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Critics, Cornell debate lake source cooling's role in chlorophyll increase

By Krisy Gashler
Staff Writer

Cornell's long-awaited report on the impact of lake source cooling shows that chlorophyll levels, which indicate algae growth, have increased dramatically in the area south of its discharge but haven't changed at all north of its discharge.

Overall, chlorophyll has increased throughout Cayuga Lake since lake source cooling came online, but whether lake source cooling is to blame for any of that increase is still being debated.

Among six lake-site comparisons, one — site 7 versus site 4 — found a statistically significant 23 percent increase in chlorophyll-a since lake source cooling came online in 2000.

The comparison is problematic, argues Nelson Hairston, associate dean of the College of Arts and Sciences, because it was the only comparison out of 28 total that found a statistically significant increase. Scientists expect that pure chance will result in a statistically significant change in every 1 in 20 comparisons, he said.

Critics of lake source cooling, led by activist and business owner Walter Hang, say the finding shows that lake source cooling is impacting the shallowest and most impaired part of the lake, which sits north of Stewart Park.

“There's no disputing that lake source cooling adds more phosphorus to a part of the lake that already has too much,” he said.

Lake source cooling works by pulling frigid water from the bottom of Cayuga Lake, pumping it into a heat exchanger where it cools other water that is sent by pipes to campus for use in air conditioning. The lake water is returned to the shallow southern end of Cayuga Lake.

Phosphorus, in the form of dead aquatic life and vegetation, naturally sinks to the bottom of the lake. When Cornell pulls water out of the bottom of the lake, 250 feet deep, it pulls this phosphorus with it. The water is returned to the shallow southern edge of the lake, about 10 feet deep.

Phosphorus, especially soluble reactive phosphorus, when exposed to sunlight can be taken up by algae and other un-rooted weeds and create algal blooms.

In order for Cornell to receive permission to use Cayuga Lake to air condition its campus, the state Department of Environmental Conservation required the university to monitor the lake and complete a Before-After-Control-Impact report to see whether factors like phosphorus and chlorophyll were being impacted by lake source cooling.

Cornell submitted its original BACI study in 2004, reporting no impact from lake source cooling. Three years later, in August 2007, DEC responded to that report and asked Cornell to revise it and include the controversial comparison of sites 7 and 4.

Site 7 is south of, and closest to, the lake source cooling discharge, which is near the eastern edge of the lake. Site 4 is approximately the same distance from the shore on the western side.

Cornell and its consultants strenuously opposed the addition, arguing that the 7 and 4 comparison shouldn't be included because it increased the chance of a false positive — or finding an effect when in fact there isn't one.

The DEC insisted the comparison be included, arguing that it was more important to not take the chance of missing a real effect.

In the BACI report, Cornell's consultants, the Upstate Freshwater Institute, provide raw data — which show the 7 and 4 impact — and two different statistical methods for countering the possibility of false positives. Under both of those scenarios, the 7 and 4 effect disappears.

To counter the problem of multiple comparisons and false positives, Cornell created an alternative analysis, which groups all eight sites into three groups — near (1 and 7), middle (3, 4 and 5), and far (6, 8 and the lake source cooling intake at the bottom of the lake).

“I think the most important thing for us here is that both the analysis done for the DEC as well as this new analysis that was done, neither one shows a statistically significant change from before and after lake source cooling,” said James Adams, director of Cornell's utilities department.

DEC Spokeswoman Lori O'Connell said the DEC has received Cornell's report but can't yet comment on any of the report's conclusions.

“As this is a very complex report, the Department expects to have its review completed in four to six weeks and will share our findings with Cornell and the public then,” O'Connell said by e-mail.

In the southeast corner of the lake, just north of Stewart Park, chlorophyll has increased 49 percent since lake source cooling came online, according to the report.

At the control site on the western side of the lake, chlorophyll also increased 31 percent, the report found.

Chlorophyll throughout Cayuga Lake has gone up in the past few years, and no one really knows why, said Cliff Kraft, associate professor of Natural Resources at Cornell.

One theory is that the lake ecosystem is recovering from the steep drop in chlorophyll during the 1990s when zebra mussels ate out a lot of vegetation, he said. Another is that chlorophyll levels cycle naturally.

But there is no evidence that the increase is related to lake source cooling, Kraft said.

Todd Cowen, associate professor of Civil & Environmental Engineering at Cornell, agreed.

“As far as I'm concerned, looking at the dataset, there's nothing statistically significant in the dataset,” he said.

Cowen argued that much of the public concern around lake source cooling is based on misunderstanding of the lake and its biology.

For example, soluble reactive phosphorus, the form of phosphorus that most worries lake source cooling critics, can be taken up by algae and other floating plants but is unusable by rooted weeds, he said.

The southern portion of Cayuga Lake was listed on the Environmental Protection Agency's impaired water bodies list in the late 1990s because of excessive phosphorus and turbidity, or silt.

Lake source cooling is one of several phosphorus contributors in the southern shelf. Six Mile Creek, Cayuga Inlet and two wastewater treatment plants also contribute to the lake. Overall, lake source cooling contributes approximately 10 percent of the lake's phosphorus load, according to Cornell's yearly lake source cooling reports.

However, in the summertime when tributary runoff is low and air conditioning needs are high, lake source cooling contributes more than 50 percent of inflowing water to the southern shelf, according to the BACI report.

In a June 2008 letter to Cornell, DEC environmental engineer James Burke wrote that this EPA listing, along with public complaints about the southeast section of the lake, mean “the agency has an obligation to require additional analysis of this portion of the lake.”
