YEAR-ROUND MONITORING OF HUMPBACK WHALE (*MEGAPTERA NOVAEANGLIAE*) CALLS IN THE GULLY MPA AND ADJACENT AREAS

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1 Introduction

In 2004, the ecologically and biologically diverse region of the Gully submarine canyon off Eastern Canada was designated a Marine Protected Area (MPA). A number of cetaceans frequent the canyon including rare and endangered species, and in order to protect the health and integrity of the Gully ecosystem the Department of Fisheries and Oceans (DFO) Canada has indicated that the year-round presence and activity of all cetaceans in the MPA should be monitored [1]. Summer surveys in the Gully have revealed that humpback whales occur in the area, particularly in late summer [2]. However, little to no research has been undertaken outside of the summer months. Here we describe the year-round acoustic occurrence of humpback whales in and around the Gully MPA.

2 Methods

Near continuous acoustic recordings were collected from the centre of the Gully (MidGul), the slope between the Gully and Shortland canyon (GulSho), and the slope between Shortland and Haldimand canyon (ShoHald) from October 2012 to September 2014 using bottom-mounted Autonomous Multichannel Acoustic Recorders (AMARs, © JASCO Applied Sciences) deployed at depths of 1400-1900 m (Figure 1). The recorders sampled at a rate of 16 kHz for 13 of every 15 min. Automated humpback whale call detectors were run during post-processing [3]. Preliminary analysis of a selection of acoustic files allowed us to define parameters to employ for the remaining visual/aural verification of humpback whale call presence. In this manner, we were able to reliably observe humpback whale calls in a large dataset, while minimizing effort and maximizing efficiency.

3 Results

3.1 Manual Analysis

The automated detector was excellent at capturing humpback whale calls, only missing ~10% of files containing calls. The wide variety of humpback whale call-types can make automated detection challenging. Preliminary analysis revealed that ~84% of files containing less than 11 detections were false and almost 100% of detections in June through September were falsely triggered by vessel noise, seismic noise, or other species. Therefore, to increase efficiency, remaining analysis was limited in

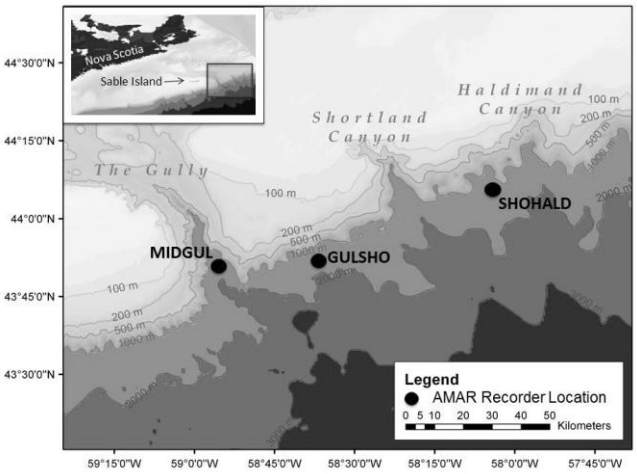

Figure 1: Bathymetric map of the MidGul, GulSho, and ShoHald stations on the Scotian Slope offshore Nova Scotia, Canada in the North Atlantic.

October through May to all files with more than 10 detections and in June through September to at least one file per detection event with more than 10 detections, where a detection event is the occurrence of 1 or more consecutive files with detections. In total, 18,037 files were manually analyzed for humpback call presence/absence (~12% of all sound files). All presence data presented here has been manually verified.

3.2 Year-round presence/absence of calls

Of the 1,835 recording days (612 at MidGul, 611 at GulSho, and 612 at ShoHald), humpback whale calls were observed on 359 days, resulting in a total of 1,855 hours with calls present.

Calls occurred in January, February, March, April, May, June, October, November and December. Call occurrence differed statistically significantly between months for all locations (Kruskall-Wallis $p<0.001$). The hours with calls present per day began to increase in early December and peaked in late December to mid-January at all stations (Figure 2). In winter 2012-2013 calls peaked on 18 Dec at MidGul, 21 Dec at GulSho, and 21 Dec at ShoHald. In winter 2013-2014 calls peaked later, on 17 Jan at MidGul, 18 Jan at GulSho, and 18 Jan at ShoHald. Calls occurred sporadically from the beginning of February to the end of May and were essentially absent during summer months across all stations (Figure 2).

