Crater Lake

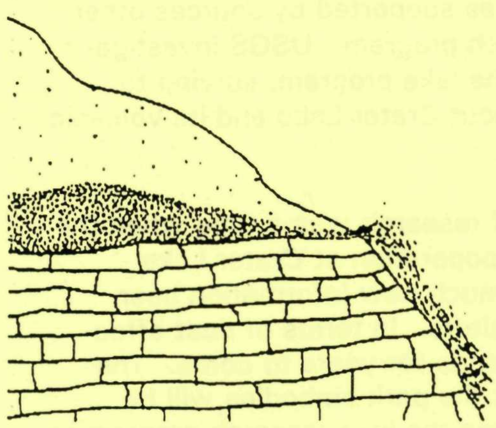
National Park
National Park Service
U.S. Department of the Interior

Ten Years of Lake Research

As one of the world's oldest national parks, Crater Lake continues to draw half a million visitors per year. As renowned as the park is, much remains to be learned about its central feature. Very little was known about the lake's ecology in 1982 when Congress funded a ten year research program in response to concerns about Crater Lake losing its famous clarity.

Ten years later, it would be safe to say that no limnological resource in the National Park System has a better data chain to support monitoring efforts. A panel of scientists recently met to review of the program's research methods and findings. They concluded that the program has met the goals and objectives set in 1982, and has gone far beyond what was envisioned a decade ago. Additional research is needed, however, because long-term change at Crater Lake could not be fully evaluated by the ten year program. This is because no comparable historical measurements exist to compare with the data set assembled since 1982.

Content and Purpose of Study



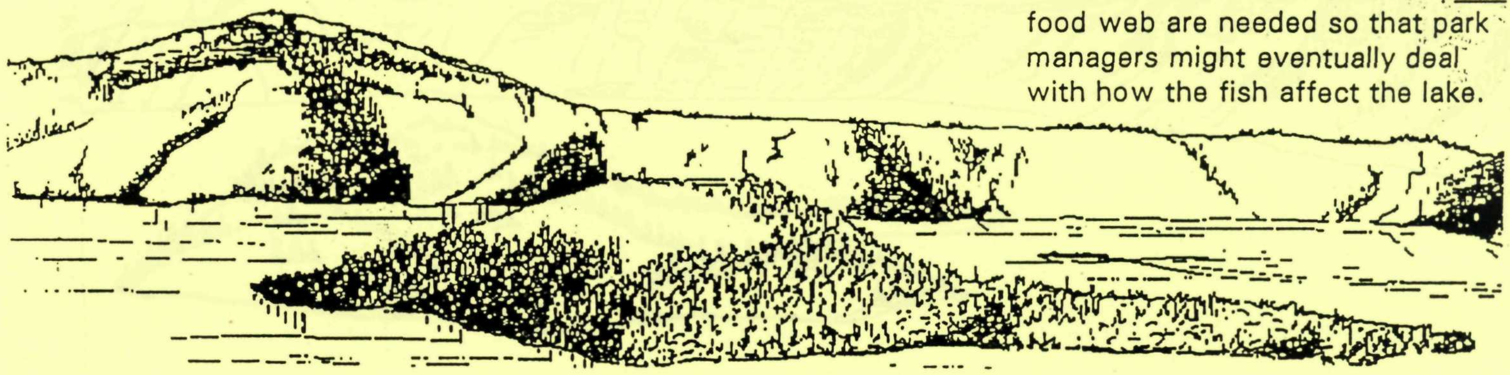
Crater Lake is a complex and dynamic oligotrophic (nutrient-poor) system. Since it is so unusual, a number of studies have been undertaken to better comprehend its physical, chemical, and biological components. These investigations include the quantity and chemistry of precipitation, lake level fluctuations, solar radiation, chemistry of intra-caldera springs, clarity, color, chemistry, particle flux, chlorophyll, primary production, phytoplankton, zooplankton, benthic (bottom of the lake) flora and fauna, as well as fish. A common thread linking all of the studies was the attempt to determine if the lake had experienced recent changes. In many cases, all the investigators could do was provide a baseline to compare against future conditions, but particular attention was paid to whether any changes in the lake's ecosystem had been caused by humans.

Much of the program's emphasis was related to the clarity issue. Seasonal and annual variability were apparent in lake clarity measurements, but the data did not support the hypothesis that Crater Lake had experienced any long-term change. This should not be taken to mean that the lake has not changed through the years. Changes in nutrient input (more nutrients added to a nutrient-poor system would tend to make the lake less clear) from atmospheric and local sources (such as nitrates) may be significant to long-term trends in lake clarity.

