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Education **Massachusetts Institute of Technology/**
Woods Hole Oceanographic Institution Joint Program Cambridge/Woods Hole, MA
Ph.D., Oceanographic Engineering, 2003. Thesis: *Mixing Processes and Hydraulic Control in a Highly Stratified Estuary.*

Cornell University Ithaca, NY
M.S., Civil and Environmental Engineering, 1996. Thesis: *Pollutant Mixing and Wake Characteristics Behind Headland Shaped Objects in Shallow Flow.*

University of New Hampshire Durham, NH
B.S.C.E., *Summa Cum Laude*, 1992. Undergraduate Honors Thesis: *Laboratory Simulation of Protozoan Transport Through a Sandy Aquifer Using Carboxylated Microspheres.*

Registration Registered Professional Engineer, Massachusetts

Research Experience **University of Massachusetts Dartmouth** New Bedford, MA
School for Marine Science and Technology
Assistant Professor (January 2003 – present)
Investigate fluid dynamics, mixing, and turbulence in the coastal ocean using observational techniques. Currently funded project (National Science Foundation) focused on the effects of mixing and turbulence on the near field spreading and evolution of a fresh water river plume. Previous and ongoing efforts have included management of the observational component of an interdisciplinary program to investigate ecosystem changes in Mt. Hope Bay (Massachusetts/Rhode Island), including observational studies of the fate and transport of heat associated with a thermal plume discharged from a 1600 MW power plant and assessments of intertidal fish habitat.

WHOI Department of Applied Ocean Physics and Engineering Woods Hole, MA
Ph.D. Candidate (July 1998 - September 2002)
Post-Doctoral Investigator (September 2002 – January 2003)
Advisor: Rocky Geyer
Investigated the dynamics and kinematics of a highly stratified estuarine outflow, using the Fraser River Estuary, (British Columbia, Canada) as a natural laboratory. Evaluated turbulent kinetic energy (TKE) production and buoyancy flux rates within the estuarine channel and near field plume using data from towed conductivity-temperature-depth (CTD) probe, and hull mounted acoustic Doppler current profiler (ADCP). Results provided insight into mixing efficiencies in highly energetic shear-stratified flows, leading to a simple turbulence closure scheme. A three-dimensional extension of two-layer hydraulic theory was generated from estuarine front observations. Variability of mixing processes in the estuarine channel was investigated with respect to secondary circulation, and mechanisms responsible for setting and maintaining stratification. Further efforts involved simulation of observations with a 3-D numerical model using the Regional Ocean Model System (ROMS).

Cornell Department of Civil & Environmental Engineering
M.S. Candidate (September 1994 - August 1996)

Ithaca, NY

Advisor: Gerhard Jirka

Analyzed the structure of wakes around headland structures in shallow flow laboratory experiments. Experiments conducted in a shallow flow tank using a planar laser induced fluorescence (PLIF) flow visualization technique. Related wake characteristics to a "shallowness" parameter (a ratio of width to depth modified by friction).

University of New Hampshire Department of Civil Engineering
Undergraduate Honors Program Research (June 1991 - May 1992)

Durham, NH

Advisor: Nancy Kinner

Investigated the transport of protozoan-sized carboxylated microspheres through laboratory sand columns as a baseline for studies of protozoa transport in sandy aquifers. Part of a larger study investigating the population dynamics of naturally occurring protozoa and bacteria in a natural aquifer with specific application to the biodegradation of organic wastes.

Teaching Experience

University of Massachusetts Intercampus Graduate School of Marine Sciences and Technology

New Bedford, MA

- **Courses Taught**

- **Pollutant Transport in the Environment** **Spring 2007**

- Developed and taught course. Topics include: turbulent diffusion from point, line, and plane sources, instantaneous and continuous sources, mixing in estuaries, jets and outfalls, reaction kinetics, air-water transfer, sediment dynamics, and ground water dispersion.

- **Waves and Tides** **Spring 2006**

- Developed and taught course. Topics include: linear wave theory, long waves, tidal dynamics, tidal harmonics, and internal waves.

