State of the Lake 1998

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Last summer in my state-of-the-lake address, I provided details of an exhaustive analysis of all of the water quality data collected by Biological Station researchers since studies began nearly 100 years ago. The study documented the long-term trend of deteriorating water quality in the lake caused by 1) pollution from human sources in the water and airsheds, 2) regulation of water level in the lake and water passage through the lake by Kerr and Hungry Horse Dams, and 3) changes in the food web of the lake associated with the invasion of opossum shrimp (Mysis). These interactive effects have increased the rate of production of offshore scums of algae, one of the key indicators of declining water quality.

Production of algae in the lake is driven by inputs of nitrogen and phosphorus, plant growth nutrients that naturally enter the lake via the Flathead River during spring runoff. However, gradually increasing amounts of nutrients also come from the mix of human activities in the basin. Indeed, the Montana Department of Environmental Quality has designated Flathead Lake as "water quality impaired," due to nutrient pollution from human sources.
The runoff in 1997 was one of the largest in history and the lake was pretty scummy on-and offshore all summer. Owing to persistent rain, which has prolonged runoff from the light winter snowpack, I expect the same situation this summer.

However, contrary to our expectations, high amounts of bluegreen algae, which are indicators of pollution, were not present in the 1997 scums. This is probably because the spring runoff is a pulse of water and materials that passes through the lake quickly. The bad blooms of bluegreens, which have occurred twice in recent years (1983 and 1993), may be related more to late summer nutrient loading and lake conditions than the spring runoff pulse.

While these nuances are interesting and important, the primary concern is the continuing trend toward increased annual production lakewide. At the turn of the century and up until 30 years ago when I started my scientific career on Flathead Lake, water quality was about 2 times better than it is today. Nutrient pollution from human activities is the cause of this gradual decrease in water quality. However, this trend can be reversed.

Our 1997 research report is the basis for a voluntary program to clean up Flathead Lake. This effort is coordinated by the Flathead Basin Commission and is called the TMDL "study," which refers to a section of Federal Clean Water Act that mandates clean up of "impaired" water bodies. A report of the TMDL study can be obtained from the Flathead Basin Commission or viewed online [on the Laker's TMDL pages].

Our 1997 report showed that modernization of urban sewage treatment plants (STPs) over the last decade reduced the pollution reaching Flathead Lake by nearly 15%. Flathead Valley STPs, especially Kalispell's, are as good or better than any in the country. However, pollution from street drainage in the urban areas, the cumulative inputs from the many septic systems in the rural and exurban areas, dust and smoke in the atmosphere and runoff from agricultural and timber lands remains a sizeable problem.

Since our report was produced, Bonnie Ellis and I have been working with the FBC to inform people in the basin about this diffuse or nonpoint pollution load. We are hopeful that substantial improvements will be made as the TMDL process moves forward. The FBC has set the TMDL goal at water quality levels that we documented during the early stages of monitoring. This will require substantial reduction in nonpoint sources, which should be attainable if citizens and industry understand and endorse pollution management practices that attenuate diffuse inputs.

Best management practices to reduce non-point pollution reaching Flathead Lake include:

- Creation (where they do not presently exist) or maintenance of "buffer strips" composed of dense native vegetation along streams and lakeshores;
- Fencing livestock out of streams and lakeshores;
- Use of constructed wetlands to naturally treat runoff from streets, pastures and feedlots;
- Reduction in quantity of agricultural and slash burning;
- Paving of rural roads to reduce dust emissions;
- Fetter prescriptions for forest harvest and road building to minimize water and sediment pulses in streams;
- Firm restrictions on construction in areas prone to flooding and not conducive to disposal of wastes via septic systems (e.g., along the Flathead River flood plain near Evergreen and certain lakeshore areas);
- Planned improvements in sewage treatment systems as loads to them increase with new residents going online; and
- Replacement of failing or old septic systems.

Issues related to dam operations also remain in the picture despite the FERC agreement on mitigation of Kerr Dam impacts and the retrofit of Hungry Horse Dam to ameliorate discharge of cold water from the reservoir. In general these mitigation activities are very positive. But, erosion and reconfiguration of the Flathead Lake shoreline, due to full pool operations at Kerr, is a persistent problem. Warmer water from Hungry Horse is a plus for the river biota and the lake will be warmer too, but nonseasonal and very erratic discharge from the dam impact fish habitat in the river and compromise Kerr operations as well as the TMDL process by abnormally pulsing water through Flathead Lake.

Perhaps the most ecologically agonizing issue currently relates to the changing food web in Flathead Lake caused by the establishment of opossum shrimp. This year shrimp numbers are up by 50% over the last few years. This probably means that lake whitefish and lake trout outgrew the shrimp food base over the last few years and the population size of juvenile fish decreased. This presumably has allowed the shrimp to increase. Very likely we will see another burst in whitefish and lake trout production as this predator-prey cycle continues to oscillate.

