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NATIONAL COUNCIL FOR AIR AND STREAM IMPROVEMENT

LONG-TERM RECEIVING WATER STUDY
DATA COMPENDIUM:
SEPTEMBER 1999 TO AUGUST 2000

TECHNICAL BULLETIN NO. 856

JANUARY 2003

by
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Acknowledgments

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PRESIDENT'S NOTE

In 1998 NCASI implemented a full range of sampling and data collection as part of the Long-Term Receiving Water Studies (LTRWS) at three different receiving waters: Codorus Creek in south central Pennsylvania, and the McKenzie and Willamette Rivers in western Oregon. In 1999 a fourth river was added, the Leaf River in south central Mississippi. The objectives of this ongoing 10- to 20-year study are a) to provide to the industry short-term and long-term information about any differences in aquatic communities upstream/downstream from representative point source effluent discharges from pulp and paper mills; and b) to determine the significance if there are any differences. The practical applications within this broad objective are creating a data base that demonstrates the natural temporal and spatial variability of abiotic and biotic properties of the study streams; studying the margin of safety for effluent addition to the stream; identifying changing receiving water conditions that might arise following possible future changes in mill processes or effluent treatment; and providing an early indication of possible subtle effluent effects that might not otherwise be known. To accomplish these goals the LTRWS created an experimental design that included a flexible monitoring and data collection program. By characterizing the aquatic communities and the river waters at multiple sites along an upstream/downstream stretch of each river, as well as the mill effluent, the experimental design provides for a comprehensive representation of the receiving waters.

This report is the second in a planned series of annual summaries of the monitoring parameters for the four LTRWS rivers, covering the study year from September 1999 to August 2000. Note that in most cases these are not the detailed data sets, but rather graphs and tables that illustrate the results of the first year of data collection. Also included are maps, photographs and descriptions of each monitoring location to illustrate the sampling plan. As demonstrated in the following pages, these summaries present a systematic picture of the extent and coverage of the data collection.

Additional reports will be issued over the course of the study. These will include the series of annual data summaries for each water year in the study, as well as reports specifically directed at the analysis and interpretation of the LTRWS database to address effluent effects questions identified in the goals of the study.

Ronald A. Yeske

January 2003

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Note du président[1]

En 1998, NCASI a réalisé des campagnes d'échantillonnage détaillées dans le cadre des études à long terme des cours d'eau récepteurs (*Long-Term Receiving Water Studies, LTRWS*) et ce, pour trois cours d'eau récepteurs différents: Codorus Creek dans le centre Sud de la Pennsylvanie de même que les rivières McKenzie et Willamette dans l'Ouest de l'Oregon. Une quatrième rivière a été ajoutée en 1999, la rivière Leaf dans le centre Sud du Mississippi. Les objectifs de cette étude qui se déroule sur une période de 10 à 20 ans sont a) fournir à l'industrie des informations à court terme et à long terme sur toute différence dans les milieux aquatiques entre l'amont et l'aval d'émissaires représentatifs de fabriques de pâtes et papiers et b) s'il y a des différences, déterminer si elles sont significatives. De ces larges objectifs découlent certaines applications pratiques dont la création d'une base de données qui permet de démontrer la variabilité temporelle et spatiale des propriétés abiotiques et biotiques des cours d'eau à l'étude; l'étude des marges de sécurité relatives à l'ajout d'un effluent dans un cours d'eau ; l'identification de changements des conditions des eaux réceptrices qui peuvent survenir suite à des modifications éventuelles des procédés ou du traitement des effluents des fabriques et la possibilité de fournir une première indication quant aux impacts subtils des effluents sur le cours d'eau, impacts qui autrement passeraient inaperçus. Afin d'atteindre ces objectifs la LTRWS a créé un design expérimental dans lequel on retrouve un programme flexible de surveillance et de collecte de données. En effectuant la caractérisation des milieux aquatiques et des rivières en différents endroits selon des tronçons amont/aval pour chaque rivière de même que la caractérisation des effluents des fabriques, le design expérimental procure une représentation complète des eaux réceptrices.

Ce rapport est le second d'une série de synthèses annuelles de surveillance des paramètres des quatre rivières à l'étude par la LTRWS et couvre la période allant de septembre 1999 à août 2000. Mentionnons que dans la plupart des cas, les données détaillées ne sont pas présentées mais on montre plutôt les graphiques et tableaux qui illustrent les résultats de la première année de collecte de données. Les cartes, photos et descriptions de chaque site de surveillance sont également incluses afin d'illustrer le programme d'échantillonnage. Tel que présentées dans les pages suivantes, les données synthèses procurent une représentation systématique de l'étendue et du champ couvert par la collecte de données.

Des rapports additionnels seront publiés tout au long de l'étude. Ces rapports incluront des séries de synthèses annuelles pour chaque année de l'étude, de même que des analyses et des interprétations de la base de données de la LTRWS afin de répondre aux questions soulevées dans les objectifs de cette étude quant aux impacts des effluents.

Ronald A. Yeske

janvier 2003

[1] Note de traduction: Afin de respecter le contexte dans lequel ce texte a été écrit et d'en faciliter la compréhension, les acronymes propres aux organismes américains (particulièrement l'EPA) ont été traduits librement et sont utilisés tels quels.

LONG-TERM RECEIVING WATER STUDY DATA COMPENDIUM: SEPTEMBER 1999 TO AUGUST 2000

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ABSTRACT

The NCASI Long-Term Receiving Water Study (LTRWS), begun in 1998, is a 10- to 20- year project involving four different U.S. receiving waters. The LTRWS objectives are to evaluate possible differences in the aquatic community upstream/downstream of representative point source effluent discharges from pulp and paper mills. The experimental design includes multiple sampling sites and variables for each of the receiving waters in the study. The measured components include water and effluent chemistry, characterization of the effluents with chronic bioassays, river temperature and flow, solar radiation, and detailed measurements of the periphyton, benthic macroinvertebrates and fish communities. This report is an overview of the findings for the period September 1999 to August 2000, the second year of the study. The data collected at Codorus Creek, Pennsylvania, during this time included four sampling dates along eight sampling sites for biotic community data; 12 sampling dates along six sites for water quality data and seven sampling dates for mill effluent. Among the findings for Codorus Creek were four divisions of periphyton, 191 macroinvertebrate taxa, and 36 fish taxa. The Leaf River, Mississippi, had two sampling dates at six sampling sites for biotic community data; 12 sampling dates along six sites for water quality data and four sampling dates for mill effluent. Among the findings for the Leaf were 70 macroinvertebrate taxa and 31 fish taxa. The McKenzie River, Oregon, data included four sampling dates at six sampling sites for biotic community data; 12 sampling dates along five sites for water quality data and three sampling dates for mill effluent. Among the McKenzie findings were five divisions of periphyton, 215 macroinvertebrate taxa, and 16 fish taxa. The Willamette River, Oregon, included three sampling dates at six sampling sites for biotic community data; 12 sampling dates along five sites for water quality data and three sampling dates for mill effluent. Among the findings for the Willamette were three divisions of periphyton, 182 macroinvertebrate taxa, and 19 fish taxa. Reports will be issued in the future addressing study objectives with respect to interpreting this data in regard to potential effects from these effluents on aquatic community health.

KEYWORDS

data summary, Long-Term Receiving Water Study

RELATED NCASI PUBLICATIONS

Technical Bulletin No. 846 (May 2002). *Turbidity: A literature review on the biological effects of turbidity on aquatic organisms and an assessment of turbidity in two long-term receiving water study rivers in Oregon.*

Technical Bulletin No. 843 (May 2002). *Long-term receiving water study data compendium: August 1998 to September 1999.*

Technical Bulletin No. 842 (February 2002). *Integrated long-term receiving water studies: site selection process and a description of the selected study sites.*

Technical Bulletin No. 841 (February 2002). *A compendium of field methods used in NCASI long-term receiving water studies.*

Technical Bulletin No. 833 (September 2001). *Evaluation of nutrient criteria and response variables based upon the NCASI long-term receiving water study experience*.

Technical Bulletin No. 829 (July 2001). *The effects of a bleached kraft mill effluent on periphyton and macroinvertebrates in streamside mesocosm studies*.

Technical Bulletin No. 828 (July 2001). *The effects of an unbleached kraft mill effluent on periphyton and macroinvertebrates in streamside mesocosm studies*.

COMPENDIUM DES DONNEES - ETUDES A LONG TERME DES COURS D'EAU RECEPTEURS : SEPTEMBRE 1999 A AOUT 2000

Bulletin technique no. 856
janvier 2003

Résumé

L'étude à long terme des cours d'eau récepteurs (LTRWS) de NCASI est un projet qui a démarré en 1998. Cette étude s'échelonne sur une période de 10 à 20 ans et implique quatre cours d'eau récepteurs des États-Unis. Les objectifs de la LTRWS sont d'évaluer les différences possibles dans le milieu aquatique entre l'amont et l'aval d'émissaires représentatifs de fabriques de pâtes et papiers. Le design expérimental comprend de nombreux sites d'échantillonnage et de nombreuses variables pour chaque cours d'eau récepteur à l'étude. Parmi les composantes mesurées mentionnons la chimie de l'eau et des effluents, la caractérisation des effluents à l'aide de bioessais de toxicité chronique, la température et le débit de la rivière, la radiation solaire et des mesures détaillées du périphyton, des macroinvertébrés benthiques et des communautés de poissons. Ce rapport présente une vue globale des résultats de recherche couvrant la période de septembre 1999 à août 2000. Cette période constitue la seconde année de l'étude. Les données recueillies lors de cette période à Codorus Creek en Pennsylvanie, portent sur quatre dates d'échantillonnage pour huit sites d'échantillonnage de la communauté biotique, douze dates d'échantillonnage pour six sites d'échantillonnage de la qualité de l'eau ainsi que sept dates d'échantillonnage des effluents de fabriques. Parmi les résultats obtenus à Codorus Creek mentionnons quatre divisions de périphyton, 191 taxons de macroinvertébrés et 36 taxons de poissons. Pour ce qui est de la rivière Leaf dans l'état du Mississippi, les données recueillies portent sur deux dates d'échantillonnage pour six sites d'échantillonnage de la communauté biotique, douze dates d'échantillonnage pour six sites d'échantillonnage de la qualité de l'eau de même que quatre dates d'échantillonnage des effluents de fabriques. Parmi les résultats obtenus à la rivière Leaf notons 70 taxons de macroinvertébrés et 31 taxons de poissons. À la rivière McKenzie dans l'Oregon, les données recueillies portent sur quatre dates d'échantillonnage pour six sites d'échantillonnage de la communauté biotique, douze dates d'échantillonnage pour cinq sites d'échantillonnage de la qualité de l'eau de même que trois dates d'échantillonnage des effluents de fabriques. Parmi les résultats obtenus à la rivière McKenzie on retrouve cinq divisions de périphyton, 215 taxons de macroinvertébrés et 16 taxons de poissons. Enfin, pour la rivière Willamette dans l'Oregon, les données recueillies portent sur trois dates d'échantillonnage pour six sites d'échantillonnage de la communauté biotique, douze dates d'échantillonnage pour cinq sites d'échantillonnage de la qualité de l'eau de même que trois dates d'échantillonnage des effluents de fabriques. Parmi les résultats obtenus à la rivière Willamette mentionnons trois divisions de périphyton, 182 taxons de macroinvertébrés de même que 19 taxons de poissons. D'autres rapports seront publiés dans le futur afin d'interpréter ces données en regard des objectifs de l'étude qui abordent les effets potentiels de ces effluents sur la santé de la communauté aquatique.

Mots clés

synthèse de données, étude à long terme des cours d'eau récepteurs

Autres publications de NCASI dans ce domaine

Bulletin technique no. 846 (mai 2002). *Turbidity: A literature review on the biological effects of turbidity on aquatic organisms and an assessment of turbidity in two long-term receiving water study rivers in Oregon.*

Bulletin technique no. 843 (mai 2002). *Long-term receiving water study data compendium: August 1998 to September 1999.*

Bulletin technique no. 842 (février 2002). *Integrated long-term receiving water studies: site selection process and a description of the selected study sites.*

Bulletin technique no. 841 (février 2002). *A compendium of field methods used in NCASI long-term receiving water studies.*

Bulletin technique no. 833 (septembre 2001). *Evaluation of nutrient criteria and response variables based upon the NCASI long-term receiving water study experience*.

Bulletin technique no. 829 (juillet 2001). *The effects of a bleached kraft mill effluent on periphyton and macroinvertebrates in streamside mesocosm studies*.

Bulletin technique no. 828 (juillet 2001). *The effects of an unbleached kraft mill effluent on periphyton and macroinvertebrates in streamside mesocosm studies.*

CONTENTS

TABLES

FIGURES

LONG-TERM RECEIVING WATER STUDY DATA COMPENDIUM: SEPTEMBER 1999 TO AUGUST 2000

1.0 INTRODUCTION

This report summarizes the data collected during the second year (1999 to 2000) of the Long-Term Receiving Water Study (LTRWS), a 10- to 20-year industry supported project. This is the second annual summary to be issued; the first was issued in May 2002 (NCASI 2002c). During the last year one additional bulletin containing analysis of specific components has been issued (NCASI 2002d). Further analyses addressing study objectives will continue to be issued separately.

The LTRWS involves four different U.S. receiving waters, including Codorus Creek in Pennsylvania (Figure 2.1), and two rivers in Oregon, the McKenzie River (Figure 2.10) and the Willamette River (Figure 2.16). A fourth river, the Leaf River in Mississippi (Figure 2.9), was added to the LTRWS in 1999, and is included in this compendium. These locations represent warm and coldwater stream types, as well as streams ranging from effluent dominated to those that are more typical of industry receiving waters. Mill process types represented in the LTRWS include both bleached and unbleached kraft. Studies now underway at these locations provide an opportunity to complete before/after process change comparisons for these mills as they go undergo "cluster rule" or other process or effluent treatment changes in the future. A detailed description of the site selection process for the LTRWS was presented in Hall et al. (1999) and NCASI (2002c).

