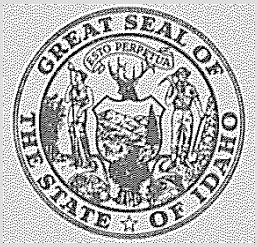
WATER QUALITY STATUS REPORT ● REPORT NO. 56

GOLD FORK RIVER
Valley County, Idaho
1985

Prepared by
Patricia Klahr



Department of Health & Welfare
Division of Environment
Boise, Idaho

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WATER QUALITY ASSESSMENT

GOLD FORK RIVER

VALLEY COUNTY, IDAHO

1985

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IDAHO DEPARTMENT OF HEALTH AND WELFARE

DIVISION OF ENVIRONMENT

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Water Quality Series No. 56

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ABSTRACT

A water quality reconnaissance survey of the Gold Fork River System, Valley County, Idaho was conducted by the Idaho Department of Health and Welfare, Division of Environment during 1985. The Gold Fork River contributed 65.6 pounds/day total phosphorus and 13.1 tons/day suspended sediment to Cascade Reservoir during the May survey. Over ninety percent of the river flow was diverted for irrigation purposes in July. The state standards for temperature, dissolved oxygen and bacteria were violated in July. Bacterial contamination in the headwaters was primarily of animal origin.

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INTRODUCTION

The eutrophication of Cascade Reservoir, located in west central Valley County on the North Fork of the Payette River, has been the focus of numerous water quality studies conducted by state and federal agencies (Clark and Wroten 1975, Environmental Protection Agency (EPA) 1977, Zimmer 1983). These studies cited the Gold Fork River, a major tributary to Cascade Reservoir, as contributing significant amounts of sediment, bacteria and phosphorus to the reservoir. The Idaho Department of Health and Welfare, Division of Environment, has never had a trend station on the Gold Fork River.

Purpose

The purpose of this reconnaissance survey was to assess the magnitude of the water quality problem in the Gold Fork River and determine if the drainage warrants an intensive water quality survey. A second objective was to identify critical areas within the drainage that should be addressed by land management agencies.

Drainage Description

The Gold Fork River drains one hundred, forty-three square miles of forest and agricultural lands northeast of Cascade Reservoir, Valley County, Idaho. It enters the reservoir after flowing under Highway 55, two miles south of Donnelly. The river, from source to mouth, is designated SWB-3242 in the Idaho Water Quality Standards (IDHW 1985). It is protected for cold water biota, salmonid spawning, and primary contact recreation.

The upper portion of the drainage lies within the Boise National Forest, where silviculture and road construction have had impacts. Grazing is the major impact in the lower reaches.

Other significant features of the drainage include a hot spring and an irrigation diversion. The spring is located on the north riverbank approximately one mile downstream from the Boise National Forest boundary.

A dam creates a small reservoir on the river approximately two miles below the confluence of Kennally Creek with the Gold Fork River. The reservoir supplies irrigation water for the Gold Fork Canal, which runs south for more than five miles, paralleling Highway 55.

Monitoring Stations

The nine sample stations in the project area were selected to show where water quality impacts may occur. Three stations were located on the Gold Fork River; the remaining stations were located on major tributaries. The sample stations are listed in Table 1.

The North and South Forks of the Gold Fork River comprise the headwaters of the drainage. A sample station was located in each stream just above the confluence to form the Gold Fork River.

The major tributaries of the Gold Fork River included in the study were: (1) Kennally Creek and its tributary, Rapid Creek, which flows south from the Payette National Forest, and (2) Grouse Creek, which drains lands in the Boise National Forest south of the Gold Fork River.

The three stations on the Gold Fork River were located at its mouth, at the first bridge above the mouth (site of an old USGS gauging station), and at the Boise National Forest boundary.

MATERIALS AND METHODS

In 1985, sampling surveys were conducted on May 16, July 17, and September 24.

Field parameters were determined with the use of portable meters. Dissolved oxygen and temperature were measured with a Yellow Springs Instrument Company Model 54A meter. The pH was determined with an Orion Model 231 digital pH/mV/temperature meter. The meters were calibrated for accuracy at the beginning of each survey and checked for accuracy at the midpoint of the survey.

All chemical samples were collected with a DH-48 suspended sediment sampler. Composite samples were collected into a churn splitter. Two cubitainers (one liter size) were filled from the churn splitter and preserved at 4° C on ice.