Some of the State and Tribal fisheries biologists believe that the lake trout expansion during the last decade since shrimp established has caused an alarming decline in the Flathead Lake bull trout. Presumably, lake trout are eating the baby bull trout as they enter the lake from the river system. A panel of fisheries experts concluded that the lake trout should be artificially controlled by netting to prevent the demise of the bull trout. This, of course, did not set well with lake trout fishermen. On the other hand, the bull trout is now listed for protection under the Federal Endangered Species Act. Lake trout reduction may be the only solution to prevent extirpation of bull trout from Flathead Lake.

However, I believe that more needs to be known about how the food web works before we invest huge sums of money in lake trout control. We must be able to reasonably forecast the consequences, not only for the lake fisheries, but also for water quality. We know that by preying heavily on large zooplankton, the shrimp have left only small zooplankton species to consume algae in the lake. Lake trout control might allow the shrimp to become substantially more abundant, further compromising the ability of the zooplankton community to forage on large algae species. Lack of grazing on large algae could cause the lake to bloom with pollution algae, especially if non-point pollution loads continue to increase. This would be a devastating blow to the TMDL process and water clarity and cleanliness in the lake.

At the Biological Station we are finalizing work on computer models that summarize food web processes. We hope this will provide insight to the fisheries managers as to how to deal with the shrimp-trout problem. We also have applied for a large research grant from the Northwest Power Planning Council and the Bonneville Power Administration that will allow us to gather new information about the food web of the lake. The proposal was favorably reviewed by a panel of scientists. A letter of support for this grant to the NWPP Council from the Lakers would be appreciated because many competing interests exist for the available funds in their Fish and Wildlife Program.

However, it is funding for maintaining the water quality record on Flathead Lake that is most problematic. While the research budget at the Biological Station is now almost $2 million per year (we are now one of the major industries in the Flathead Basin), most of this research money is from the National Science Foundation and other federal sources for specific research objectives. It *cannot* be used for the routine monitoring of water quality in the lake. Funding for the monitoring program must come from State and local sources. The annual monitoring program now costs $80,000, but the only dependable sources of funding have been the Montana Water

Quality Bureau and Montana Power Company, but their contribution is only half of the total needed. In the past, the Tribes, Lake and Flathead Counties made up the balance of the monitoring budget, but these sources have dried up. My endowed professorship has made up the budget shortfall over the last 3 year, but that money was never intended to support a monitoring program and must now be used elsewhere.

Loss of the monitoring program would be a shame given the economic importance of Flathead Lake. Without the monitoring program, the success or failure of the TMDL process will be unknown and the state-of-the-lake will have to be determined from bits and pieces of information forthcoming from the research program. This is ironic since the State is required by the Clean Water Act to reverse impairment. One would think that monitoring of the most economically important water body in Montana would be top priority for the State. Unfortunately, Governor Racicot's recent letter to the Flathead Lakers strongly suggests Flathead Lake is not anywhere near top priority, as he states the current DEQ funding of $40,000 is the best the State can do. Forty thousand is not enough to continue a meaningful and accurate monitoring program on Flathead Lake. I am prepared to work with the Flathead Lakers and any other entity to solve this dilemma, but I will have to stop the monitoring this winter if we are unsuccessful.

I want to end on a brighter note. Flathead Lake is a priceless resource and we enjoy better water quality than in most lakes worldwide. We have problems to solve, but we also have a good track record for meeting challenges. The Biological Station will continue to be a primary source of environmental information in the Crown of the Continent Ecosystem, as well as for Flathead Lake.

Next year (1999) will mark 100 years that scientists at the Flathead Lake Biological Station have studied our big, beautiful lake. I certainly hope the Lakers will join The University of Montana in celebrating our centennial year. We are planning to host prominent scientists working on big lakes around the world to help us highlight the importance of the work that is done at the Biological Station. We will offer special displays, seminars and citizen workshops on all aspects of water quality and ecology in the Crown of the Continent Ecosystem. We also hope to develop an endowment for the Station that will ensure that monitoring and research on Flathead Lake will continue for the next 100 years.

To kick off our centennial year, we are hosting a special open house all day on Saturday, July 18. I invite you all to visit our facilities at Yellow Bay, meet our faculty and students and find out firsthand what is going on at the world's best Biological Station. See you July 18!!

I would like to hear from you. Visit me at the Station or contact me at 406-982-3301. My email address is stanford@selway.umt.edu. Check out the Station's web page at http://www.umt.edu/biology/flbs.

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