YTS - 1194 Rev 25

Quarterly Progress Report

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Biological Monitoring Program for East Fork Poplar Creek

Submitted to

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1. Introduction

In May 1985, a National Pollutant Discharge Elimination System (NPDES) permit was issued for the Oak Ridge Y-12 Plant. As a condition of the permit, a Biological Monitoring and Abatement Program (BMAP) was developed to demonstrate that the effluent limitations established for the Y-12 Plant protect the classified uses of the receiving stream (East Fork Poplar Creek; EFPC), in particular, the growth and propagation of aquatic life (Loar et al. 1989). A second objective of the BMAP is to document the ecological effects resulting from the implementation of a water pollution control program designed to eliminate direct discharges of wastewaters to EFPC and to minimize the inadvertent release of pollutants to the environment. Because of the complex nature of the discharges to EFPC and the temporal and spatial variability in the composition of the discharges, a comprehensive, integrated approach to biological monitoring was developed. A new permit was issued to the Y-12 Plant on April 28, 1995 and became effective on July 1, 1995. Biological monitoring continues to be required under the new permit. The BMAP consists of four major tasks that reflect different but complementary approaches to evaluating the effects of the Y-12 Plant discharges on the aquatic integrity of EFPC. These tasks are (1) toxicity monitoring, (2) biological indicator studies, (3) bioaccumulation studies, and (4) ecological surveys of the periphyton, benthic macroinvertebrate, and fish communities.

Monitoring is currently being conducted at five sites, although sites may be excluded and/or others added depending upon the specific objectives of the various tasks. Criteria used in selecting the sites include: (1) location of sampling sites used in other studies, (2) known or suspected sources of downstream impacts, (3) proximity to U.S. Department of Energy (DOE) Oak Ridge Reservation (ORR) boundaries, (4) concentration of mercury in the adjacent floodplain, (5) appropriate habitat distribution, and (6) access. The sampling sites include upper EFPC at kilometers (EFKs) 24.4 and 23.4 [upstream and downstream of Lake Reality (LR) respectively]; EFK 18.7 (also EFK 18 and 19), located off the ORR and below an area of intensive commercial and limited light industrial development; EFK 13.8 (also EFK 14), located upstream from the Oak Ridge Wastewater Treatment Facility (ORWTF); and EFK 6.3 located approximately 1.4 km below the ORR boundary (Fig. 1.1). Other sampling sites on EFPC are utilized as appropriate for individual tasks. Brushy Fork (BF) at kilometer (BFK) 7.6 is used as a reference stream in most tasks of the BMAP. Additional sites off the ORR are also occasionally used for reference, including Beaver Creek, Bull Run, Hinds Creek, Paint Rock Creek, and the Emory River in Watts Bar Reservoir (Fig. 1.2).

2. Toxicity Monitoring (*L. A. Kszos, D. S. Cicerone, A. J. Stewart and L. F. Wicker*)

2.1. Introduction

The ambient toxicity monitoring task includes three subtasks: toxicity monitoring, toxicity experiments, and supporting studies. Toxicity monitoring uses U.S. Environmental Protection Agency (EPA) approved methods with *Ceriodaphnia dubia* and fathead larvae to provide systematic information that can be used to determine changes in the biological quality of EFPC through time. Toxicity experiments are conducted to test specific hypotheses about stream water quality. The hypotheses are addressed experimentally by the systematic application of ambient toxicity test methods. Supporting studies are used to (1) investigate the relationship between the physicochemical and biological conditions in EFPC, particularly as they relate to processes or rates of ecological recovery and (2) develop better methods for accurately predicting ecological recovery with changes in water quality in EFPC. Toxicity monitoring at the upstream sites from Bear Creek Road [Lake Reality outfall or LR-o (EFK 23.8), LR