- **Dynamics of Estuarine Circulation** **Spring 2005**

- Developed and taught course: Topics included: tides in estuaries, turbulence and stratification, salt balance, dynamic balance, tidal straining, lateral circulation, two layer hydraulics, fronts, plumes, and sediment dynamics.

- **Introduction to Marine Turbulence** **Spring 2004, 2005, 2007**

- Co-developed and co-taught course. Topics included: dimensional analysis, microscales, Reynolds averaging and Reynolds stress, TKE and turbulent vorticity equations, spectra, transport and diffusion, and stratified turbulence.

- **Thesis Proposal Development** **Spring 2004**

- Taught course to first year graduate students (primarily M.S. students), designed to guide them through preparation of their thesis research proposal.

- **Graduate Student Advisement**

- **Current Students:**

Fei Chen	Ph.D. Program	Major Advisor
Grant Stuart	M.S. Program	Committee Member
Zhankun Wang	Ph.D. Program	Committee Member

- **Graduated Students:**

Adrienne Pappal	M.S.	Major Advisor (June 2006)
Christopher Pease	M.S.	Committee Member (June 2005)

Consulting Experience	TRC Environmental Corporation Lowell, MA Civil/Environmental Engineer. (February 2001 – December 2003). Provide on-call expertise for hydrologic/hydraulic modeling and design issues, related to various environmental projects. Led modeling effort (HEC-RAS) used to identify impacts due to proposed landfill construction in 100 year flood plain of the Hoosic River (Vermont).
	GZA GeoEnvironmental, Inc. Newton Upper Falls, MA Civil/Environmental Engineer. (October 1993-August 1994, October 1996-June 1998) (Part time: July 1998 - May 2000). Modeled hydrologic/hydraulic systems and dam break scenarios, managed dam safety inspection program (approximately 50 dams in MA), and provided litigation support for expert witness testimony regarding flooding incidents and Superfund liability. Developed and implemented remedial cleanup strategies for hazardous waste disposal sites under Massachusetts Department of Environmental Protection and US Environmental Protection Agency jurisdiction, utilizing a variety of technologies, including air sparging, soil vapor extraction, high vacuum extraction, excavation and disposal, engineered barriers, groundwater extraction and treatment, and product recovery systems. Performed design, construction oversight, and operation activities for pilot and full-scale remediation systems.
	Action Environmental, Inc. Newton, MA Civil/Environmental Engineer. (November 1992 - October 1993). Performed environmental site assessments, operations and monitoring for long-term remedial projects, and emergency response for leaking underground storage tanks.
Research Funding	Collaborative research: Mixing, spreading, and water mass modification in near field river plumes. National Science Foundation. \$345,186.00 (\$521,094.00 total). Mar. 2006 – Feb. 2009.
Patents	<i>Enhanced Surface Cooling of Thermal Discharges.</i> D. MacDonald. Provisional U.S. patent filed January 2007.
Publications & Presentations	Refereed Journal Articles MacDonald, D.G., L. Goodman and R.D. Hetland, 2006. Turbulent dissipation in a near field river plume: A comparison of control volume and microstructure observations with a numerical model. <i>J. Geophys. Res.</i> , submitted. Chen, F., and D.G. MacDonald , 2006. Role of mixing in the structure and evolution of a buoyant discharge plume, <i>J. Geophys. Res.</i> , 111 , C11002, doi:10.1029/2006JC003563. MacDonald, D.G. , 2006. Estimating an estuarine mixing and exchange ratio from boundary data with application to Mt. Hope Bay (Massachusetts/Rhode Island), <i>Estuarine, Coastal and Shelf Science</i> , 70 , 326-332. MacDonald, D.G. , and W.R. Geyer, 2005. Hydraulic control of a highly stratified estuarine front. <i>Journal of Physical Oceanography</i> . 35 (3), 374-387. MacDonald, D. G. , and W. R. Geyer, 2004. Turbulent energy production and entrainment at a highly stratified estuarine front, <i>Journal of Geophysical Research – Oceans</i> , 109 , C05004, doi:10.1029/2003JC002094. Harvey, R.W., N.E. Kinner, A. Bunn, D. MacDonald and D. Metge, 1995. Transport behavior of groundwater protozoa and protozoa-sized microspheres in sandy sediments. <i>Applied Environmental Microbiology</i> . v. 61, p. 209-217. Harvey, R., N. Kinner, D. MacDonald , D. Metge, and A. Bunn, 1993. Role of physical heterogeneity in the interpretation of small-scale laboratory and field observations of bacteria, microbial-sized microspheres, and bromide transport through aquifer sediments. <i>Water Resources Research</i> . v. 29(8), p. 2713-2722.

