Monitoring: The Key to Understanding and Protecting Flathead Lake

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The University of Montana Flathead Lake Biological Station has carefully documented the status of water quality in Flathead Lake and its tributaries for over 100 years. The Biological Station, located at Yellow Bay on Flathead Lake, is one of the oldest active biological field research stations in the United States.

Starting in 1977, scientifically rigorous water quality data have been collected at least 15 times a year. The Flathead Lake water quality database is one of the longest and most detailed for large lakes worldwide. These data have allowed Biological Station scientists to describe the long term trends in water quality that have occurred as population has expanded and land uses changed in the watershed.

Decline in water quality is caused mainly by nutrient (phosphorous and nitrogen) pollution in runoff from populated areas and deposition of wind-carried smoke and dust particles on the lake surface. But other changes in the watershed and lake have had an impact also. Food web change caused by the introduction of nonnative species of invertebrates and fish, changes in water flux caused by regulation of runoff by Kerr and Hungry Horse Dams, and changes in algal metabolism caused by increasing lake water temperatures associated with two decades of warm weather also are involved.

Biological Station research has shown that the Flathead River upstream from the lake is closely connected to the floodplain and alluvial aquifer (shallow groundwater) stretching a mile or more from the river. The flow of river water through the gravel and cobble substrate creates an underground aquatic environment that contains a complex food web that cycles nutrients and creates mosaics of riparian habitats that help sustain clean water in the river and lake.

Recently, Biological Station professor Dr. Bonnie Ellis analyzed the long term data for Flathead Lake. The analysis shows that water quality gradually declined as the human footprint in the watershed increased. A 1983 pollution algal bloom and declining summer oxygen levels in the 1980s signaled the onset of nutrient pollution.

However, the biggest change in the lake was not due to pollution, but was clearly and directly related to the introduction of various fish species over the years and the Mysis shrimp introduction in the early 1980s. These introductions have dramatically changed the fisheries in the lake at the expense of native fish. Likewise, new introductions into Flathead Lake are a real threat. Zebra mussels and walleye are two of the many nonnative species that could negatively impact Flathead waters if introduced.

Water quality in the lake, as measured in terms of water clarity, algae production, and deep water oxygen content, among other key variables, remains remarkably good given the large number of people living around the lake and in the Flathead Watershed. In fact, Flathead Lake remains among the cleanest of the world's large lakes owning to two key attributes. First, the Flathead River dominates the water moving through the lake. The river water is clean, clear and cold because it comes mostly from Glacier National Park and the Bob Marshall Wilderness Complex.

Second, water quality management in the lake and watershed is very good overall. All of the urban centers have good sewage collection and treatment facilities. Kalispell's is among the best in the country. Best management practices on forest lands are well established and monitored. But agricultural practices and stormwater runoff from residential and commercial development is poorly monitored. Some groundwater monitoring wells have high nitrate concentrations and detectable levels of pesticides and herbicides.

Another change is that Flathead Lake appears to be warming. The volume of the warm upper layers in the lake has increased substantially since 1990. The lake has not frozen over since 1988 and persistence of ice in the bays is declining. Summer surface temperatures routinely exceed 70°F (21°C), too warm for cold-adapted cutthroat trout to grow, thus compounding the food web problem that has pushed cutthroat to the brink of extirpation. Moreover, algae thrive in warm water as the nutrient supply increases, and Ellis' analyses show that nitrogen inputs have steadily increased over the last two decades.

Managers and the public must be vigilant and proactive to preserve Flathead Lake's water quality. Conversion of agricultural lands to urban and commercial uses is gradually increasing the nonpoint source pollution in the Flathead River and Flathead Lake. Gravel mining along the Flathead River is reducing the resiliency of the alluvial aquifer to reduce pollutant loads. Encroachment of human uses into riparian buffer zones along the river and lake increase every year, reducing natural trapping of nitrogen and phosphorus, the nutrients that increase algae production in the lake. Coal mining in Flathead headwaters could have negative impacts on water quality all the way to Flathead Lake, although a recent agreement between British Columbia and Montana put coal mines in the Flathead's North Fork off the table for now.

The Flathead Basin Water Quality Monitoring Program and additional research conducted by the Biological Station help people understand the complex ecological processes in the Flathead Lake and river system. These processes sustain the clean water Flathead Watershed communities depend on. Continuing the Biological Station's monitoring program is essential to keep track of changes in water quality in the lake and watershed. Only with the information continuous monitoring provides can effective management actions be taken to maintain Flathead Lake's clean waters.