The scope and framework for these studies were developed based on input from a committee of industry representatives with knowledge and skills in aquatic biology and environmental issues related to mill effluent discharges. Two broad objectives were established a) to determine whether there were detectable differences in biological monitoring parameters upstream and downstream of mill effluent discharges, and b) to determine the significance of these differences in terms of broader river ecological functioning. Specific project goals included a) addressing temporal variability over a 10- to 20-year timeline, b) addressing spatial variability along upstream/downstream river gradients, c) identifying the margin of safety for effluent addition, d) investigating possible changes in effluent effects that might arise from mill process or effluent treatment changes, e) providing an early indication of adverse effects by carrying out a study of exceptional depth and detail, and f) providing a study template for use by others. Hall and Miner (1997) reported further details of the LTRWS scope and framework as well as other study attributes, which were considered to be desirable.

To address the objectives and goals of the study, the experimental design needed to be broad, incorporating multiple spatial and temporal scales; field and laboratory assays; and biotic and abiotic components. The spatial aspect included multiple upstream/downstream sampling sites to address spatial variation, and also components to address responses on different spatial scales, from instream habitat evaluations to watershed-based risk assessments. The temporal scale was incorporated through sampling schedules to address seasonal variation and long-term annual variations. Field studies included instream or streamside monitoring of abiotic (water temperature, water flow, conductivity and solar radiation), and biotic (periphyton, benthic macroinvertebrates and fish) components. Laboratory evaluations included water chemistry and effluent chronic bioassays. A more detailed description of the experimental design is given in NCASI (2002b).

This compendium will give a brief outline of the sampling schedule and the sampling design for each river (Section 2) including a general list of sampling sites for each LTRWS river. A short description of the field methods will be provided at the start of each section of data (Section 3). A complete

description of the LTRWS sites and field methods is presented in NCASI Technical Bulletin No. 841 (2001a).

2.0 APPROACH

2.1 Experimental Design

The experimental design for the biotic and abiotic components of the study was originally set to maximize the ability to analyze temporal variations within and between different sets of study variables. At the outset it was recognized that flexibility would be needed to accommodate any unknown factors that might occur during such a long study (e.g., changing conditions in the field necessitating changing site locations; additions, subtractions, or modification to field or laboratory methodologies). Changes that occurred during the 1999 to 2000 study year are described in Table 2.1.

Table 2.1 Changes to the LTRWS Sampling, Analysis or Data Handling for the Study Year 1999 to 2000

Type of Change	LTRWS Component	Description
Addition	River Flow	Leaf River added.
Modification	River Flow	The McKenzie River flow data were modified to better represent the flow conditions at the mill outfall.
Addition	Water Chemistry	Leaf River monthly sampling started July 1999.
Modification	Water Chemistry	Total Kjeldahl nitrogen analysis replaced with Total Nitrogen for all rivers.
Discontinuation	Water Chemistry	Ammonia, orthophosphate, nitrate and nitrite analyses were discontinued after the December 1999 sampling for all rivers.
Addition	Effluent Analysis	Leaf River facility (New Augusta, MS) effluent analysis started in October 1999.
Addition	Effluent Bioassays	Leaf River added.
Addition	Biological: Periphyton	Leaf River biannual sampling started May 2000.
Addition	Biological: Macroinvertebrates	Leaf River biannual sampling started May 2000.
Addition	Biological: Fish	Leaf River boat electrofishing annual sampling started September 1999.

2.2 Sampling Schedule

River water was sampled monthly (Table 2.2) for chemical analysis at each river; biotic components were sampled quarterly (Table 2.3) for Codorus Creek, the McKenzie River, and the Willamette River; the Leaf River was sampled once in the fall of 1999 for fish and once in the spring/summer of 2000 for benthic macroinvertebrates and periphyton.

Table 2.2 Water Quality Sampling Schedule, Study Year 1999 to 2000

Month	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Day(s)	7	19	30	14	24	28	27	17	22	26	24	28

Table 2.3 Biological Sampling Schedule, Study Year 1999 to 2000

Season	Codorus Creek	Leaf River	McKenzie River	Willamette River
Fall 1999	Sep. 13 to 16	September[a]	Sept. 1 to 2	Aug. 30 to 31
Winter 1999	Nov. 15 to 18		Jan. 18 to 19	Cancelled (high water)
Spring 2000	Mar. 6 to 9		March 23 to 24	Mar. 21 to 23
Summer 2000	May 3 to 4	May/July[b]	June 2 to 3	May 31 to June 2

[a] Fish only
[b] Benthic macroinvertebrate and periphyton only

2.3 Codorus Creek Sampling Area

Codorus Creek is located in York County in south central Pennsylvania. The study area of the creek extends from just above Lake Marburg (created from the impoundment of one tributary of the West Branch of Codorus Creek) to its confluence with the Susquehanna River (Figure 2.1). There were eight sampling locations along this stretch of the creek (Table 2.4); six were sampled for all biotic and abiotic elements; one (East Branch) was sampled for fish, periphyton and macroinvertebrates only; another (Indian Rock) was sampled for fish only. The East Branch and Indian Rock sampling was done as part of the Western Washington University Research Agreement fish experimental design. A detailed description of each site is available in NCASI Technical Bulletin No. 841 (2002a) and NCASI Technical Bulletin No. 842 (2002b). Figures 2.2 through 2.8 show upstream views taken at each of the quarterly seasonal sampling events for periphyton and macroinvertebrates.

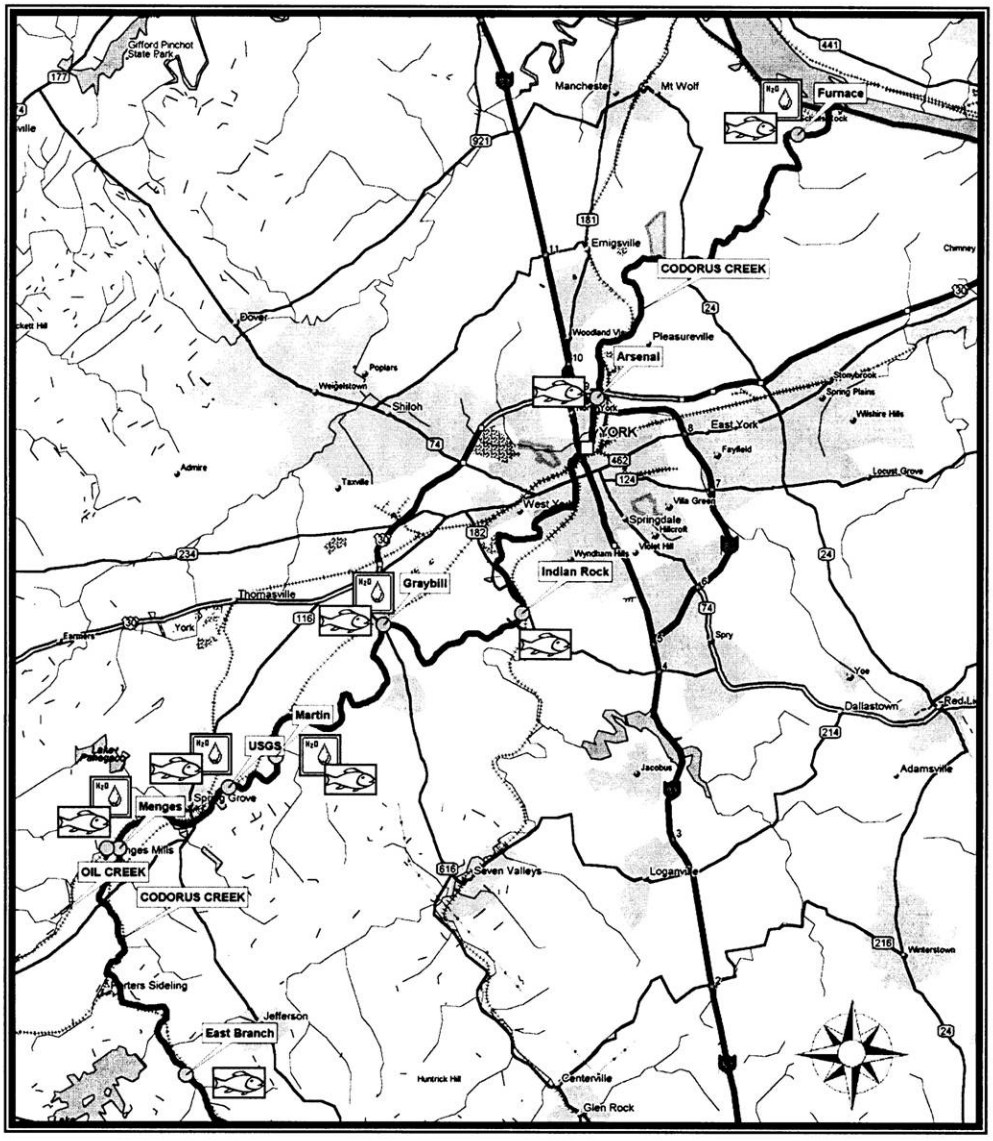


Figure 2.1 Codorus Creek in the Area of the LTRWS. Symbols Indicate the Elements Sampled at That Site (Fish=Biotic; Water Drop=Water Quality).

Table 2.4 Sampling Site Descriptions for Codorus Creek, Pennsylvania

Sample Site	Site Description	Sampled Elements
East Branch	Located on the West Branch above Lake Marburg Dam	All biotic elements No abiotic elements
Menges	Located on the West Branch below the hypolimnetic discharge from Lake Marburg and above the Mill	All biotic elements All abiotic elements
USGS	Located on the West Branch below the Mill thermal effluent outfall	All biotic elements All abiotic elements
Martin	Located on the West Branch below the Mill process water effluent outfall	All biotic elements All abiotic elements
Graybill	Located on the West Branch	All biotic elements All abiotic elements
Indian Rock	Located on the West Branch just above the confluence with the South Branch	Fish only No abiotic elements
Arsenal	Located on the main stem of Codorus Creek, in the City of York	All biotic elements All abiotic elements
Furnace	Located on the main stem just above its confluence with the Susquehanna River	All biotic elements All abiotic elements

September 1999 (Not sampled due to flood conditions)

November 1999

March 2000

May 2000

Figure 2.2 East Branch, Codorus Creek

September 1999

November 1999

March 2000

May 2000

Figure 2.3 Menges, Codorus Creek

September 1999

November 1999

March 2000

May 2000

Figure 2.4 USGS, Codorus Creek

September 1999

November 1999

March 2000

May 2000

Figure 2.5 Martin, Codorus Creek

September 1999

November 1999

March 2000

May 2000

Figure 2.6 Graybill, Codorus Creek

September 1999

November 1999

March 2000

Site Not Sampled for
Periphyton/Macroinvertebrates

May 2000

Figure 2.7 Arsenal, Codorus Creek

September 1999

November 1999

March 2000

Site not Sample for
Periphyton/Macroinvertebrates

May 2000

Figure 2.8 Furnace, Codorus Creek

2.4 Leaf River Sampling Area

The Leaf River is located in SE Mississippi, flowing in a southeasterly direction from its headwaters, joining with the Chickasawhay River to form the Pascagoula River. The LTRWS is located downstream of Hattiesburg and extends 32 river miles, most of which is located in Perry County. The sampling locations begin four river miles above the paper mill discharge at New Augusta and extend downstream of the mill discharge to just below McLain (Figure 2.9). Of the twelve sampling locations along this stretch of the river (Table 2.5), six were sampled for abiotic elements; the remaining six were sampled for the biotic elements. A detailed description of each site is available in NCASI Technical Bulletin No. 841 (2002a) and NCASI Technical Bulletin No. 842 (2002b). The site photograph element of the habitat data was not done during the sampling period covered in this bulletin.

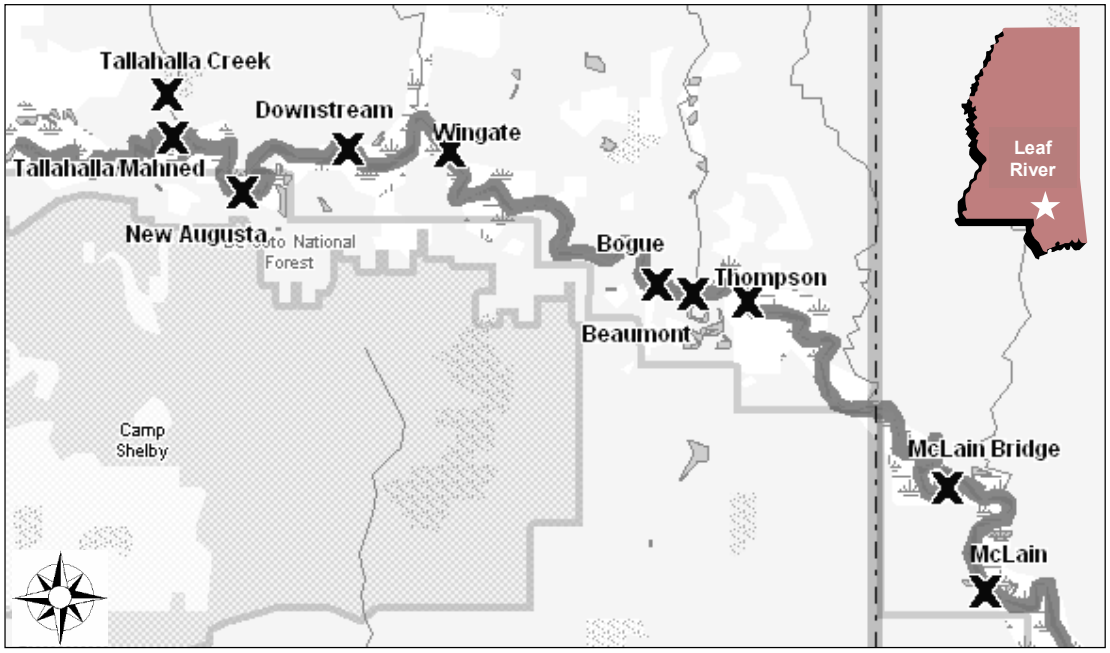


Figure 2.9 Leaf River in the Area of the LTRWS

Table 2.5 Sampling Site Descriptions for the Leaf River

Sample Site	Site Description	Sampled Elements
Tallahalla Creek	Located on the tributary stream, upstream of its confluence with the Leaf	Abiotic elements only
Tallahalla	Located on the Leaf River upstream of the confluence with Tallahalla Creek and 4.3 river miles upstream of the mill effluent	Biotic elements only
Mahned	Located on the Leaf River 4.7 river miles upstream of the mill effluent outfall	Abiotic elements only
New Augusta	Located on the Leaf River 1.5 river miles upstream of the mill effluent outfall	Biotic elements only
Downstream	2 sites (A and B) located approximately 2 river miles downstream of the mill outfall	Biotic elements only
Wingate	Located 4.4 river miles downstream of the mill effluent outfall.	Abiotic elements only
Bogue	Located upstream of the town of Beaumont, 10.3 river miles downstream of the effluent outfall	Biotic elements only
Beaumont	Located in Beaumont, 12.2 river miles downstream of the effluent outfall	Abiotic elements only
Thompson	Located downstream of Beaumont, 13 river miles downstream of the mill	Biotic elements only
McLain Bridge	Located at the highway bridge, upstream of the town of McLain, 26.8 river miles downstream of the mill	Abiotic elements only
McLain	Located downstream of the highway bridge, 27.5 river miles downstream of the mill	Biotic elements only

2.5 McKenzie River Sampling Area

The McKenzie River originates in the Cascade Mountains in Central Oregon and runs west into the Willamette Valley where it joins the Willamette River. The study area of the river extends approximately 20 river miles, from Hendricks Bridge at the upstream end to Armitage State Park at the downstream end (Figure 2.10). There are five water quality sampling locations, five macroinvertebrate and periphyton locations, four backpack electrofishing areas, and five boat electrofishing areas (Table 2.6). A detailed description of each site is available in NCASI Technical Bulletin No. 841 (2002a) and NCASI Technical Bulletin No. 842 (2002b). Figures 2.11 through 2.15 show upstream views taken at each of the quarterly seasonal macroinvertebrate/periphyton sampling events.

