



## Daniel G. MacDonald

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### Research Interests

Stratified hydrodynamics, turbulence and frontal dynamics, with specific emphasis on estuarine flows, river plumes, and industrial discharges; marine renewable energy; coastal and environmental engineering.

### Current Research

*Collaborative research: Mixing, Spreading, and Water Mass Modification in Near Field River Plumes.* National Science Foundation. \$345,186 (\$521,094 total). March 2006–February 2009. Observational and numerical study of mixing and spreading in a near field river plume in order to quantify and predict important changes in water mass structure across the first several kilometers of a river plume. Observations focus on the mouth of the Merrimack River (Newburyport, MA) and include velocity, density and turbulent microstructure surveys. The project requires detailed measurements of turbulence in the near field of the plume, as well as delineation of streamlines and spreading. Numerical modeling of the outflow will be carried out in collaboration with colleagues at Texas A&M University.

*Marine Renewable Energy Consortium.* University of Massachusetts President's Office. \$160,000. June 2008–June 2009. This grant provides funding to expand UMass Dartmouth's existing programs in marine renewable energy (primarily wave and tidal energy).

Other ongoing research includes the development of alternative outfall designs for thermal discharges associated with fossil fuel and nuclear power plant operations. The alternative designs have been developed to enhance direct heat transfer to the atmosphere and limit the need for conversion to closed-cycle cooling processes and the construction of cooling towers. This research is based on previous studies of mixing, turbulence, and residence times associated with local industrial/thermal discharges.

### Recent Publications

- MacDonald, D. G., and A. R. Horner-Devine, 2008, Temporal and spatial variability of vertical salt flux in a highly stratified estuary, *J. Geophys. Res.* *113*, C09022, doi:10.1029/2007JC004620.
- Hetland, R. D., and D. G. MacDonald, 2008. Spreading in the near-field Merrimack River plume, *Ocean Model.* *21*, 12-21, doi:10.1016/j.ocemod.2007.11.001.
- MacDonald, D.G., and K.R. Dyer, 2007. Estuarine Oceanography. *Encyclopedia of Science and Technology*, 6, 685-691, McGraw-Hill, New York.
- MacDonald, D.G., L. Goodman, and R.D. Hetland, 2007. Turbulent dissipation in a near-field river plume: A comparison of control volume and microstructure observations with a numerical model, *J. Geophys. Res.* *112*, C07026, doi:10.1029/2006JC004075.
- Chen, F., and MacDonald, D.G., 2006. Role of mixing in the structure and evolution of a buoyant discharge plume, *J. Geophys. Res.* *111*(C11002), doi:10.1029/2006JC003563.
- MacDonald, D.G., and R.A. Rountree (eds.) 2006. *Natural and Anthropogenic Influences on the Mt. Hope Bay Ecosystem, Northeastern Naturalist* *13*, Special Issue 4.
- MacDonald, D.G., 2006. Estimating an estuarine mixing and exchange ratio from boundary data with application to Mt. Hope Bay (Massachusetts/Rhode Island). *Estuar. Coast. Shelf S.* *70*(1-2), 326-332.
- MacDonald, D.G., and W.R. Geyer, 2005. Hydraulic control of a highly stratified estuarine front. *J. Phys. Oceanogr.* *35*(3), 374-387.
- MacDonald, D. G., and W. R. Geyer, 2004. Turbulent energy production and entrainment at a highly stratified estuarine front, *J. Geophys. Res.* *109*, C05004, doi:10.1029/2003JC002094.