Bacterial grab samples were collected into sterile 250ml Nalgene bottles and preserved on ice to 4° C.

Chemical and bacterial analyses were conducted by the State of Idaho, Bureau of Laboratories following Standard Methods (American Public Health Association 1980).

Stream flow was measured with a Marsh-McBirney Model 201 portable water current meter. Depth and width measurements were taken at each station for discharge calculations. Due to probe failure during the September survey, the speed of flow was measured with a floating object. The data were multiplied by a coefficient to account for streambed friction.

Photographs of each sample station were taken with a single lens reflex camera.

RESULTS AND DISCUSSION

Physical Parameters

Table 1 lists pH, temperature, dissolved oxygen and discharge measurements for all nine stations for each sampling period.

Discharge

The discharge on the Gold Fork River fluctuated widely due to seasonal trends and irrigation diversion. Data supplied by the U. S. Geological Survey, Boise, for water years 1960-68 list maximum discharges for the Gold Fork River between 558 cfs and 1,710 cfs with an average of 1,050 cfs. This coincides with flow values found by Clark and Wroten (1975).

At the mouth of the Gold Fork River during the first survey of the season, May 16, the discharge was 609.3 cfs. It was a warm spring with an early runoff. Peak discharge probably occurred prior to this date.

In July, the maximum discharge on the Gold Fork River was 32.1 cfs at Station 4, below the Forest Service boundary. The next station downstream on the Gold Fork, below the irrigation canal diversion, had a discharge of 1.8 cfs. Over 90% of the water in the Gold Fork River was being diverted to the Gold Fork Canal at this time. Stream flow at the mouth of the Gold Fork River was essentially nonexistant in July. Cascade Reservoir had inundated the sample station. The other data support the visual determination that the system had changed from a lotic to a lentic environment at Station 1 in July.

In September the discharge at the mouth returned to 111.4 cfs.

pH

The pH of the Gold Fork River over the entire survey was well within the range (6.5-9) established by the state (IDHW 1985).

Temperature

The temperature of the Gold Fork River at its mouth varied seasonally from a low of 4.5° C in May to a high of 27° C in July. The Gold Fork River is protected for cold water biota. State standards specify the water temperature for cold water biota should not exceed a maximum of 22° C. This was exceeded on at least one occasion, suggesting the Gold Fork River may be of marginal water quality for trout and other cold water biota.

Dissolved Oxygen

The dissolved oxygen in the Gold Fork River fluctuated inversely with temperature. Water quality standards specify the dissolved oxygen should not fall below 6.0 mg/l for cold water biota. Again, this standard was violated at the mouth of the Gold Fork River during July where a reading of 4.8 mg/l was measured. This can be attributed to the high water temperature and lack of stream flow at this station in July.

Bacteria

Fecal coliform bacteria are found in the intestine or feces of warm blooded animals. They are often used as indicators of the sanitary quality of the water. Fecal streptococcal bacteria are also found in the intestine of warm blooded animals. Their presence is considered to verify fecal pollution.

The Gold Fork River is protected by the state for primary contact recreation. The Idaho Water Quality Standards (1985) specify waters designated for primary contact recreation are not to contain fecal coliform bacteria concentrations exceeding 500/100 ml at any time. This was exceeded in the Gold Fork River on July 17, 1985 at Station 2, where a sample containing 1,100/100 ml was obtained. The flow at this station was 1.8 cfs and water temperature was 24° C. This was the only occasion the standard was exceeded.

During May detectable limits of bacteria were obtained only at Station 2 on the Gold Fork River, the same station that exceeded the state standard in July. Total coliform were 109/100 ml.

Station 2 had a fecal coliform/fecal streptococcus (FC/FS) ratio of 7.86 in July. Clausen et al. (1977) found a ratio exceeding 4 is an indication of contamination from human wastes. A fecal coliform count of 1,100/100 ml and a FC/FS ratio of 7.86 indicate a direct input of human wastes into the Gold Fork River in the vicinity of Station 2.

Figure 1 shows the total number of fecal coliform and fecal streptococcus found in the drainage in July. The headwaters contained significantly higher numbers of fecal streptococcus than fecal coliform. The same pattern, but with total lower counts, was repeated in September (Figure 2).

