Measuring particulate fluxes in shallow aquatic systems

JAMES T. WAPLES[1]

[1]School of Freshwater Sciences, University of Wisconsin-Milwaukee, Milwaukee, WI 53204 (jwaples@uwm.edu)

Naturally occurring radionuclides can be used to quantify particulate fluxes in shallow turbulent systems if the nuclide source and removal terms are fully understood. Our interests in particulate flux here focus on how food is delivered to mussels living in nearshore Lake Michigan.

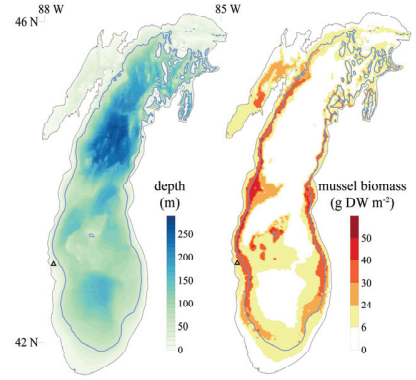

Figure 1. Lake Michigan bathymetry (left); 2010 dreissenid mussel biomass (right). Study site (delta) at ~20 m depth.

We measured the vertical particulate organic carbon (POC) and particulate phosphorus (PP) flux in nearshore Lake Michigan using two naturally occurring daughter/parent radionuclide pairs (^{234}Th/^{238}U and ^{90}Y/^{90}Sr) and compared these fluxes to coincident benthic chamber estimates of respiration and total phosphorus efflux by mussels on the lakebed. Concordance between the ^{234}Th-, ^{90}Y-, and mussel-derived fluxes was observed only under conditions where cross-shore advection, vertical turbulent diffusion, and complete bottom scavenging of total (dissolved + particle-bound) ^{234}Th and ^{90}Y were included in the flux calculations [1]. Evidence of significant bottom scavenging in the nearshore has been observed in multiple time-series experiments and is supported by: (1) the ratio of nuclide inventories in bottom sediment, (2) similar shallow water experiments with ^{131}I and ^{7}Be [2], and (3) the "normal" scavenging of both ^{234}Th and ^{90}Y by settling particles in deeper offshore waters.

[1] Waples et al. (2017) *Limnol. Oceanogr. Lett.* **2**, 18-28. [2] Montenero et al. (2017) *J. Environ. Radioact.*. (in review).