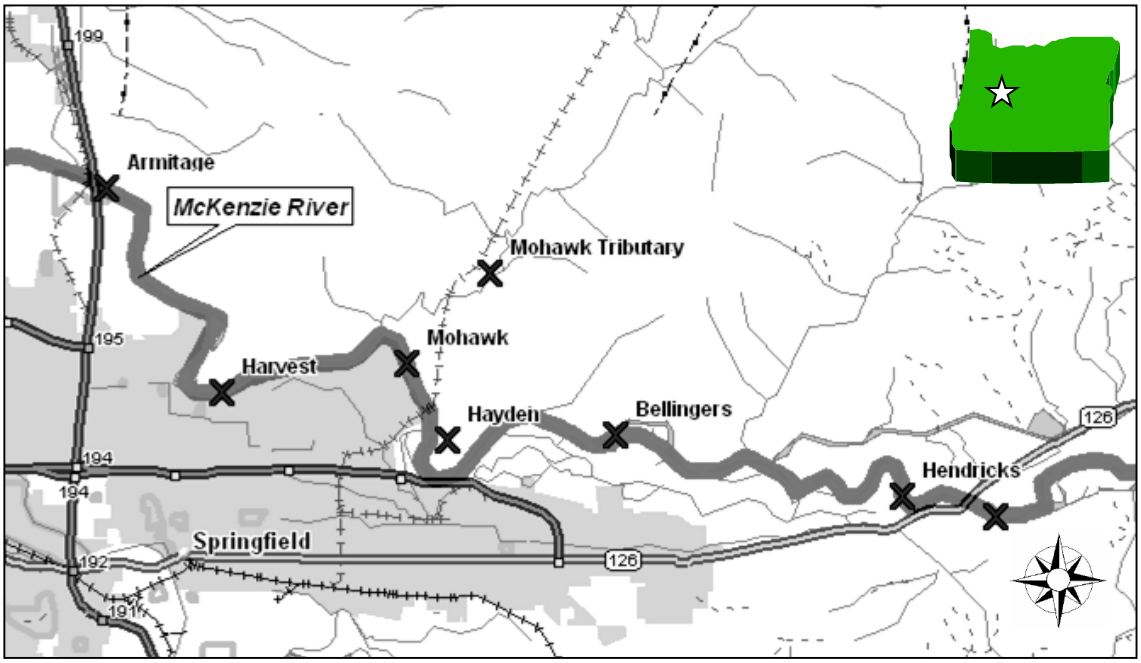


Figure 2.10 McKenzie River in the Area of the LTRWS

Table 2.6 Sampling Site Descriptions for the McKenzie River, Oregon

Sample Site	Site Description	Sampled Elements
Hendricks	RM26-26.5	Fish only
Hendricks	RM22.4 located 7.6 river miles above the mill effluent discharge.	Macroinvertebrate and periphyton All abiotic elements
Bellingers	RM18.5-19 located approximately 3.5 river miles above the mill effluent discharge	All biotic elements
Hayden	Located just above the mill effluent discharge.	Abiotic elements only
Mohawk	RM14 located 1.1 river miles below the mill effluent discharge.	All biotic elements
Harvest	RM10 Located approximately 4 river miles below the mill effluent discharge	All biotic elements All abiotic elements
Armitage/Coburg	RM6 located 8.3 river miles below the mill effluent discharge	All biotic elements All abiotic elements
Mohawk River	Tributary sampled upstream of the confluence with the McKenzie River	Abiotic elements only

Site not sampled;
inaccessible due to
low water

September 1999

January 2000

March 2000

June 2000

Figure 2.11 Hendricks RM 22.4, McKenzie River, Upstream View

September 1999

January 2000

March 2000

June 2000

Figure 2.12 Bellingers RM 18.5, McKenzie River, Upstream View

September 1999

No Photo Available

January 2000

March 2000

June 2000

Figure 2.13 Mohawk RM14, McKenzie River, Upstream View

September 1999

January 2000

March 2000

June 2000

Figure 2.14 Harvest RM10, McKenzie River, Upstream View

September 1999

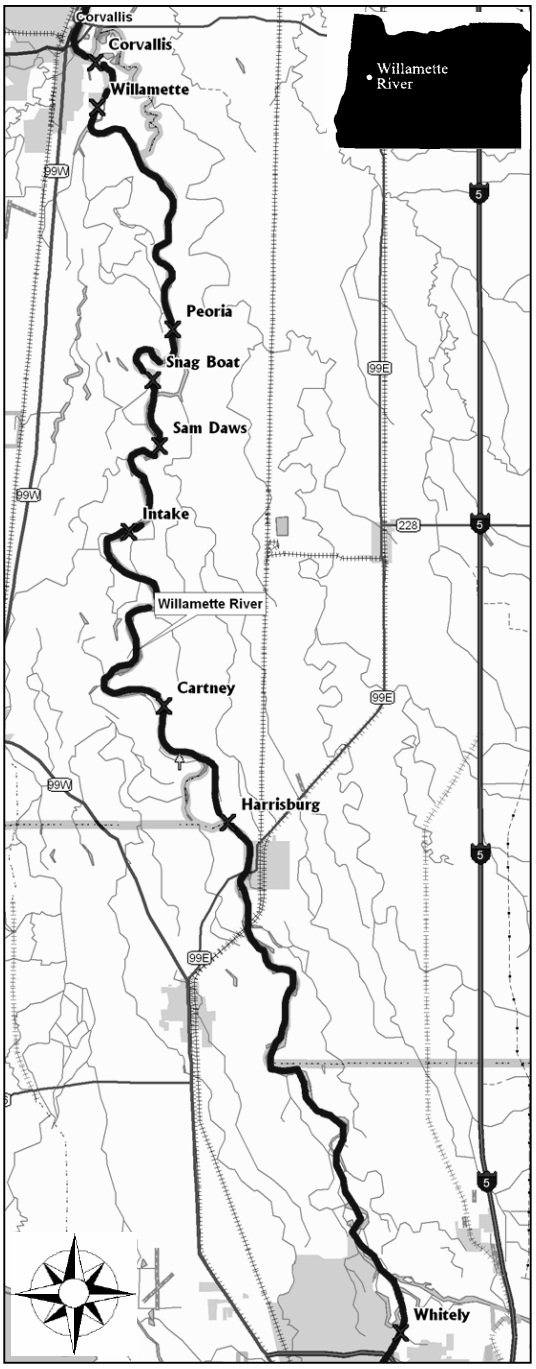
January 2000

March 2000

June 2000

Figure 2.15 Armitage RM6, McKenzie River, Upstream View

2.6 Willamette River Sampling Area



The Willamette River is located in the Willamette Valley, which runs between the Coastal Range and the Cascade Mountain Range in Western Oregon. The study area of the river extends from Harrisburg to Corvallis, a length of approximately 32 river miles (RM) (Figure16). There were five water quality sites, seven macroinvertebrate/periphyton sites, six boat electrofishing sites,and four backpack electrofishing sites (Table 2.7). While different sample elements were of necessity collected from different regions of a sample site, if they came from the same general area they have the same site name. A detailed description of the sites is available in NCASI Technical Bulletin No. 841 (2002a) and NCASI Technical Bulletin No. 842 (2002b). Figures 2.17 through 2.23 show upstream views taken at each of the quarterly/seasonal sampling events for periphyton and macroinvertebrates.

Figure 2.16 Willamette River in the Area of the LTRWS

Table 2.7 Sampling Site Descriptions for the Willamette River, Oregon

Sample Site	Site Description	Sampled Elements
Whitely	RM176 located above the confluence with the McKenzie River	Macroinvertebrates and periphyton
Harrisburg	RM160. located below the city of Harrisburg and 14.7 river miles above the mill effluent discharge	All biotic elements All abiotic elements
Cartney	RM156 located 12.7 river miles above the mill effluent discharge	All biotic elements All abiotic elements
Intake	RM148 located 0.6 river miles above the mill effluent discharge	All biotic elements
Sam Daws	RM 145.5 located 1.0 river mile below the mill effluent discharge	Fish
Snag Boat	RM143.5 located 2.2 river miles below the mill effluent discharge	Macroinvertebrates and periphyton
Peoria	Located just downstream of the city of Peoria	Fish and water quality
Long Tom Confluence	RM136	Fish
Willamette	RM134	All biotic elements
Corvallis	RM128	All biotic elements All abiotic elements
Long Tom River	Tributary sampled just upstream of the confluence with the Willamette River	Water quality

September 1999

Site not sampled due
to high water

January 2000

March 2000

No photo available

June 2000

Figure 2.17 Whitely RM176, Willamette River

August/September 1999

Site not sampled
due to high water

November 1999

March 2000

May/June 2000

Figure 2.18 Harrisburg RM160, Willamette River

August/September 1999

Site not sampled
due to high water

November 1999

March 2000

May/June 2000

Figure 2.19 Cartney RM156, Willamette River

August/September 1999

Site not sampled
due to high water

November 1999

March 2000

May/June 2000

Figure 2.20 Intake RM148, Willamette River

August/September 1999

Site not sampled
due to high water

November 1999

March 2000

May/June 2000

Figure 2.21 Snag Boat RM143.5, Willamette River

August/September 1999

Site not sampled
due to high water

November 1999

March 2000

May/June 2000

Figure 2.22 Willamette RM134, Willamette River

August/September 1999

Site not sampled
due to high water

November 1999

March 2000

May/June 2000

Figure 2.23 Corvallis RM128, Willamette River

3.0 METHODS AND RESULTS

3.1 Water Temperature

In-river temperatures were recorded for the Willamette and McKenzie Rivers. Vemco Minilog-T data loggers were placed near the mill discharge points south of Peoria for the Willamette River, and near the mill intake for the McKenzie River. No temperature data were collected for Codorus Creek or the Leaf River. The seven-day moving mean of the maximum temperature smoothes out some of the daily fluctuations and provides a picture of the average temperature over a period of time. It was calculated by taking the mean of the 24h maximum for a 7-d period encompassing the 3-d prior and the 3-d after each day. Daily fluctuations represent the difference between the minimum and the maximum temperatures that occur during the 24h period from midnight to midnight. Gaps in the line segment indicate data gaps due to loss of the data logger or loss of data in the electronic transfer.

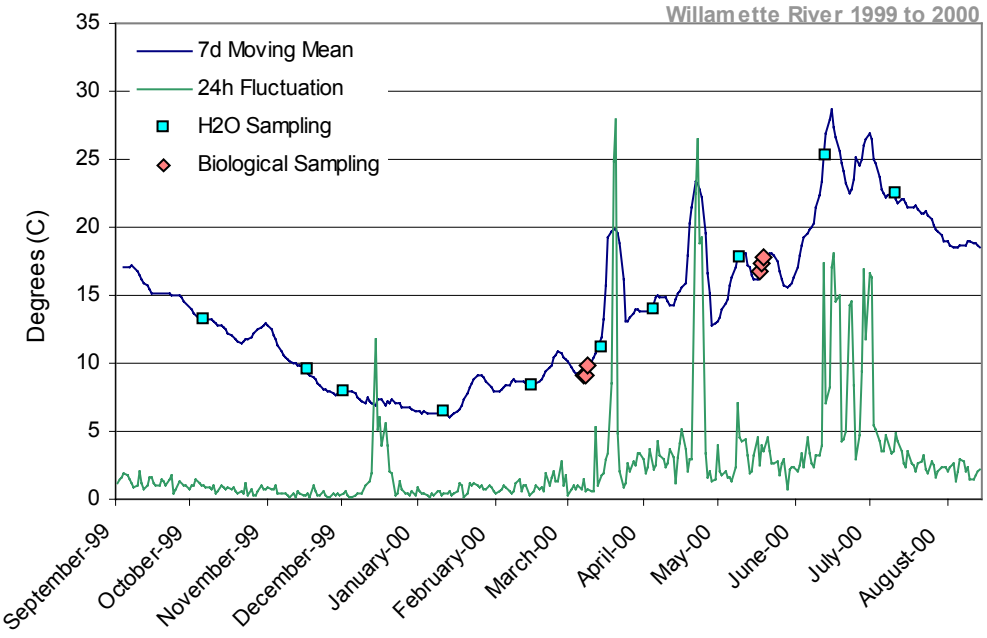


Figure 3.1 Willamette River Water Temperature, 7d Moving Average of the Maximum and 24h Fluctuation, from September 1999 to August 2000, Measured at Halsey, Oregon. LTRWS Sampling Dates are Indicated by Symbols.

