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PREPARED IN COOPERATION WITH THE IDAHO DIVISION OF ENVIRONMENTAL QUALITY

Changes to Idaho's Statewide Surface-Water Quality Monitoring Program Since 1995

BACKGROUND

In 1990, the U.S. Geological Survey (USGS), in cooperation with the Idaho Division of Environmental Quality (formerly Idaho Department of Health and Welfare, Division of Environmental Quality), implemented a statewide water-quality monitoring program in response to Idaho's antidegradation policy as required by the Clean Water Act (CWA). The objective was to provide water-quality managers with a coordinated statewide program to detect trends in surface-water quality.

The program design included chemical analyses of water samples collected at 56 sites on the Bear, Clearwater, Kootenai, Pend Oreille, Salmon, Snake, and Spokane Rivers and their tributaries (fig. 1). Samples were collected every year (1990 through 1995) at 5 sites (annual sites), every other year at 19 sites (biennial sites), and every third year at 32 sites (triennial sites). Each year, 25 of the 56 sites were sampled. During water years 1990–95 (October 1, 1989, to September 30, 1995), samples were collected bimonthly. Onsite analyses consisted of discharge, specific conductance, pH, temperature, dissolved oxygen, bacteria (fecal coliform and fecal streptococci), and alkalinity. Laboratory analyses consisted of major ions, nutrients, trace elements, turbidity, and suspended sediment.

Analytical results from the five annual sites sampled during water years 1990–93 are presented in a report by O'Dell and Berenbrock (1994).

CHANGES TO THE PROGRAM

In 1996, biological analyses were added to the monitoring program to more effectively assess the status and trends of stream quality in Idaho. So that biological analyses could be added without increasing program costs, analyses of trace elements in water were dropped and analyses of major ions and alkalinity were

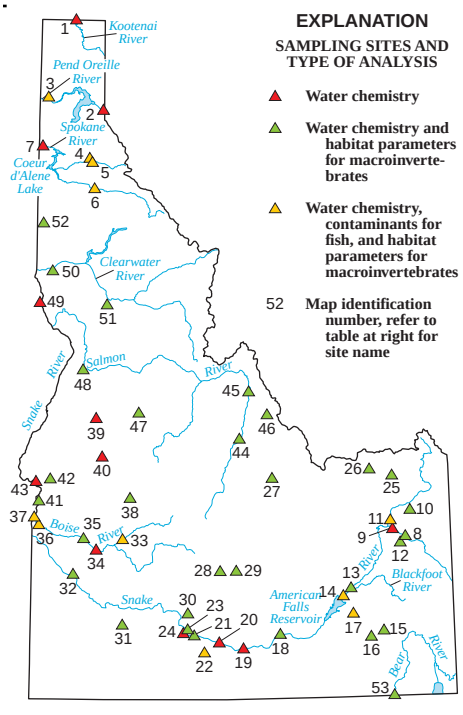


Figure 1. Locations of sampling sites comprising the Idaho statewide surface-water quality monitoring program.

Table 1. Sampling sites that compose the Idaho statewide surface-water quality monitoring program

