

67 Protecting public health at Lake Powell

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Only few years ago, Lake Powell, the centerpiece of Glen Canyon National Recreation Area, was beginning to have the reputation as a dirty lake. A number of beaches had been closed due to bacterial contamination. Exhaustive efforts were undertaken by the National Park Service (NPS) in cooperation with the states of Arizona and Utah to improve the water quality and protect public health at Lake Powell.

Improving the water quality of Lake Powell is a large task if only because of the lake's size. The mainstem is nearly 200 miles long. Covering 163,000 acres, the lake is composed primarily of flooded canyons. All of the sinewy passages create a shoreline that is 2,000 miles long, roughly equal to the entire West Coast of the contiguous USA. Scattered along that shoreline are an unknown and variable number of beaches that are used for extended camping trips by nearly 3 million people every year.

In 1995, twelve beaches were closed due to violation of state bacterial standards. The bacteria are an indicator of fecal contamination, which presents the possibility of disease transmission during water-based recreation. To avert future public health hazards, Utah, Arizona, and NPS entered into an agreement and strategic plan to protect the water quality at Lake Powell.

The plan included a wide range of strategies to affect visitor behavior and develop scientific understanding. Intense recreational pressure on the lake was presumed to be a large source of the problem. Educational efforts, rule changes, and facility improvements gave visitors the awareness and means to act responsibly. To assure that the best science was used to deal with the issue and that public health was adequately protected, the Lake Powell technical advisory committee (TAC) was created. The TAC expanded beach monitoring on the lake, established health standards and protocols for sample collection and processing, and identified areas where additional research was needed.

The plan called for outreach. Clear public notification protocols were established for when beach closures occur. Public meetings were held to scope out interested parties and public opinion. A contact list of enforcement, education, and public health agencies was developed, providing a bank of expertise from which the TAC was drawn.

The current laws were evaluated and changes were made to the superintendent's compendium requiring all lake-campers to have toilet facilities on their boat or carry a porta-potty. All marine sanitation devices (MSDs) must be emptied only at approved dump stations and be incapable of overboard discharge. Law enforcement agencies active on the lake, including Arizona and Utah State police, the U.S. Coast Guard, and NPS, were coordinated.

Education figures prominently in the plan. An education program was begun to raise visitor awareness of the procedures and importance of proper human waste disposal. Visitor education encompasses numerous signs and displays at all marinas, visitor centers, and remote access points. Rangers make contacts on the launch ramps and patrol large areas, contacting campers to educate them about the regulations and check for compliance. Visitors tend to want to do the right thing when armed with a little information; nobody wants to swim in contaminated water or tarnish the pure waters of beautiful Lake Powell.

Many facility improvements were outlined in the strategic plan. All marina pump-outs were expanded. The wastewater treatment facilities were evaluated for adequacy. Floating pump-out docks were deployed in remote locations. Additional shore-based toilets and dump stations were installed. Porta-potty cleaning stations were incorporated into all dumping facilities. Entrance stations were built as part of the Fee Demo program to provide a means for the dissemination of information and the collection of fees to fund many of these efforts.

Consensus was built with the concessionaire, who shared an interest in preserving Lake Powell. Porta-potties were stocked in marina stores. All rental boats were brought into compliance, and all new and refurbished rental boats are configured to contain even graywater. Marina boat slip rentals require that the boat be inspected for MSD compliance.

The Lake Powell TAC is composed of over 20 experts in the fields of public health, microbiology, and environmental quality. Members represent interested agencies and organizations including the Arizona and Utah Departments of Environmental Quality, Navajo Nation Environmental Protection Agency, U.S. Environmental Protection Agency (EPA), Northern Arizona University, Utah State University, University of Utah, Utah Department of Health, Southeast and Southwest Utah Public Health Departments, NPS Intermountain Region, NPS Water Resources Division, and Glen Canyon National Recreation Area. Arizona, Utah, and NPS agreed that decisions made by the TAC would be acceptable to all parties.

The strategic plan called for the seeking of a “no discharge” designation for Lake Powell from EPA. The joint application from the states of Utah and Arizona was coordinated through the TAC. The TAC was an excellent avenue for creating the application because both states are represented. EPA required proof of adequate wastewater treatment facilities and convenient dump stations. The facility improvements outlined in the strategic plan and implemented in subsequent years easily met EPA’s requirements, and the “no discharge” designation was granted in the summer of 2000.

A beach monitoring program on Lake Powell began in 1988, and made it possible to identify the public health hazard. Under the guidance of the TAC, the Lake Powell beach monitoring program has blossomed into a model program with national recognition. Certified through the Utah Department of Health, the park operates two laboratories to cover the vast distances on the lake without exceeding sample holding time. Laboratory certification ensures confidence in lab results and legal defensibility to support regulatory action.

