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Determining biomass-based methylmercury concentrations in phytoplankton from the North Atlantic Ocean, with the support of an Imaging Flow Cytobot and Flow Cytometer

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Methylmercury (MeHg) is toxic to humans who are primarily exposed to it through the consumption of marine fish. Laboratory experiments have shown that MeHg enters the marine food web via phytoplankton. These studies demonstrated that uptake from seawater results in volume-based concentration factors (VCFs) that are 6–9 orders of magnitude higher than seawater concentrations. However, despite these experimental advances, these results have not been validated by feild-based observations of MeHg concentrations in natural marine phytoplankton, largely because accurate estimates of phytoplankton biovolume and biomass from filtered samples have been impossible or difficult to obtain. This project employs a new approach to quantify MeHg per unit biovolume and biomass using the Imaging FlowCytobot (IFCB) and a Flow Cytometer (FCM). Both instruments analyze live phytoplankton directly from seawater: the IFCB captures images of individual cells, while the FCM measures cell size based on forward light scattering. Together, they generate cell counts and size-related attributes (e.g., diameter and biovolume) for phytoplankton in the ~1–150 µm size range. By combining these data with MeHg measurements using modified EPA Method 1630 from sequentially filtered (size-fractionated) phytoplankton samples, we calculate MeHg VCFs (unitless) and concentrations in ng/g wet weight. Using this approach, we will for the first time share MeHg concentrations in micro-, nano-, and picoplankton from the North Atlantic Ocean and compare the resulting VCFs with those previously reported from laboratory experiments on pure cultures of ranging cell sizes.