Site No.	Site name	Site No.	Site name
1	Kootenai River at Porthill	26	Beaver Creek at Spencer
2	Clark Fork River below Cabinet Gorge Dam, near Cabinet	27	Big Lost River near Chilly
		28	Big Wood River near Bellevue
3	Priest River near Priest River	29	Silver Creek near Picabo
4	North Fork Coeur d'Alene River at Enaville	30	Malad River near Gooding
		31	Bruneau River near Hot Springs
5	South Fork Coeur d'Alene River near Pinehurst	32	Snake River near Murphy
		33	Boise River near Twin Springs
6	St. Joe River at Calder	34	Boise River below Diversion Dam
7	Spokane River near Post Falls	35	Boise River at Glenwood Bridge
8	Snake River near Heise	36	Boise River near Parma
9	Snake River at Lorenzo	37	Snake River at Nyssa
10	Teton River near St. Anthony	38	South Fork Payette River at Lowman
11	Henrys Fork near Rexburg	39	North Fork Payette River at McCall
12	Willow Creek near Ririe	40	North Fork Payette River at Cascade
13	Blackfoot River near Blackfoot	41	Payette River near Payette
14	Snake River near Blackfoot	42	Weiser River near Weiser
15	Portneuf River at Topaz	43	Snake River at Weiser
16	Marsh Creek near McCammon	44	Pahsimeroi River at Ellis
17	Portneuf River at Pocatello	45	Salmon River at Salmon
18	Snake River near Minidoka	46	Lemhi River near Lemhi
19	Snake River at Milner	47	Johnson Creek at Yellow Pine
20	Snake River near Kimberly	48	Little Salmon River at Riggins
21	Blue Lakes Spring	49	Snake River near Anatone, WA
22	Rock Creek at Daydream Ranch	50	Lapwai Creek near Lapwai
23	Box Canyon Springs	51	South Fork Clearwater River at Stites
24	Salmon Falls Creek near Hagerman	52	Palouse River near Potlatch
25	Camas Creek at Red Road	53	Bear River at Idaho-Utah State line

reduced to one set of samples collected during base-flow conditions in September. Discharge, specific conductance, pH, temperature, turbidity, dissolved oxygen, bacteria, nutrients, and suspended sediment continue to be analyzed. Temperature is recorded continuously during summer months (June to September) at sites where samples are collected for biological analyses.

The resulting water-quality monitoring program consisted of 53 sites (fig. 1). Forty of these sites were designated as biological sampling sites. Because of limited funding, sites at which biological data were collected were divided among three regions—southeastern, southwestern, and northern. These sites are sampled once over a 3-year rotation in each of the three regions. The first rotation of sampling in the southeastern and southwestern regions was completed during 1996–97. Sampling in the northern region is scheduled for summer/fall 1998.

The frequency of water-chemistry sample collection was changed from bimonthly during October to September, to monthly during April through September, when recreational uses are the most intensive. Biological sampling was targeted for summer/fall low-flow conditions, when coldwater biota (a primary beneficial use) are most limited as a result of reduced streamflow, which causes thermal stress and habitat loss.

WHY THE CHANGES?

The original water-quality monitoring program, consisting of conventional water-chemistry analyses, was not adequate for beneficial-use assessment. More quantitative measurements of biotic integrity were needed to assess the status of designated beneficial uses. Because aquatic biological communities integrate stream-chemistry and habitat changes resulting from human activities in a river basin, measuring the biotic integrity of these communities will provide an effective approach for evaluating trends in surface-water quality. Collection of aquatic biological data also will provide a better understanding of the structure and composition of biological communities in large rivers (such as the Snake River) in Idaho, information that currently is lacking.

Ultimately, this improved surface-water quality monitoring program will better meet the goals of the CWA by providing more information for addressing water-resource management issues such as the Total Maximum Daily Load process. This process involves the State of Idaho developing pollution control strategies for water-quality limited water bodies. Data collected during the surface-water quality monitoring program will be used to prioritize water bodies for treatment and to evaluate the effectiveness of this pollution abatement process.

BIOLOGICAL DATA COLLECTION

Data collected at biological sampling sites consisted of macroinvertebrates, fish, and associated stream-habitat parameters. Biological data were collected following protocols designed for the National Water-Quality Assessment (NAWQA) Program (Crawford and Luoma, 1993; Cuffney and others, 1993a, 1993b; Meador and others, 1993a, 1993b; Plafkin and others, 1989). Application of NAWQA protocols provides nationally consistent and standardized methods for collecting and analyzing biological data, which ensures comparability of existing and future data.

Fish were collected from all habitats in a representative riffle reach. Whole-body fish-tissue and fish-liver composite samples were analyzed for 26 organic compounds and 22 inorganic compounds, respectively. In addition, the number of fish species were counted, and the fish were measured and examined for external anomalies (for example, deformities, lesions, tumors, and parasites). A macroinvertebrate and fish community assessment for each site was completed using various community attributes, pollution tolerances, and temperature preferences.

