Paper ID: 85975
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IAF EARTH OBSERVATION SYMPOSIUM (B1)
Interactive Presentations - IAF EARTH OBSERVATION SYMPOSIUM (IPB)

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MONITORING NORTH ATLANTIC RIGHT WHALES FROM SPACE

Abstract

The North Atlantic right whale (NARW) is a critically endangered species. NARWs are in decline and their number is now estimated to be only 336 individuals. To mitigate acute anthropogenic threats to NARWs, the governments of Canada and the USA have implemented various protection measures to reduce vessel strikes and entanglement in fishing gear. The effectiveness of these measures relies on the ability to accurately detect the presence of NARWs using both visual observation and acoustic detection to inform the location and timing of zones restricting human activity. Satellite imaging techniques offer the ability to acquire data across very large spatial scales, potentially covering entire ocean basins on a daily basis. The first observation of NARWs at 30cm resolution, was made over Cape Cod Bay in 2021 by Fluvial System Research "Satellite Acquisition and Right Whales Detection Algorithm" (SARDA) project under the Canadian Space Agency's smartWhale program. A summary of the subject and a report on this observation appears in [1]. Satellite imagery acquired over Cape Cod Bay in April 2023 and the Gulf of St-Lawrence in the summers of 2022 and 2023 have also demonstrated the association of NARWs with biogenic slicks observed in Synthetic Aperture Radar (SAR) images, which may be related to oils produced by copepods. Since NARWs feed on copepods, identifying the food-source related slicks in SAR imagery could be used to predict the presence of whales. RADARSAT Constellation Mission 3m Compact Polarization data have been used to repeatedly image slicks. The results furthermore show that the presence of NARWs may be detectable against a low sea clutter. However, SAR observations are indirect and depend on wakes produced by NARW movement on or near the surface. Therefore, possible NARW signatures require validation by revisiting the SAR detections with high resolution optical imagery. These observations have demonstrated that the main species in the slicks are NARWs. This paper presents a 3 steps methodology, demonstrated under the SARDA project, to improve the monitoring and detection of NARWs by using both SAR and optical satellite data.

This project was undertaken with the financial support of the Canadian Space Agency and the Department of Fisheries and Oceans in collaboration with Transport Canada, as part of the "smartWhales" initiative to explore improved methods for the detection of NARW using satellite data.

[1] Hodul et al., "Individual North Atlantic right whales identified from space," Marine Mammal Science, August 2022.