A FC/FS ratio less than 0.7 is indicative of animal wastes (Clausen et al. 1977). In July, the ratio was less than 0.7 at every station except Station 2 on the Gold Fork River. In September, the ratio was less than 0.7 at Stations 6, 7, 8 and 9. This is a strong indication that most of the contamination, especially in the headwaters, is of animal derivation.

Phosphorus

Total phosphorus concentrations for the survey are summarized in Table 3. The only significant peak in the total phosphorus concentration occurred at Station 1 in July, where 0.10 mg/l was found. As mentioned previously in this report, the physical characteristics at this station had changed from a flowing to a nonflowing environment. The water temperature was 27° C and the dissolved oxygen was 4.8 mg/l, both values in violation of state water quality standards. This peak can probably be attributed to the significant change in the physical environment.

The National Eutrophication Report on Cascade Reservoir (EPA 1977) cited the Gold Fork River as contributing 10,140 kg (22,308 pounds) phosphorus to Cascade Reservoir in an average year.

Clark and Wroten (1975) found during their period of study the Gold Fork River contributed an average of 20 kg/day (44 pounds/day) of phosphorus to the reservoir.

Phosphorus loading to Cascade Reservoir can be estimated for two of the three sampling dates:

Date	Flow (cfs)	Total P (mg/l)	Total P (lbs/day)
May 16	609.3	0.02	65.6
September 24	111.4	0.01	12.0

The average of the May and September loadings is 38.8 pounds/day.

During July there was no flow at the mouth of the Gold Fork River. The phosphorus loading could be estimated from Station 2, which had a flow of 1.8 cfs and 0.04 mg/l total phosphorus for a loading of 0.39 pounds/day. The average phosphorus loading for all three surveys yields a value of 26 pounds/day.

The small data base does not allow accurate estimates of the average yearly phosphorus loading by the Gold Fork River to Cascade Reservoir.

Suspended Sediment

Suspended sediment is composed of chemical and biochemical precipitates and decomposed organic matter that is maintained in suspension above the streambed. Large quantities of sediment in water systems can change the structure and productivity of aquatic communities and obliterate fish spawning beds.

Suspended sediment loadings by the Gold Fork River to Cascade Reservoir have not been previously determined. Visible evidence of the Gold Fork River's sediment contribution to the reservoir is readily available at the mouth of the river. A deposit of sand approximately 3 feet deep and 75 feet long had accumulated on the north riverbank by the September survey (Figure 3).

During "spring runoff" in May the Gold Fork River contributed 13.1 tons/day of suspended sediment to Cascade Reservoir (Figure 4). As discussed earlier, this may be a conservative estimate based on the

assumption peak discharge occurred prior to this date.

By mid-summer the suspended sediment loadings to the reservoir had dropped to 7.76 pounds/day, based on Station 2 (Figure 5). Of all the surveyed tributaries, the North and South Forks of the Gold Fork River had the highest suspended sediment loadings in July. The North and South Forks were contributing 197 and 187.6 pounds/day of suspended sediment, respectively, to the Gold Fork. Kennally Creek had nondetectable levels of suspended sediment at its mouth even though it carried a load of 313 pounds/day in its headwaters.

By September there was no detectable suspended sediment in any sample station on the Gold Fork River, even though discharge had risen.

SUMMARY AND RECOMMENDATIONS

The Gold Fork River contributed 65.6 pounds/day total phosphorus and 13.1 tons/day suspended sediment to Cascade Reservoir during the May sampling survey. These values probably do not represent peak loadings as the discharge on that sampling date was below average peak discharges reported by the U. S. Geological Survey.

Kennally Creek was the largest tributary surveyed. At its mouth in May, it had a discharge of 268 cfs and was contributing 43.3 pounds/day phosphorus and 7.94 tons/day suspended sediment to the Gold Fork River.

The Idaho Water Quality Standards for temperature and dissolved oxygen were violated at the mouth of the Gold Fork in July, indicating this river is marginally suitable for cold water biota.

The fecal coliform/fecal streptococcal ratio was less than 0.7 at all stations but one in July, and at the four headwaters stations in September. This is a strong indication of bacterial contamination from animals, especially in the headwaters of the Gold Fork River.

The state bacterial standard for primary contact recreation was violated in the Gold Fork River in July.

