

The State of Ocean Acidification in a Newfoundland Fjord

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Background

Ocean Acidification (OA) is caused by the oceanic uptake of anthropogenic carbon dioxide (CO_2) emissions. This uptake causes changes to ocean chemistry, mainly a decrease in pH and carbonate ion concentration. Observations in both polar and coastal oceans are already experiencing undersaturation with respect to the aragonite form of calcium carbonate. Given the profound importance of coastal areas to fisheries and other marine resources and services, this study investigated the state of OA through dissolved inorganic carbon (DIC) and total alkalinity (TA) measurements.

Bonne Bay, Newfoundland

This study was located in Bonne Bay, a relatively pristine fjord located in Western Newfoundland. It is comprised of two distinct basins, the East (EA) and South (SA) Arms, which are connected to the Gulf of St. Lawrence (GSL). EA is a 12 km long, semi-enclosed basin reaching depths of 230 m. There is a sill with a depth of 12 m that partially separates EA from GSL. The outer basin including SA and Bonne Bay proper, is 20 km long, open to GSL and reaching depths of 140 m.

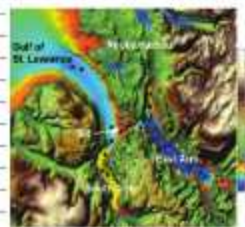


Figure 1. Map of Bonne Bay showing the East Arm (EA) and South Arm (SA) connected to the Gulf of St. Lawrence (GSL).

East Arm

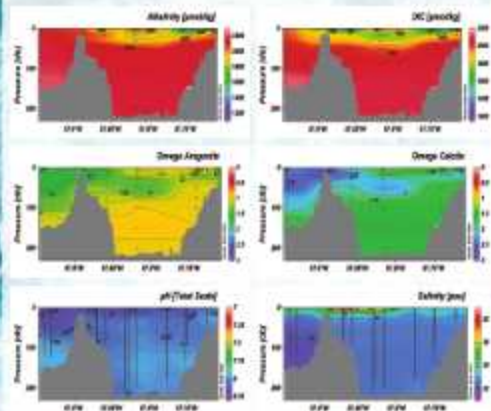


Figure 2. Section plots of East Arm showing distribution of TA, DIC, Ω_{ar} , Ω_{ca} , pH, and Salinity. Dotted lines indicate CTD or mooring sampling station. Section Layout: (Left) GSL and (Right) Head of East Arm.

South Arm

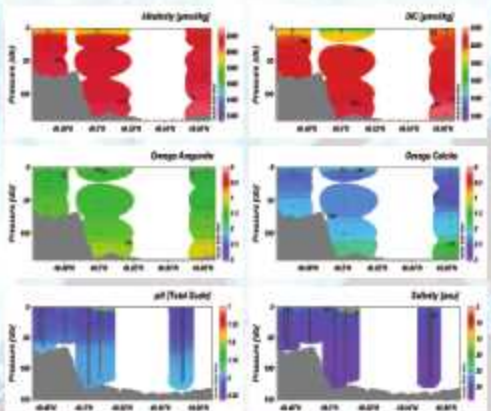


Figure 3. Section plots of South Arm showing distribution of TA, DIC, Ω_{ar} , Ω_{ca} , pH, and Salinity. Dotted lines indicate CTD or mooring sampling station. Section Layout: (Left) Head of South Arm and (Right) GSL.

Take Home Messages: In both EA and SA, DIC and TA showed a similar distribution in relation to salinity. Low DIC and TA in the surface waters were most likely influenced by freshwater inputs. Ω_{ca} was supersaturated throughout SA and EA, although the bottom waters of EA were less saturated than those in SA. Bottom waters in EA were undersaturated with respect to Ω_{ar} . The aragonite saturation horizon was at a depth of approximately 125 m.

Methods

Sampling occurred during Spring 2012 in Bonne Bay. 21 stations were sampled using a CTD (SBE 25 logger) measuring salinity, temperature, pH, and fluorescence. 9 of these stations had water samples collected and analysed for DIC, TA and pH. pH_{total} , Ω_{ca} and Ω_{ar} were calculated from DIC and TA measurements using the CO2SYS program (Lewis & Wallace, 1998).