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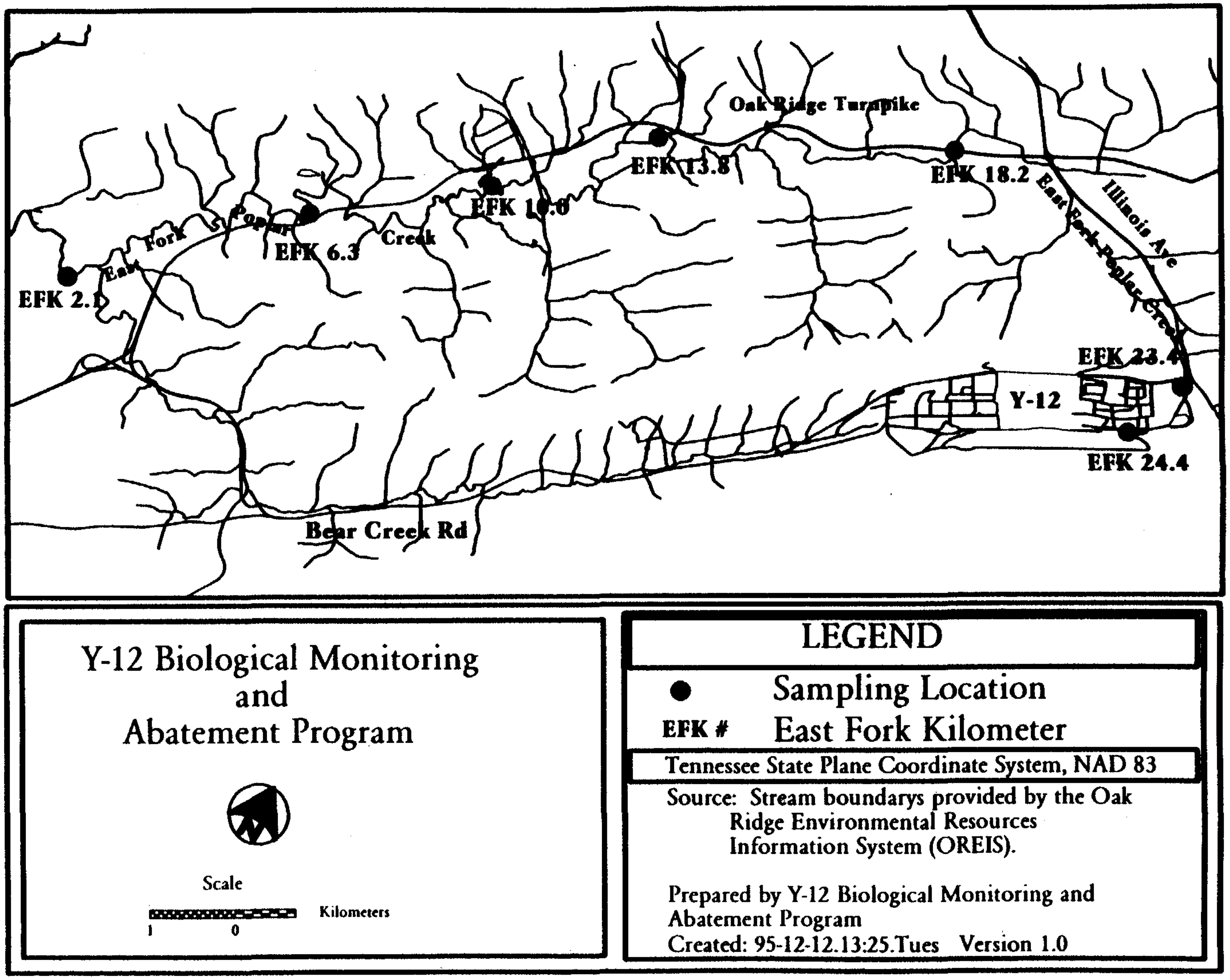

Figure 1.1. Location of biological monitoring sites on East Fork Poplar Creek in relation to the Oak Ridge Y-12 Plant.

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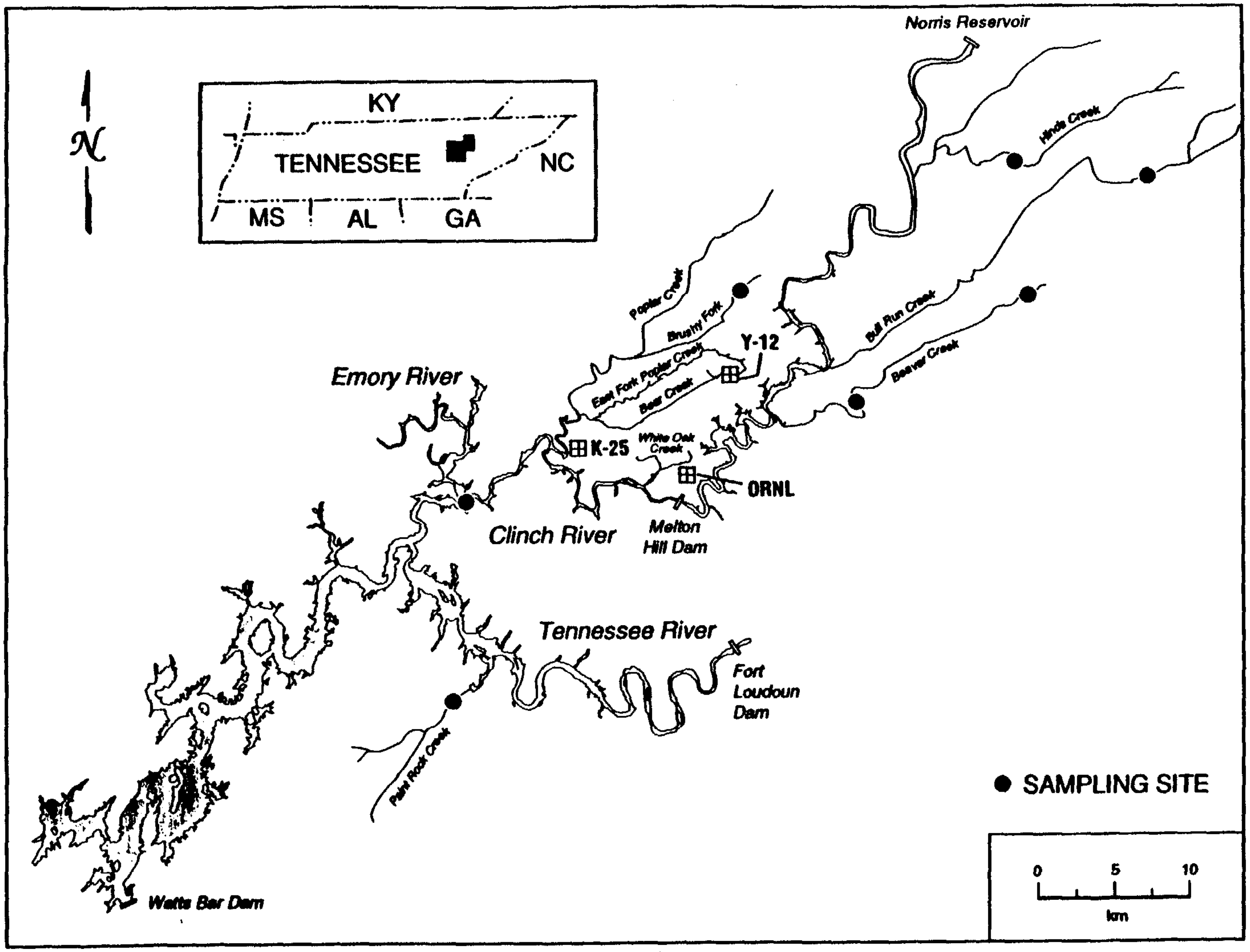