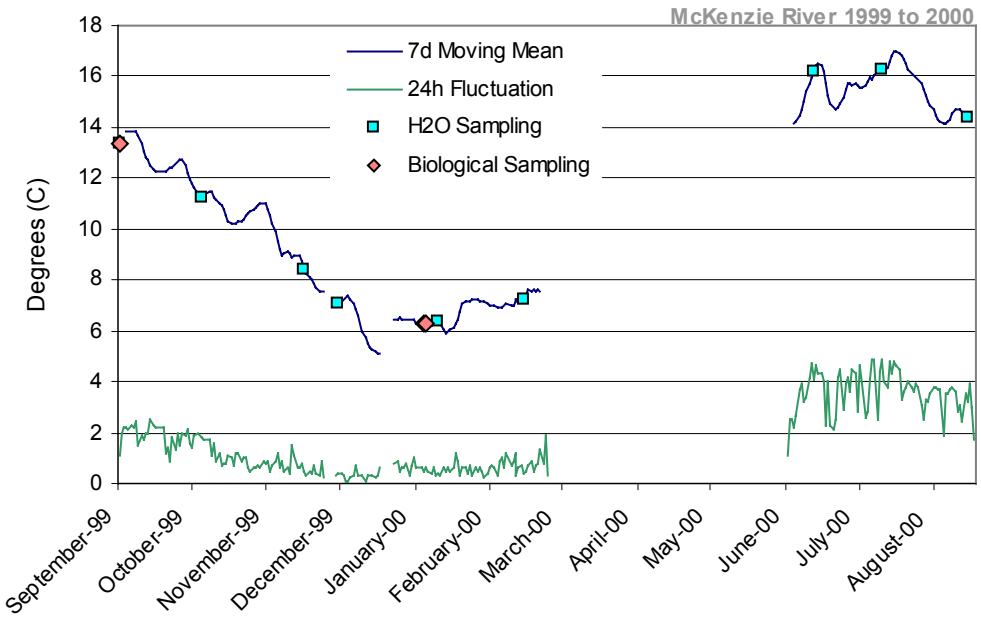


Figure 3.2 McKenzie River Water Temperature, 7d Moving Average of the Maximum and 24h Fluctuation, from September 1999 to March 2000, Measured at Springfield, Oregon. LTRWS Sampling Dates are Indicated by Symbols.

3.2 Solar Radiation

Solar radiation measurements were made using LI-COR LI-200SA pyranometer sensors placed near the mill effluent outfall locations for Codorus Creek (Spring Grove, Pennsylvania) and the Willamette River (near Halsey, Oregon). The pyranometers were deployed for the entire sampling season, with data downloaded in conjunction with fieldwork. The sensors record the solar radiation between 400 nm and 1100 nm wavelength every three hours and report an integrated value (in W h m^{-2}). The 8 measurements per 24h were summed to give the total solar radiation per day.

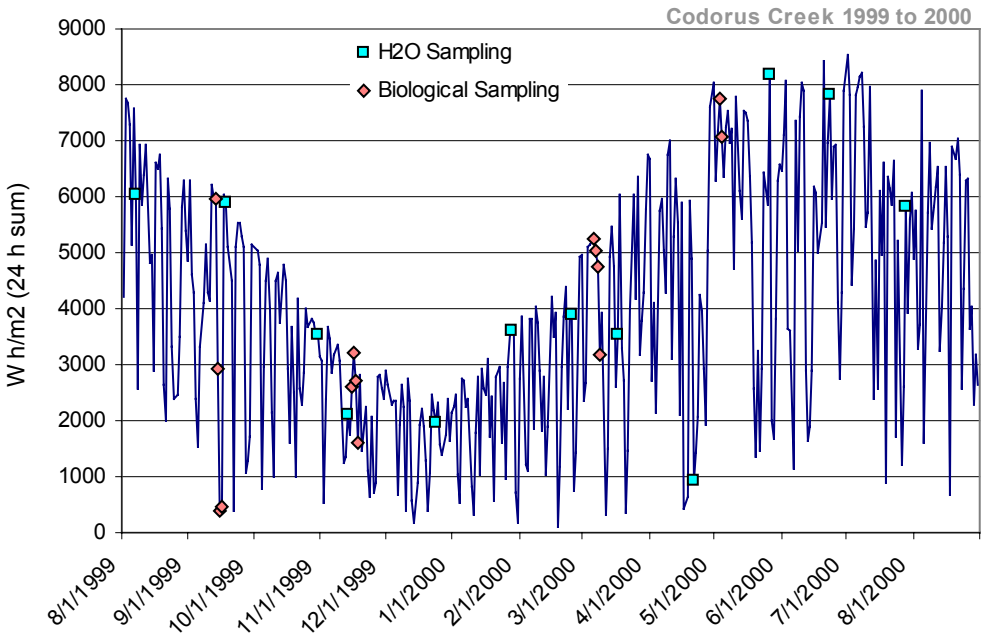


Figure 3.3 Daily Solar Radiation for the Codorus Creek LTRWS Area, Measured at Spring Grove, Pennsylvania, from September 1999 to August 2000. LTRWS Sampling Dates are Indicated by Symbols.

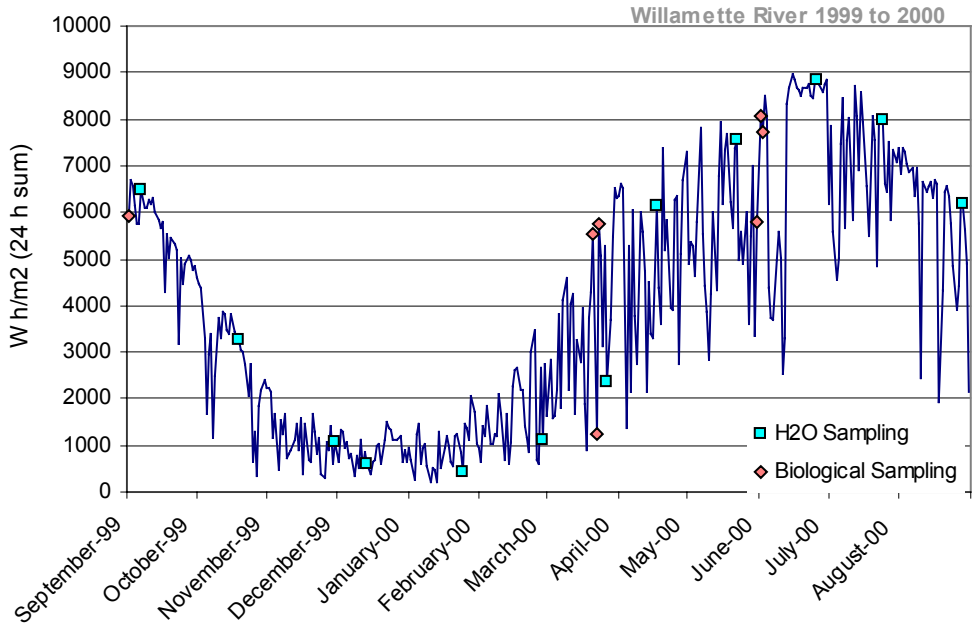


Figure 3.4 Daily Solar Radiation for the Willamette River LTRWS Area, Measured Near Halsey, Oregon, from September 1999 to August 2000. LTRWS Sampling Dates are Indicated by Symbols.

3.3 Water Flow

River flow data were obtained from the US Geological Survey (USGS) web site. Reported values were daily flow in cubic feet per second (cfs) and feet above datum. The measurements for Codorus Creek were taken from USGS gauging station #01574500 at Spring Grove, Pennsylvania, located within the study area. The Leaf River measurements were recorded at USGS gauging station #0247460 near New Augusta, Mississippi. The McKenzie River data were recorded at USGS gauging station #14162500 at Vida, Oregon, located 16 river miles upstream of the study area. The Willamette River data were recorded at USGS gauging station #14166000 at Harrisburg, Oregon, located at the most upstream point of the study area.

The McKenzie River gauging station, unlike the other three LTRWS rivers, is located outside of the LTRWS area, therefore a modification was applied to the flow data in order to better represent flow conditions in the study area. This was begun with the study year 1999 to 2000. A 1.1916 multiplication factor was applied to the river flow data. This factor was derived from the ratio of the river flow data from a now defunct river gauge at Coburg (in the LTRWS area) less the additional flow from the Mohawk River at that point, to the river flow data for the upstream site of Vida. All data used to calculate the modification were taken from the same period, 1965 to 1971. The modified flow is a more accurate representation of the river flow at the location of the mill effluent discharge.

Instream waste concentration was calculated as percent effluent per total river volume. The daily amount of effluent discharged from the plant in million gallons per day was converted to instream flow in cfs. The total river volume is the river flow plus the effluent discharge. The values represent the theoretical effluent concentration at the point of discharge without any consideration for jet or diffuser dynamics or mixing.

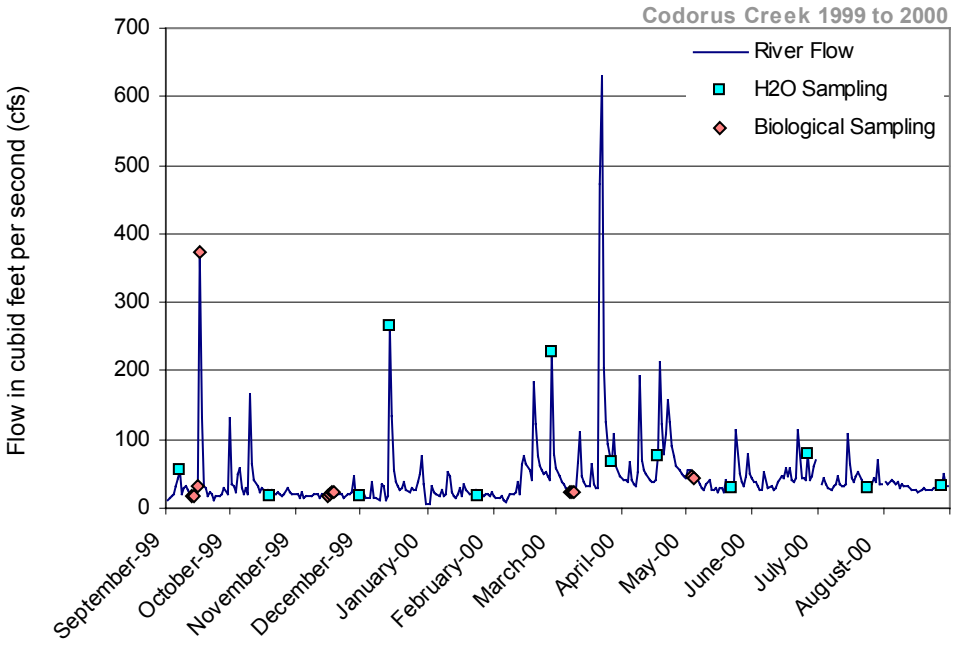


Figure 3.5 Codorus Creek Water Flow from September 1999 to August 2000. LTRWS Sampling Dates are Indicated by Symbols.

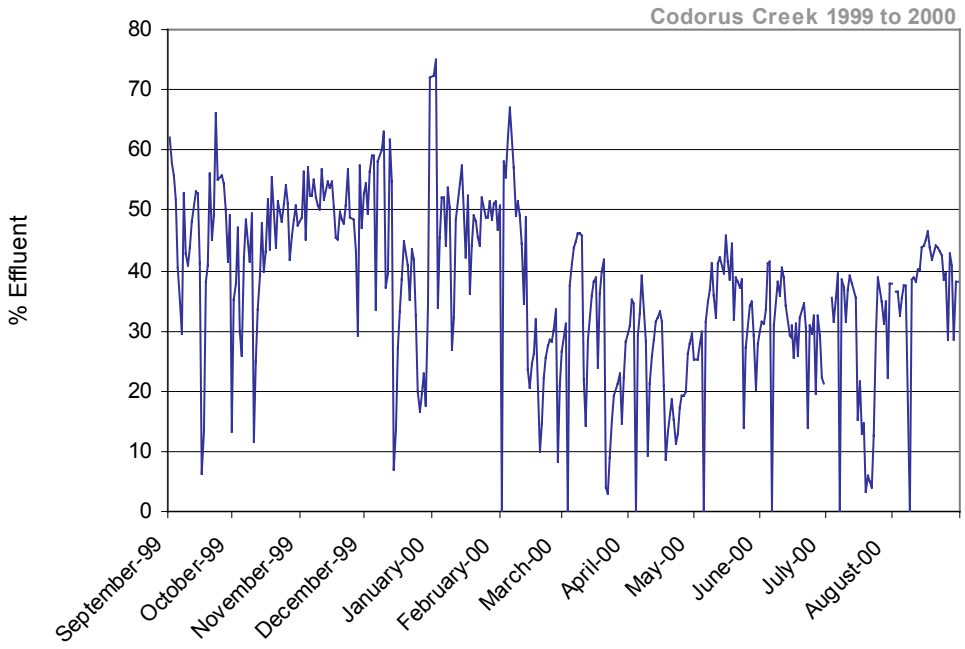


Figure 3.6 Codorus Creek Instream Waste Concentration at Point of Discharge as a Percent of Total River Volume, from September 1999 to August 2000

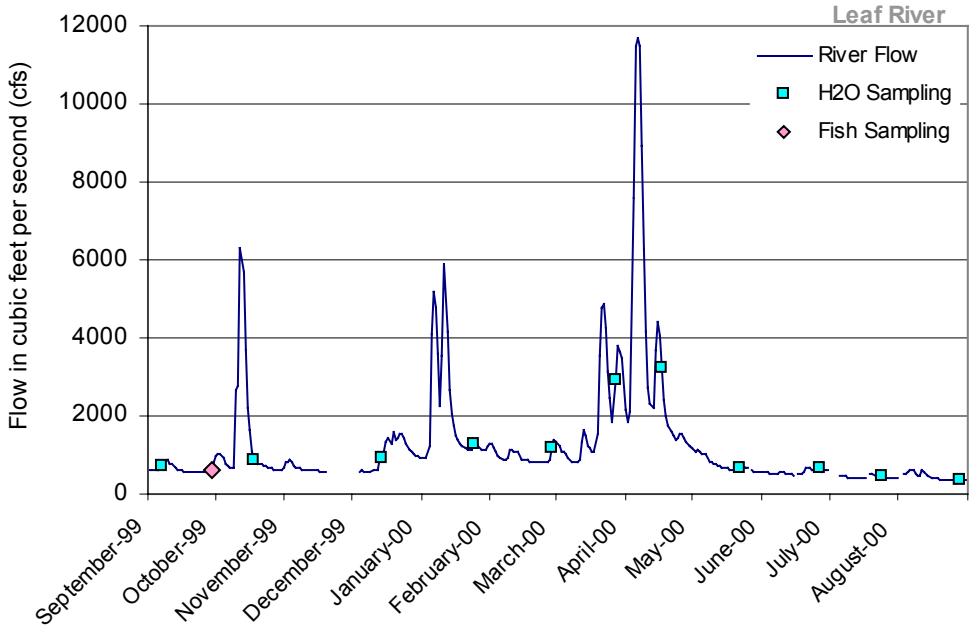


Figure 3.7 Leaf River Water Flow from September 1999 to August 2000. LTRWS Sampling Dates are Indicated by Symbols.

