

Virginia Pasour

US ARMY RESEARCH OFFICE

e-mail: virginia.pasour@us.army.mil

Laura Miller

UNC - MATHEMATICS

Steve Ellner

CORNELL - EEB

Influence of Macrophytes on Biological Residence Time in a Flow-Through System

While plankton have often been thought to behave as passive tracers, completely at the mercy of the hydrodynamic flow, the commonness of plankton patches, as well as field studies showing evidence of microorganism movement against the bulk (or mean) flow, suggests that individual plankton behavior such as vertical/horizontal migration may dominate at smaller scales. In natural water bodies such as embayments and estuaries, macrophytes can have a significant and complex effect on water flow and can greatly complicate physical/biological interactions. Using a two-dimensional hydrodynamic model to create flows in an idealized channel with macrophytes modeled as a porous layer, we first model the channel under a number of different macrophyte regimes, varying the number of patches and height and density of the macrophytes. We next model plankton behavior under these different flow regimes with an individual-based model and explore the extent to which vertical migration in the presence of macrophytes affects plankton trajectories. In particular, we are interested in studying how the interaction of plankton migration behaviors and macrophyte structures affect biological retention and whether a set of migration regimes exists for a given hydrodynamic forcing that will allow the plankton to stay within the study system (avoid washout) 'forever.'