Examining exports of nutrients, mercury, and invertebrate mercury bioaccumulation in a restored wetland impacted by gull guano on Brier Island, Nova Scotia

Nelson J. O'Driscoll[1], Holly Turner[1], Mia Doncaster, Mark Mallory[1], N. Kirk Hillier[1], Nick Hill[2]

[1]*Acadia University, Wolfville, Nova Scotia, Canada*
[2]*Southwest Nova Biosphere Reserve Association, Yarmouth, Nova Scotia*

Abstract
Big Meadow Bog (Brier Island, NS) underwent water table restoration in 2018 that returned the bog to its original water levels prior to ditching. The Northern bog hosts a cluster of 4000-6000 herring gulls that feed at nearby mink farms and aquaculture sites. Previous research from our group has shown that bird biomass and guano are increasing trace metals and nutrients in groundwater. Analysis of gull guano shows very high water-soluble PO_4^{3-} but lower total mercury (THg) and methylmercury (MeHg). Water from the norther primary surface outflow was collected over five years (2018-2023) and also recently from newly installed weirs (2024, 2026). Mean concentrations of MeHg, DOC, PO_4^{3-}, and NO_3^- in water were significantly higher in the first-year post-flooding and decreased through subsequent years from 2018-2023. MeHg, DOC, and NO_3^- concentrations were all strongly correlated and significantly higher in summer months than in winter months. Invertebrate families were collected over three summers (2021, 2022, and 2023). On average, invertebrates at the bog site had 1.61 times higher MeHg than comparable undisturbed wetland sites. In addition, MeHg concentrations in water positively correlated with those in resident Gammaridae (a benthic invertebrate bioindicator) tissues. Water samples (2024) from weirs in the three northern outflows confirmed hypereutrophic concentrations of nutrients in the central outflow (Weir 2) but the highest MeHg was located at the eastern outflow (Weir 1). This talk will summarize recent 2026 weir data as well as the past 9 years of research from the mercury lab at Acadia and discuss future questions to be resolved.

Keywords: bioaccumulation, gull guano, mercury, nutrients, restoration