



Aerial Photo-identification and Mark Type Analysis of Northern Bottlenose Whales (*Hyperoodon ampullatus*)



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Background

- Northern bottlenose whales (NBW):** Sexually dimorphic species of large beaked whales¹. Their skin is often mottled and scarred².
- Scotian Shelf (SS) population:** A small Endangered population of ~210 NBW that inhabit deep submarine canyons off the Scotian Shelf.
- The Whitehead Lab has compiled a **dorsal ID** photo catalog of the SS NBW since 1988². Drone footage of NBW has been collected since 2021.
- Problem:** Gaps between drone data in marine mammal research and existing longitudinal photo-ID catalogs.



Figure 1. Map of the Gully Marine Protected Area – habitat for SS NBW.

Research Objectives

- Assess whether drone footage can be used to identify individual NBW by matching them to an existing dorsal fin catalog.
- Determine what the most prevalent types of markings visible in drone footage are and how they vary based on type, location, and sex.
- Compare markedness between the dorsal region in the aerial footage and the dorsal region in the dorsal catalog photographs.

Methods

Data collection

- Drone footage and boat-based photos collected in 2024 & 2025 in the Gully Marine Protected Area

Individual Identification matching

- Identified useful markings on individuals
- Filtered and searched the dorsal catalog for a match

Mark type analysis

- Divided the body into 4 sections
- Counted the number of marks of each type (slough skin, patch, linear line, parallel line, back indent, notch) in each section and in the dorsal catalog

Statistical analyses

- Generalized linear mixed models (GLMM)

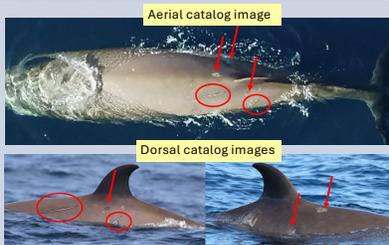


Figure 2. Aerial catalog and dorsal catalog images for the same individual. Example of key marks used to match the individual between catalogs.



Figure 3. View of dorsal plane from drone footage, separated into four body sections.

Results

Photo-identification and matching

Matching success rate

- 2024 = 76% matched
- 2025 = 86% matched

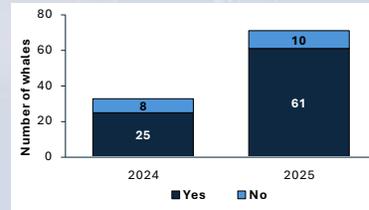
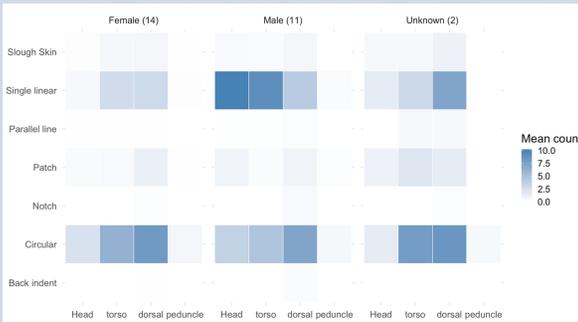


Figure 4. Proportion of successful and unsuccessful NBW identifications for 2024 and 2025 by matching aerial footage to the dorsal catalog.

Mark Type Analysis



Mark type	Proportion of NBW with each type (%)
C	93
SL	82
P	75
SS	61
PL	25
N	18
BI	11

Figure 5. Heat map showing the mean count of seven mark types across four body areas for 27 individual NBW. Data are grouped by qualitative sex with sample sizes indicated in parentheses.

Comparison of dorsal section marks

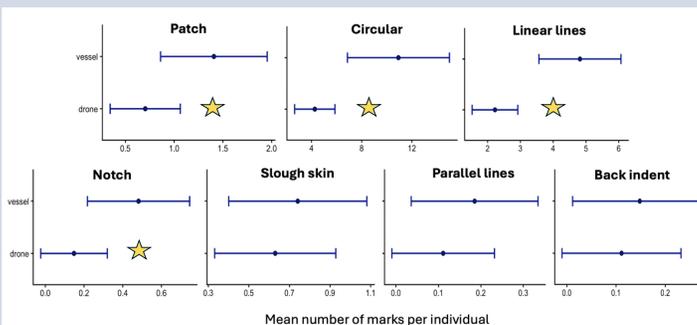


Figure 6. Comparison of the mean count of seven mark types visible on the dorsal section of the aerial footage (drone) versus the dorsal fin ID catalog (vessel) across 27 individual NBW. Results obtained using a GLMM negative binomial. A star indicates a significant difference ($p < 0.05$) in means between the drone and vessel.

Key Takeaways

- High matching success rates indicate that drone footage offers a reliable method for identifying individuals.
- Circular markings are the most common mark type, present on 93% of individuals, and are most abundant on the dorsal region of both males and females.
- Single linear lines are most abundant on the head region of males.
- The mean number of visible circular, single linear, patch, and notch marks are significantly greater in vessel images than drone images.
 - Drone footage shows less marks than vessel photos and may not be as useful for assessing scarring.

Research Significance

- Individual identification allows for studies of movement, population structure, and social relationships and improves monitoring efforts for endangered populations.
- Linking the novel aerial catalog and the longitudinal dorsal catalog at the individual level allows for the combination of analyses from each dataset and advances potential research on behavior, health metrics, and social networks.
- Comparing the visible markings between the dorsal catalog and aerial catalog helps assess the utility of drones for the evaluation of markings on NBW.

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References:

