearshore or mid-shelf sighting
[b] aerial sighting

HDR Catalog ID	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total No. Days Seen	Total No. Years Seen	Biopsied? (Y/N)/ Gender (M/F/U)	Satellite Tagged? (Y/N)	D-/CATS Tagged? (Y/N)	Estimated Age Class (A/SA/J/ C)	Propeller or Entanglement Scars or Injuries? (Y/N/P/E/I)	Total No. Focal Follows	Total No. Focal Follow Minutes
HDRVABp093							1		1	2	4	3	N/U	N	N	SA/A	N	0	—
HDRVABp094							1				1	1	N/U	N	N	SA/A	N	0	—
HDRVABp095							1				1	1	N/U	N	N	SA/A	N	0	—
HDRVABp096							1				1	1	N/U	N	N	SA/A	N	0	—
HDRVABp097							1	1[a]	1[a]		3	3	N/U	Y	N	J; SA/A	N	0	—
HDRVABp098							1				1	1	N/U	N	N	J	N	0	—
HDRVABp099							1				1	1	N/U	N	N	J	N	0	—
HDRVABp100							1				1	1	N/U	N	N	SA/A	N	0	—
HDRVABp101							1				1	1	N/U	N	N	SA/A	N	0	—
HDRVABp102							1				1	1	N/U	N	N	J	Y (E)	0	—
HDRVABp103							1				1	1	N/U	N	N	J	N	0	—
HDRVABp104								1[a]			1	1	N/U	N	N	SA/A	N	0	—
HDRVABp105								1			1	1	N/U	N	N	J	N	0	—
HDRVABp106								1[a]			1	1	N/U	N	N	J	N	0	—
HDRVABp107								1			1	1	N/U	N	N	SA/A	N	0	—
HDRVABp108								1			1	1	N/U	N	N	J	N	0	—
HDRVABp109								1			1	1	N/U	N	N	SA/A	N	0	—
HDRVABp110								1			1	1	N/U	N	N	J	N	0	—
HDRVABp111								1			1	1	N/U	N	N	J	N	0	—
HDRVABp112								1			1	1	N/U	N	N	J	N	0	—
HDRVABp113								1			1	1	N/U	N	N	J	N	0	—
HDRVABp114									1[a]		1	1	N/U	N	N	SA/A	N	0	—
HDRVABp115									1[a]		1	1	N/U	N	N	SA/A	N	0	—

Key: a = deceased; ID = Identification Number; No. = Number; Y = yes; N = no; M = Male; F = Female; U = Unknown; A = adult; SA = sub-adult; J = juvenile; C = calf; P = prop; E = entangled; I = injury; D-Tag = Digital Acoustic Recording Tag; CATS Tag = Customized Animal Tracking Solutions Tag
[a] nearshore or mid-shelf sighting
[b] aerial sighting