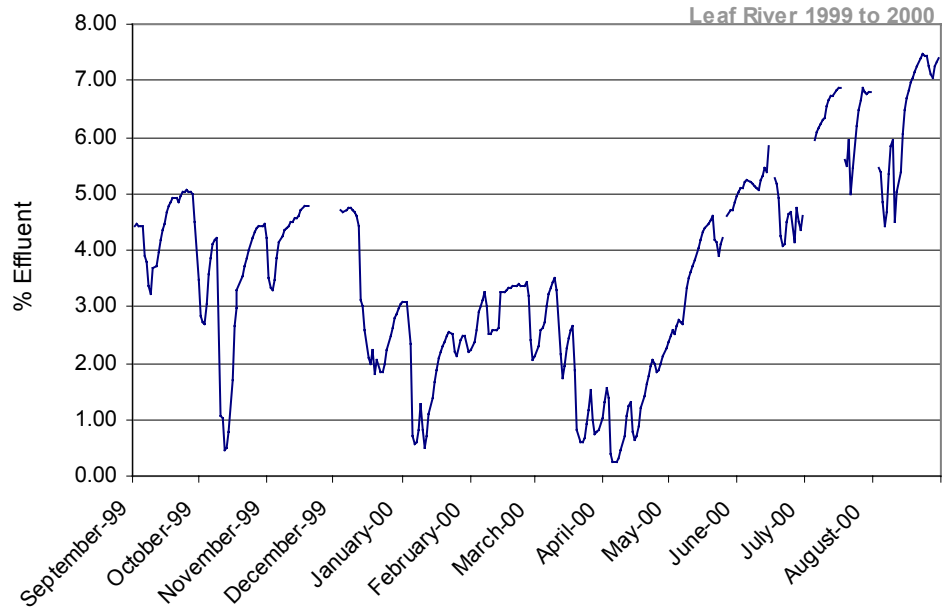


Figure 3.8 Leaf River Instream Waste Concentration at Point of Discharge As A Percent of Total River Volume, from September 1999 to August 2000

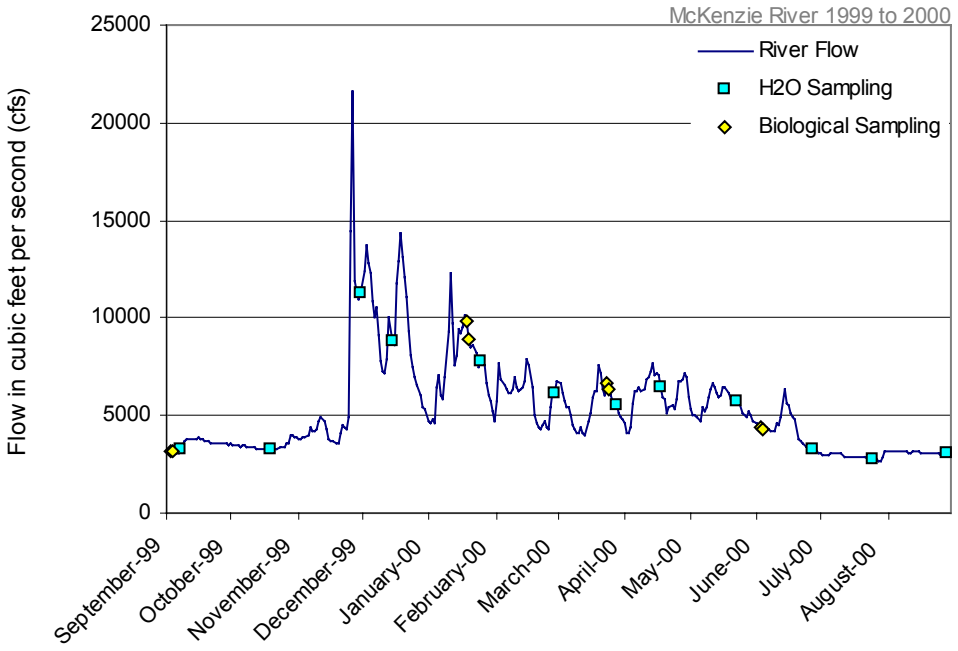


Figure 3.9 McKenzie River Water Flow from September 1999 to August 2000. LTRWS Sampling Dates are Indicated by Symbols.

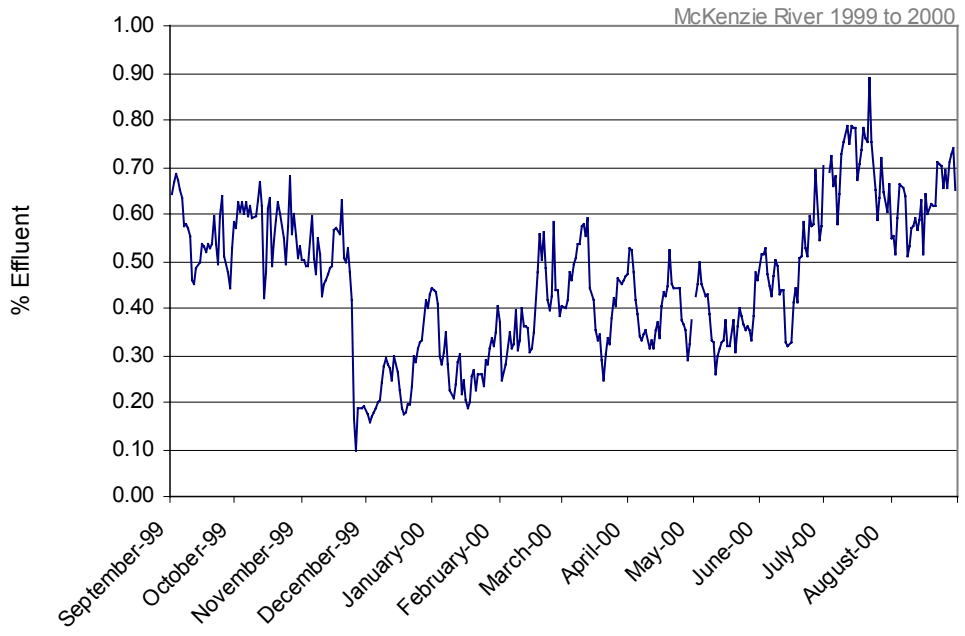


Figure 3.10 McKenzie River Instream Waste Concentration at Point of Discharge as a Percent of Total River Volume, from September 1999 to August 2000

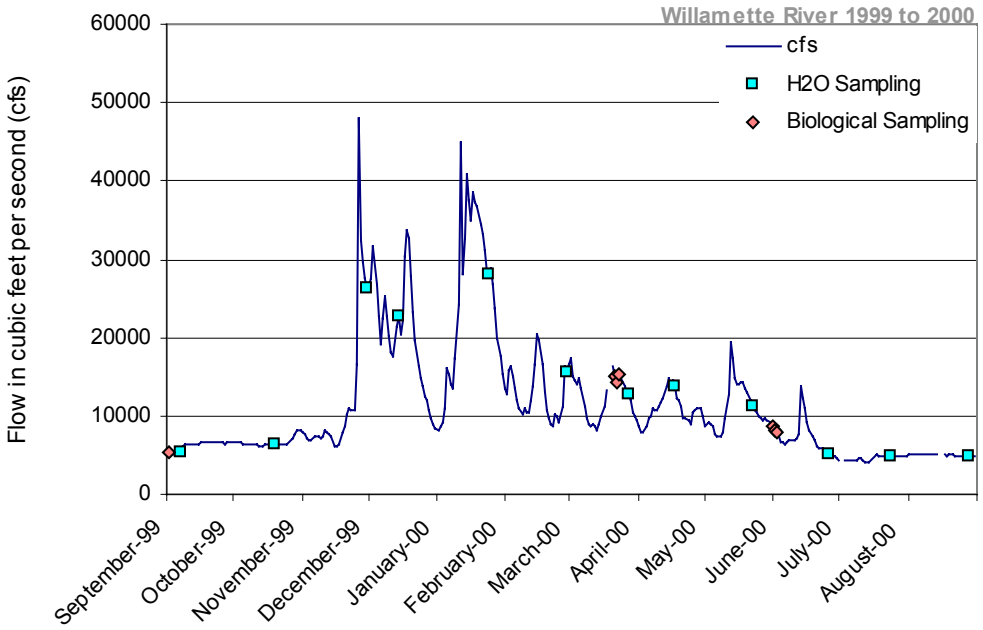


Figure 3.11 Willamette River Water Flow from September 1999 to August 2000. LTRWS Sampling Dates are Indicated by Symbols.

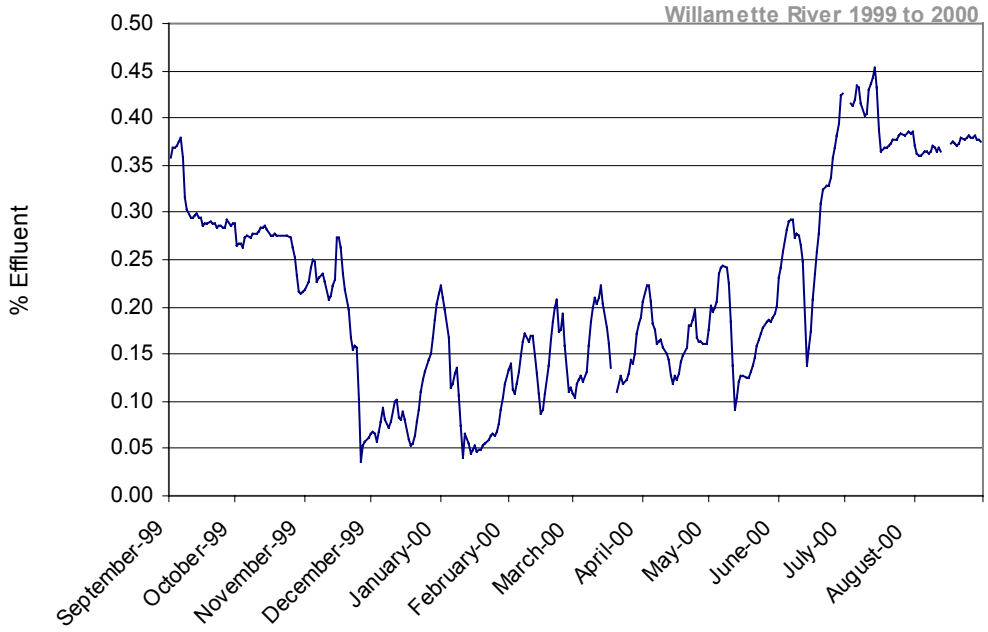


Figure 3.12 Willamette River Instream Waste Concentration at Point of Discharge as a Percent of Total River Volume, from September 1999 to August 2000

3.4 Water Chemistry

River water samples were taken monthly for analysis at each LTRWS river. All sites were sampled on the same day and in a downstream to upstream direction. Grab samples were collected 6 inches below the surface in acid-washed bottles, and shipped cold to the NCASI Anacortes Northwest Aquatic Biology Facility (NABF) within 24 h and processed within 48 h. Most of the water quality analysis in this report was done at the NABF; exceptions were river pH and temperature, which were recorded in the field at the time of sampling. Analysis included, but was not limited to, pH, temperature, color, conductivity, turbidity, COD, ammonia, nitrate and nitrite, orthophosphate, total phosphorus and nitrogen. Ammonia, nitrate and nitrite, and orthophosphate analyses were discontinued after the December 1999 sampling for all rivers; COD analysis was discontinued on the McKenzie and Willamette River samples in 1998 due to persistent non-detect levels. Total Kjeldahl nitrogen (TKN) was replaced with total nitrogen for all rivers beginning in January, 2000. Sampling on the Leaf River was begun in September of 1999.

Table 3.1 Codorus Creek Water Chemistry

Station	Date	pH	Temp. (C)	Color (Pt-Co Units)	Conduc-tivity (µS/cm)	Turbidity (NTU)	COD (mg/L)	Ammonia (mg/L)	Nitrate + Nitrite (mg/L)	ortho-Phosphate (mg/L)	Total Phos-phorus (mg/L)	Total Kjeldahl Nitrogen (mg/L)
Menges	09/7/99	7.2	16.8	50	177	36	26	0.28	1.63	0.16	0.19	0.89
USGS	09/7/99	7.5	21.1	22	212	23	21	0.25	1.20	0.10	0.23	0.90
Martin	09/7/99	7.7	23.6	60	550	16	40	0.17	1.20	0.08	0.14	0.72
Graybill	09/7/99	7.7	24.1	87	665	21	46	0.16	1.00	0.08	0.18	0.69
Furnace	09/7/99	7.8	23.4	43	202	53	29	0.11	0.96	0.22	0.24	0.72
Oil Creek	09/7/99	7.7	22.2	48	261	153	29	0.18	1.75	0.33	0.41	0.87
Menges	10/19/99	7.2	9.4	12	189	3	FQA	0.06	2.82	ND [<0.02]	0.05	0.33
USGS	10/19/99	7.6	11.1	19	371	3	FQA	0.05	3.92	0.05	0.09	0.48
Martin	10/19/99	7.6	17.4	150	1350	2	FQA	0.05	1.91	0.04	0.08	1.35
Graybill	10/19/99	7.6	14.3	103	1048	2	FQA	0.04	3.35	0.04	0.07	0.82
Furnace	10/19/99	7.9	13.1	42	650	2	FQA	0.04	4.80	0.12	0.16	0.83
Oil Creek	10/19/99	8.0	10.7	19	892	5	FQA	ND [<0.03]	7.76	0.32	0.39	0.62
Menges	11/29/99	7.0	6.5	9	173	2	4	ND [<0.03]	1.23	ND [<0.02]	0.12	0.41
USGS	11/29/99	7.5	9.8	20	299	5	-1	0.08	2.06	0.06	0.14	0.59
Martin	11/29/99	7.5	14.7	149	1101	3	83	0.45	1.16	0.04	0.13	1.46
Graybill	11/29/99	7.5	11.7	155	1167	3	77	0.41	1.70	0.05	0.13	1.28
Furnace	11/29/99	7.5	9.4	32	506	2	18	ND [<0.03]	3.30	0.04	0.12	0.85
Oil Creek	11/29/99	7.5	5.5	12	719	3	14	0.04	6.20	0.26	0.35	0.54
Menges	12/13/99	7.0	4.5	21	188	3	3	ND [<0.01]	2.18	0.01	0.04	0.20
USGS	12/13/99	7.5	7.3	11	347	5	9	0.03	2.38	0.05	0.09	0.37
Martin	12/13/99	7.5	14.7	167	1498	9	85	0.07	0.98	0.03	0.09	1.06
Graybill	12/13/99	7.4	10.0	157	1267	6	64	0.08	1.73	0.02	0.10	0.96
Furnace	12/13/99	7.3	6.8	38	532	3	17	0.04	3.28	0.04	0.08	0.86
Oil Creek	12/13/99	7.4	5.0	31	821	4	14	0.10	4.53	0.27	0.03	0.81