Refereed Journal Articles Submitted or In Preparation

Pappal, A., R. Rountree, and **D. MacDonald**. Habitat preferences of juvenile winter flounder, *Pseudopleuronectes americanus*, in the presence of cobble. In preparation.

Non Peer-Reviewed Articles

MacDonald, D.G. and K.R. Dyer, 2007. Estuarine Oceanography. *McGraw-Hill Encyclopedia of Science and Technology*, McGraw-Hill, New York.

R.A. Rountree and **D.G. MacDonald**, 2006. Introduction to the special issue: Natural and Anthropogenic Influences on the Mt. Hope Bay Ecosystem, *Northeast Naturalist*, **13**, Special Issue 4, pp 1-26.

MacDonald, D.G. and R.A. Rountree, 2006. Conclusion to the special issue: Natural and Anthropogenic Influences on the Mt. Hope Bay Ecosystem, *Northeast Naturalist*, **13**, Special Issue 4, pp 199-204.

Editorships

D.G. MacDonald and R.A. Rountree (Editors), 2006. Natural and Anthropogenic Influences on the Mt. Hope Bay Ecosystem. Special issue of the *Northeast Naturalist*, **13**, Special Issue 4.

Conference Papers, Posters, and Presentations

MacDonald, D.G., R. Hetland, and L. Goodman. Observations of spreading and entrainment in a near-field river plume. Poster presented at Physics of Estuaries and Coastal Seas (PECS) Meeting, Astoria, Oregon, September 2006.

Pappal, A.L., R. Rountree, and **D. MacDonald**. Habitat Preferences of Juvenile Winter Flounder, *Pseudopleuronectes americanus*, in the Presence of Cobble. Presentation at the 2006 Winter Meeting, Southern New England Chapter of the American Fisheries Society, Narragansett, Rhode Island, January 18, 2006.

MacDonald, D. Estuarine exchange processes and turbulent mixing through a narrow estuarine channel. Abstract submitted to the 18th Biennial Conference of the Estuarine Research Federation (ERF), Norfolk, Virginia, October 2005.

Chen, F. and **D. MacDonald**. Mixing processes and buoyancy flux rates in a thermal plume. Abstract submitted to the 18th Biennial Conference of the Estuarine Research Federation (ERF), Norfolk, Virginia, October 2005.

Pappal, A.L., R. Rountree, and **D. MacDonald**. Habitat use by juvenile winter flounder, *Pseudopleuronectes americanus*, a laboratory study. Poster presented at the 9th annual meeting of the American Fisheries Society, Flatfish Biology Conference, Westbrook, Connecticut, December 1-2, 2004.

MacDonald, D., L. Zhao, W. Brown, C. Chen and L. Goodman. The Mt. Hope Bay Natural Laboratory: Unraveling the physics of a heavily impacted ecosystem. Poster presented at the Mid-Atlantic Bight Physical Oceanography and Meteorology (MABPOM) Meeting, Fall River, Massachusetts, October 16-17, 2003.

MacDonald, D. and R. Geyer. Froude angle control at a highly stratified estuarine front. Paper and poster presented at the 2nd Meeting on the Physical Oceanography of Sea Straits, Villefranche Sur Mer, France, April 2002.

MacDonald, D. and R. Geyer. Turbulent energy production and mixing at a highly stratified estuarine front. Presented at Ocean Sciences 2002 Conference, Honolulu, HI, February 2002.

MacDonald, D., and R. Geyer. Dissipation and 3-D plume structure at a highly stratified river mouth. Poster presented at Gordon Research Conference on Coastal Ocean Circulation, New London, NH, June 2001.

MacDonald, D., A. Horner, and R. Geyer. Vertical salt flux in a salt wedge estuary. Poster presented at American Geophysical Union Fall Meeting, San Francisco, CA, December 2000.