HDR Catalog ID	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total No. Days Seen	Total No. Years Seen	Biopsied? (Y/N)/ Gender (M/F/U)	Satellite Tagged? (Y/N)	D-/CATS Tagged? (Y/N)	Estimated Age Class (A/SA/J/ C)	Propeller or Entanglement Scars or Injuries? (Y/N/P/E/I)	Total No. Focal Follows	Total No. Focal Follow Minutes
HDRVABp116									1[b]		1	1	N/U	N	N	SA/A	N	0	—
HDRVABp117								1			1	1	N/U	N	N	Unk	N	0	—
HDRVABp118									1[b]		1	1	N/U	N	N	SA/A	N	0	—
HDRVABp119										*1*	1	1	N/U	N	N	SA/A	N	0	—
HDRVABp120										1	1	1	N/U	N	N	SA/A	N	0	—
HDRVABp121										1	1	1	N/U	N	N	SA	N	0	—
HDRVABp122										1	1	1	N/U	N	N	J/SA	N	0	—
HDRVABp123										1	1	1	N/U	N	N	J/SA	N	0	—
HDRVABp124										1	1	1	N/U	N	N	SA/A	N	0	—
HDRVABp125										1	1	1	N/U	N	N	SA/A	N	0	—
HDRVABp126										1	1	1	N/U	N	N	SA/A	N	0	—
HDRVABp127										1	1	1	N/U	N	N	SA/A	N	0	—
HDRVABp128										1	1	1	N/U	N	N	SA/A	N	0	—
HDRVABp129										2	2	1	N/U	N	N	SA/A	Y (P)	0	—
HDRVABp130										1	1	1	N/U	N	N	SA/A	N	0	—
HDRVABp131										1	1	1	N/U	N	N	SA/A	N	0	—
HDRVABp132										1	1	1	N/U	N	N	SA/A	N	0	—
HDRVABp133										1	1	1	Y/U	N	Y	SA/A	N	0	—
HDRVABp134										1	1	1	N/U	N	N	A	N	0	—
HDRVABp135										1	1	1	N/U	N	N	A	N	0	—
HDRVABp136										1	1	1	N/U	N	N	SA/A	N	0	—
HDRVABp137										2	2	1	N/U	N	N	SA/A	N	0	—
HDRVABp138										1	1	1	N/U	N	N	SA/A	N	0	—

Key: a = deceased; ID = Identification Number; No. = Number; Y = yes; N = no; M = Male; F = Female; U = Unknown; A = adult; SA = sub-adult; J = juvenile; C = calf; P = prop; E = entangled; I = injury; D-Tag = Digital Acoustic Recording Tag; CATS Tag = Customized Animal Tracking Solutions Tag

[a] nearshore or mid-shelf sighting

[b] aerial sighting

HDR Catalog ID	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total No. Days Seen	Total No. Years Seen	Biopsied? (Y/N)/ Gender (M/F/U)	Satellite Tagged? (Y/N)	D-/CATS Tagged? (Y/N)	Estimated Age Class (A/SA/J/ C)	Propeller or Entanglement Scars or Injuries? (Y/N/P/E/I)	Total No. Focal Follows	Total No. Focal Follow Minutes
HDRVABp139										1	1	1	N/U	N	N	SA/A	N	0	—
HDRVABp140										1	1	1	N/U	N	N	J/SA	N	0	—
HDRVABp141										1	1	1	N/U	N	N	SA/A	N	0	—
HDRVABp142										1	1	1	N/U	Y	N	SA/A	N	0	—
HDRVABp143										1	1	1	Y/U	Y	N	SA/A	N	0	—
HDRVABp144										1	1	1	N/U	N	N	SA/A	N	0	—
HDRVABp145										1	1	1	N/U	N	N	SA/A	N	0	—
HDRVABp146										1	1	1	N/U	N	N	SA/A	N	0	—
HDRVABp147										1	1	1	N/U	N	N	SA/A	N	0	—
HDRVABp148										3	3	1	N/U	N	N	SA/A	Y (P)	0	—
HDRVABp149										1	1	1	N/U	N	N	SA/A	N	0	—
HDRVABp150										1	1	1	N/U	N	N	SA/A	N	0	—
HDRVABp151										1	1	1	N/U	N	N	SA/A	N	0	—
HDRVABp152										1	1	1	N/U	N	N	SA/A	N	0	—
HDRVABp153										1	1	1	N/U	N	N	SA/A	N	0	—
HDRVABp154										1	1	1	N/U	N	N	SA/A	N	0	—
HDRVABp155										1	1	1	N/U	N	N	SA/A	N	0	—
HDRVABp156										1	1	1	N/U	N	N	SA/A	Y (I)	0	—
HDRVABp157										1	1	1	N/U	N	N	SA/A	N	0	—
HDRVABp158										1	1	1	N/U	N	N	SA/A	N	0	—
HDRVABp159										1	1	1	N/U	N	N	J/SA	N	0	—
HDRVABp160										1	1	1	N/U	N	N	SA/A	N	0	—
HDRVABp161										1	1	1	N/U	N	N	SA/A	N	0	—

