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Increase in bottom water temperatures in the St. Lawrence Estuary and Gulf over the last century: results of an oxygen isotopic study of benthic foraminifers.

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Progressive depletion of dissolved oxygen in the bottom water of the Lower St. Lawrence Estuary (LSLE) has lead to the recent establishment of severe hypoxia. Most of the depletion has been ascribed to a change in the ocean circulation in the Northwest Atlantic and a modification of the properties of the water that enter the Gulf of St. Lawrence through Cabot Strait (Gilbert et al., 2005). Nevertheless, variations in oxygen levels as these waters travel landward indicate that additional processes contributed to the establishment of hypoxic conditions. Among these: 1) enhanced nutrient inputs leading to eutrophication and a greater flux of reactive organic matter to the seafloor and/or 2) increased metabolic rates in response to bottom water warming. In order to evaluate temporal variations of LSLE bottom water temperatures over the last century, we analyzed the oxygen isotope composition of benthic foraminifer shells belonging to *Globobulimina auriculata* in two sediment cores (MD99-2220: 48˚38.32N/68˚37.93W, water depth 320 m; CR02-23: 48˚42.01'N/68˚38.89'W, water depth 345 m). The upper part of the sedimentary sequence, spanning the last century, records a δ^{18}O decrease of 0.4 ‰ from 3.1 to 2.7 ‰ which corresponds to a warming of 1.6˚C if we assume an invariant ambient water δ^{18}O signature. The temperature estimates from δ^{18}O is consistent with historical, instrumental data that show a 1.7˚C increase in bottom water temperature since 1932 AD. The results from the LSLE are in agreement with isotopic data from a core recovered in the central part of the Gulf of St. Lawrence (COR0503-CL05-37BC: 48º20'N/61º30'W water depth 410 m). At this site, δ^{18}O values in benthic foraminifer shells belonging to *Bulimina exilis* decrease from 3.1 to 2.7 ‰ over the last century. The increase in bottom water temperatures appears to be a regional feature at the scale of the Gulf and St. Lawrence Estuary. In order to examine the temporal variability in bottom water temperatures beyond the last century, the δ^{18}O was measured on *Globobulimina auriculata* in the upper 200 cm of core MD99-2220, which covers the last millennium. Mean δ^{18}O values measured below 30 cm (i.e. about 1900 AD) were 3.09 ± 0.08 ‰ a far narrower range than recorded over the last century in cores MD99-2220 and CR02-23 (3.1 to 2.7 ‰). Hence, the results highlight a recent, significant increase in bottom water temperatures in the St. Lawrence system, with no equivalent over the last millennium.