

Is Meromixis Over? Stratification Since 1995 Expected to Break Down Soon

by Greg Reis

We knew something was up when Education Director Bartshé Miller returned from a September canoe tour.

“The lake is really green” he said, “you can’t see the yellow end of a paddle in the water, and there are hardly any brine shrimp!”

I immediately contacted Bob Jellison, a UCSB researcher. Jellison said that he hadn’t seen such a bloom the week before, but he was going to be out sampling on the lake the next day and would let us know what he found.

Why is everyone excited over an algae bloom? Well, Mono Lake has been in a state of meromixis since 1995. Meromixis occurs when a large inflow of fresh water stratifies the lake into a fresher upper layer and a denser, saltier lower layer. Due to the strong density gradient, the lake doesn’t mix in the winter like it usually does, causing nutrients that fall into the lower layer to be trapped there. Prior to 1995, this condition was last observed in the lake from 1982–1988. When the lake turned over in the fall of 1988, algae bloomed and the basin smelled like ammonium. In the Winter 1989 *Newsletter*, Jellison wrote:

“The abrupt mixing of previously isolated bottom water has created interesting conditions. Ammonium, which had accumulated deep in the lake, has been mixed upward leading to much higher than usual surface concentrations of this nutrient. Oxygen concentrations were reduced to near zero throughout the lake, as a combination of chemical and biological processes consumed the available oxygen. The brine shrimp populations abruptly declined and algae have increased to above-normal concentrations for this time of year.”

Since meromixis returned in 1995, Jellison has produced a model of meromixis in Mono Lake that he has been constantly improving. In 2000 only 1/3 of the lake area and 15% of the lake volume was below the chemocline (the boundary between the upper and lower layer), and primary productivity was back at 1994 levels. 25% of the freshening of the lower layer is believed to be due to freshwater spring inputs from the bottom of the lake. In June 2001 the model showed Mono Lake was likely to be meromictic for less than 10 years.

This year, what Jellison found in the lake made him think that it would turn over, if not this fall, then certainly next year. Only 10% of the lake volume is

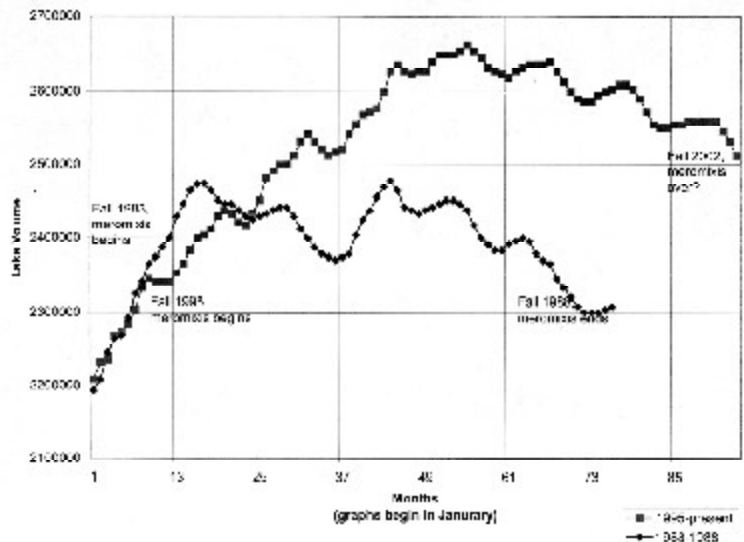


Chart: Episodes of Meromixis in Mono Lake Compared.

below the chemocline. The Secchi depths, a measure of transparency and algal abundance, were unusually low for September, and only this low in September one other year: 1988, the last time meromixis ended.

What causes meromixis to break down and the lake to turn over is evaporative concentration of the upper layer. When that layer gets close enough in salinity to the lower layer, then the two layers can mix. In early November, a storm that dropped nine inches of water in the form of snow at Gem Pass and four inches of water in the form of rain in Lee Vining caused Mono Lake to rise about 0.2 feet. This reduced the evaporative concentration of the upper layer, possibly delaying the end of meromixis until next year.

“Even if it does not completely mix this year,” Jellison says, “we can expect next year to have very high levels of primary productivity as nutrient concentrations increase throughout the water column due to the entrainment of nutrient-rich monimolimnetic water.”

This is exciting for several reasons. The main reason, of course, is that Mono Lake will return to its normal mixing regime—monomixis (mixing once a year). Another reason is that Mono Lake is about four feet higher now than it was the last time it was monomictic. The last time it was this high, and monomictic, was in 1974—two years before the comprehensive 1976 ecological study of the lake’s ecosystem. The lake will have never been studied as intensively as now during monomixis and at this low salinity. This is exciting because it offers ample opportunities to learn new things about the lake’s ecosystem. ❖

Greg is the Committee’s Information Specialist. He has celebrated 13 solstices with adventures around the Mono Basin.

6417'

Prediversion lake level, 1941

6392'

Future lake level (average)

6382'

Current lake level

6372'

Historic low, 1982