Biologists assess fish communities using electrofishing techniques on the Portneuf River, Idaho. Some fish are sent to laboratories where their tissue is analyzed for the presence of pollutants (photograph by T. R. Maret)

Sampling for benthic invertebrates in the Big Lost River, Idaho (photograph by T. R. Maret)

RESULTS TO DATE FOR SELECTED SITES

Temperature

According to Idaho Water Quality Standards and Wastewater Treatment Standards (Idaho Department of Health and Welfare, 1985), temperature of water designated for coldwater biota beneficial use must be "22 degrees Celsius [°C] or less with a maximum daily average of no greater than 19 degrees C." During 1996–97, the daily average temperature of 19°C was exceeded at sites on Marsh Creek (site 16) and the Blackfoot, Portneuf, and Boise Rivers (sites 15, 17, and 36, respec-

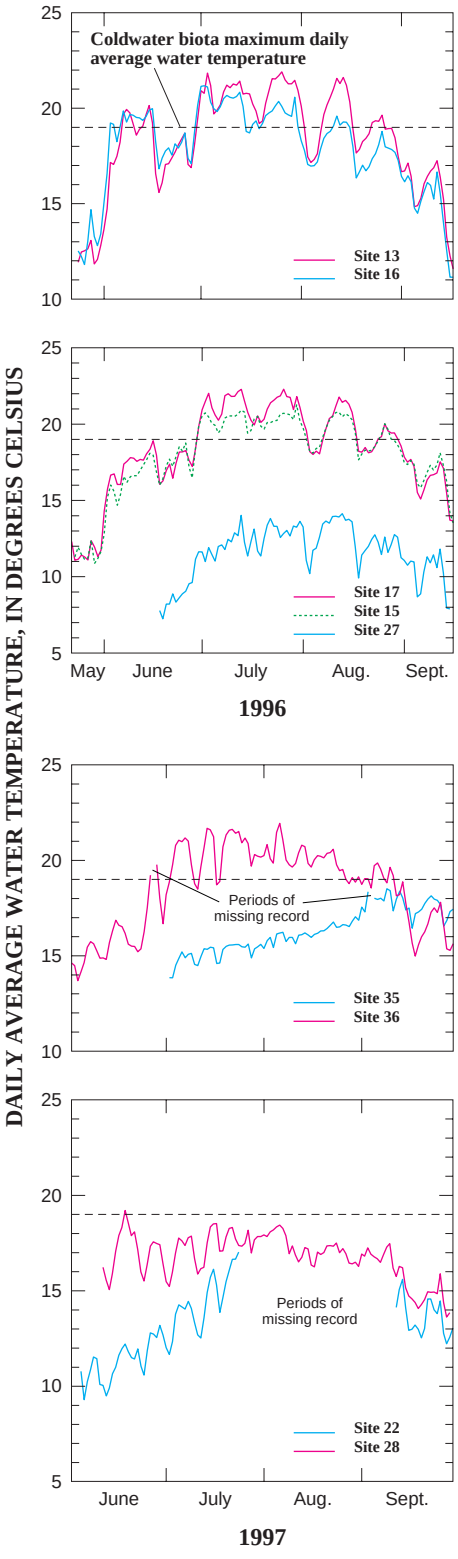


Figure 2. Water temperature analyzed in samples collected at selected sites in Idaho during 1996–97. (See figure 1 for site locations; see table 1 for site names)

tively; fig. 2). Because of the significance of this temperature information and its potential effect on beneficial use, continuous-temperature monitoring will be expanded to include all 1998 statewide surface-water quality monitoring sites.