There are no permitted point source discharges in the watershed. Phosphorus loadings, suspended sediment loadings, and violations of state water quality standards must be attributed to nonpoint sources and natural sources. The small data base does not provide enough information to associate land use practices with water quality impacts. However, this survey does provide sufficient data to suggest the contribution of phosphorus by the Gold Fork River is not significantly different than the previously established ranges(EPA 1977, Clark and Wroten 1975, Zimmer 1983). Most of the variance between these studies can be attributed to differences in runoff.

A comparison of phosphorus loadings reported for the Gold Fork with loadings reported for other major tributaries of Cascade Reservoir(North Fork Payette River, Boulder Creek, Lake Fork Creek) indicates the Gold

Fork's contribution is of similar magnitude. Therefore, it is recommended that an intensive water quality survey of the Gold Fork River not be initiated. Instead, further studies on the impacts to Cascade Reservoir should be approached in a comprehensive basin-wide strategy.

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TABLE 1. Identification and location of monitoring sites.

Station No.	Station	Location
1	Gold Fork at Highway 55 bridge	Sec. 26, T.16N., R.3E.
2	Gold Fork at first bridge above mouth	Sec. 29, T.16N., R.4E.
3	Kennally Creek at mouth	Sec. 33, T.16N., R.4E.
4	Gold Fork at USFS boundary	Sec. 1, T.15N., R.4E.
5	Grouse Creek at mouth	Sec. 1, T.15N., R.4E
6	South Fork Gold Fork at mouth	Sec. 31, T.16N., R.5E.
7	North Fork Gold Fork at mouth	Sec. 31, T.16N., R.5E.
8	Kennally Creek above Powelson Creek	Sec. 25, T.17N., R.4E.
9	Rapid Creek at Paddy Flat Campground	Sec. 27, T.17N., R.4E.

TABLE 2. Physical parameters for the Gold Fork River System survey conducted in 1985.

DATES / PARAMETERS	STATIONS 1	2	3	4	5	6	7	8	9
May 16, 1985									
DO (mg/l)	10.5	12.4	10.9	10.8	10.5	12.2	12.1	12.2	12.0
Temp. (°C)	4.5	4.0	4.5	5.0	5.6	4.8	5.0	4.0	4.5
pH	6.5	6.8	7.3	7.3	7.3	7.0	7.0	6.4	6.8
Flow (cfs)	609.3	479.8	268.0	160.0	16.35	47.1	105.0	140.0	75.0
July 17, 1985									
DO (mg/l)	4.8	8.0	7.0	7.4	7.7	6.9	6.8	8.5	8.8
Temp. (°C)	27.0	21.0	24.0	16.0	13.0	13.0	13.0	10.5	11.0
pH	6.9	7.4	7.4	7.5	7.5	7.4	7.3	7.3	7.5
Flow (cfs)	0.0[1]	1.8	37.2	32.1	1.7	6.0	22.9	24.2	9.4
September 24, 1985									
DO (mg/l)	9.5	10.6	9.2	9.7	10.5	10.5	9.8	9.8	9.6
Temp. (°C)	11.0	7.0	9.2	5.8	5.0	4.5	5.0	5.0	4.0
pH	7.7	7.5	7.7	7.6	7.8	7.7	7.9	8.0	7.8
Flow (cfs)	111.4	110.0[2]	54.2	37.0	4.2	11.2	33.8	45.5	29.2

[1] Cascade Reservoir had inundated the Gold Fork River; flow was essentially zero.
[2] Determined from USGS gauge located 200 yards upstream of station.

TABLE 3. Summary of laboratory analyses for the Gold Fork River System survey conducted in 1985. All values are mg/l except for turbidity, which is NTU.

