Total mercury concentrations in liver and muscle of European whitefish (Coregonus lavaretus (L.)) in a subarctic lake - Assessing the factors driving year-round variation.

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Abstract: Subarctic lakes are characterised by extreme seasonal variation in light and temperature which influences growth, maturation, condition and resource use of fishes. However, our understanding of how seasonal changes affect mercury concentrations of fishes is limited. We conducted a year-round study (3 ice-covered months, 3 open-water months) with open-water inter-annual aspect (3 years: samples from August/September), focusing on total mercury (THg) concentrations and ecological characteristics of a common freshwater fish, European whitefish (Coregonus lavaretus (L.)) from a subarctic lake. We measured THg concentrations from tissues with fast (liver, n = 164) and moderate (muscle, n = 225) turnover rates, providing information on THg dynamics over different temporal scales. In both tissues, lipid-corrected THg concentrations were highest in winter (liver: 1.70 ± 0.88 µg/g, muscle: 0.24 ± 0.05 µg/g) and lowest in summer (liver: 0.87 ± 0.72 µg/g, muscle: 0.19 ± 0.04 µg/g). THg concentrations increased in winter following the summer-autumn dietary shift to pelagic zooplankton and starvation after spawning. Whitefish THg concentrations decreased towards summer, and were associated with consumption of benthic macroinvertebrates and subsequent growth dilution. Mercury bioaccumulated in both tissues with age, both showing the strongest regression slopes in winter and lowest in summer. THg concentrations in liver and muscle tissue were correlated throughout the year, however the correlation was lowest in summer, indicating high metabolism during somatic growing season in summer and growth dilution. Multiple linear regression models explained 50% and 55% of the THg variation in liver and muscle both models dominated by seasonally-variable factors i.e. sexual maturity, d13C, and condition factor. Seasonally varying bioaccumulation slopes and the higher level of intra-annual variation (21%) in whitefish THg concentration in muscle than the inter-annual accumulation (8%) highlight the importance of including seasonal factors in future THg studies.

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