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BACTERIOLOGICAL WATER QUALITY OF BEAVER RESERVOIR, ARKANSAS

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ABSTRACT

Beaver Reservoir water quality was determined through enumeration of Total coliforms and Fecal coliforms bacterial parameters at selected locations during 1991. Several areas of the reservoir contained high numbers of indicator bacteria, suggesting excessive fecal contamination. Significant numbers of salmonella-like bacteria were also cultured on SS agar, and several strains were serotyped positive for *Salmonella* antigens.

INTRODUCTION

Beaver Reservoir is a Corps of Engineers impoundment of approximately 12,000 hectares on the White River in northwestern Arkansas. During the past two decades, this area of the state has experienced dramatic growth in both human population and industry. Demands on the reservoir for recreation, as a water supply and for waste disposal have increased proportionally. Therefore, water quality must be a concern for all who depend upon the reservoir for a source of clean, natural water.

This paper resulted from a contractual study carried out during April-December, 1991, and the data suggest the reservoir is receiving a significant load of organic waste. This raises the question of how long the reservoir can continue to serve its multiple uses under such stress.

METHODS AND MATERIALS

Samples were collected as surface grab samples in sterile Whirl-pak bags biweekly from April through October, and once during December, 1991. The locations of sampling stations are presented in Table 1. Bacterial analyses included Total coliforms (TC) on mEndo and Fecal coliforms (FC) on mFC media (Difco) according to standard methods of membrane filtration (APHA, 1990).

Table 1. Sampling stations on Beaver Reservoir

Station No.	Location
1	West of Rolloff Mt. over old river channel
3	Southwest of Larue over old river channel
4	At city water supply intake over old river channel
6	Prairie Creek west of Ventris
7	White River above city wastewater treatment plant
8	White River below city wastewater treatment plant
9	Town Branch below industrial park
10	Richland Creek
11	War Eagle Creek
12	Prairie Creek

Enumeration of salmonella-like bacteria was on SS medium (Difco) by membrane filtration. One or more typical colonies were isolated from each enumeration plate for further characterization. Serotypes were determined with Salmonella O poly A-I and Vi and Salmonella H poly a-z antisera (Difco). Two strains of *Salmonella enteritidis* (ATCC 13076 and Carolina Biological Supply Co.) were used as positive controls.

RESULTS AND DISCUSSION

The main stem of the reservoir which appeared to be relatively free of contamination (Stations 1,3,4,6; Table 2). Comparison of stations 7 and 8 suggest the Fayetteville wastewater treatment facility approximately doubled the load of fecal contamination carried into the upper riverine

Table 2. Mean number of coliforms at each station

Station No.	No. Samples	Numbers of coliform bacteria* (cfu/100 ml)	
		Total coliforms	Fecal coliforms
1	14	146/348	13/42
3	16	202/187	8/15
4	17	287/362	8/13
6	17	312/322	5/6
7	12	4289/4700	181/222
8	14	9724/19749	398/808
9	18	34761/77902	2097/3145
10	16	7577/8736	369/577
11	15	6068/7731	231/266
12	17	7548/9632	373/494

* mean/standard deviation

section of the reservoir. The highest numbers of bacteria encountered were from station 9 on Town Branch, which flows from the city industrial park. Stations 7-12 could all be considered major tributaries to the reservoir proper, and all contained significantly higher numbers of bacteria than the reservoir main stem.

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All stations yielded some *Salmonella*-like bacteria (Table 3). The reservoir main stem contained the lowest numbers. The tributaries were

Table 3. Mean number of *Salmonella*-like bacteria at each sampling station.

Station No.	No. of Samples	Mean (cfu/100 ml)
1	2	7
3	3	12
4	3	18
6	3	15
7	3	283
8	3	787
9	4	1260
10	3	2360
11	3	480
12	3	887

significantly higher, particularly Town Branch and Richland Creek. Further characterization of these isolates indicated them to be *Salmonella* spp. which may constitute a threat to public health (Table 4).

Table 4. Characterization of *Salmonella*-like isolates.

Character	Isolates positive/Total tested
SS agar	46/46 Typical colonies
Gram stain	46/46 Gram(-) bacilli
MacConkey agar	31/46 Nonfermenters
TSI agar slant	15/46
Poly O serotypes	15/46
Motility	12/15
Poly H serotypes	10/15

A recent review of water quality data from other studies of the reservoir pointed out excessively high fecal coliform numbers in some areas with an extreme of 14,000 cfu/100 ml at the Richland Creek site (Moore, 1991). Therefore, it is concluded that the reservoir has been receiving a large amount of contamination for several years.

Beaver Reservoir is heavily used for primary contact recreation and as a municipal water source. This study indicated the reservoir is receiving a large burden of fecal contamination from multiple sources. Although the protocols established by the Arkansas State Health Department and Department of Pollution Control and Ecology (DPCE, 1985) regarding sampling frequency were not followed, it seemed likely that some tributaries of the reservoir would exceed the standards for safe primary contact recreational use. The major downstream areas of the reservoir remain relatively free of contamination. However, the condition of the tributaries along with the presence of potentially pathogenic salmonellae suggest that some corrective measures are needed to prevent further deterioration of water quality.

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