DATES / PARAMETERS	STATIONS 1	2	3	4	5	6	7	8	9
May 16, 1985									
Total P	0.02	0.01	0.03	0.02	0.01	0.01	0.01	0.01	0.02
Suspended Sediment	8.0	5.0	11.0	5.0	4.8	2.0	3.6	8.8	5.4
Turbidity	0.6	0.7	1.1	0.6	0.8	0.5	0.5	0.3	0.3
NH_3	0.110	0.082	0.475	0.047	0.137	0.101	0.046	0.039	0.042
$NO_2 + NO_3$	0.084	0.051	0.288	0.033	0.059	0.093	0.026	0.051	0.165
July 17, 1985									
Total P	0.10	0.04	0.03	0.02	0.03	0.04	0.03	0.02	0.02
Suspended Sediment	8.2	0.8	<0.2	0.2	0.4	5.8	1.6	2.4	3.4
Turbidity	3.5	0.8	0.8	0.6	0.8	0.9	0.5	0.5	1.0
NH_3	0.028	0.014	0.014	0.014	0.018	0.024	0.019	0.016	0.038
$NO_2 + NO_3$	0.007	0.007	0.014	0.006	0.019	0.015	0.014	0.008	0.087
September 24, 1985									
Total P	0.02	0.01	0.02	0.02	0.02	0.03	0.02	0.02	0.01
Suspended Sediment	<2.0	<2.0	<2.0	<2.0	<2.0	4.0	2.0	4.0	2.0
Turbidity	0.9	0.8	0.8	0.8	0.6	1.3	0.5	1.0	1.2
NH_3	0.019	0.111	0.086	0.040	0.061	0.022	0.013	0.035	0.019
$NO_2 + NO_3$	0.012	0.017	0.020	0.009	0.006	0.006	0.009	0.014	0.034