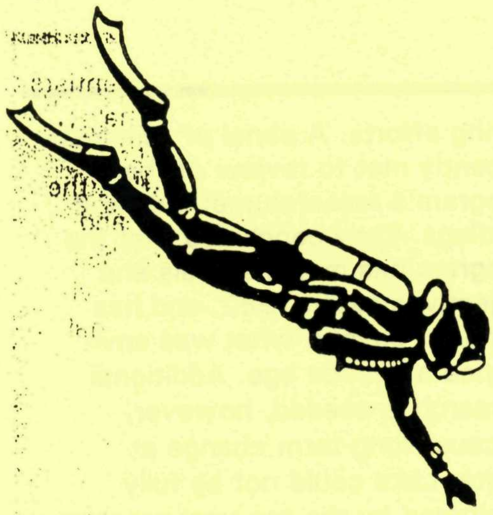
Overall Ecosystem

Three springs on the caldera wall exhibited relatively high nitrate concentrations, something which may or may not be related to human activity. Nitrate from these springs, however, contribute less than three percent of the total annual nitrate input to the lake. As a result, the greatest human-related threats to Crater Lake are considered to be global climate change, air pollution, on-site auto and boat use, and the non-native fish.

In general, the Crater Lake ecosystem was judged to be pristine except for the consequences of fish introductions. Fish exhibited the clear potential to alter the open-water and near-shore food webs and to affect in-lake nutrient flow. Although stocking of both species (kokanee salmon and rainbow trout) was stopped in 1941, their continued reproduction in Crater Lake present long-term implications for the lake's ecology. Measurements of Crater Lake's food web are needed so that park managers might eventually deal with how the fish affect the lake.



Hydrothermal Findings



Confirmation of the long-suspected hydrothermal inputs to the lake was probably the most publicized finding of the ten year program. They were found to be at least partly responsible for the lake's stable water quality through the time. Hydrothermal inputs were also determined to be highly significant in maintaining Crater Lake's ecosystem and its processes.

These findings continue to spark controversy over protecting the lake. For several years a geothermal energy company desired to utilize its leases for drilling outside the park's boundaries, hoping to tap a heat source in the mountain (Mazama) which holds Crater Lake. Disagreement over whether possible geothermal development might affect the lake's pristine qualities raged while a one person submarine explored the bottom of Crater Lake in 1988 and 1989. These dives were the first of their kind at the park and added a new dimension to the ten year program. Not only did they confirm the presence of the vents, but many new discoveries were made. Two of the most publicized were bacterial mats related to hydrothermal inputs and a new species of mite.

Impetus for the dives was a Congressional mandate to identify significant thermal features in national parks. As a result, additional funding was made available to the National Park Service and Oregon State University to conduct the hydrothermal studies. Other cooperators who sponsored dives were the National Geographic Society and the U.S. Geological Survey.

Past and Future

Scientists from the USGS were present throughout the ten year program, continuing their studies of Crater Lake that go as far back as 1886. Most of their work, however, was supported by sources other than funds dedicated to the lake research program. USGS investigations have had a synergistic effect on the lake program, serving to broaden the scope of what is known about Crater Lake and its volcanic origins.

Seen in perspective, this past decade of research was a time when the tradition of interdisciplinary study and cooperation at Crater Lake bloomed. Not since the 1930s had so much new information been generated for interpreting the lake to visitors. In terms of cost effectiveness, the taxpayer will receive dividends for years to come. The educational and inspirational values that the park embodies will be articulated even further if Congress allows the lake research program to continue.

What is Limnology?

Webster's Dictionary defines "limnology" as "the scientific study of the biological, chemical, geographical, and physical features of fresh waters, especially lakes and ponds." A fundamental feature of the earth is an abundance of water, which covers 71% of its surface to an average depth of 3800 meters. Over 99% of the earth's water is dposited in oceans. This precious 1% maintains most terrestrial life.

Our knowledge of the operation of freshwater systems, such as Crater Lake, has come a great distance in this century. We have passed the point at which we can continue to use freshwater without casting back some comprehensive efforts to maintaining its equilibrium. Nature is remarkably resilient to human insults; however, humans must learn what are nature's dynamic capacities without unleasing its intolerable vengeance.