Figure 1.2. Location of reference sites in relation to the Oak Ridge Y-12 Plant.

inlet or LR-i (EFK 24.1) are conducted quarterly. Testing of ambient sites downstream from Bear Creek Road (EFKs 22.8, 21.9, 20.5, 18.2, 13.8, and 10.9) has been discontinued under the revised BMAP sampling plan (Y-TS-1613).

As required by the Y-12 Plant's National Pollutant Discharge Elimination System (NPDES) permit, quarterly toxicity tests with fathead minnows and *Ceriodaphnia* are also conducted at Outfall 201. Because of the close proximity of Outfall 201 (an instream NPDES location in upper EFPC) to EFK 25.1, toxicity tests at the outfall meet the intent of the BMAP Plan (Adams et al. 1996) to conduct quarterly toxicity tests at EFK 25.1. The results of the Outfall 201 tests are reported elsewhere (Discharge Monitoring Reports issued by the Y-12 Plant to the Tennessee Department of Environment and Conservation).

2.2 Results/Progress

2.2.1 Toxicity Monitoring

Ambient water samples from EFK 24.1 and EFK 23.8 were evaluated for acute and chronic toxicity to *C. dubia* during October 1 - 7, 1997. On each sampling day, grab samples were collected by ESD personnel for testing. Results of toxicity tests and chemical analyses are shown in Tables 2.1 and 2.2. During the test period, no toxicity was observed in any of the ambient water samples. *Ceriodaphnia* survival in water from each site was equal to 100%. *Ceriodaphnia* reproduction in the water samples was not significantly reduced compared to the controls.

Table 2.1. Results of *Ceriodaphnia dubia* toxicity tests of ambient sites from East Fork Poplar Creek conducted October 1 - 7, 1997

Sample	Concentration (%)	Survival (%)	Mean Reproduction (offspring/surviving female ± SD)
Control	100	100	33.2 ± 3.4
EFK 24.1	100	100	31.8 ± 2.0
EFK 23.8	100	100	34.2 ± 4.0

Note: EFK = East Fork Poplar Creek kilometer. SD = standard deviation.

2.2.2 Special Studies

In the fourth quarter, a manuscript summarizing the results of the calcite-production and calcite-dissolution studies involving Lake Reality was completed, reviewed internally, and submitted to a technical journal (*Limnology and Oceanography).* The title of this manuscript is "Diel calcite production in an eutrophic spill-control basin." In October, we also received notice that an earlier manuscript, "Longevity and reproduction of *C. dubia* in receiving waters", has been accepted for publication in *Environmental Toxicology and Chemistry*. One significant aspect highlighted in the "Longevity..."

Table 2.2. Summary (mean ± SD) of water chemistry analyses conducted during toxicity tests of ambient samples from East Fork Poplar Creek, October 1 - 7 1997

Sample	pH (su)	Alkalinity (mg/L as $CaCO_3$)	Hardness (mg/L as $CaCO_3$)	Conductivity (µS/cm)
Control	8.45 ± 0.24	89.1 ± 5.8	98.6 ± 1.5	226.1 ± 7.5
EFK 24.1	8.17 ± 0.07	115.0 ± 2.0	146.3 ± 2.7	332.0 ± 5.5
EFK 23.8	8.39 ± 0.12	117.0 ± 3.2	146.7 ± 7.1	334.5 ± 4.4

Note: EFK = East Fork Poplar Creek kilometer. SD = standard deviation.

manuscript is that extended exposure of *Ceriodaphnia* to water from Lake Reality does not result in adverse effects on *Ceriodaphnia* survival or reproduction. Thus, the lack of chronic toxicity at Lake Reality outfall, as determined through use of 7-d ambient-water tests with this daphnid, is not a "false negative" result attributable to insufficient exposure periods.

Studies to characterize the kinetic properties of cadmium, zinc and cobalt in relation to calcite production and dissolution were completed. The results of experiments with cadmium were included in the manuscript that was recently submitted to *Limnology and Oceanography*; the results of experiments with cobalt and zinc are now being evaluated and analyzed.

3. Biological Indicators

3.1 Bioindicators of Fish Health (*S. M. Adams*)

3.1.1 Introduction

This task involves the use and application of bioindicators of fish health, in addition to other investigative approaches, to evaluate the effects of water quality and other environmental variables on fish in EFPC. A suite of diverse bioindicators of fish health has been examined since fall 1985 to evaluate the health of a sentinel species, the redbreast sunfish (*Lepomis auritus*), as a component of the BMAP program.