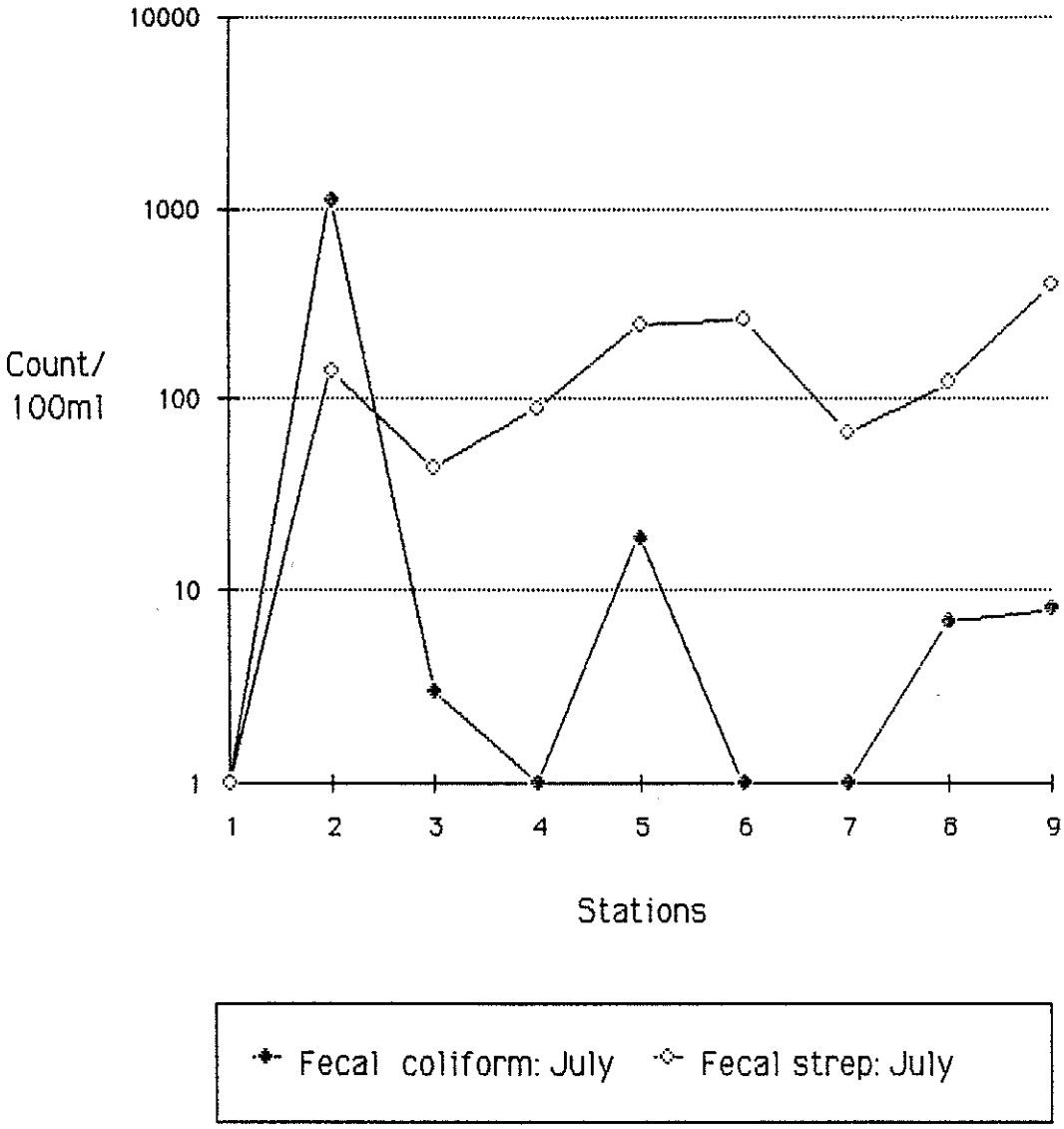

Figure 1. Fecal coliform and fecal streptococcus bacteria in the Gold Fork River, July, 1985

