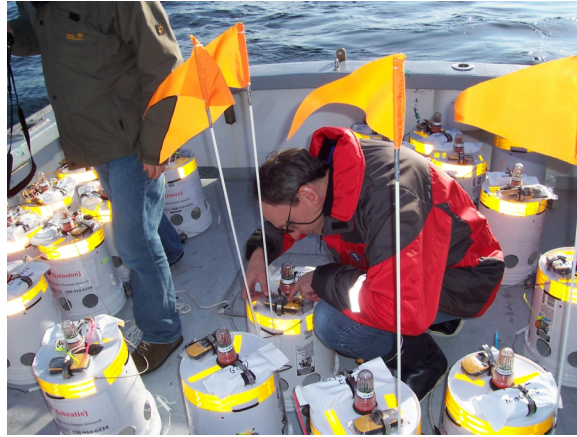


## ***River Plume Collaboration Offers Wide-Spread Benefits for Researchers, Students***

In 2006, Prof. Daniel MacDonald, an associate professor in the Department of Estuarine and Ocean Sciences at UMass Dartmouth, was awarded a grant by NSF to investigate the poorly understood near-field region of river plumes, focusing on the nearby discharge of the Merrimack River into the Gulf of Maine, in a research project known as the Merrimack River Mixing and Divergence Experiment (MeRMADE). Now, three years later, he is back at the same river to expand his research with another grant by NSF. MeRMADE II will be focused on the mid-field region, so he can better understand dramatic changes within the structure of the river plume.



Dr. MacDonald prepares drifters for launch during the November 2009 drifter release experiment in the Merrimack plume.

When fresh water from a river flows into the salty ocean, a river plume is created. The two types of water also have a difference in temperature, density, and velocity. The evidence of the fresh water input can be noted hundreds of miles away from the mouth of the river in the far-field region of the river plume, but more than half of the mixing occurs in the near-field region, which typically extends only 1-2 miles from the river mouth. Somewhere in the mid-field region, spreading is stopped and mixing is reduced. The direction of the flow also changes dramatically, from moving directly offshore to a coastal current flowing parallel to the shore, but it is not clear how this transition occurs.

River plume research will have far-reaching impacts. A river plume brings sediments, nutrients, and toxins from the mainland to the ocean. Debris that floats in a river may ultimately end up along the coast. “Some of the practical outcomes of this research,” says Dr. MacDonald, “include helping us understand where all of these things contained in the river discharge might end up. Whether they might impact downcoast, shellfish beds, or bathing beaches, for instance.” It will also provide a better understanding of how a coastal current is created, which is important research, not only for the physical oceanography community, but for researchers in a wide array of disciplines focused on coastal processes, from biology to chemistry to geology.

Dr. MacDonald will once again be working with Dr. Robert Hetland of Texas A&M University, a numerical modeler whom he worked with in his near-field river plume research, and this time, Dr. Alexander Horner-Devine of the University of Washington, an expert in laboratory simulations of river plumes, has also been brought on board. Dr. Lou Goodman, a researcher at UMass Dartmouth, has also participated in both projects by providing his laboratory’s turbulence Autonomous Underwater Vehicle to measure



MeRMADE researchers, students and boat crew during the 2007 field campaign. Front row (L to R): Ray Rock, Captain of the the Lucky Lady, Dr. MacDonald, Dr. Hetland, SMS alumni Fei Chen, UW alumni Emily Spahn. Top row (L to R): SMS alumni Zhankun Wang, TAMU student Julia O'Hearn, SMAST engineer Chris Jakubiak, TAMU student Laura Rubiano-Gomez, Dr. Horner-Devine.

turbulence and other quantities within the plume. This collaborative project also brings a unique opportunity for the graduate students involved. Since several different researchers from multiple institutions are represented in this study with a graduate student at each university, all of the students are exposed to different approaches of research that can be done, including field observations, numerical modeling, and lab experiments.

Students also play an integral role in the research; the experiments are conducted across multiple vessels, allowing students to work independently from Dr. MacDonald and the other researchers. Georgia Kakoulaki, a current SMS doctoral student, is working with Dr. MacDonald on the research. She helped with a drifter release experiment that was completed in November, and will also be involved, along with her fellow students at Texas A&M and UW, in the field effort that is scheduled for this May.