

Investigating a Novel Photo-Identification Framework for Individual Identification of Blue Sharks (*Prionace glauca*) Using Ampullae of Lorenzini and Fin Morphology



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Research Objectives

- Evaluate whether ampullae of Lorenzini patterns enable individual identification in blue sharks.
- Determine whether combined fin contours enable individual identification in blue sharks.
- Assess the feasibility of automated identification using existing image recognition software.

Background

- Individual identification aids species monitoring¹.
- Photographic identification (photo-ID) offers a non-invasive alternative for individual recognition via unique markings¹⁻³.
- Dorsal fin photo-ID has been used in some sharks⁵ but many shark lack conventionally used markings.
 - For such species, alternative markings are needed.
- Ampullae of Lorenzini vary among shark species⁴, but individual variation is unknown.
- The contour of multiple fins offers increased individual variation.



Figure 1. Frame from a video of a blue shark taken while aboard the Atlantic Shark Expeditions. Video taken by Geraldine Fernandez of the FOME lab of Dalhousie University, August 2025

Blue Shark (*Prionace glauca*)

- The Blue shark is an example of an elasmobranch species that lacks conventional markings.
- This species ranges widely, with juvenile females aggregating seasonally off Nova Scotia⁶.

Hypotheses

- Individual blue sharks exhibit distinctive ampullae patterning and fin contour morphologies.
- Automated image-recognition software can identify individuals using ampullae and fin features.

Data Collection

- 170 videos.
- 77 blue sharks.
- ~12.12hrs of shark in frame content.



Figure 2. Photograph of Geraldine Fernandez and the Shark Bar prototype created by the FOME Lab at Dalhousie University. Photo taken by Robin Fisher July 2025.

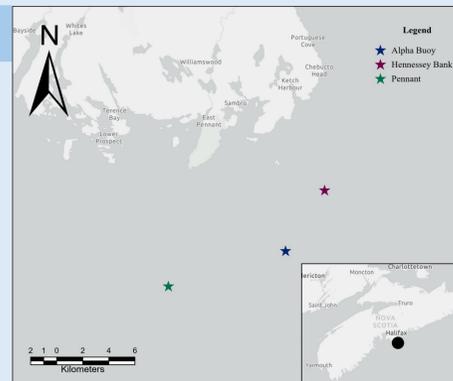


Figure 3. Map of the primary sites visited during the Halifax shark season by Atlantic Shark Expeditions from July to September 2025. Map was created using ArcGISPro. Basemap was provided by ERSI, USGS and spatial reference is WGS 84 / UTM zone 20N.

Methods

- An online photo-ID database was constructed using images suitable for ampullae and fin analysis
- Images were pre-processed to standardize scale, orientation, and distortion.

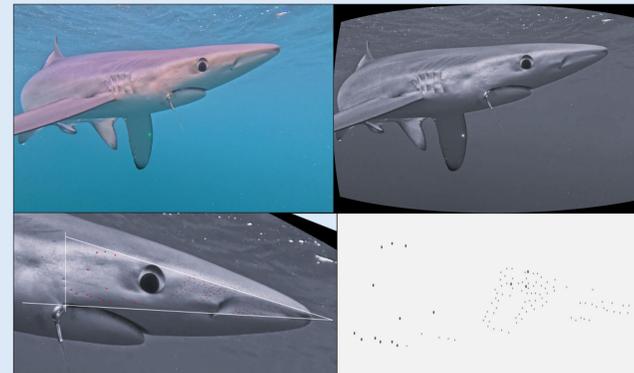


Figure 4. Overview of the pre-processing and annotation workflow for manual comparison of ampullae of Lorenzini. A) Raw video frame of an individual showing visible ampullae. B) Undistorted and contrast-enhanced frame to improve ampullae visibility. C) Oriented frame with the face aligned ~90° and ampullae annotated within a defined triangulated area. D) Final ampullae point map to assess individual distinctiveness.



Figure 5. Overview of the pre-processing and annotation workflow for manual comparison of fin contour. A) Raw video frame of an individual showing lateral view of all fins. B) Undistorted and contrast-enhanced frame to improve contour visibility. C) Annotated fin contours including intermediate areas. D) Final fin contour map to assess individual distinctiveness.

- Manual Feature Extraction
 - All ampullae within a predefined area were annotated to generate individual ampullae maps.
 - Fin contours of the 1st and 2nd dorsal, caudal, anal, and pelvic fins were traced to capture individual fin morphology.
- Computer-Aided Identification
 - Individual Identification System (I³S; Classic and Contour modes) was used to evaluate automated differentiation among individuals.
 - System performance was assessed by first choice ranking accuracy.



Photo Flowthrough of Manual Comparisons

Take Aways and Next Steps

- This study evaluates novel identification features for blue sharks, a species lacking conventionally used photo-ID markings.
- Preliminary results suggest some individuality in ampullae of Lorenzini.
- Ongoing work includes continued analysis of individuals and evaluating I³S' performance using a one-tailed test to assess statistical significance of the system's ranking.

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References