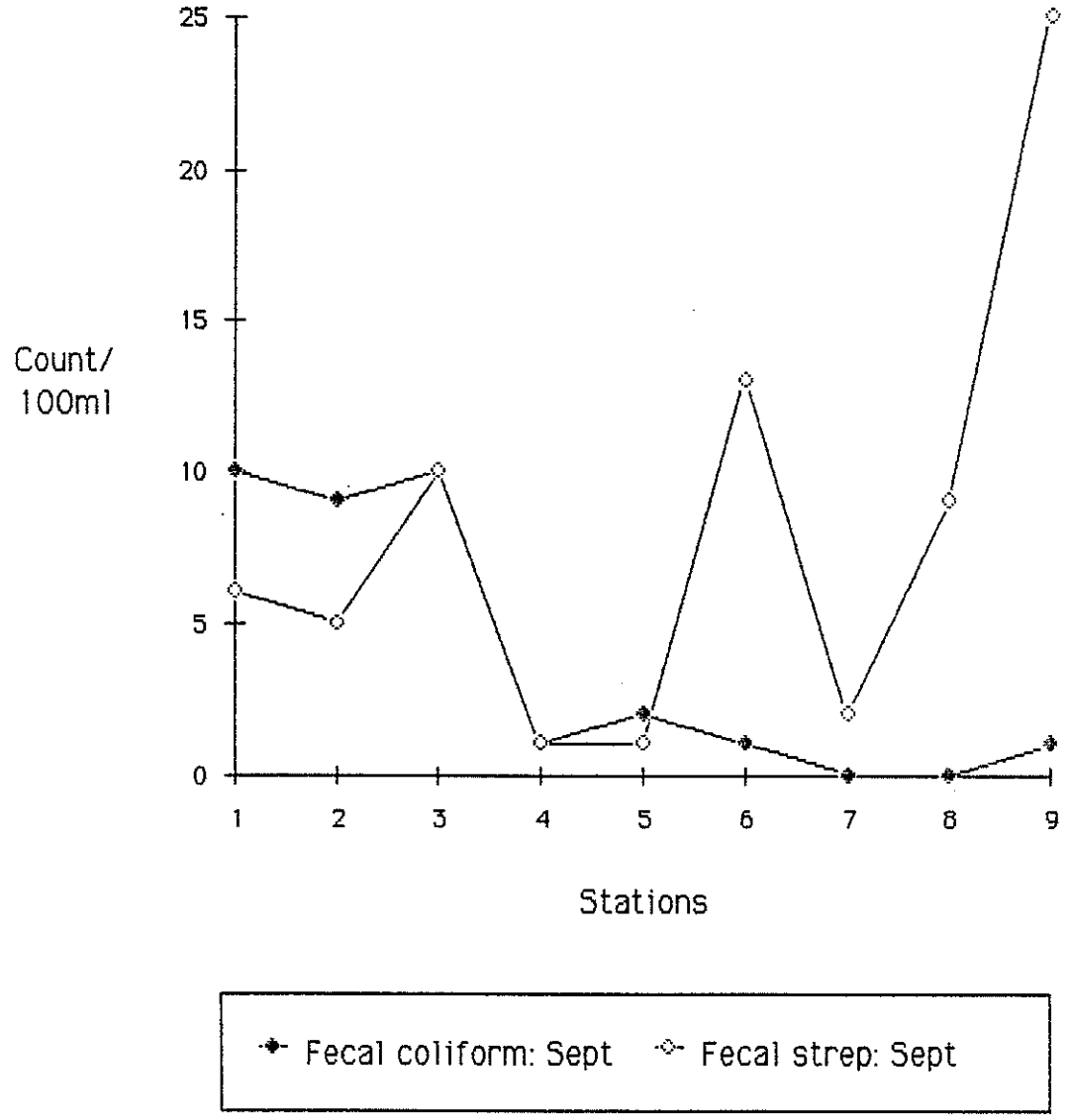

Figure 2. Fecal coliform and fecal streptococcus bacteria in the Gold Fork River, September, 1985

Figure 3. Gold Fork River at Highway 55 bridge, September 24, 1985. Large sand deposits formed a sandbar on the north riverbank.

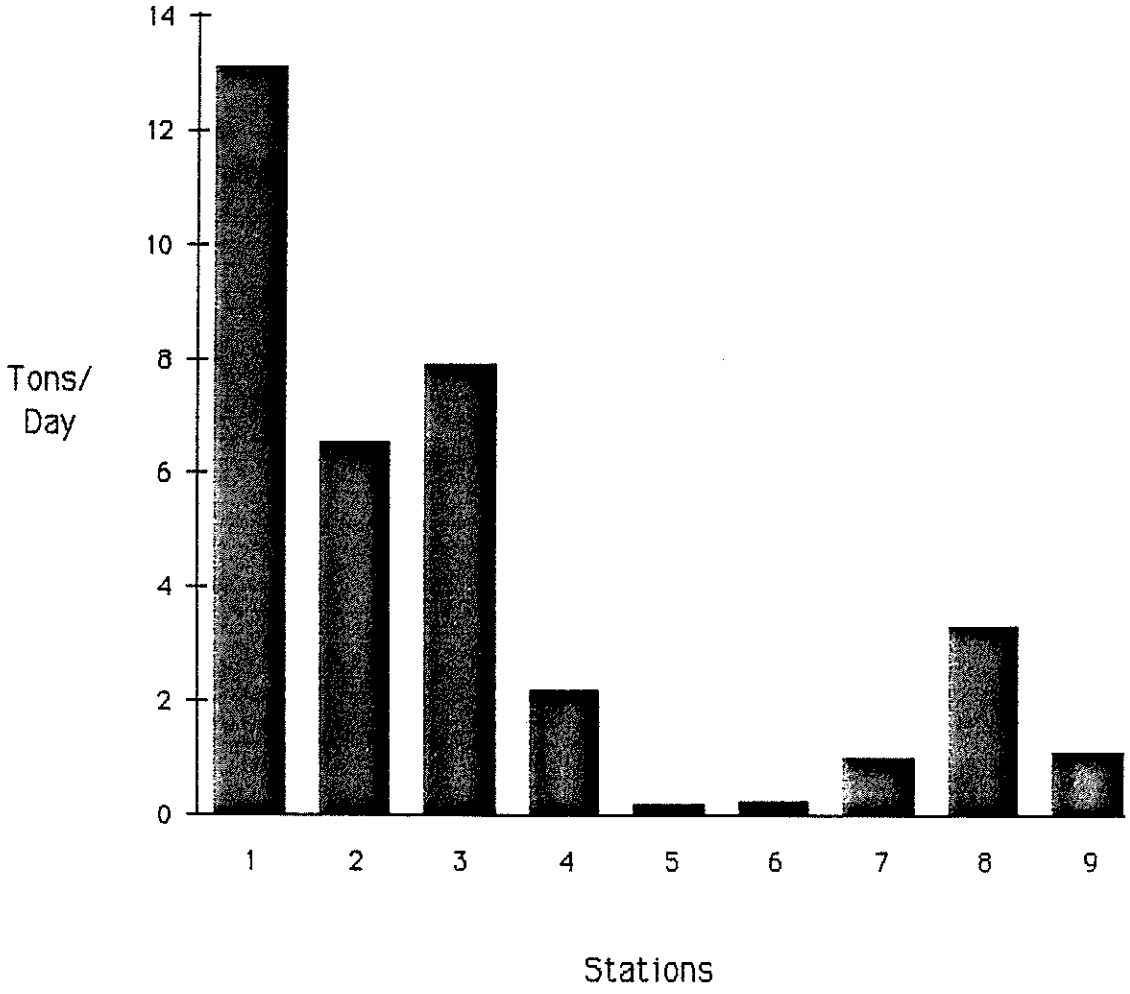

Figure 4. Suspended sediment loadings for the Gold Fork River, May, 1985.

