

**Circulation Patterns in Merrymeeting Bay and its Tributaries**  
**Friends of Merrymeeting Bay: 2009**  
[www.friendsofmerrymeetingbay.org](http://www.friendsofmerrymeetingbay.org)

**Abstract**

A Friends of Merrymeeting Bay circulation study was performed between 2005 and 2009. The study used GPS and radio transmitter equipped PVC pipe drifters to investigate spatial and temporal aspects of flows in Merrymeeting Bay, its tributaries to head of tide and in the lower Kennebec River. Drifter deployments were made in low, medium and high flow regimes. In the four small tributaries: Abbagadasset, Muddy, Cathance and Eastern rivers it was found with commonly occurring net downstream gains of only 100 yards per tide, residence time could be as much as 50 days. Because of this, it made sense to think of these tributaries more as embayments of the Bay. Flows in minor tributaries were found to be largely governed by water levels in the open Bay. Inflows to these tributaries could under no conditions, outweigh higher water levels and flows from the Kennebec and to a lesser extent the Androscoggin. Residence time on the Kennebec and Androscoggin rivers was typically 1-2 days to reach the Bay. Ample evidence was seen that once drifters from one tributary entered the Bay, they could easily find their way into a different river instead of passing directly through the Chops and down the lower Kennebec.

In addition to drifter deployments in the tributaries, numerous deployments were made from the Chops on incoming and outgoing tides during flow levels from 3,000-70,000 cfs measured at the North Sidney reference site. Deployments here quickly made obvious in all but very high flows, water could have a very difficult time leaving the system. At low flows on an outgoing deployment for example, only 2 of 24 drifters made it as far as Bath and they were back in the Bay the next day. As flow levels increased, there was a net migration downstream of these Chops-deployed drifters until at 70,000 cfs, a number of drifters were recovered in Casco Bay and two on the beaches of Cape Cod, MA.

Threats posed by contaminant spills, overboard discharges, excessive phosphorus or nitrogen, marina growth and development, sediment runoff and others, are all increased by long residence times. The study provides a method for calculating approximate residence time for any given point on a tributary river. While it is clear from short-term deployments, extensive mixing and long residence times may continue once water enters the Bay, extensive tidal flats, copious vegetation and drifter length combine to prevent long-term accurate deployments within this area. Data from this study could provide a basis for future shallow water modeling efforts in Merrymeeting Bay.