Key: a = deceased; ID = Identification Number; No. = Number; Y = yes; N = no; M = Male; F = Female; U = Unknown; A = adult; SA = sub-adult; J = juvenile; C = calf; P = prop; E = entangled; I = injury; D-Tag = Digital Acoustic Recording Tag; CATS Tag = Customized Animal Tracking Solutions Tag
[a] nearshore or mid-shelf sighting
[b] aerial sighting

HDR Catalog ID	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total No. Days Seen	Total No. Years Seen	Biopsied? (Y/N)/ Gender (M/F/U)	Satellite Tagged? (Y/N)	D-/CATS Tagged? (Y/N)	Estimated Age Class (A/SA/J/ C)	Propeller or Entanglement Scars or Injuries? (Y/N/P/E/I)	Total No. Focal Follows	Total No. Focal Follow Minutes
HDRVABp162										1	1	1	N/U	N	N	SA/A	N	0	—
HDRVABp163										1	1	1	N/U	N	N	J	N	0	—
HDRVABp164										1	1	1	N/U	N	N	SA/A	N	0	—
HDRVABp165										1	1	1	N/U	N	N	SA/A	N	0	—
HDRVABp166										1	1	1	N/U	N	N	SA/A	N	0	—
Totals	**8**	**7**	**22**	**50**	**9**	**6**	**15**	**15**	**11**	**59**	**—**	**—**	**Y-10 / 4-F; 6M**	**20**	**1**	**—**	**4-P; 4-E; 3-I**	**2**	**93**

Key: a = deceased; ID = Identification Number; No. = Number; Y = yes; N = no; M = Male; F = Female; U = Unknown; A = adult; SA = sub-adult; J = juvenile; C = calf; P = prop; E = entangled; I = injury; D-Tag = Digital Acoustic Recording Tag; CATS Tag = Customized Animal Tracking Solutions Tag

[a] nearshore or mid-shelf sighting

[b] aerial sighting

Table A-3. Sighting history (number of days seen per season) and additional information for all photo-identified minke whales off Virginia Beach, Virginia: 2015, 2017–2020, 2022, and 2024.

HDR Catalog ID	2015	2017	2018	2019	2020	2022	2024	Total No. Days Seen	Total No. Seasons Seen	Biopsied? (Y/N)/ Gender (M/F/U)	Satellite Tagged? (Y/N)	D-/CATS Tagged? (Y/N)	Estimated Age Class (A/SA/J/	Propeller Scars or Injuries? (Y/N/P)
HDRVABa001	1							1	1	N/U	N	N	A	N
HDRVABa002		1						1	1	N/U	N	N	A	N
HDRVABa003		1						1	1	N/U	N	N	A	N
HDRVABa004		1						1	1	N/U	N	N	A	N
HDRVABa005		1						1	1	N/U	N	N	A	N
HDRVABa006		1						1	1	N/U	N	N	A	N
HDRVABa007		1						1	1	N/U	N	N	A	N
HDRVABa008			1					1	1	N/U	N	N	A	N
HDRVABa009			1					1	1	N/U	N	N	A	N
HDRVABa010				1				1	1	N/U	N	N	A	N
HDRVABa011				1				1	1	N/U	N	N	A	N
HDRVABa012				1				1	1	N/U	N	N	A	N
HDRVABa013				1				1	1	N/U	N	N	A	N
HDRVABa014					1			1	1	N/U	N	N	A	N
HDRVABa015						2		2	1	Y/U	Y	CATS	A	N
HDRVABa016							1	1	1	N/U	N	N	A	N
Totals	**1**	**6**	**2**	**4**	**1**	**1**	**1**			**1**	**1**	**1-CATS**		**0**