3.1.2 Results/Progress

Using several bioindicators, information presented in the previous quarterly report (3rd Quarter 1997 Y-12 BMAP Quarterly Report) demonstrated that the health of individual fish in upper EFPC improved after 1990. Levels of creatinine in the blood of redbreast sunfish indicated improved kidney function. The levels of lipids particularly in female sunfish increased over this period showing improvement in the bioenergetic/nutritional capacity of these fish, while the spleno-somatic index decreased over this period providing evidence of decreased infection and/or disease in the sunfish population. This report provides additional evidence of improvement in individual fish health and demonstrates the temporal response relationships between bioindicators at various levels of biological organization and function.

Prior to 1993, the growth of redbreast sunfish in upper EFPC remained relatively consistent at approximately 110-120% of reference fish growth. After this period, however, growth increased to 130-140% of reference values (Fig. 3.1B). The dramatic increase in growth in 1993 immediately following initiation of dechlorination processes was probably more related to dechlorination than to long-term decreases in mercury levels in upper EFPC. Prior to 1993, there was no obvious change in growth as was observed for serum creatinine levels (Fig. 3.1). Temporal improvement in kidney function was probably related to mercury abatement in upper EFPC because mercury is nephrotoxic and impairs kidney function. One reasonable explanation for the increase in growth after 1993 could be that dechlorination allowed for an increase in the bioavailability of food resources such as benthic macroinvertebrates which provided an increased energy source to consumers such as the redbreast sunfish population.

One of the main advantages of bioindicators is that they are sensitive to environmental stressors and can provide early indications of environmental restoration and recovery. For example, in Fig. 3.1, the temporal response relationships between four different levels of biological organization/function are shown. At the physiological level, improvement of organ (*kidney*) function (Fig. 3.1A) preceded observed changes at the individual level (*growth*) (Fig. 3.1B), the fish community level *(no. of sensitive species*) (Fig. 3.1D), and the benthic macroinvertebrate community level (*species richness*) (Fig. 3.1C). Changes in growth of fish coincided with the appearance of sensitive fish species in upper EFPC. Similarly, increases in benthic community health, as demonstrated by species diversity, increased gradually after 1992 concomitant with dechlorination and improvement in fish health at the individual and fish community level. Thus, not only do bioindicators function as sensitive early indicators of improvement in the ecological health of EFPC, but also track and reflect changes at higher levels of biological organization and function.

3.2 Bioindicators of Reproductive Competence (*M. S. Greeley, Jr.)*

3.2.1 Introduction

Successful reproduction of fish populations requires that adult fish be capable of producing and spawning viable gametes. To address the reproductive competence of adult fish in EFPC, various reproductive indicators, representing several different levels of reproductive organization related to gamete production, have been routinely examined in redbreast sunfish sampled from EFPC and reference streams at the beginning of each annual breeding season since 1988. Establishment and maintenance of stable fish populations also requires that offspring be able to develop normally into subsequent reproductive cohorts. Beginning in 1990, water samples from several sites in EFPC and other streams on and about the ORR have been tested for their effects on fish developmental processes utilizing a medaka (*Oryzias latipes*) embryo-larval test.

3.2.2 Results/Progress

During May and June, 1997, redbreast sunfish were sampled from 4 sites in EFPC (EFKs 24.6, 23.4, 18.2 and 13.8) and 2 sites in reference streams (Brushy Fork and Hinds Creek), in order to assess relative reproductive condition at the beginning of the breeding season. Blood samples were drawn from each fish and frozen for later analysis of reproductive hormones. Fish body weights and lengths were measured and recorded. Reproductive organs were weighed, then preserved in fixative for later analysis.

