Winter ice and sediment budgets in upper Fundy

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Extensive winter ice develops routinely in the extremities of the Bay of Fundy: Minas Basin / Cobequid Bay and Cumberland Basin. Much research has been carried out on estuarine ice formation, both in Fundy and elsewhere and these processes are fairly well understood. The relation between winter ice and the estuarine sediment budget, however, is an intelligent guess at best. Winter ice affects marshes both verti-

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cally and laterally. Supratidal marshes are inundated by high tide only at extreme spring tides, at most about 100 hours per year in years with sufficiently high tides. Typically, half of these inundations take place in (late) winter. Large ice cakes may be floated on top of supratidal marshes (just landward from tidal creeks) and remain stranded there, because flood currents continue to flow landwards for about 30 minutes after the time of high water. The sediment concentration of ice cakes may vary from 0 to 23% by weight and appears to consist mostly of silt-sized and finer material, but its variation within ice cakes as well as geographically is unknown and nearly impossible to predict. Research elsewhere suggests that coastal marsh accretion accelerated after colder winters and that amounts of ice-rafted debris equaled amounts of summer sediment accretion. Hence the hypothesis that winter ice contributes significantly to tidal marsh accretion. Erosion of tidal marshes by winter ice seems to occur mostly in a lateral sense, i.e. on the banks of tidal creeks and channels. However, the creation of vertical ice walls along tidal creeks also has a stabilizing effect. This process too, has never been quantified.

As much as 60–85% of original tidal marshlands have been locked away behind dykes, a process that affected the storage capacity of the estuary as documented elsewhere. Tidal marshes are important primary organic matter producers, contributing significantly to the food chain. Questions regarding the mutual effects between winter ice and the construction of tidal turbines are not part of the Strategic Environmental Assessment (SEA), presently carried out under auspices of the Nova Scotia Government, thus suggesting that this is a solvable engineering issue. Thus, the extent to which winter ice contributes to the health of the few remaining salt marshes and the extent to which tidal turbines may interfere with ice formation, ice circulation and sediment budget of a fragile environment remains a risky unknown.