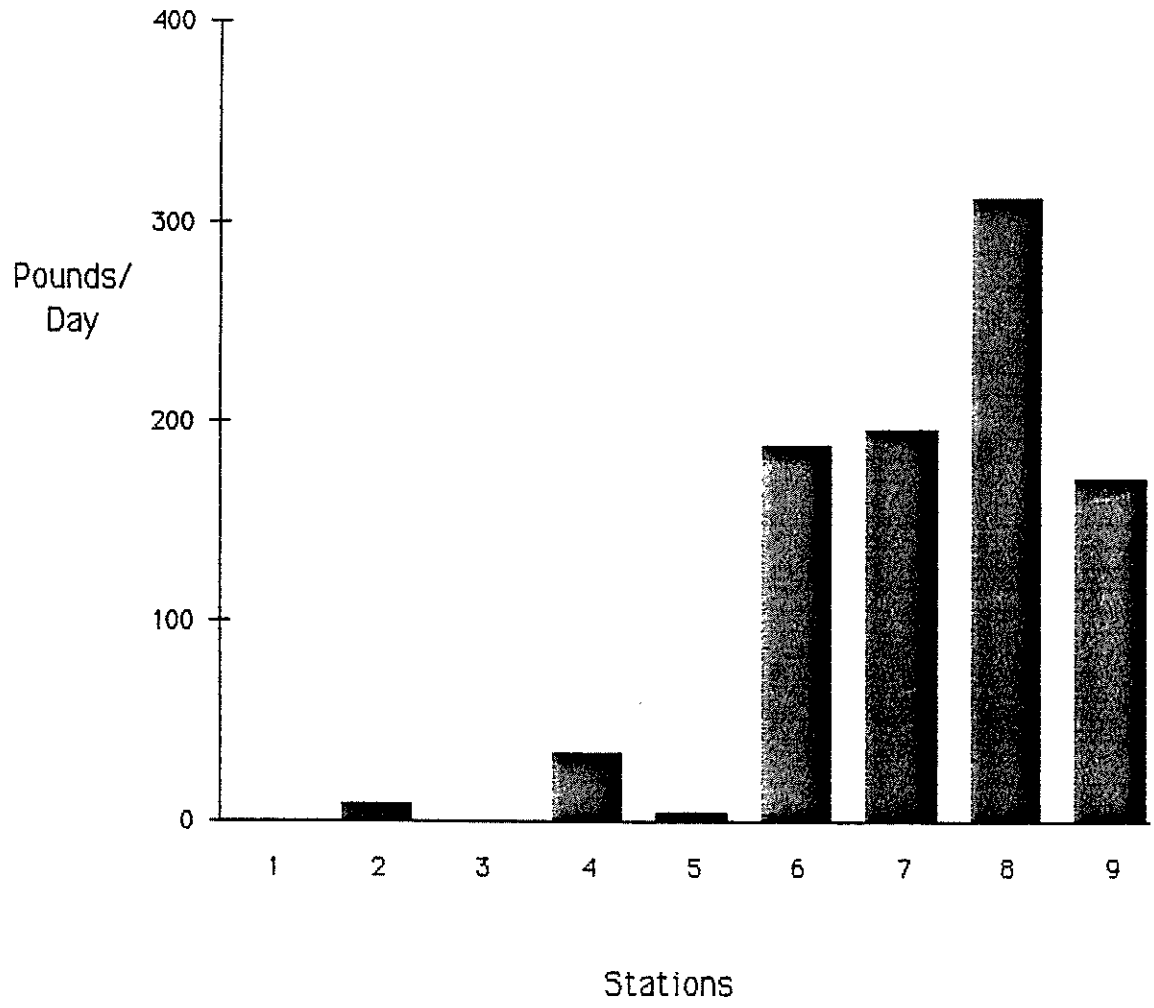

Figure 5. Suspended sediment loadings for the Gold Fork Rive July, 1985.