Key: ID = Identification Number; No. = Number; Y = yes; N = no; M = Male; F = Female; U = Unknown; A = adult; SA = sub-adult; J = juvenile; P = propeller; D-Tag = Digital Acoustic Recording Tag; CATS Tag = Customized Animal Tracking Solutions Tag

Appendix B.
Documents Related to the Mid-Atlantic Humpback Whale Catalog Meeting

Wednesday June 26, 2024
HDR Office: 249 Central Park Avenue Suite 201, Town Center, Virginia Beach, VA

Time	Duration	Title	Presenter
8:30 AM	0:30	Welcome & Introduction	Jackie Bort
9:00 AM	0:20	Overview - HDR / VA	Jessica Aschettino / Amy Engelhaupt
9:20 AM	0:20	Overview - Rudee Flipper / VA	Alexis Rabon / Kristin Rayfield
9:40 AM	0:10	Overview - Virginia Aquarium / VA	Alex Epple / Allyson McNaughton
10:00 AM	0:20	Break	
10:20 AM	0:10	Overview - NC Strandings	Karen Clark
10:30 AM	0:20	Overview - Cape May Whale Watch / NJ	Melissa Laurino / Carlee Dunn
11:50 AM	0:20	Overview - Wildlife Conservation Society / NY	Carissa King-Nolan
11:10 AM	0:20	Overview - Coastal Research & Education Society of L	Marianne McNamara
11:30 AM	0:20	Overview - Gotham Whale / NY	Danielle Brown
12:00 PM	1:00	Lunch	
1:00 PM	1:00	MAHWC overview + Happywhale	Jess Ozog / Jackie Bort / Jessica Aschettino
2:00 PM	1:00	Discussion Period	All
3:00 PM	0:15	Break	
3:15 PM	0:45	Discussion / Wrap-Up / Moving Ahead	All
4:00 PM		Adjurn	
6:30 PM	1:30	Dolphin watching trip - Rudee Flipper (Virginia Beach Fishing Center) - start boarding ~6:00 pm	

You are invitied to a scheduled Zoom meeting.

Join Zoom Meeting
https://hdrinc.zoom.us/j/92768741628?pwd=1TjTc050Raqaq0aK0ZKObeqqs3Hris.1

Meeting ID: 927 6874 1628
Passcode: 145870
One tap mobile
+16694449171,,92768741628#,,,,*145870# US
+16699006833,,92768741628#,,,,*145870# US (San Jose)

Dial by your location
+1 669 444 9171 US

The Mid-Atlantic Humpback Whale Photo-identification Catalog
Protocol for Data Access

Introduction
The Mid-Atlantic Humpback Whale Catalog was designed as a collaborative tool to facilitate understanding of the identity, residency, site fidelity, and habitat use of humpback whales in the waters off the mid-Atlantic and southeastern United States. Organizations and individuals between New York and Florida can contribute sighting and photographic information for inclusion in the catalog. This catalog is comprised of images and data contributed by researchers or teams conducting independent photo-ID and stranding investigation studies. The catalog provides an opportunity for contributors to collaborate on projects by serving as a centralized and standardized repository of information.

Funding support for management is through United States Navy Fleet Forces Command under the U. S. Navy's Marine Species Monitoring Program. HDR, Inc. provides contractual support and technical expertise, as well as contributes data to the catalog. Additional funding for development and primary project oversight from 2016 to 2020 was provided by the Virginia Aquarium & Marine Science Center Veterinary Science and Research Department. Kim Urian at Duke Marine Lab and Ei Fujioka at the Duke University Marine Geospatial Lab provided online catalog design and implementation expertise through the OBIS-SEAMAP web portal.

These data represent a scientific resource, and access to the data for scientific, educational, conservation and management purposes is encouraged. Bona fide requests for data access from scientists, managers, educators, students and/or other individuals will be reviewed by the catalog curator and the relevant contributors.

