Research: No easy answers to Clear Lake's mercury issues

Contributed by Elizabeth Larson
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LAKEPORT – On Tuesday the Board of Supervisors received an update on years of scientific research that is offering a new understanding of the impact of mercury on Clear Lake and its complex food web.

Dr. Tom Suchanek of the University of California, Davis, presented the findings – compiled over the last two decades – of a group of UC Davis researchers who have looked closely at mercury cycling and bioaccumulation in Clear Lake.

The studies, which were published in the journal Ecological Applications, have undergone significant peer review by other scientists, said Suchanek.

Clear Lake is significant in a number of ways, said Suchanek, noting that a lot of positive things in and around the lake are happening.

He said the group of researchers did a complete ecosystem study, which was funded by several sources, including the federal Environmental Protection Agency Superfund, UC Davis and the US Geological Survey.

To put Clear Lake's mercury issues in perspective, Suchanek reported that there are 300 abandoned mercury mines and prospects in California's Coastal Range alone. Mercury was used in gold and silver mining.

The main mine impacting the lake in the Sulphur Bank mercury mine, first mined for sulfur but changed over to mercury mining in 1873, he said. Mercury mining continued there until 1957.

Suchanek said the Sulphur Bank mine is responsible for 100 metric tons of mercury in Clear Lake's ecosystem.

The mine's tailings and waste rock piles contributed, as did the open pit mining that began on the site in 1927.

Suchanek said the year 1927 is important in understanding how mercury got into the lake in a specific way – through the introduction of open pit mining.

He said the Herman Pit, a large pond on the mine site, has a pH value of 3, compared to the lake's pH value of 8.

Researchers are most concerned about the interface between the lake and the pit, which are separated by a small area of land. Suchanek said the Herman Pit's acidic water leaches through the ground to enter the lake. It's that method of entry that scientists believe is responsible for the “significant inputs” of mercury into Clear Lake.

In 1992, an emergency remediation was done on a steep slope of pilings near the lake, Suchanek said. The work was meant to prevent erosion and sediments from reaching the lake.

The inorganic mercury that enters the lake from the mine isn't very toxic, and is less of a concern than methylmercury, a highly toxic organic material that results when bacteria acts on the mercury, said Suchanek.

Methylmercury is ingested by various levels of the food chain, eventually reaching eagles and osprey. Suchanek said it also moves up the planktonic pathway.

He said researchers did a “mass balance” of mercury in an effort to estimate how much is coming from the atmosphere and how much is going from the lake and evaporating up into the atmosphere. They also did a simplified food web for Clear Lake.

The only amount of mercury they couldn't measure was that which is coming from the mercury mine into the lake. However, they were able to estimate that the mine is responsible for between 320 and 330 kilograms per year, even after the 1992 remediation.

The predominant northwest winds that blow along the axis of the lake – Suchanek said 80 percent of the winds in the area come from the northwest – cause mercury to revolatilize, or pass into vapor.

He said mercury mining was in its heyday between the 1920s and 1940s. Wooden storage tanks were used, and the mercury – derived primarily from cinnabar – was cooked down to quicksilver.

The inorganic variety of mercury is relatively insoluble, and Suchanek. Researchers don't fully understand how bacteria converts it to methylmercury.

Though the mine is a factor in introducing mercury into the lake, Suchanek said the inorganic variety of mercury is found in very low concentrations throughout the lake. It's very soluble and goes easily into organisms, where it bioaccumulates easily and becomes the very toxic methylmercury, the kind of mercury that's of most concern.

Before the advent of open pit mining, there was no evidence of an increase of mercury in the lake, said Suchanek. However, after open pit mining was introduced, the presence of mercury began to increase.

As far as dealing with the mercury in the lake, Suchanek said the scientists were against the dredging option. “We believe that would be a real mistake. We shouldn't dredge the lake.”

