Nova Scotia Energy Research and Development Forum 2012

Shaun Gelati, Dalhousie University

Title: Tidal Power Potential in the Bay of Fundy and Related Far-Field Impact on Sediment Distribution

Research Advisor: Dr. Paul S. Hill

Category: Environment

Nova Scotia's government has committed to increase the province's usage of renewable energy sources in the near future. One renewable energy source that is in abundant supply in Nova Scotia is the tides. It has been estimated that 7.6 GW of tidal energy can be extracted in the Minas Passage alone (Hasegawa et al., 2011). This represents ~3 % of Canada's energy consumption. A project that would extract this much tidal energy could affect the surrounding region's marine ecosystems, fisheries and coastal communities. The objectives of this study are: 1) to characterize the present-day sediment distribution of the Bay of Fundy (BoF) and Gulf of Maine (GoM) system, in relation with the near-bed flow field and 2) to assess the impact on sediment distribution of two scenarios of tidal energy extraction in the same region. To meet these objectives, information compiled from ~10,000 sediment samples and a 3-D coastal ocean circulation model are used. In the GoM, it is found that in regions of bed shear stress (BSS) > 0.5 Pa, silt and clay content, and sorting correlate negatively with BSS. Mean grain size and associated estimated critical shear stress exhibit an opposite trend. In the BoF, trends are harder to identify. The glacial past of the system may explain in part why sediment properties show variability for a range of similar near-bed hydrodynamic conditions. But regions with high BSS seem to be in a more advanced stage of adjustment with near-bed flow, as variability decreases in textural parameters with increasing BSS. Finally, impact of tidal energy extraction on the sediment distribution of the BoF is found to be more important than for the GoM, with the caveats that the characterization of the present-day environment impose.