Bacteria

Fecal coliform is an indicator of fecal contamination by warmblooded animals and can indicate the presence of pathogenic micro-organisms. Concentrations of fecal coliform bacteria in water designated for primary contact recreation (swimming, water skiing, or skin/scuba diving) cannot exceed 500 colonies per 100 milliliters (mL) of water at any time, and concentrations in only 10 percent of the total samples collected over a 30-day period can exceed 200 colonies per 100 mL (Idaho Department of Health and Welfare, 1985). Concentrations of fecal coliform bacteria in water designated for secondary contact recreation (fishing, boating, or wading) cannot exceed 800 colonies per 100 mL at any time, and concentrations in only 10 percent of the total samples collected over a 30-day period can exceed 400 colonies per 100 mL (Idaho Department of Health and Welfare, 1985). Fecal coliform concentrations exceeded primary contact recreation standards in samples from the Portneuf River at Pocatello, Rock Creek at Daydream Ranch, Boise River near Parma, and Bear River at Idaho-Utah State line (sites 17, 22, 36, and 53, respectively); and exceeded secondary contact recreation standards in samples from the Portneuf River at Pocatello and Boise River near Parma (sites 17 and 36, respectively; fig. 3).

Nutrients

Nitrate is an important nutrient for aquatic plants. Common human sources of nitrate are agricultural fertilizers, manure from livestock feedlots and dairy-cattle operations, and effluent from sewage-treatment plants. A nitrate concentration of 0.3 milligram per liter (mg/L) is considered the limit for preventing nuisance growths of algae and aquatic plants in streams (Idaho Department of Health and Welfare, 1985). Concentrations of dissolved nitrate in samples from the Portneuf River at Pocatello, Rock Creek at Daydream Ranch, Boise River near

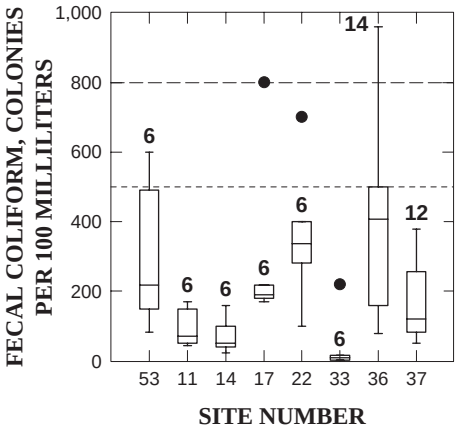


Figure 3. Fecal coliform analyzed in water samples collected at selected sites in Idaho during 1996–97. (See figure 1 for site locations; see table 1 for site names)

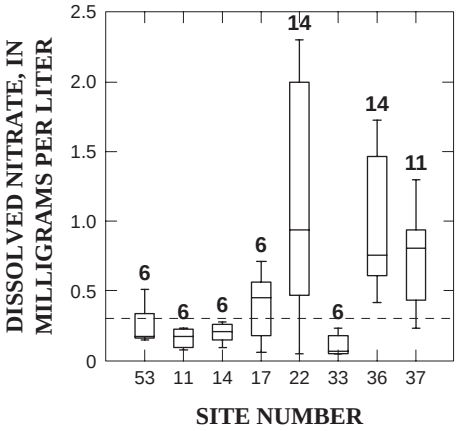
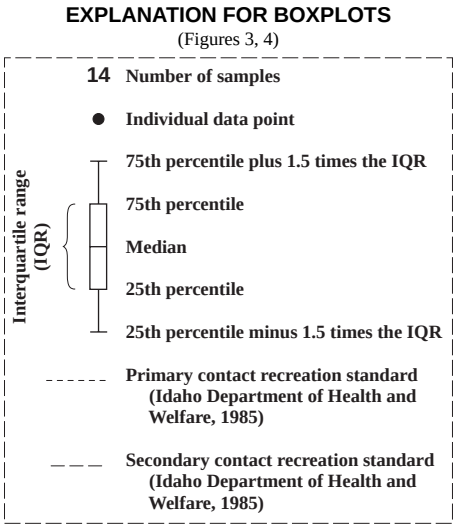


Figure 4. Dissolved nitrate analyzed in water samples collected at selected sites in Idaho during 1996–97. (See figure 1 for site locations; see table 1 for site names)



Parma, Snake River at Nyssa, and Bear River at Idaho-Utah State line (sites 17, 22, 36, 37, and 53, respectively) exceeded 0.3 mg/L (fig. 4).