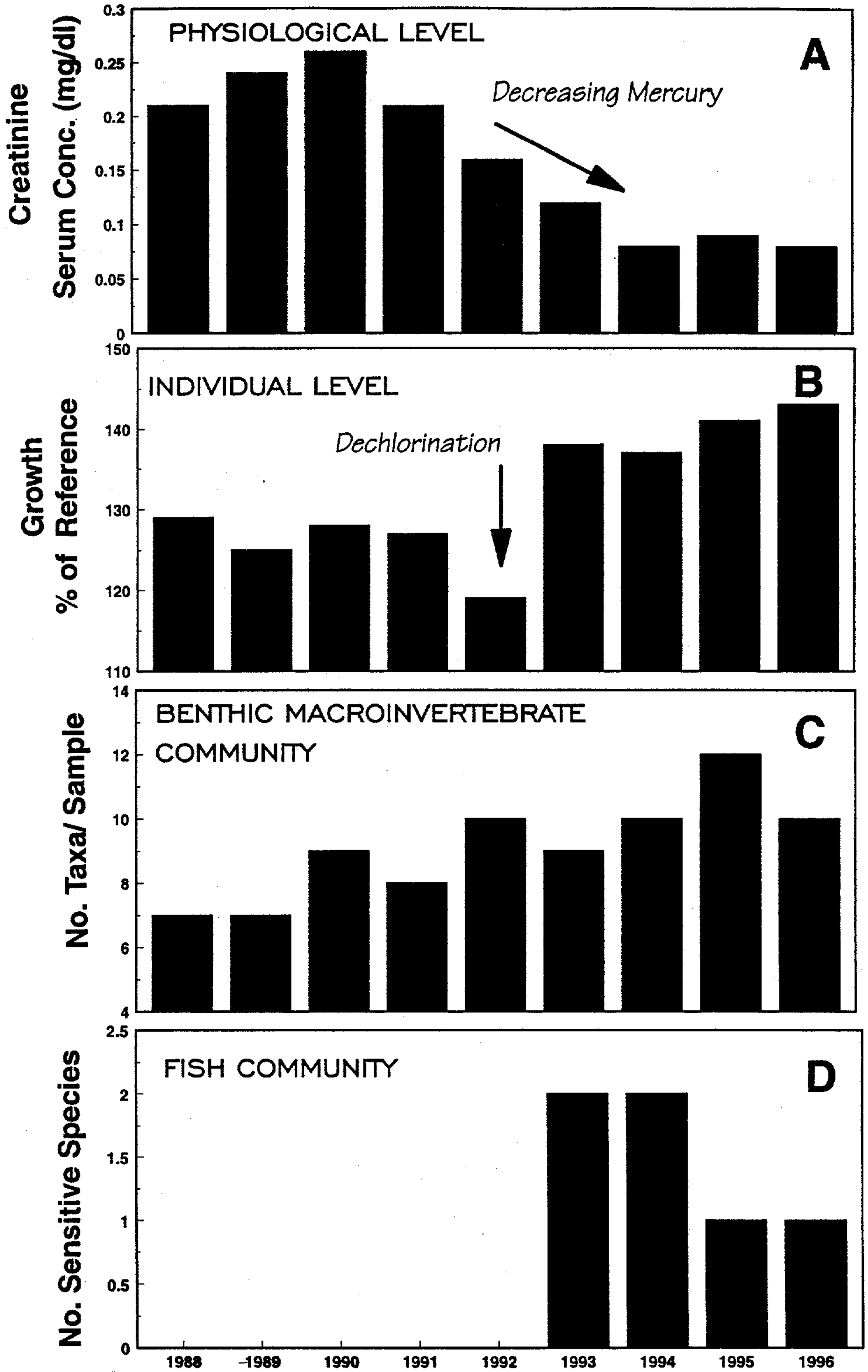

Fig. 3.1. Temporal response relationships between various levels of biological organization/function for the redbreast sunfish population and macroinvertebrate community in upper East Fork Poplar Creek.

Testes from male fish were subsequently prepared for histopathological examination, while ovaries from female fish were directly analyzed for the occurrence of ovarian parasites, the abundance of atretic (dead or dying) oocytes, and fecundity. Partial results of these analyses were presented in the previous quarterly report (Table 3.1, 3rd Quarter 1997 Y-12 BMAP Quarterly Report). Additional analyses continued during the past quarter, and will be reported as completed.

4. Bioaccumulation Monitoring

4.1 Routine Bioaccumulation Monitoring (*M. J. Peterson and G. R. Southworth*)

4.1.1 Introduction

The focus of the bioaccumulation task is on evaluating spatial and temporal trends in mercury and polychlorinated biphenyls (PCB) contamination in redbreast sunfish collected twice annually from the mid to upper reaches of EFPC. Past monitoring has identified these substances in fish as posing the greatest potential health concerns to human consumers. On an annual basis stoneroller minnows (*Campostoma anomalum*) are also collected at one site in upper EFPC to evaluate the potential ecological concerns due to metal accumulation. For this quarter, the routine fall collection of sunfish and stonerollers was begun.

4.1.2 Results/Progress

Fall sampling for the bioaccumulation studies task began on November 24, 1997. Over the following three weeks, six redbreast sunfish of a size likely to be taken by fisherman (50-150 g) were collected from each of five stream sites. Fish were fileted in the laboratory and samples prepared for mercury and PCB determination. Three composite samples of ten stonerollers were also collected from EFK 24.8 (above Lake Reality). Surprisingly, there was no difficulty in obtaining stonerollers or redbreast sunfish from this reach. Sampling will continue until the remaining site in EFPC (Lake Reality) has been completed.

4.2 Special Mercury Studies (*G. R. Southworth*)

4.2.1 Introduction

NPDES permits at DOE facilities in Oak Ridge seek to control mercury bioaccumulation by regulating the concentration of total mercury in waters receiving effluent discharges. "Safe" or allowable total mercury concentration (0.012 µg/L) follows U.S.EPA guidance (water quality criteria). Bioaccumulation of mercury is known to be influenced by site specific factors, hence a "safe" concentration of total mercury in the limestone fed streams of the Appalachian Ridge and Valley Province is likely to be different from that determined to be safe in soft, low pH waters of the southern coastal plains or northern Midwest. Studies conducted in 1996 and 1997 indicate that mercury bioavailability varies widely even among streams considered to be chemically and geologically similar.