Note: ND=non-detect; FQA=failed quality assurance

(Continued on next page)

Table 3.1 Continued

Station	Date	pH	Temp. (C)	Color (Pt-Co Units)	Conduc-tivity (µS/cm)	Turbidity (NTU)	COD (mg/L)	Ammonia (mg/L)	Nitrate + Nitrite (mg/L)	ortho-Phosphate (mg/L)	Total Phos-phorus (mg/L)	Total Nitrogen (mg/L)
Menges	01/24/00	7.2	0.2	8	196	3	2				FQA	3.39
USGS	01/24/00	7.7	2.6	9	335	4	5				FQA	3.18
Martin	01/24/00	7.7	10.1	152	1434	8	97				FQA	2.80
Graybill	01/24/00	7.8	6.0	131	1184	5	93				FQA	2.99
Furnace	01/24/00	8.0	3.0	53	697	4	28				FQA	4.96
Oil Creek	01/24/00	8.0	0.4	20	733	4	5				FQA	7.30
Menges	02/28/00	7.1	7.8	66	188	202	34				0.24	4.79
USGS	02/28/00	7.4	9.1	79	251	261	36				0.17	4.08
Martin	02/28/00	7.4	9.8	85	341	255	42				0.17	4.15
Graybill	02/28/00	7.5	10.4	60	381	143	43				0.05	5.64
Furnace	02/28/00	7.6	9.1	62	316	153	34				0.05	3.85
Oil Creek	02/28/00	7.4	8.0	93	250	210	35				0.16	3.87
Menges	03/27/00	7.1	9.3	ND [<10 Pt-Co]	188	8	3				ND	5.75
USGS	03/27/00	7.4	11.5	11	293	12	7				ND	5.53
Martin	03/27/00	7.4	14.3	66	656	11	30				ND	4.66
Graybill	03/27/00	7.5	13.0	49	537	9	28				0.03	5.22
Furnace	03/27/00	7.6	11.6	14	351	9	6				ND	5.11
Oil Creek	03/27/00	7.6	8.8	11	409	11	5				0.05	6.55
Menges	04/17/00	6.8	14.1	12	190	4	4				ND	3.89
USGS	04/17/00	7.2	16.4	16	331	14	9				0.02	4.15
Martin	04/17/00	7.4	17.3	133	1006	12	57				ND	4.33
Graybill	04/17/00	7.4	16.6	91	750	13	35				0.01	4.45
Furnace	04/17/00	7.4	14.8	32	423	6	7				ND	4.04
Oil Creek	04/17/00	7.3	14.2	18	422	10	10				0.08	5.41
Menges	05/22/00	7.8	14.7	14	179	14	8				ND	3.74
USGS	05/22/00	7.8	18.2	12	329	16	14				0.06	4.52
Martin	05/22/00	7.7	21.0	176	1152	11	74				0.02	3.23
Graybill	05/22/00	7.7	18.1	103	905	11	50				0.04	3.77
Furnace	05/22/00	7.8	16.7	36	501	11	21				0.08	4.14
Oil Creek	05/22/00	7.9	15.4	19	487	25	14				0.29	6.58

Note: ND=non-detect

(Continued on next page)

Table 3.1 Continued

Station	Date	pH	Temp. (C)	Color (Pt-Co Units)	Conduc-tivity (μS/cm)	Turbidity (NTU)	COD (mg/L)	Ammonia (mg/L)	Nitrate + Nitrite (mg/L)	ortho-Phosphate (mg/L)	Total Phos-phorus (mg/L)	Total Nitrogen (mg/L)
Menges	06/26/00	7.3	17.5	33	175	147	17				0.22	2.94
USGS	06/26/00	7.6	22.2	30	390	64	28				0.27	5.94
Martin	06/26/00	7.6	23.9	70	603	41	35				0.16	4.75
Graybill	06/26/00	7.6	24.8	79	578	75	41				0.10	3.21
Furnace	06/26/00	7.5	24.7	44	321	37	31				0.10	2.71
Oil Creek	06/26/00	7.6	22.2	77	276	243	32				0.47	5.19
Menges	07/24/00	7.3	13.9	ND [<10 Pt-Co]	165	6	10				ND	1.89
USGS	07/24/00	7.3	21.9	13	269	10	12				0.01	2.78
Martin	07/24/00	7.6	24.7	163	917	9	63				ND	2.26
Graybill	07/24/00	7.7	22.2	142	856	10	57				ND	2.73
Furnace	07/24/00	7.9	21.2	54	593	8	27				0.39	4.76
Oil Creek	07/24/00	8.0	19.6	38	701	14	7				0.14	5.90
Menges	08/28/00	7.2	14.3	20	175	16	19				0.06	2.30
USGS	08/28/00	7.4	18.8	9	261	20	20				0.07	2.31
Martin	08/28/00	7.6	22.0	88	642	23	45				0.06	2.00
Graybill	08/28/00	7.6	22.5	107	704	37	53				0.09	2.24
Furnace	08/28/00	7.6	21.7	53	311	65	22				0.24	2.77
Oil Creek	08/28/00	7.6	20.4	45	358	47	34				0.29	4.06

Note: ND=non-detect

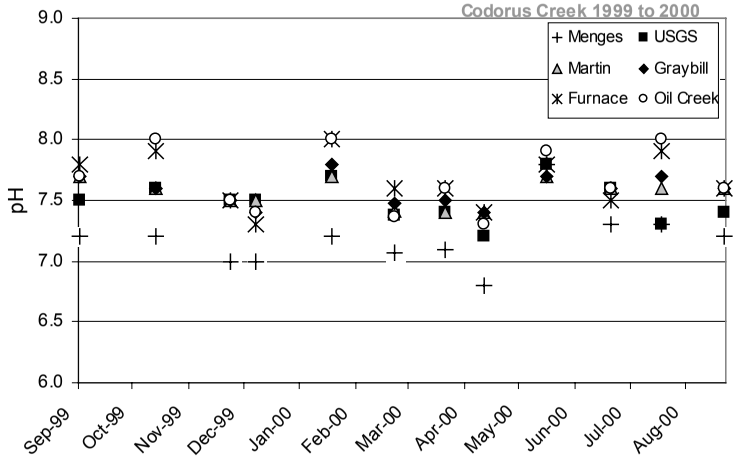


Figure 3.13 Codorus Creek pH

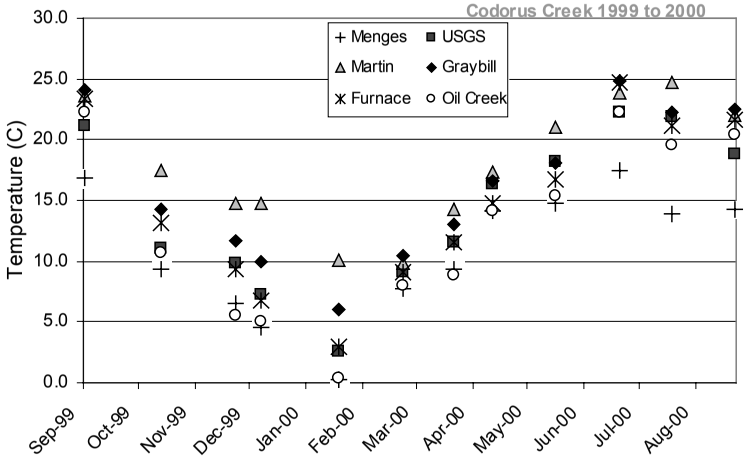


Figure 3.14 Codorus Creek Temperature

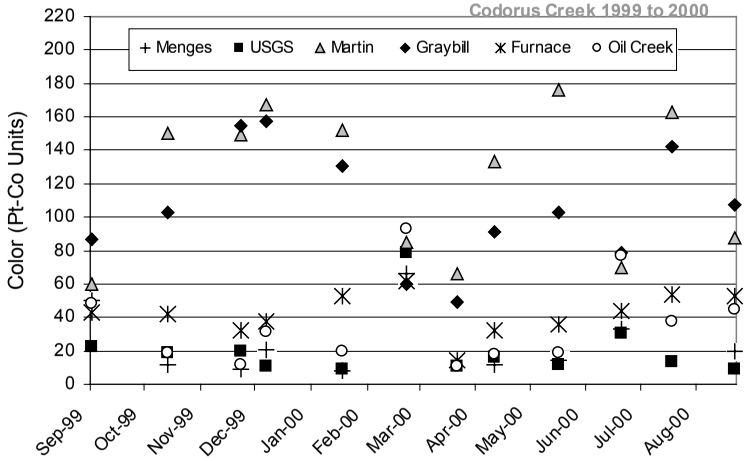


Figure 3.15 Codorus Creek Color

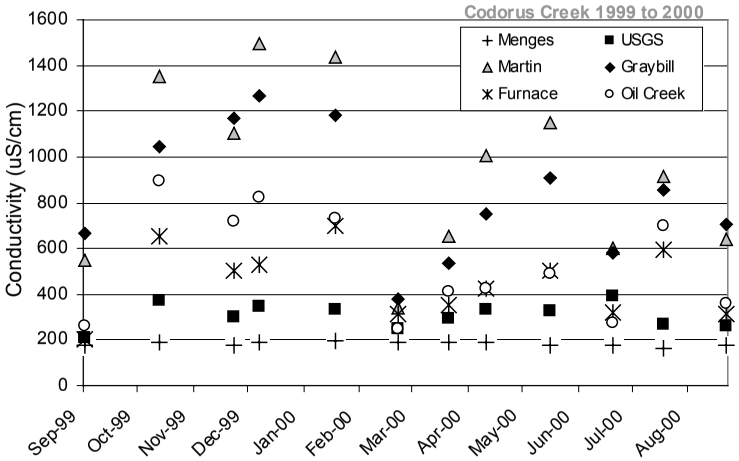
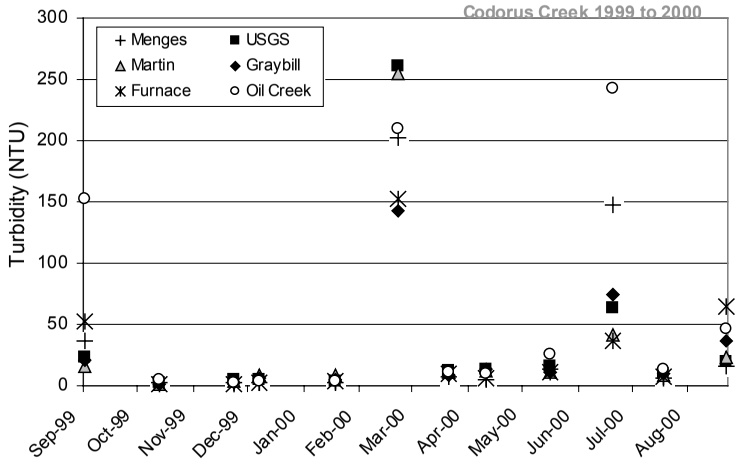


Figure 3.16 Codorus Creek Conductivity



3.17 Codorus Creek Turbidity

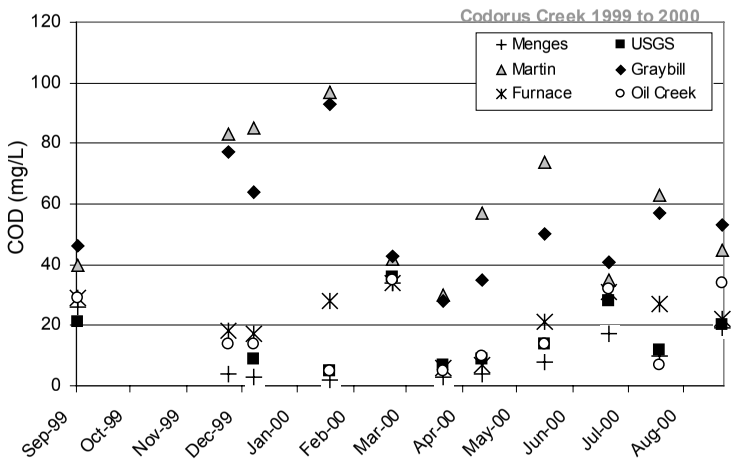
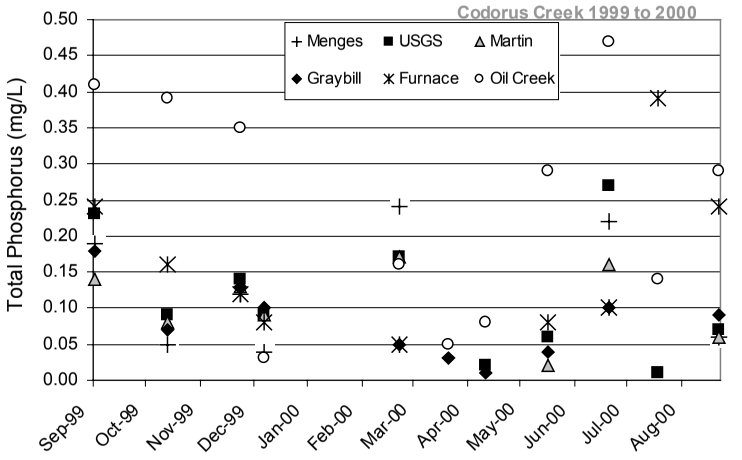
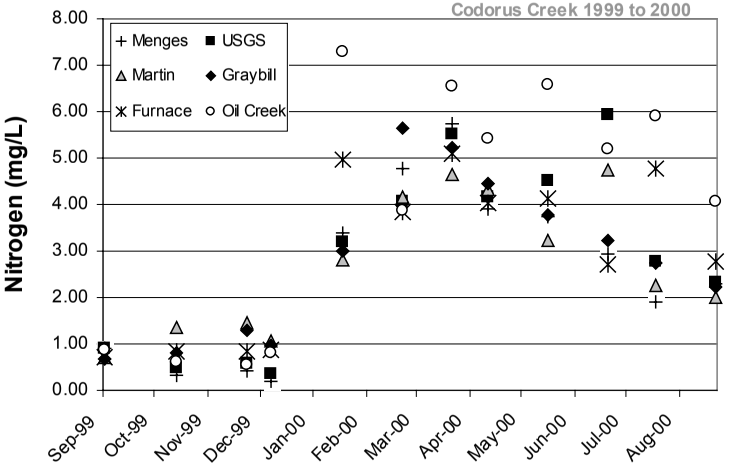