Fish Tissue

Preliminary results of analyses of fish tissue for seven sites are presented in figure 5. Mercury was detected in the tissue (livers) of fish at all sites sampled during 1996 but did not exceed the U.S. Fish and Wildlife Service guideline of 0.1 microgram per gram, wet weight, for the protection of fish-eating birds and wildlife (fig. 5). Total PCBs were detected in whole-body samples of fish at 5 of 7 sites sampled during 1996. In 1993, PCB concentrations in tissue of fish from the Portneuf River at Pocatello (site 17), which were collected as part of the NAWQA Program, exceeded the National Academy of Sciences/National Academy of Engineering guideline of 500 micrograms per kilogram, wet weight, for the protection of fish-eating birds and wildlife. Analytical results of fish-tissue samples collected during 1997 were not yet available when this report was written.

FUTURE PLANS

All water-chemistry and biological data will continue to be published annually in the USGS Water Resources Data report for Idaho. The first rotation of biological sampling in all three regions will be completed in 1998. A complete analysis of the statewide surface-water quality monitoring program is planned to identify sites that best characterize basin conditions.

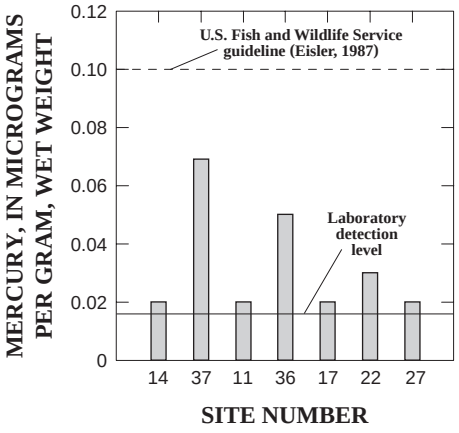


Figure 5. Mercury analyzed in livers of fish collected at selected sites in Idaho during 1993 and 1996. (See figure 1 for site locations; see table 1 for site names)

Cutthroat trout, a popular sportfish found in Idaho, also are considered a sensitive indicator of stream conditions (photograph © 1996 by W. H. Mullins and published with permission)

REFERENCES CITED

Crawford, J.K., and Luoma, S.N., 1993, Guidelines for studies of contaminants in biological tissue for the National Water-Quality Assessment Program: U.S. Geological Survey Open-File Report 92–494, 69 p.

Cuffney, T.F., Gurtz, M.E., and Meador, M.R., 1993a, Guidelines for processing and quality assurance of benthic invertebrate samples collected as part of the National Water-Quality Assessment Program: U.S. Geological Survey Open-File Report 93–407, 80 p.

———1993b, Methods for collecting benthic invertebrate samples as part of the National Water-Quality Assessment Program: U.S. Geological Survey Open-File Report 93–404, 66 p.

Eisler, Ronald, 1987, Mercury hazards to fish, wildlife, and invertebrates, a synoptic review: U.S. Fish and Wildlife Service Biological Report 85 (1.10), 90 p.

Idaho Department of Health and Welfare, 1985, Idaho water quality standards and wastewater treatment requirements: Boise, Idaho Department of Health and Welfare, Division of Environmental Quality, 78 p.

Meador, M.R., Cuffney, T.F., and Gurtz, M.E., 1993a, Methods for sampling fish communities as part of the National Water-Quality Assessment Program: U.S. Geological Survey Open-File Report 93–104, 40 p.

Meador, M.R., Hupp, C.R., Cuffney, T.F., and Gurtz, M.E., 1993b, Methods for characterizing stream habitat as part of the National Water-Quality Assessment Program: U.S. Geological Survey Open-File Report 93–408, 48 p.

O'Dell, Ivalou, and Berenbrock, Charles, 1994, Idaho's surface-water quality monitoring program—results from five sites sampled during water years 1990–93: U.S. Geological Survey Fact Sheet FS–94–026.

Plafkin, J.L., Barbour, M.T., Porter, K.D., Gross, S.K., and Hughes, R.M., 1989, Rapid bioassessment protocols for use in streams and rivers—benthic macroinvertebrates and fish: Washington, D.C., U.S. Environmental Protection Agency, Office of Water Report EPA/444/4–89–001.

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