4.2.2 Results/Progress

Streams in the study appeared to fall into three groups based on the bioavailability of mercury (Fig. 4.1). The first group, where mercury is most available, consists of uncontaminated and mercury-contaminated

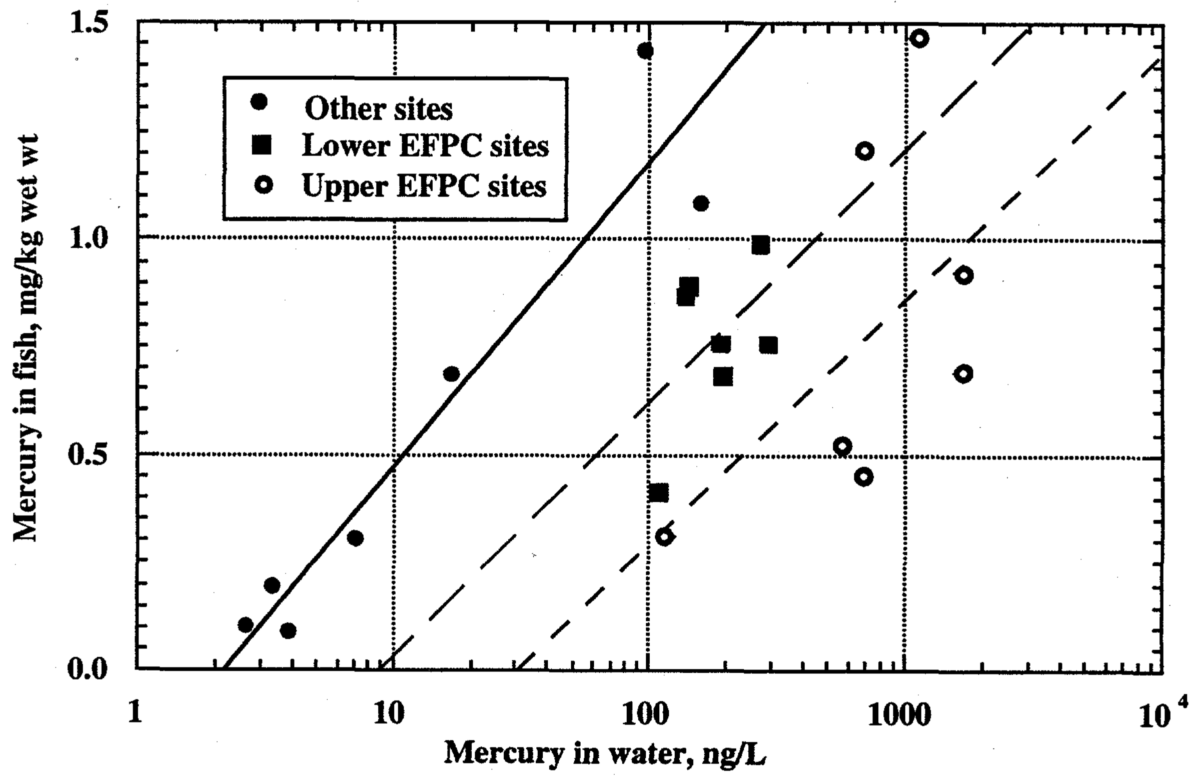

Fig. 4.1. Relationship between total aqueous mercury and mercury in fish in sites off the Oak Ridge reservation ("other sites"), lower EFPC (EFK 2.1 - 18.2), and upper EFPC (EFK 23.4 - N/S pipe, and White Oak Creek). Lines are least squares regression of $[Hg]_{fish}$ vs log $[Hg]_{water}$.

streams in Virginia, Tennessee, and Kentucky, with the exception of East Fork Poplar Creek and White Oak Creek. The sites where mercury is least biologically available include White Oak Creek below ORNL and East Fork Poplar Creek within the Y-12 Plant. The third group includes the middle and lower reaches of EFPC, where mercury bioavailability appears to be intermediate between the other two groups. The wide range in mercury bioavailability among the three groups can be discerned by comparing the aqueous mercury concentrations at which mercury concentration in fish is predicted (by the least squares regression) to be 0.5 μg/g (Fig 4.1). For the upper EFPC group, this value is about 220 ng/l, while for the lower EFPC and other sites values are 60 and 10 ng/L, respectively.

The low degree of accumulation of mercury in fish in upper EFPC and White Oak Creek at ORNL suggest that some characteristic of the ORNL and Y-12 discharges acts to interfere with the net production of methylmercury or its uptake and retention in aquatic organisms in these creeks. In both streams, most of the streamflow downstream from the DOE facilities is comprised of dechlorinated discharged process water that originates from the same water treatment plant. Both streams also receive inputs of various metals and other chemicals, including anti-corrosives, associated with operation of the facilities. Identification of a chemical agent responsible for the low degree of mercury bioavailability in these streams could provide a tool for helping ensure that reductions in mercury discharges achieve the goal of reducing contamination in aquatic biota.

4.3 PCB Source Identification *(J. F. McCarthy)*

4.3.1 Introduction

Passive monitoring of PCBs using semipermeable membrane devices (SPMD) is being employed to determine the sources and sinks of PCBs at the Y-12 Plant.

4.3.2 Results/Progress

In December, the results of a SPMD deployment completed in June-July of 1997 were presented to the Y-12 Plant Department of Environmental Management. The same presentation was repeated at a later date for members of the Jacobs Engineering Remedial Investigation team. The goal of the deployment was to identify the sources of PCB discharges from the Y-12 Plant to EFPC. Principal objectives included: (1) identifying the sources of PCBs entering the North/South (N/S) Pipe; (2) determining the sources and sinks for PCBs in Upper EFPC (N/S Pipe to Station 17); and (3) comparing the magnitude of PCB releases from Y-12 to EFPC and Bear Creek.