Data Access and Categories
Access to MAHWC data must be requested to ensure that research being planned or currently conducted by contributors is not compromised or duplicated, and that proper authorship or acknowledgment of all data contributors occurs.

There are three categories of data access requests:

  I.   data for research that will lead to a peer-reviewed publication ("Data for Publication")
  II. data that will be used solely for management purposes ("Data for Management")
  III. data specifically for education and outreach purposes ("Data for Education")

The second and third request types would not result in publication of data and the third request would not require analysis of data acquired from the MAHWC. Each type of request has a separate access protocol. Requests for data access should be submitted to the MAHWC curator to circulate to the relevant contributors.
To submit a request, please use this link.

This protocol for data requests to the MAHWC is based on the Protocol for Data Access for the North Atlantic Right Whale Consortium Data and the Mid-Atlantic Bottlenose Dolphin Catalog.

I. Data for Publication
a) Protocol for data access
Any request for data must be submitted to the MAHWC in the form of a brief proposal. The proposal should at a minimum contain the following:

• Name of the requesting institution(s) and of the Principal Investigator and all potential contributors/co-authors of the proposed project;
• Outline of the proposed work, including questions being addressed or hypotheses tested;
• Anticipated data requirements;
• Anticipated products of the work (e.g. scientific paper, conference presentation or poster, student thesis, EA/EIS);
• Estimated time frame for completion of the study

Proposals for scientific analyses and publication will be reviewed by the relevant contributors and the curator within three weeks of submission. Their review will ensure: duplication of effort is minimized; appropriate analyses are proposed; and that appropriate co-authors are identified.

Recommendations for authorship will be sent to the applicant; in some cases, the reviewers may suggest that, instead of authorship, acknowledgement of the MAHWC and/or certain institutions/persons be included in any published document. Once authorship has been agreed upon by the applicant, contributors and curator, the data will be released.

The curator and the reviewers will treat proposals as confidential and ideas or hypotheses that they may contain will not be shared with third parties. The only exception to this confidentiality may occur if the reviewers wish to obtain peer review of the proposed work to judge its feasibility or merit, but would only be done with prior approval of the applicant.
The MAHWC encourages multi-investigator proposals where interests of several investigators may overlap. Conflicts over the use of the data will be mediated by MAHWC contributors and curator in as timely a fashion as possible.

Grounds for rejection of a proposal will include, but are not limited to: a lack of qualification; lack of necessary resources; an assessment that the scope of the project is unreasonably large or not feasible within the proposed time frame; unwillingness of the applicant(s) to acknowledge or offer authorship to major data contributors; proposed methods that do not adequately address a meaningful question or hypothesis, or a determination that the proposed work is already underway by the original contributors or by someone else.

b) Conditions for data access
Provision of any data use will be subject to the conditions given below, to which the applicant must agree within his/her proposal. These conditions are designed to eliminate misunderstanding and to protect the applicant, the data contributors and their organizations, and the curator.

• For a reasonable period of time (generally that of the estimated time frame of the applicant's proposed study), the MAHWC will not provide similar data to others for the same or similar scientific purposes described in the applicant's proposal, without first obtaining the applicant's written permission.
• The applicant will use the requested materials only for those purposes set forth in his/her proposal. Requests for significant departures from the scope of the proposal must be submitted in writing to the MAHWC contributors and curator for approval.

This protocol for data requests to the MAHWC is based on the Protocol for Data Access for the North Atlantic Right Whale Consortium Data and the Mid-Atlantic Bottlenose Dolphin Catalog.

• The applicant will not share the requested materials with any third party without first obtaining written permission from the MAHWC contributors and curator.
• The applicant agrees to complete the work in the time frame given, although requests for reasonable extensions of this time frame will be considered.
• The applicant agrees to publish the results in a refereed journal in a timely manner. A draft of the manuscript must be submitted to the MAHWC contributors and curator prior to submission to the journal. Failure to supply a draft will preclude further data access.