Figure 3.18 Codorus Creek COD



3.19 Codorus Creek Total Phosphorus



3.20 Codorus Creek Nitrogen

Table 3.2 Leaf River Water Chemistry

Station	Date	pH	Temp (C)	Color (Pt-Co Units)	Conduc-tivity (µS/cm)	Turbidity (NTU)	COD (mg/L)	Ammonia (mg/L)	Nitrate + Nitrite (mg/L)	ortho-Phosphate (mg/L)	Total Phos-phorus (mg/L)	Total Kjeldahl Nitrogen (mg/L)
Tallahala	09/07/99											
Mahned	09/07/99											
New Augusta	09/07/99	6.3	30.0	35	82	6	13	0.07	0.51	0.12	0.15	0.25
Wingate	09/07/99	6.7	30.5	70	257	6	27	0.07	0.50	0.12	0.16	0.24
Beaumont	09/07/99	6.6	30.0	84	241	8	29	0.05	0.48	0.11	0.19	0.93
McLain Bridge	09/07/99	6.8	29.5	80	256	7	17	0.05	0.53	0.11	0.15	0.53
Tallahala	10/19/99	na	22.0	62	108	6	FQA	0.07	0.71	0.17	0.23	0.52
Mahned	10/19/99	na	22.5	52	78	6	FQA	0.10	0.78	0.10	0.16	0.45
New Augusta	10/19/99	6.5	22.5	58	83	6	FQA	0.10	0.62	0.11	0.15	0.53
Wingate	10/19/99	6.3	22.5	64	171	6	FQA	0.09	0.74	0.11	0.12	0.54
Beaumont	10/19/99	6.7	23.0	67	166	6	FQA	0.09	0.62	0.10	0.14	0.60
McLain Bridge	10/19/99	6.8	23.0	67	155	7	FQA	0.09	0.47	0.09	0.53	1.65
Tallahala	11/29/99	6.8	16.0	42	147	4	1	ND [<0.03]	0.08	0.20	0.26	0.68
Mahned	11/29/99	6.5	16.5	47	80	4	0	0.06	0.68	0.12	0.15	0.45
New Augusta	11/29/99	6.6	15.5	49	87	4	5	0.05	0.57	0.12	0.17	0.34
Wingate	11/29/99	6.7	16.0	79	192	3	24	0.05	0.65	0.11	0.16	0.34
Beaumont	11/29/99	6.6	15.0	77	186	3	15	0.06	0.50	0.11	0.16	0.34
McLain Bridge	11/29/99	6.3	15.0	77	182	3	21	0.05	0.60	0.10	0.16	0.41
Tallahala	12/13/99	6.7	17.0	23	179	4	7	0.02	0.23	0.16	0.19	0.36
Mahned	12/13/99	6.6	17.0	30	78	13	5	0.08	0.66	0.11	0.15	0.35
New Augusta	12/13/99	6.6	16.5	24	87	8	2	0.06	0.60	0.11	0.16	0.31
Wingate	12/13/99	6.7	17.0	38	227	11	13	0.06	0.52	0.11	0.14	0.30
Beaumont	12/13/99	6.5	17.5	42	256	8	9	0.06	0.50	0.10	0.14	0.29
McLain Bridge	12/13/99	6.2	17.5	42	254	7	15	0.07	0.48	0.09	0.12	0.39

Note: ND=non-detect; FQA=failed quality assurance

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Table 3.2 Continued

Station	Date	pH	Temp. (C)	Color (Pt-Co Units)	Conduc-tivity (µS/cm)	Turbidity (NTU)	COD (mg/L)	Ammonia (mg/L)	Nitrate + Nitrite (mg/L)	ortho-Phosphate (mg/L)	Total Phos-phorus (mg/L)	Total Nitrogen (mg/L)
Tallahala	01/24/00	6.6	12.5	54	127	12	11				FQA	0.92
Mahned	01/24/00	6.6	13.0	47	84	11	11				FQA	1.10
New Augusta	01/24/00	6.6	13.0	48	102	10	8				FQA	1.05
Wingate	01/24/00	6.6	13.8	72	157	10	21				FQA	1.05
Beaumont	01/24/00	6.5	13.8	71	155	10	22				FQA	1.01
McLain Bridge	01/24/00	6.5	13.5	76	156	11	22				FQA	0.92
Tallahala	02/28/00	6.6	18.5	38	159	10	18				0.13	0.74
Mahned	02/28/00	6.6	19.0	28	71	7	12				0.56	0.86
New Augusta	02/28/00	6.6	19.0	29	90	7	9				0.50	0.77
Wingate	02/28/00	6.7	19.0	72	184	7	28				0.62	0.91
Beaumont	02/28/00	6.5	19.5	59	168	6	20				0.53	0.80
McLain Bridge	02/28/00	6.2	19.5	55	155	6	18				0.66	0.55
Tallahala	03/27/00	6.3	20.0	101	85	43	34				0.11	0.83
Mahned	03/27/00	6.3	20.0	88	67	26	26				0.09	0.79
New Augusta	03/27/00	6.2	20.0	87	77	29	33				0.07	0.67
Wingate	03/27/00	6.3	20.0	97	103	31	31				0.06	0.80
Beaumont	03/27/00	6.4	19.5	99	110	27	32				0.07	0.75
McLain Bridge	03/27/00	6.3	20.5	98	99	23	29				0.06	0.72
Tallahala	04/17/00	6.4	21.5	81	97	10	19				0.07	1.15
Mahned	04/17/00	6.3	21.5	107	61	20	26				0.06	0.83
New Augusta	04/17/00	6.4	21.0	101	65	21	21				0.06	0.85
Wingate	04/17/00	6.3	21.5	108	85	24	28				0.06	0.77
Beaumont	04/17/00	6.2	21.5	106	83	23	28				0.07	0.85
McLain Bridge	04/17/00	5.8	21.5	105	80	16	28				0.09	0.78
Tallahala	05/22/00	6.8	29.0	27	119	4	14				0.20	0.75
Mahned	05/22/00	6.6	29.0	30	87	4	12				0.21	0.72
New Augusta	05/22/00	6.6	28.5	29	94	4	10				0.45	0.75
Wingate	05/22/00	6.7	28.5	54	193	4	20				0.27	0.75
Beaumont	05/22/00	6.6	28.1	50	184	5	18				0.35	0.85
McLain Bridge	05/22/00	6.0	28.5	46	201	4	17				0.29	0.52

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Table 3.2 Continued

Station	Date	pH	Temp. (C)	Color (Pt-Co Units)	Conduc-tivity (µS/cm)	Turbidity (NTU)	COD (mg/L)	Ammonia (mg/L)	Nitrate + Nitrite (mg/L)	ortho-Phosphate (mg/L)	Total Phos-phorus (mg/L)	Total Nitrogen (mg/L)
Tallahala	06/26/00	6.4	29.0	30	129	1	18				0.23	0.75
Mahned	06/26/00	6.5	29.0	41	67	13	8				0.25	0.86
New Augusta	06/26/00	6.6	29.0	39	77	7	13				0.21	0.74
Wingate	06/26/00	6.2	29.5	46	158	7	20				0.19	0.73
Beaumont	06/26/00	6.5	29.0	53	186	5	21				0.16	0.87
McLain Bridge	06/26/00	6.6	29.5	52	191	8	25				0.23	0.40
Tallahala	07/24/00	6.6	30.1	29	87	6	18				0.15	0.78
Mahned	07/24/00	6.5	30.5	29	81	8	17				0.10	0.74
New Augusta	07/24/00	6.6	30.1	24	84	9	18				0.14	0.84
Wingate	07/24/00	6.7	30.1	53	276	6	31				0.14	0.76
Beaumont	07/24/00	6.6	30.0	51	240	10	13				0.15	0.75
McLain Bridge	07/24/00	6.2	30.0	45	210	10	20				0.27	0.78
Tallahala	08/28/00	6.6	32.0	19	92	4	14				0.19	0.56
Mahned	08/28/00	6.5	31.0	15	91	5	13				0.21	0.63
New Augusta	08/28/00	6.6	30.0	19	93	6	15				0.17	0.77
Wingate	08/28/00	6.6	32.0	49	260	4	28				0.24	0.67
Beaumont	08/28/00	6.4	31.0	57	268	5	28				0.20	0.59
McLain Bridge	08/28/00	6.2	31.0	42	237	5	27				0.24	0.30