The principal results and conclusions of that study included:

- The principal sources entering the N/S Pipe were identified. Most of the PCB flux is contributed by NPDES-150, although other SWHISS Houses have higher PCB concentrations.
- Of the outfalls entering upper EFPC that were monitored in this study, NPDES-135 and -125 had the highest concentration and were the principal contributors to PCB flux from outfalls. Although discrete input sources were identified, these inputs were insignificant compared to unknown sources entering upper EFPC at two stream reaches (N/S Pipe-to-109 Bridge and Station 8 Bridge-to-East Patrol Road Bridge). It is likely that these sources reflect releases from historic contamination in the vicinity of the stream bed and enter the Creek through shallow groundwater flow. The source of elevated mercury contamination upper EFPC arises from historic releases in the same reach between the N/S Pipe and the 109 Bridge. There is a second source of PCBs slightly further downstream that

may be associated with releases from the Z-oil Pumping Station or transformers stored near the Creek along this reach. Decreases in PCB flux downstream of these sources are postulated to be caused by the rapid association of dissolved PCBs with suspended particles or with sediment. This phenomena clearly delimits the zones of contaminant input since in the absence of such inputs, the flux of PCBs declines dramatically. However, it also suggests that a much larger inventory of PCBs may be exiting upper EFPC, albeit in a particle-associated form.

- The flux of dissolved PCBs exiting Y-12 through EFPC is approximately 4-fold higher than that transported by Bear Creek.

Discussion at the meeting also addressed the benefits of alternatives for future studies. It was decided that another SPMD deployment should be conducted in FY 1998 focusing on upper EFPC. Since the 1997 deployment was conducted in the summer, when water tables are low, the 1998 deployment will be conducted in the winter when water elevations are near their highest point (probably February of March).

A manuscript was prepared for submission to *Environmental Toxicology and Chemistry* describing results of a deployment of semipermeable membrane devices in 1996. In that study, passive monitoring of polychlorinated biphenyls (PCB) using SPMDs was employed to identify and evaluate the contribution of point and nonpoint sources to the total PCB flux in the drainage system encompassing three Department of Energy (DOE) industrial and research facilities in eastern Tennessee . That manuscript is currently in review at ORNL and Y-12.

5. Community Studies

5.1 Periphyton (*W. R. Hill*)

5.1.1 Introduction

Periphyton monitoring in EFPC occurs four times a year (as close to a quarterly sampling regime as environmental conditions will allow). Rocks and their associated periphyton are collected from three sites on EFPC (EFKs 24.4, 23.4, 6.3) and one site on Brushy Fork (BFK 7.6). Four rocks from each site are used in determining algal biomass (chlorophyll *a*) and rate of photosynthesis (^{14}C incorporation).

5.1.2 Results/Progress

Periphyton biomass and photosynthesis was measured on Dec. 15,1997. The results of the periphyton analysis appear in Table 5.1. Biomass and photosynthesis for all sites were well within the range of historical means and were roughly similar to data obtained in July and September. It was hypothesized in the previous quarterly report that periphyton biomass would increase at EFK 24.4 in response to the reduction in stoneroller densities brought about by the dechlorination event of July 24. This response has not occurred, suggesting that sufficient stonerollers survived the event to keep algal biomass steady at EFK 24.4, or that periphyton biomass at this site is constrained by a factor other than stoneroller grazing. Algal biomass increased approximately 50% at EFK 23.4 from July to December, perhaps because of reduced stoneroller populations at this site.

Periphyton was collected for analyses of metal concentrations on October 2, 1997. These samples have been processed and are scheduled to be analyzed for cadmium, chromium, cobalt, copper, iron, lead, manganese, nickel, silver, zinc, total mercury, and methylmercury.

Table 5.1. Means and standard errors for biomass, photosynthesis, and chlorophyll-specific photosynthesis rates of periphyton collected from EFPC and Brushy Fork, December 15, 1997.

Site	Algal biomass (μg chla/cm^2)	Photosynthesis (μgC/cm^2/h)	Chlorophyll-specific photosynthesis (μgC/μgchla/cm^2/h)
EFK 24.4	52.6 ± 5.0	14.5 ± 1.0	0.28 ± 0.03
EFK 23.4	52.5 ± 11.0	15.6 ± 2.1	0.32 ± 0.04
EFK 6.3	39.8 ± 6.9	17.8 ± 2.0	0.47 ± 0.06
BFK 7.6	8.57 ± 2.1	2.65 ± 0.61	0.33 ± 0.04

Note: EFK = East Fork kilometer, BFK = Brushy Fork kilometer

5.2 Benthic Macroinvertebrate Community Monitoring (*J. G. Smith*)

5.2.1 Introduction

The objectives of the benthic macroinvertebrate task are to monitor the benthic macroinvertebrate community in EFPC in order to provide information on the ecological condition of the stream, and to evaluate the response of macroinvertebrates to operational changes, abatement activities, or remedial actions at the Y-12 Plant as a measure of the effectiveness of these actions. To meet these objectives, routine quantitative benthic macroinvertebrate samples have been collected at least twice annually (April and October) since 1985 from four sites on EFPC (EFK 24.4, EFK 23.4, EFK 13.8, and EFK 6.3). Since 1986, two reference sites unimpacted by industrial discharges have also been monitored: one site each on Brushy Fork (BFK 7.6) and Hinds Creek (HCK 20.6) (Figs.1.1 and 1.2).