Suchanek said 95 percent of the methylmercury in fish is found in the muscle tissue that people eat. Once it's in the body, mercury doesn't leave, he said. “The older the fish, the more mercury it's going to have.”

The Oaks arm of the the lake has a higher concentration of mercury in bass than other areas, Suchanek noted. Government health guidelines warn against eating fish with more than 0.3 parts per million of mercury.

One of the most significant organisms in the lake that controls the movement of mercury is the threadfin shad, said Suchanek. The small, invasive fish – which every few years dies off in massive numbers – has a “disproportionate influence” on Clear Lake's mercury.

Suchanek said researchers noted dramatic fluctuations in mercury in young bass that correlated with the rise of threadfin shad numbers.

In 1985, the threadfin shad appeared and the mercury in bass rose, Suchanek said. Then, in 1990, the threadfin shad disappeared, and the mercury bioaccumulation in bass dropped. The threadfin shad reappeared again in 2000.

Scientists believe the reason for the fluctuations is that threadfin shad outcompete bass for plankton, which forces bass

to have to dive down deeper into the lake and eat from a part of the food chain with higher mercury concentrations.

However, one year – 1995 – showed an anomaly, with bass juvenile largemouth bass showing high mercury concentrations despite the threadfin shad not being present.

Suchanek said they believed the anomaly was due to 1995 being an El Nino year. That year, there was flooding, with the Herman Pit overflowing in January and March.

The lake's grebes show a general trend of having less mercury bioaccumulation, but those levels rose along with mercury concentrations in juvenile bass. Concentrations declined dramatically in 1998 but were up again in a 2003 sampling.

“This increase in mercury is reverberating through the whole system,” up through the highest parts in the food chain, he said.

Suchanek told the board that county, state and federal regulations are standing in the way of finding an optimal solution to the lake's mercury issues. “Somebody needs to think outside the box here.”

Supervisor Jeff Smith said he wants to see the Herman Pit addressed. “I'd love to see something done because it affects everyone in Lake County.”

Supervisor Anthony Farrington said methylmercury in the lake is lower than some other water bodies. The entire issue impacts tourism and economic development.

“There has been a debate about whether to dredge the lake for various reasons,” he said, raising concerns about the mercury-laden soils.

Suchanek said if the lake were dredged it would move around sediments and mercury, which will reintroduce more mercury into the system.

Farrington asked about the affect of restoring wetlands, particularly as part of the Middle Creek Restoration Project.

“That's a question that's been asked many times,” said Suchanek.

He said no study has been completed of Middle Creek with relation to mercury and methylmercury. However, he said wetlands produce higher levels of methylmercury than other areas, based on studies of the Bay Delta.

“It will stimulate and promote the production of methylmercury,” he said.

But how much it will produce will have to be measured to be specific. Wetlands tend to be stagnant and produce low concentrations of oxygen, said Suchanek.

However, at the same time, they will remove some of the nutrients loading the lake by restoring the wetlands, he said.

Clear Lake, added Suchanek, has mercury levels in fish comparable to about 14 other lakes with mercury advisories.

During public comment, Dr. John Zebelean said there is a remedy to solve the mercury mine problem, but it requires money.

“It's not simple but it's not complicated at all,” he said.

Zebelean, a proponent of dredging Clear Lake, said new technology will not disturb the sediments, and will capture between 95 and 97 percent of the mercury.

He said five to 10 years from now Clear Lake's water won't be allowed into the Bay Delta or the Bay Area because of the high mercury levels, which will contaminate the ocean an violate international law.

Suchanek said there may be newer dredging technologies, but they don't solve the problem that arises from a deeper lake, which produces more methylmercury.

Zebelean was prepared to offer more comments, but Board Chair Denise Rushing suggested he and Suchanek speak after the meeting.

Supervisor Jeff Smith said the board should ask the federal Environmental Protection Agency to come and update the board after a May meeting on the mercury issues.

The reports Suchanek discussed can be found at www.esajournals.org/toc/ecap/18/sp8.

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