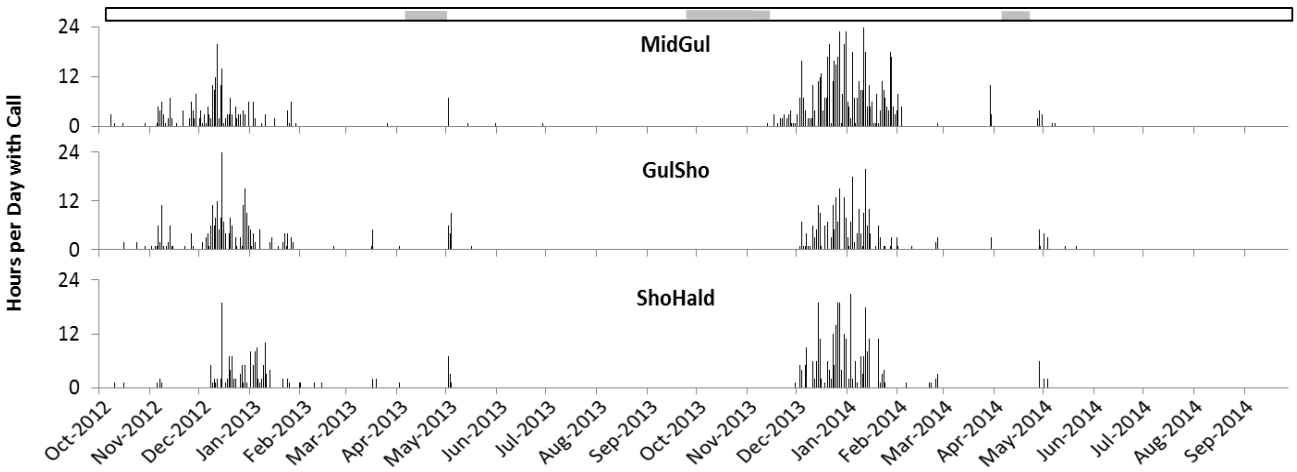

Figure 2: Plots of the number of hours per day in which humpback whale calls occurred for the MidGul, GulSho, and ShoHald stations on the Scotian Slope from October 2012 to September 2014 where the shaded area on the top bar indicates timeframes when recording did not take place.

4 Discussion

This study shows that humpback whale calls occur in and around an offshore, deep-water submarine canyon in the North Atlantic predominantly in the winter months. Following the absence of calls in the summer, call occurrence began to increase in the fall. Previously conducted visual summer surveys similarly found humpback sightings to be rare in the Gully, predominantly occurring late in the season [2]. The peak in calls in December to January observed here closely precedes a peak in calls described in the Stellwagon Bank National Marine Sanctuary (SBNMS) in October to December [4]. We propose that in December some whales move from more inshore areas such as the SBNMS to offshore productive areas such as the Gully MPA before continuing south to the winter breeding grounds. Some individuals may not migrate south, but remain in the Gully region, attributing to the sparse calls observed in February and March. The calls in April and May could either be from non-migrating whales, or whales returning from the breeding grounds, a route that has been previously documented [5].

Passive acoustic monitoring of the Scotian Slope has allowed us to collect a large amount of data at relatively low cost and effort from a highly remote MPA. However, the method has its limitations. Noise created by the mooring, vessel traffic, and seismic activities can mask whale calls; a problem amplified in the particularly noisy summer months. Whales that do not produce calls go undetected. Therefore, these results represent the minimum presence of humpback whales in and around the Gully MPA and are biased towards whales that are acoustically active during periods with low noise.

5 Conclusion

The Gully MPA and its nearby areas act as a winter migratory corridor and/or provide alternative wintering grounds for North Atlantic humpback whales, a finding that significantly expands our understanding of the importance of the MPA to this species. A more thorough analysis of call-type and structure may provide clues as to which whales are calling (male vs. female) and what behaviour is occurring (feeding vs. mating calls). Expanded acoustic monitoring efforts in the future on the Scotian Shelf are required to more fully understand how humpback whales utilize the region throughout the year.

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