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Changes in Multiyear Sea Ice in Yelverton Bay, Ellesmere Island, Canada

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This study combines fieldwork and remote sensing image analysis to quantify changes in multiyear landfast sea ice (MLSI) for the last 60 years in Yelverton Bay and Yelverton Inlet, on the northwestern coast of Ellesmere Island. Yelverton Bay features a range of ice types, including first and second year sea ice, rolling-surface multiyear sea ice, and calved glacier ice; this study presents the first dedicated, in situ assessment and sampling of these. Sea ice thicknesses were determined using a 500 MHz GPR system towed behind a snowmobile. Shallow ($<$3 m) ice cores of the various sea ice types were used to both validate the GPR thickness readings and to determine temperature and salinity profiles in the ice. These results enable improved identification of various ice types in SAR and visible satellite imagery, which in turn allows improved mapping of sea ice changes in this area since the early 1990's.

Analysis of early air photo mosaics indicates the presence of persistent MLSI in Yelverton Bay since the 1950s. This MLSI created an incipient ice shelf across the mouth of Yelverton Inlet, which reached 20-30 km into Yelverton Bay. Much of this MLSI (690 km^2) was lost in August 2005. Recent RADARSAT images indicate that the old MLSI fragments remaining from this break-up event were refrozen into the first year sea ice of the Bay between 2005 and 2007, but blew out of outer Yelverton Bay in late summer 2008. Air photos from 1959 also indicate the presence of a small, unnamed ice shelf near Wootton Peninsula on the western edge of Yelverton Bay; recent RADARSAT-1 and ASTER images indicate that 16 km^2 of this ice shelf has been lost. The loss of MLSI along this coastline, related to regional warming, has occurred in tandem with recent ice shelf and Arctic Ocean sea ice losses.