5.2.2 Results/Progress

The routine collection of benthic macroinvertebrate samples was completed in October 1997 as scheduled. These samples and those collected in October 1996 were submitted to JAYCOR for processing with an anticipated completion date of late March, 1998.

5.3 Fish community monitoring (M. G. Ryon)

5.3.1 Introduction

Fish population and community studies can be used to assess the ecological effects of water quality and/or habitat degradation. Fish communities, for example, include several trophic levels and species that are at or near the end of food chains. Consequently, they integrate the direct effects of water quality and habitat degradation on primary producers (periphyton) and consumers (benthic invertebrates) that are utilized for food. Because of these trophic interrelationships, the well-being of fish populations has often been used as an index of water quality. Moreover, statements about the condition of the fish community are easily understood by the general public.

The two primary activities conducted by the Fish Community Studies task in EFPC are: (1) biannual, quantitative estimates of the fish community at six EFPC sites and two reference stream sites; and (2) investigative procedures in response to fish kills near the Y-12 Plant. The quantitative sampling of the fish populations at sites is conducted by electrofishing during the March–April and September–October periods. The resulting data are used to estimate population size (numbers and biomass per unit area), determine length frequency, estimate production, and calculate Index of Biotic Integrity values. Fish kill investigations are conducted in response to chemical spills, unplanned water releases, or when dead fish are observed in EFPC. The basic tool used for fish kill investigations is a survey of upper EFPC (above Bear Creek Road to the N/S Pipes) in which numbers and locations of dead, dying, and stressed fish are recorded. This baseline is supplemented by special toxicity tests, histopathological examinations, and water quality measurements in an effort to determine the cause of observed mortality.

5.3.2 Results/Progress

This quarter, quantitative fish community sampling was completed for the EFPC sites and the reference sites according to the sampling plan schedule. Data from these quantitative surveys of EFPC sites were entered into computer databases and will be processed through quality assurance procedures during the next quarter. No substantial fish kills occurred during this quarter, and funding for this activity is currently on hold.

6. Data Management (*S. W. Christensen, C. C. Brandt, and T. W. Beaty*)

6.1. Introduction

Environmental Compliance projects are required by provisions of the Oak Ridge Reservation Federal Facilities Agreement (FFA) and the State of Tennessee Oversight Agreement (TOA) to transmit their data to the Oak Ridge Environmental Information System (OREIS). BMAP data managers receive data packages from the PIs of the other tasks, transform the data into appropriate OREIS formats, and facilitate the data transfer to OREIS. This task also administers the BMAP workstation.

6.2. Results/Progress

During the last quarter, data managers sent to the Oak Ridge Environmental Information System (OREIS) data from toxicity testing and benthic macroinvertebrate community studies tasks. These transmittals updated historical data that were transmitted the previous quarter. They were also made available to SAIC for their use in preparing the EFPC Remedial Investigation report. Data management system operation and maintenance activities were also conducted.

7. Upcoming Field Activities

This is a new section of the Y-12 BMAP quarterly report designed to provide information to the Y-12 Environmental Compliance Office and other interested parties concerning BMAP plans for field activities in upper EFPC and adjacent environs during the subsequent calendar quarter.

Toxicity monitoring - Toxicity monitoring of ambient water from EFPC sites will be conducted with *C. dubia* in January, 1998.

Previous investigations showed that a pollution-intolerant species of snail (*Elimia clavaeformis*) was absent or extremely rare in EFPC upstream of EFK 22.8. A prediction arising from these investigations was that as water quality in upper EFPC continues to improve, the snail would gradually increase in abundance at sites farther upstream, both by immigration of individuals from tributary refuges and reproduction. A snail survey will be conducted in late January or early March, 1998 to determine *Elimia*'s status with respect to re-invasion of upper EFPC.

Bioaccumulation - The bioaccumulation task will be completing the winter collection of fish from EFPC in mid- to late- January. A successful sampling of the one remaining site, Lake Reality, depends on a specific combination of weather-related factors which will determine the actual sampling date. Deployment of SPMDs in EFPC is tentatively planned for the end of the quarter.

Bioindicators - No major fish sampling activities are planned during the 1st quarter of 1998 for the bioindicators of fish health and reproductive competence tasks. A medaka embryo-larval test of ambient water from EFPC sites will be conducted in either January or February, 1998. Water samples for an ongoing special study involving fish embryo-larval development will be collected occasionally during the quarter from various sites in upper EFPC.

Community Studies - Periphyton biomass and photosynthesis in EFPC will be assayed in March at the usual sampling sites (EFK 24.4, EFK 23.4, EFK 6.3 and BFK 7.6). If weather cooperates, an experiment *in situ* (EFK 24.4) will test the effect of different levels of shade on contaminant (metals and PCBs) accumulation by periphyton. There are no major sampling activities scheduled for the task for the 1st quarter of calendar year 1998. The fish community task will begin spring sampling in March. Plans to release painted rocks in the diversion channel to measure substrate stability for the habitat enhancement initiative of the Environmental Management Department are currently on hold pending funding of the project. Fish mortality background surveys that would normally be scheduled for this time-period have been canceled due to budget cuts.

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