Offshore blooms of *Alexandrium* fundyense in the Gulf of Maine and the possible influence of North Atlantic Oscillation in recent decades.

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Blooms of the toxic dinoflagellate, *Alexandrium* fundyense, have been studied as part of the ECOHAB-Gulf of Maine program since 1998. We will review our earlier studies where we observed that the highest densities of cells are routinely found offshore in two patches: one in the Bay of Fundy and another in shelf and offshore waters of the central and eastern Gulf of Maine in association with the Eastern Maine Coastal Current. We suggested earlier (Townsend et al., 2001, 2005) that these offshore patches of relatively high densities of *Alexandrium* are naturally-occurring and can be related to inorganic nutrient fluxes, particularly nitrate.

It is possible that these offshore blooms may have become more common, and may be reaching higher cell densities in recent decades, as a result of altered nutrient fluxes to the Gulf as perhaps controlled by the North Atlantic Oscillation. Multi-decadal cycles of the North Atlantic Oscillation impart variations in the loads of nitrate and silicate that enter the Gulf through the Northeast Channel. During periods of NAO High Indices, nitrate concentrations that enter in Warm Slope Water are relatively higher (by about 50%) than periods of NAO Low Indices when the entering deep and bottom waters are dominated by Labrador Slope Water.

The concentrations of silicate, on the other hand, do not vary by as much. Since 1972, a predominance of NAO High Index years has likely resulted in an excess of nitrate over silicate in those offshore waters brought to the surface in the EMCC. That is, following the annual spring diatom bloom, which is fueled by both nitrate and silicate in approximately equal proportions, some 2-5 uM nitrate would remain in surface waters, thus favoring subsequent growth of dinoflagellates. By extension, NAO High Index years could be argued to have led to greater offshore blooms of *Alexandrium* since the 1970s.