II. Data for Management
a) Protocol for data access
The MAHWC recognizes that access to current data will allow natural resource managers to inform management decisions regarding humpback whales in the western North Atlantic. Requests for data that will be used solely for management purposes should be submitted to the curator who will then circulate it to the appropriate contributor(s). The requests should include:

• Name of the requesting institution(s) and of the Principal Investigator and all affiliated participants/recipients;
• Anticipated management application (e.g. Stock Assessment Update);
• Anticipated data requirements;
• Anticipated products of the work;
• Estimated time frame for completion

If no conflicts are evident, the applicant will be provided with the requested data, with the method determined by the size of the requested information file.

b) Conditions for data access
• Applicants may use the data for other management related analyses on the condition that they inform the curator of additional projects. This process allows the MAHWC to establish links between the applicant and other managers and/or scientists interested in similar analyses. Also, by tracking the manner in which the data are used, the MAHWC can further illustrate the benefits of data sharing. Although persons other than the initial applicant may perform the additional analyses, it remains the responsibility of the initial applicant to inform the MAHWC of the additional work.

• If the analyses conducted for management needs result in publishable information, the applicant is required to submit an additional request for publication. If another individual has already applied for data to publish a similar analysis, the MAHWC will encourage a dialog among the parties, but publication rights will go to the applicant who first applied for data under the publication request process.

III. Data for Education
a) Protocol for data access
Many contributions to the MAHWC are from individuals and organizations involved in education and outreach programs. Access to information included in the MAHWC will allow educators to inform the public and students on the ecology and management of humpback whales within the western North Atlantic. These data would be used to enhance the education and experience of students and teachers, and the general public. Requests for data that will be used solely for education and outreach purposes should be submitted to the curator who will then pass it to the appropriate contributor(s). The requests should include:

This protocol for data requests to the MAHWC is based on the Protocol for Data Access for the North Atlantic Right Whale Consortium Data and the Mid-Atlantic Bottlenose Dolphin Catalog.

• Name of the requesting institution(s) and of the Principal Investigator;
• Anticipated education or outreach program (e.g. public presentations, displays);
• Anticipated data requirements;
• Anticipated products of the work;
• Estimated time frame for completion, when appropriate

If no conflicts are evident, the applicant will be provided with the requested data, with the method determined by the size of the requested information file.

b) Conditions for data access
• Applicants may use the data for other education programs on the condition that they inform the curator of additional projects. As stated above, by tracking the manner in which the data are used, the MAHWC can further illustrate the benefits of data sharing.

• If any analyses conducted for education or outreach purposes result in publishable information, the applicant is required to submit an additional request for publication. If another individual has already applied for data to publish a similar analysis, the MAHWC will encourage a dialog among the parties, but publication rights will go to the applicant who first applied for data under the publication request process.

Social Media
A formal data access request or proposal is not required for information intended to be shared on social media. However, the MAHWC curator and relevant contributor(s) should be notified via email of any planned social media post and contributors should be given the opportunity to approve the content before posting. All posts should include credits/acknowledgement of the relevant contributor(s), as well as the MAHWC.

MAHWC is allowed to use/read/make a link to the published article(s), report(s) or social media that resulted from the proposed study/project.

If you have any questions, please contact the MAHWC curator (navymarinespeciesmonitoring@gmail.com). Proposals will be distributed to the appropriate contributors for review and/or to the curator of the data, as applicable.
All proposals must include the following agreement:

_____

Agreement:
I have read and understand all conditions for data access and use listed in the "Mid-Atlantic Humpback Whale Catalog Conditions for Data Access" and agree to be bound by them.

Name: _____   Date: ___/___/_____

Organization: _____

This protocol for data requests to the MAHWC is based on the Protocol for Data Access for the North Atlantic Right Whale Consortium Data and the Mid-Atlantic Bottlenose Dolphin Catalog.