MacDonald, D.G. and W.R. Geyer, 2000. Observations of shear-induced mixing in a salt wedge estuary, in Lawrence, G., R. Pieters and N. Yonemitsu, eds., *Fifth International Symposium on Stratified Flows*, Vancouver, B.C., Canada, July 10-13, 2000: Vancouver, University of British Columbia, Dept. of Civil Engineering, v. 2, p. 895-900.

MacDonald, D., A. Horner, S. Inagaki, Y. Kasajima, C. Troy, R. Geyer, D. Jay, S. Monismith, and P. Rhines. Salt wedge dynamics in the Fraser River Estuary. Poster presented at Ocean Sciences 2000 Conference, San Antonio, TX, January 2000.

MacDonald, D.G. and G.H. Jirka, 1997. Characteristics of headland wakes in shallow flow, in Wang, S., and Carstens, T., eds., *Environmental and Coastal Hydraulics: Protecting the Aquatic Habitat: Proceedings of Theme B: The 27th Congress of the International Association of Hydraulic Research*, San Francisco, CA, August 10-15, 1997: New York, American Society of Civil Engineers, p. 88-93.

Harvey, R.W., N.E. Kinner, **D. MacDonald**, A.L. Bunn, and D.W. Metge, 1996. Transport of indigenous protozoa in a sandy aquifer, Cape Cod, Massachusetts, in Morganwalp, D.W., and Aronson, D.A., eds., *U.S. Geological Survey Toxic Substances Hydrology Program--Proceedings of the Technical Meeting*, Colorado Springs, Colorado, September 20-24, 1993: U.S. Geological Survey Water-Resources Investigations Report 94-4015, v. 1, p. 253-257.

Harvey, R.W., N. Kinner, A. Bunn, and **D. MacDonald**, 1993. Transport of protozoa through an organically contaminated sandy aquifer, in Stanford, J., and Simons, J., eds., *Proceedings of the First International Conference on Ground Water Ecology*, Tampa, Florida, April 26-29, 1993: Huntsville, Alabama, American Water Resources Association, p. 111-118.

Invited Presentations

MacDonald, D.G. Mixing in a Salt Wedge Estuary: A Physical Overview of the Fraser River (British Columbia) Estuarine System. Southampton College (NY), 14 April 2004.

MacDonald, D.G. Science, the media, and Mt. Hope Bay: A Scientists perspective. University of Rhode Island/Metcalf Institute for Marine and Environmental Reporting & The Providence Journal, Science Seminar for Editors, 25 April 2003.

MacDonald, D.G., and W.R. Geyer. Turbulent kinetic energy and buoyancy flux in a highly stratified estuary. University of Massachusetts Dartmouth, School for Marine Science and Technology. 14 November 2002.

MacDonald, D.G., and W.R. Geyer. Turbulent kinetic energy and buoyancy flux in a highly stratified estuary. Texas A&M University, Department of Oceanography. 6 November 2002.

MacDonald, D.G. Estuaries and stratified flows. Woods Hole Oceanographic Institution, Exhibit Center Public Seminar Series. July 2001.

MacDonald, D.G., and W.R. Geyer. Salt wedge dynamics and diapycnal mixing in the Fraser River Estuary. Woods Hole Oceanographic Institution, Coastal Ocean Fluid Dynamics Laboratory (COFDL) seminar. September 2000.

MacDonald, D.G. Estuarine dynamics and mixing: An introduction to river channel oceanography. Woods Hole Oceanographic Institution, Joint Program Student Seminar series. August 2000.

- Academic Service** Department (DEOS) and School (SMAST) Curriculum Committees, 2003-2007
(Chair of Department and SMAST Committees 06-07)
UMass School for Marine Science Curriculum Committee, 2006-07
SMAST Graduate Student Review Committee, 2006-2007
University Calendar Committee, 2006-2007
Faculty Evaluation Committee, 2005-2006
Search and screen committees (2), 2003
- Memberships** American Geophysical Union
- Honors** National Science Foundation Graduate Fellow (1994-1999)
UNH College of Engineering and Physical Sciences Class Marshall (1992)
UNH Governor's Success Scholar (1988-1992)
National Merit Scholar (1988)
Presidential Scholar (1988).