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## Paleo-biology and paleo-hydrology of the Bear Lake Basin, Utah

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## PALEO-BIOLOGY

Many ancient clam and snail shells have been found around the shoreline of Bear Lake. Local residents have at times gathered the shells as a source of calcium for their chickens. These shells are well preserved and have been dated to be 10,000 years old (Smart, 1963). Curators at the Smithsonian Institute identified all 6 species of snail and one species of clam. Carbon dating performed by Columbia University estimated shells gathered from the Ideal Beach area of Bear Lake to be 12,000 years old. During this era (Pleistocene) waters around the west were at much higher levels. Bear Lake was estimated to be 33 feet above current high water marks (Smart, 1963). Increased lake elevation flooded much of the north end of the Bear Lake valley and lowered the water hardness creating extensive warm, productive shallow areas ideal for mollusk growth. A dry period (~ 4,000–5,000 years ago) reduced the water level of Bear Lake. Increases in water hardness and lowered productivity caused the extirpation of these large mollusks.

The California floater has historically been found in the Bear Lake area. It is considered a species of concern due to reductions in population and range. No live specimens have been found in the area for many years. Another mussel that historically was found in small streams in the Bear Lake area is the western pearlshell. It is also a species of concern, and it is unclear if it still exists in the area (Utah Division of Parks and Recreation, 2005).

The shells of a freshwater mussel *Anodonta oregonensis* can be found in erosional zones of the margin of the lake. Recent sightings of live specimens have been reported anecdotally, but no recent official documentation of the mussel has been accomplished. *A. oregonensis* was likely extirpated. Currently there are 2 mollusks in the lake, a small pisid clam and an unidentified *valvata* snail, both are found in low density in the upper half of the lake's benthos (Kennedy, 2005).

## PALEO-HYDROLOGY

Bear Lake has many advantages for recording the history of climate change in the western United States. The deep lake provides nearly 250,000 years of continuous sedimentary sequence. Bear Lake has experienced large fluctuations in elevation over time. Laabs and Kaufman (2003) suggest that during the Pleistocene era, 15,000-10,000 years ago, the lake elevation was estimated to be at 6000 feet above sea level, a full 76 feet above current high levels. Further evidence uncover that the surrounding wetlands transgressed at least 3 times to 5,960 feet, 5,950 feet and 5,935 feet (Laabs, 2003).

The transition from clay-rich sediment to aragonitic mud records the change from a lake dominated by inflow of the Bear River during the Pleistocene to a groundwater-fed lake during the Holocene. Root structures in sediments require very shallow water or subaerial exposure. Carbon dates indicate that they formed before 7,000 BP. These dates are similar to periods of severe drought in other Great Basin Lakes (Smoot, 2002).

Bear Lake has been disconnected from Bear River inflow for at least 8,000 years. During isolation the only water sources entering the lake are from springs, local runoff, and precipitation. Holocene era (10,000 years ago to present) was a time of large fluctuations in water cycles in the intermountain west. Drought cycles and disconnection from Bear River waters lead to low Bear Lake water levels that would have averaged 45 feet lower than historic averages. Similar hydrological regimes during this era have been documented from other regions of the west by using tree ring analysis (Rosenbaum, 2004).

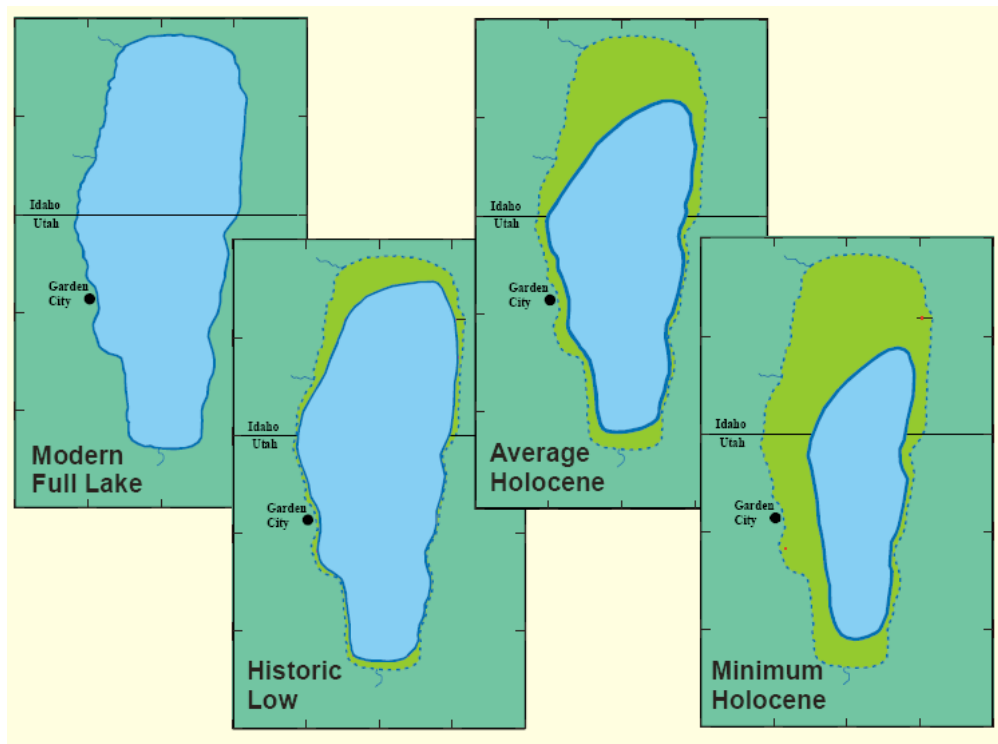


Figure 13. Estimates of Bear Lake Fullness During the Last 10,000 years (Holocene era). From sediment coring analysis of the United States Geological Survey ([http://www.bearlakewatch.com/Bear\\_Lake\\_EcoSym/rosenbaum.pdf](http://www.bearlakewatch.com/Bear_Lake_EcoSym/rosenbaum.pdf)).

Estimates of Bear Lake water levels during the last 30,000 years indicate that the Bear River has flown intermittently into Bear Lake. Dominant sediments in cores indicated that Bear River water flowed into Bear Lake from 30,000-17,000; from 14,000-11,000; and from 9,000-8,000 year ago (Rosenbaum, 2004).

Using a network of high-resolution seismic reflection profiles, a sonar mosaic and bathymetric map was created to access sublacustrine spring discharge and fault scarps on the lake floor. Numerous springs and vents occur along the southern part of the east and west shoreline at depth of 30-50 feet have been revealed and diagramed. (Denny, 2002).