HEAVY METAL STEW: AN ANALYSIS OF THE WATER QUALITY OF BARBARA'S LAKE, ORANGE COUNTY, CA

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Barbara's Lake is the largest of three naturally occurring lakes in Orange County, California. This lake is part of the Laguna Coast Wilderness Park, located off SR-133 in Laguna Canyon. Water levels are maintained by runoff from a nearby housing development and surrounding hillsides. There is no surface outlet. Lake levels vary according to the seasons. After heavy winter rains, the maximum depth is approximately 4 m. During summer, evaporation decreases lake levels by 2 to 3 meters. The lake's water quality is significantly impacted. Nutrients, such as phosphate and nitrate, are depleted, and blue-green algae are abundant, indicating eutrophication. Fish kills have been observed. The bottom waters are reducing, as evidenced by the lack of dissolved oxygen below 50 cm and release of hydrogen sulfide gas during sampling. An assessment during summer 2008 revealed high concentrations of specific metals, principally copper. Continued monitoring over the last 2 years indicates that metal concentrations are strongly linked to lake level. Copper concentrations are as high as 35mg/L during low stands and plummet to as low as 1 mg/L after substantial rainfall. The summer (low stand) levels of copper, cadmium and zinc exceed the EPA Criterion Continuous Concentration (CCC) and/or the Criteria Maximum Concentration (CMC). However, these data drop below the CCC during lake high stands. There is no clear spatial pattern to heavy metal concentrations, except for generally higher concentrations near a pole in the west basin. A second metal pole occupies the east basin, and a metal fence runs down the center of the lake between them. This fence emerges during lake low stands. The high concentration of several metals and persistent reducing conditions suggest that the metal poles and fence are a likely source of the contaminants. To reduce concentrations we recommend removing the fence line and aerating the lake.