CHEMICAL INDICATORS

The National Lakes Assessment (NLA) measures the chemical, physical and biological condition of lakes across the conterminous U.S. In addition to the national survey, NLA supports intensifications that provide more specific information on lake condition for states. In 2017, Minnesota conducted an intensification that assessed sediment contaminants as a chemical indicator (Crane 2021). In collaboration with the EPA, Nord et al. (2024) compared sample results to literature-based benchmarks and ambient background threshold values established in Crane et al. (2021). These benchmarks were applied to describe national lake condition for sediment contamination.

Box 1: Sediment Contaminant Sample Collection

Sediment was collected in a single location near the deepest point of each lake. A total of two surficial sediment (top 5 cm) samples were collected using a gravity corer. See the NLA 2017 Field Operations Manual for more details on field collection and methodology.



Sediment Contaminants

Sediment contaminants are chemicals—which include metals, metalloids, and organic compounds—that have accumulated in the bottom substrate of aquatic ecosystems. These chemicals can naturally enter aquatic systems, such as lakes, through processes such as bank erosion, mineral weathering, and natural oil seeps. Human activity including industrial, urban, and agricultural runoff, oil and chemical spills, and atmospheric deposition from coal burning and hazardous waste incineration can also lead to more extensive sediment contamination.

When metal and organic contaminants accumulate in aquatic sediments, they can pose a risk to both aquatic life and human health. Contaminants can be ingested by bottom dwelling invertebrates and fish, where they can disrupt development and reproduction cycles. These contaminants can also travel up aquatic food webs, posing a potential threat to people who eat

contaminated fish and shellfish. By measuring the extent of sediment contamination and comparing levels to benchmarks, we can characterize the relative condition of lakes.

The sediment contaminant indicator uses an effect concentration index to categorize lakes into good, fair, and poor categories. The mean <u>probable effect concentration quotients</u> (mean PEC-Qs) for each site was calculated from **seven individual metal(loid) PEC values**,—As, Cd, Cr, Cu, Pb, Ni, and Zn—and **the sum of seven low molecular weight PAHs**—acenaphthene, acenaphthylene, anthracene, fluorene, 2-methylnaphthalene, naphthalene, and phenanthrene—**and six high molecular weight PAHs**—benz(*a*), anthracene, benzo(*a*)pyrene, chrysene, dibenz(*a*,*h*)anthracene, fluoranthene, and pyrene). Condition categories based on this index are defined below:

- Good: Lakes with mean PEC-Q ≤ 0.1
- Fair: Lakes with mean PEC-Q > 0.1 and < 0.6
- Poor: Lakes with mean PEC-Q \ge 0.6

What was the condition in 2017?

Nationally, a majority lakes (69%) were in fair condition for sediment contamination. A smaller proportion of lakes were in good condition (26%) and a small percentage of lakes were in poor condition (2%)



How was condition distributed across ecoregions?

Across the nine different aggregated ecoregions, condition trends varied but were similar to the national results. For a more details on ecoregional results, please refer to <u>Nord et al. (2024)</u>.



References:

USEPA. 2017. National Lakes Assessment 2017. Field Operations Manual. EPA 841-B-16-002. U.S. Environmental Protection Agency, Washington, DC.

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