The Paradox of a Great Salt Lake

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Public perception of the Great Salt Lake has fluctuated since European Americans permanently settled the region in the mid-1800s, but an impression of confounded expectations has generally prevailed. When the Mormon pioneers descended from the Wasatch Mountains, they expected to find the shores of the Pacific Ocean, yet after circumnavigating the lake found no outlet to the sea. What was hoped to be a rich resource appeared instead to be "dead." However, the surrounding wetlands, which supported large populations of Native Americans, also sustained the settlers. Tourism peaked in the 1920s with the popular SaltAir, a shoreline dancehall and boardwalk built by the Mormon church and serviced by train from Salt Lake City. Since then, interest has waned and few Utahns regularly visit. Yet most are aware of the lake, if only because of the "lake stink" carried on predominantly northwesterly winds. Currently, research and education concerning the lake's significant economic and ecological resources are altering public perception and driving a renewed awareness of this inland sea. This shift is analogous to the natural biogeochemical fluxes occurring in the system.

Management of the lake varies with both physical changes in the lake and changing societal needs. Recent management efforts culminated in the release in 2000 of the final draft of the Great Salt Lake Comprehensive Management Plan, sponsored by divisions within the Utah Department of Natural Resources, including the Utah Division of Forestry, Fire and State Lands, which has primary responsibility for the lake's management. The plan is intended to guide coordinated natural resources management and address established policies guided by multiple use and sustained yield principles. In considering the long-term protection and conservation of this resource, as well as the many stakeholders, the policies fall under the general categories of lake level fluctuation, water quality, ecology, industry, and recreation and access.

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Lake Level Fluctuation

The most apparent evidence of physical change at Great Salt Lake is the lake level, which fluctuates with climate and precipitation, the majority of which falls as snow. Dams, diversions, and other human influences have exacerbated drought or flood conditions by influencing the amount of water that enters the lake. Historic records indicate the surface elevation of Great Salt Lake has varied as much as 21 feet, with a maximum elevation of 4,211.6 feet in 1986 and a minimum of 4,191 feet in 1964 (see chart next page).

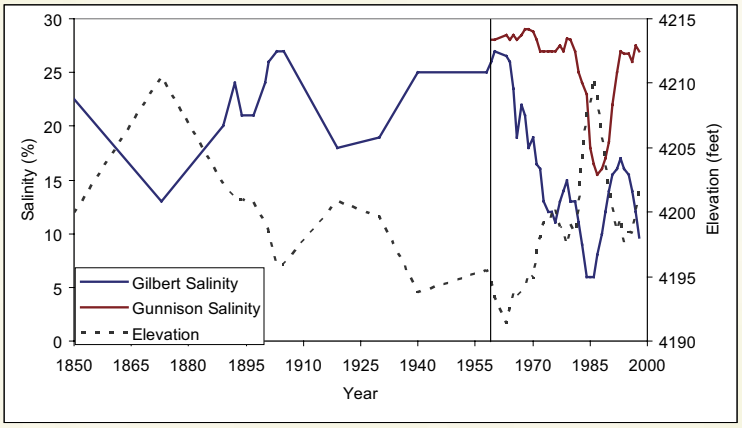
The shallow depth of this system (32 feet maximum at an elevation of 4,202 feet) means that relatively small changes in surface elevation result in large changes in surface area. Relevant to lake level is the issue of sovereign lands, which begin at the historic meander line. Disagreement continues over the exact location of the line, while competing interests challenge the classification and subsequent use of these lands. Another issue concerns rising lake levels, which occasionally destroy crops, inundate rangeland, and damage infrastructure within the floodplain. In 1986, the state installed pumps to check floodwaters threatening commercial, public, and private properties. Political and economic factors will likely determine the level at which these pumps operate in the future.

Water Quality

Recent changes in the lake's chemistry are largely anthropogenic. Salinity levels are affected by the construction of dikes and causeways that divide the lake into four distinct water bodies. The two of greatest area are Gilbert Bay, which covers most

of the southern part of the lake, and Gunnison Bay, the northern portion. The two bays are separated by a railroad causeway. Gilbert Bay currently has a 16 percent salinity, but this has ranged from six to 17 percent over the past 25 years with variations in lake level elevation (see chart). In contrast, Gunnison Bay, with minimal fresh water sources entering it, has salinity concentrations near saturation, at 28 percent. Although breaches in the causeway have been made, it nevertheless restricts mixing between the northern and southern parts of the lake.

In addition to salinity, general water quality is also an issue in Great Salt Lake. Some conservation interests are calling for quantitative water quality standards for the lake, much like California has implemented in Mono Lake. As outlined by the Clean Water Act, such standards would theoretically be more effective in protecting the chemical, biological, and physical integrity of the lake than the existing narrative standards. However, until the lack of quantitative standards interferes with the use of sovereign land or results in irreversible ecosystem impacts, the Division of Water Quality opposes their development (Utah, 2000).



Salinity and lake elevation in Gilbert and Gunnison bays over time.

Ecology

Lake levels and salinity influence a variety of ecosystem processes in Great Salt Lake and the surrounding wetlands. The lake has a relatively simple food web, but surrounding wetlands make the system ecologically complex. For example, changes in salinity can affect algal growth; algae, in turn, are a major component of the food web and essential for populations of brine shrimp (*Artemia franciscana Kellogg*) and brine fly (*Ephydra spp.*). Actively managed and monitored since 1994, these organisms are a major food source for migratory bird populations of international significance.

Industry

Several industries rely on Great Salt Lake for their livelihood, and the 2000 management plan encourages promotion of industries that aid the state's economy. Among these are the shrimp cyst industry, which contributes about $80 million annually to Utah's economy, according to H.H. Lee, a doctoral candidate at the University of Utah. Mineral extraction is also important: in 1995, six companies mined sodium chloride, magnesium chloride, potassium chloride, and magnesium metal, among other minerals, from the heavy brine (Utah Geological Survey, 1997), often by channeling this dense, mineral-laden water from Gunnison Bay to evaporation ponds. To the dismay of industry, other stakeholders periodically consider breaching the Gunnison Bay causeway to reduce salinity concentrations, but the potential for success of this project is uncertain. Recently, a new industry entered the region: a permit has been granted to construct a landfill on the northern shores for solid waste disposal.

Recreation and Access

Near the landfill site lies the breeding ground of one of the four largest colonies of American white pelicans in North America. Wildlife represents a significant recreational resource on the lake for hunters and a growing number of birders in the region. Consequently, many of the public lands surrounding the Great Salt Lake are managed by state and federal agencies to conserve avian populations. Management efforts must walk a fine line between encouraging Utahns to experience the lake and restricting access to recreational activities that may disrupt seasonal breeding and nesting.

The Great Salt Lake is unique among terminal lakes because it is adjacent to a major metropolitan center. Growing population pressures will necessitate ongoing sociological, political, economic, and ecological discussions. Nearly two million people, representing 80 percent of the state's population, live in the 11 Utah counties within the Great Salt Lake Basin (U.S. Census Bureau, 2003). While "great" in size, the unfortunate paradox of the lake is that few recognize it as a remarkable and significant resource. An awareness and understanding of the lake by Utahns will be the foundation for future sustainable management of this inland sea.

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