



## What About This Great Salt Lake?

### IV. Lake Scents: Things science knows your nose might not

THAT UNPLEASANT ODOR that periodically visits us from Great Salt Lake can be attributed to hydrogen sulfide, also referred to as “rotten egg gas.” Specialized species of bacteria living in lakebed sediments respire anaerobically—without oxygen. They acquire the minimal amounts of oxygen they need from various compounds in the mud, notably those containing sulfur. From this respiration, sulfate is reduced to hydrogen sulfide. This gas then finds its way into the air, particularly when wind-driven waves mix sediment and water layers. Under certain circumstances, storms bring this smell to communities quite far from the lake.

AS IF TO OFFSET THIS OFFENSE, these same anaerobic bacteria also break down surplus nitrates and in the process return nitrogen gas to our atmosphere, which is itself approximately 78% nitrogen. This provides all earthly life an essential ecological service by helping to close the loop for the global nitrogen cycle—a cycle that begins when other players in the bacterial world transform atmospheric nitrogen into nitrogenous compounds required by plants as nature’s “fertilizer.”

THAT'S NOT REALLY THE LAKE WE SMELL. Boaters and researchers who spend a great deal of time out on the lake report the most notable scent to be that of salt, reminiscent of a pleasant sea breeze. Offensive odors tend to be confined to shallow bays or mudflats where the aforementioned chemical transformations are taking place.

FARMINGTON BAY IS THE BIG OFFENDER, thanks in large part to human influences. Water flowing into this bay, located close to human settlement in southeastern Great Salt Lake, has become laden with excessive nutrients from agriculture, industry and sewage treatment. These nutrients promote an extraordinary and often explosive growth of algae. Algae at Great Salt Lake is beneficial to the lake’s aquatic and avian life, but too much algae is not. As the ever-abundant algae in Farmington Bay dies and drifts down onto the submerged lakebed, ongoing decomposition creates the anoxic conditions ideal for those bacteria that produce hydrogen sulfide. To make matters worse, Farmington Bay has become virtually separated from the main body of the lake by the causeway built to Antelope Island. This causeway, combined with a gravel roadbed at the south end of Farmington Bay conspire with periods of

low lake levels to prevent most of the bay’s nutrient-rich water from mixing with the main body of the lake.

THE ODOR IS NOT NEW to this or other lake systems. Parts of Great Salt Lake have probably been producing olfactory evidence of its biotic processes since before Lake Bonneville evaporated away nearly 15,000 years ago. Historically, some of the first reports of smells attributed to Great Salt Lake were made by early explorers, John C. Fremont and Howard Stansbury. Upon approaching the lake through Bear River Bay in 1843, Fremont wrote: “Getting overboard, [we] commenced dragging the boat—making

by this operation a very curious trail and a very disagreeable smell in stirring up the mud as we sank above the knee at every step.” Out on the main body of the lake seven years later, Stansbury recorded: “A belt of soft, black mud, more than knee-deep lay between the water and the hard, rocky beach, and

seems to be impregnated with all the villainous smells which nature’s laboratory was capable of producing.” Burgeoning human population near the lake has quite likely resulted in even greater smells than were noted by Fremont and Stansbury, particularly in Farmington Bay.

WHY GREAT SALT LAKE has shown itself to be such a champion odor producer, as compared with other lakes, is explained by several factors. First is the lake’s high sulfate concentration, which affords a correspondingly generous bacterial production of hydrogen sulfide. Sulfates and many other salts and minerals are able to accumulate here because Great Salt Lake is a “terminal lake,” with no outlet. Second, our lake is a shallow one, with more places for wind and currents to stir mud and gases into the air. Third, our lake fluctuates in elevation from spring to fall and from year to year, causing different portions of the lakebed to become exposed to wind and waves. In addition, a shallow lake warms significantly during summer, which promotes bacterial incubation and proliferation. Many of these conditions exist in lakes and wetlands all over the world, but generally not to the extent of Great Salt Lake. In many lakes the production of hydrogen sulfide in the sediment layers may only become apparent during the spring when upper and lower water layers mix.

Now, if only we could help Great Salt Lake generate as much attention to its globally important living assets as it has to its chemical achievements...