About 30 routine sites are monitored at least every other week. The first routine sample list was developed from personal knowledge of heavily used areas of the lake. The TAC established protocols by which beaches can be added and dropped from the list. Any routine beach that has not had a high bacterial count in three consecutive years can be dropped. Some beaches meet this criterion, but remain on the list due to high visitor use. Any beach that experiences a closure is added to the list. All ranger boats are equipped with sampling kits, which including sterile sample bottles, gloves, data sheets, and instructions for sampling non-routine beaches and other areas any time a problem is suspected.

Routine sampling is also augmented with randomized sampling. A customized geographic information system (GIS) project allows beaches to be randomly selected for sampling. The lake has been divided into 13 zones from which random beaches can be selected differentially, allowing the sampling effort in each zone to reflect the zone's needs and logistical constraints. Through random sampling, the beach monitoring is truly lakewide, even remote areas are monitored, and the potential to identify new problem areas is increased.

While protecting public health is the purpose of the beach monitoring program, beach closures must be taken very seriously and only be enacted when they are scientifically warranted. Beach closures unduly influence the general perception of water quality in the lake and cause economic repercussions in the local communities. It was important that the TAC clearly define a beach closure protocol that is protective of public health and responsible within the scientific context of the testing being done.

To maximize the number of areas tested, most beaches are sampled by taking a single sample. The TAC established sampling protocols and standards. Samples are collected from 4 inches beneath the surface adjacent to the selected beach where the water is 4 feet deep. This standardization focuses sampling on the most likely source of exposure during beach-related water recreation. Because Lake Powell crosses the border between Utah and Arizona, which have separate bacterial concentration standards, the TAC established standards to be used throughout the lake. Two sample-processing methods and indicator organisms are used to incorporate the best science into a political compromise between the states.

When a problem is detected, the area is re-sampled. Re-sampling continues daily until the problem is over. During re-sampling, multiple samples are taken along the beach to better estimate the true concentration of bacteria present in the strip in water defined by the sampling protocol. Because both sample-processing methods require 24 hours to complete, the re-sampling step is very important. By the time the first sample results are known, the condition at the beach may have changed. Re-sampling identifies the persistent contamination events that warrant reaction, and the sample replication provides confidence to support the presumption of predictability inherent in the use of a 24-hour test to determine closures.

After a beach is closed, at least five days' worth of samples must be collected for the beach to re-open. When the most recent sample as well as the most recent 2-, 3-, 4-, and 5-sample geometric means are all within the established limits, a beach can re-open. Such a conservative beach re-opening protocol ensures that the problem is over before a closure is lifted.

The TAC has also identified additional research needs and participated in studies related to the problem. Correlations between visitor-use statistics and bacterial counts were explored. Comparisons between the concentrations of the two indicator organisms have been done. The spatial variability of bacterial counts along beaches was examined. A microbial source-tracking study identified the various sources of contamination, including humans, cattle, and wildlife. A long-term study has been started to monitor the amount of human waste left on the beaches.

The exhaustive efforts of the strategic plan seem to have been a great success. Today, beach closures are very rare: there was one in 1999 and none in 2000. Even more telling than the frequency of beach closure is the total number of high bacterial counts detected. In the first year after adoption of the strategic plan, the number of high bacterial counts detected at beaches dropped from 95 to 31 (Figure 67.1). The number of high counts has continued to drop, with only a single instance during the 2000 season.

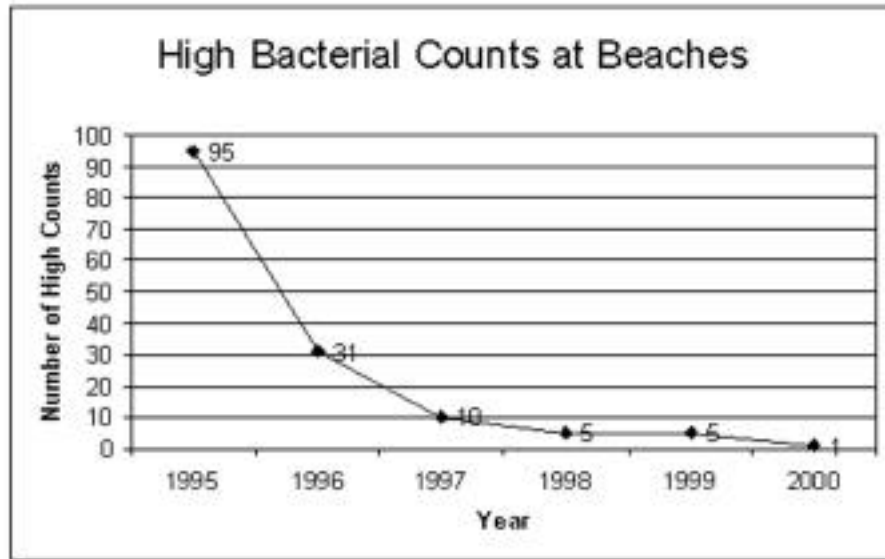


Figure 67.1. High bacterial counts at Glen Canyon National Recreation Area beaches, 1995-2000.