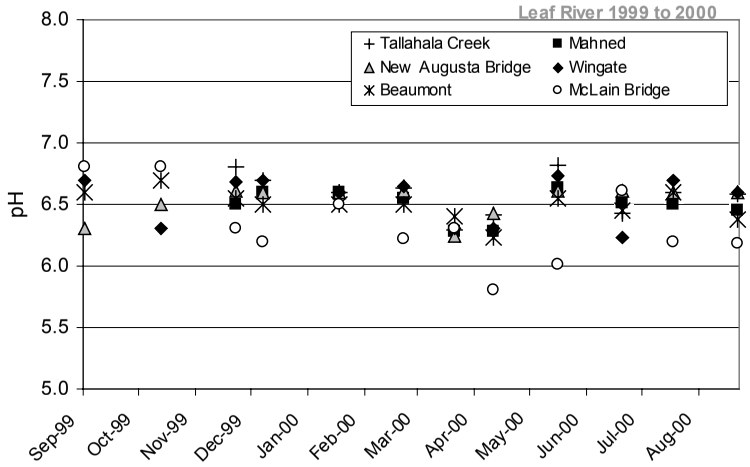

Figure 3.21 Leaf River pH

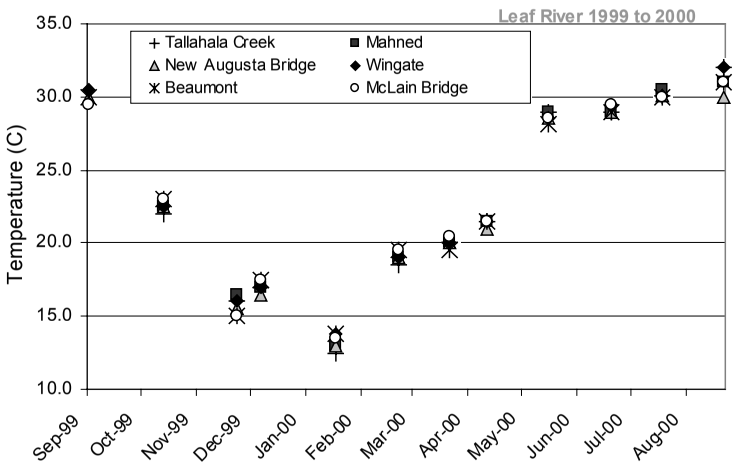

Figure 3.22 Leaf River Temperature

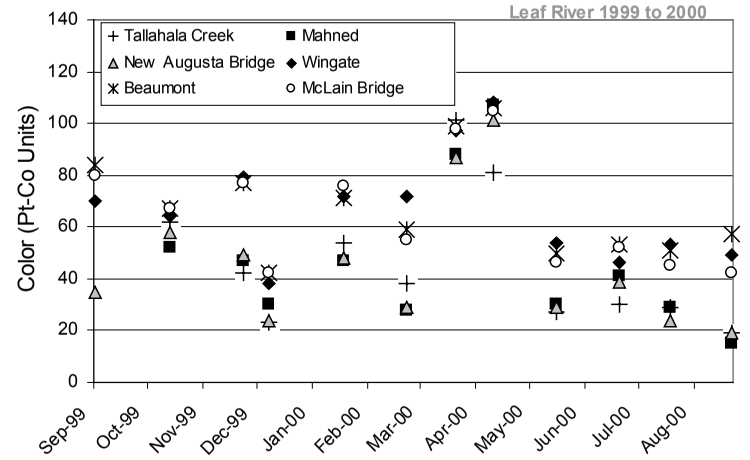

Figure 3.23 Leaf River Color

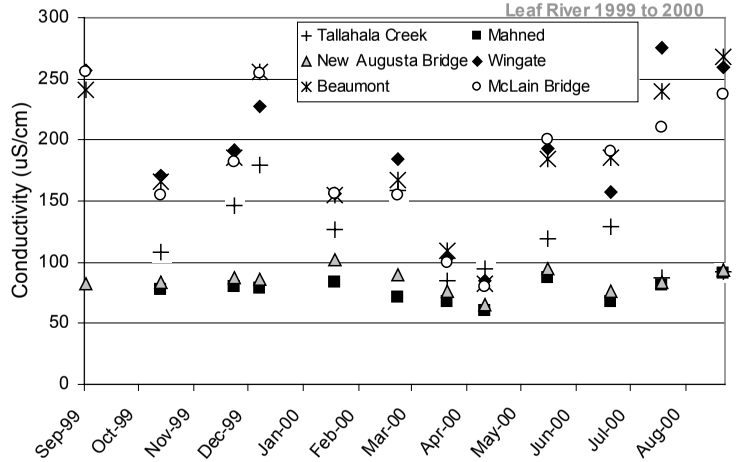

Figure 3.24 Leaf River Conductivity

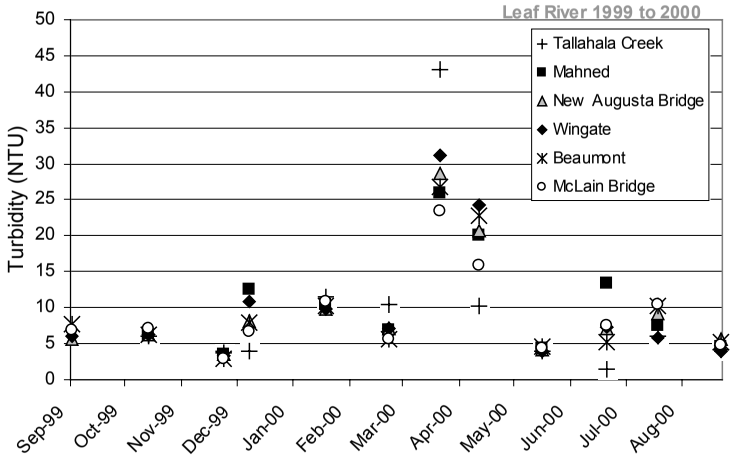

Figure 3.25 Leaf River Turbidity

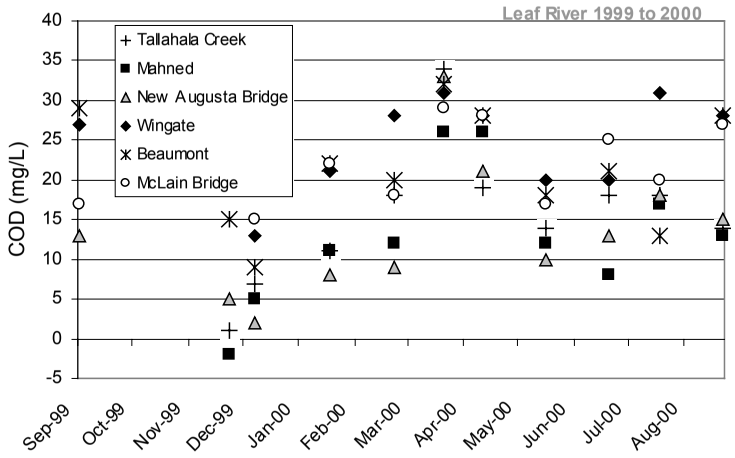

Figure 3.26 Leaf River COD

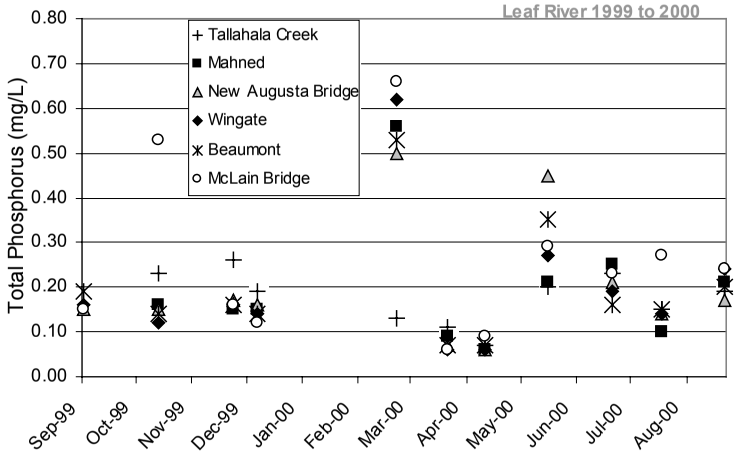

Figure 3.27 Leaf River Total Phosphorus

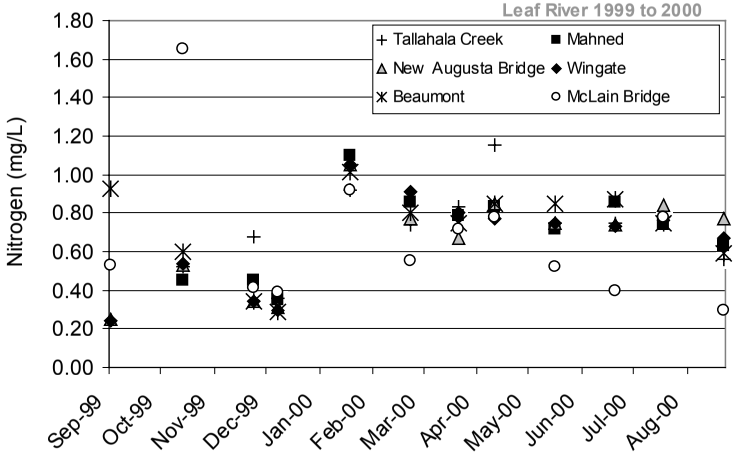

Figure 3.28 Leaf River Nitrogen

Table 3.3 McKenzie River Water Chemistry

Station	Date	pH	Temp. (C)	Color (Pt-Co Units)	Conduc-tivity (µS/cm)	Turbidity (NTU)	Ammonia (mg/L)	Nitrate + Nitrite (mg/L)	ortho-Phosphate (mg/L)	Total Phos-phorus (mg/L)	Total Kjeldahl Nitrogen (mg/L)
Hendricks Bridge	09/07/99	7.7	14.0	3	55	1	ND [<0.01]	0.02	0.02	0.04	0.10
Hayden Bridge	09/07/99	7.6	13.5	8	54	1	ND [<0.01]	0.02	0.02	0.05	0.10
Harvest	09/07/99	7.6	13.0	3	63	1	ND [<0.01]	0.03	0.02	0.05	0.19
Armitage (Coburg)	09/07/99	7.7	13.0	3	66	1	ND [<0.01]	0.04	0.02	0.05	FQA
Mohawk River	09/07/99	7.6	18.0	14	64	3	ND [<0.01]	0.05	ND [<0.01]	0.03	0.16
Hendricks Bridge	10/19/99	7.8	12.0	10	58	1	ND [<0.03]	0.09	0.03	0.05	0.08
Hayden Bridge	10/19/99	7.8	11.0	8	58	1	ND [<0.03]	0.03	0.03	0.05	0.08
Harvest	10/19/99	7.8	10.5	7	66	1	ND [<0.03]	ND [<0.01]	0.03	0.08	0.10
Armitage (Coburg)	10/19/99	7.8	10.0	9	68	1	0.03	ND [<0.01]	0.03	0.05	0.13
Mohawk River	10/19/99	7.8	10.0	24	71	2	ND [<0.03]	ND [<0.01]	ND [<0.02]	0.03	0.15
Hendricks Bridge	11/29/99	7.2	8.0	29	43	18	0.05	0.08	0.07	0.11	0.25
Hayden Bridge	11/29/99	7.3	8.0	30	46	14	0.04	0.10	0.07	0.11	0.19
Harvest	11/29/99	7.3	8.0	33	44	15	0.06	0.03	0.09	0.11	0.17
Armitage (Coburg)	11/29/99	7.4	8.0	36	47	15	0.05	ND [<0.01]	0.07	0.12	0.23
Mohawk River	11/29/99	7.2	8.5	43	41	9	ND [<0.03]	0.29	0.03	0.10	0.20
Hendricks Bridge	12/13/99	6.4	6.5	13	43	6	ND [<0.01]	0.07	0.02	0.04	0.12
Hayden Bridge	12/13/99	6.5	7.0	12	42	5	ND [<0.01]	0.06	0.02	0.06	0.07
Harvest	12/13/99	6.5	7.0	15	45	6	ND [<0.01]	0.07	0.02	0.08	0.17
Armitage (Coburg)	12/13/99	6.5	7.0	18	44	7	0.01	0.08	0.03	0.07	0.19
Mohawk River	12/13/99	6.3	7.5	27	45	9	ND [<0.01]	0.17	0.01	0.05	0.17

Note: ND=non-detect; FQA=failed quality assurance

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Table 3.3 Continued

Station	Date	pH	Temp. (C)	Color (Pt-Co Units)	Conduc-tivity (µS/cm)	Turbidity (NTU)	Ammonia (mg/L)	Nitrate + Nitrite (mg/L)	ortho-Phosphate (mg/L)	Total Phos-phorus (mg/L)	Total Nitrogen (mg/L)
Hendricks Bridge	01/24/00	5.5	6.0	1	49	4				FQA	0.29
Hayden Bridge	01/24/00	5.5	6.5	5	50	4				FQA	0.20
Harvest	01/24/00	5.5	6.0	4	56	5				FQA	0.23
Armitage (Coburg)	01/24/00	5.5	6.0	9	48	5				FQA	0.25
Mohawk River	01/24/00	5.5	6.5	24	46	16				FQA	0.36
Hendricks Bridge	02/28/00	5.3	7.5	3	46	2				0.04	0.05
Hayden Bridge	02/28/00	5.7	7.5	5	43	4				0.02	0.02
Harvest	02/28/00	6.0	7.5	11	54	5				0.03	0.11
Armitage (Coburg)	02/28/00	5.9	9.5	6	107	5				0.04	1.87
Mohawk River	02/28/00	5.9	8.5	25	41	13				0.02	0.11
Hendricks Bridge	03/27/00	6.1	8.0	ND [<10 Pt-Co]	48	1				ND	ND
Hayden Bridge	03/27/00	6.1	8.5	ND [<10 Pt-Co]	45	2				ND	ND
Harvest	03/27/00	6.1	8.5	ND [<10 Pt-Co]	54	2				ND	ND
Armitage (Coburg)	03/27/00	6.1	9.0	ND [<10 Pt-Co]	53	2				ND	ND
Mohawk River	03/27/00	6.0	8.5	ND [<10 Pt-Co]	44	5				ND	ND
Hendricks Bridge	04/17/00	6.2	10.0	1	42	1				ND	ND
Hayden Bridge	04/17/00	5.8	9.5	3	43	2				ND	ND
Harvest	04/17/00	5.7	9.0	5	52	3				ND	ND
Armitage (Coburg)	04/17/00	6.1	9.0	4	49	2				ND	0.09
Mohawk River	04/17/00	5.9	12.0	34	48	9				ND	0.11
Hendricks Bridge	05/22/00	6.3	12.5	13	46	1				0.05	0.14
Hayden Bridge	05/22/00	6.2	12.5	ND [<10 Pt-Co]	43	1				0.04	ND
Harvest	05/22/00	6.2	13.0	ND [<10 Pt-Co]	53	1				0.09	0.15
Armitage (Coburg)	05/22/00	6.2	12.0	ND [<10 Pt-Co]	50	1				0.06	0.17
Mohawk River	05/22/00	6.1	15.0	12	47	4				0.07	0.19

Note: ND=non-detect

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Table 3.3 Continued

Station	Date	pH	Temp. (C)	Color (Pt-Co Units)	Conduc-tivity (μS/cm)	Turbidity (NTU)	Ammonia (mg/L)	Nitrate + Nitrite (mg/L)	ortho-Phosphate (mg/L)	Total Phos-phorus (mg/L)	Total Nitrogen (mg/L)
Hendricks Bridge	06/26/00	6.2	17.5	11	54	1				0.05	0.07
Hayden Bridge	06/26/00	6.2	16.0	ND [<10 Pt-Co]	52	1				0.07	0.06
Harvest	06/26/00	6.2	16.0	ND [<10 Pt-Co]	62	1				0.06	0.10
Armitage (Coburg)	06/26/00	6.3	17.0	ND [<10 Pt-Co]	60	1				0.06	0.08
Mohawk River	06/26/00	6.1	19.5	17	51	3				0.07	0.26
Hendricks Bridge	07/24/00	6.3	17.0	ND [<10 Pt-Co]	55	1				0.10	0.09
Hayden Bridge	07/24/00	6.4	20.5	ND [<10 Pt-Co]	54	1				0.08	0.16
Harvest	07/24/00	6.5	16.5	ND [<10 Pt-Co]	70	1				0.08	0.12
Armitage (Coburg)	07/24/00	6.5	16.0	ND [<10 Pt-Co]	67	1				0.09	0.12
Mohawk River	07/24/00	6.5	16.0	ND [<10 Pt-Co]	57	3				0.02	0.28
Hendricks Bridge	08/28/00	6.7	13.0	ND [<10 Pt-Co]	52	2				0.03	ND
Hayden Bridge	08/28/00	6.6	13.0	ND [<10 Pt-Co]	53	2				0.02	ND
Harvest	08/28/00	6.5	12.0	ND [<10 Pt-Co]	66	2				0.05	0.07
Armitage (Coburg)	08/28/00	6.4	12.0	ND [<10 Pt-Co]	64	2				ND	0.03
Mohawk River	08/28/00	6.6	17.0	13	65	4				ND	0.09

Note: ND=non-detect

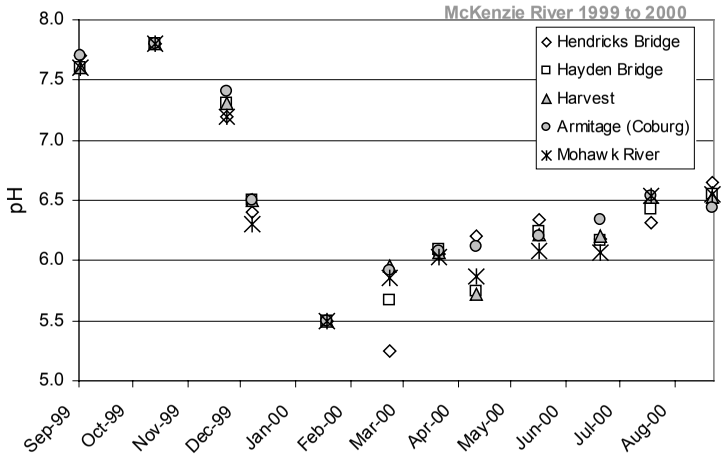

Figure 3.29 McKenzie River pH

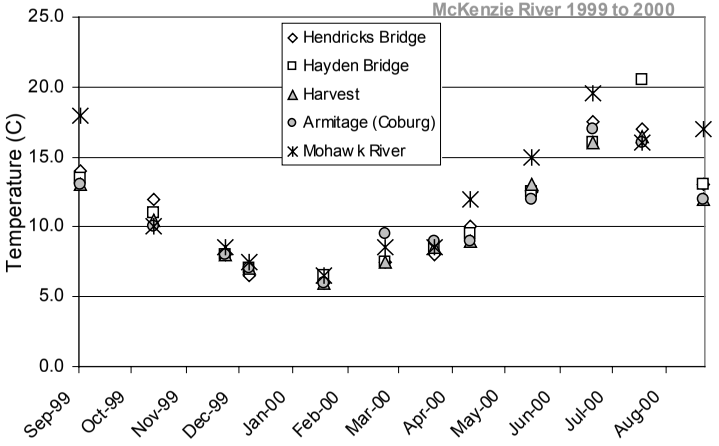

Figure 3.30 McKenzie River Temperature

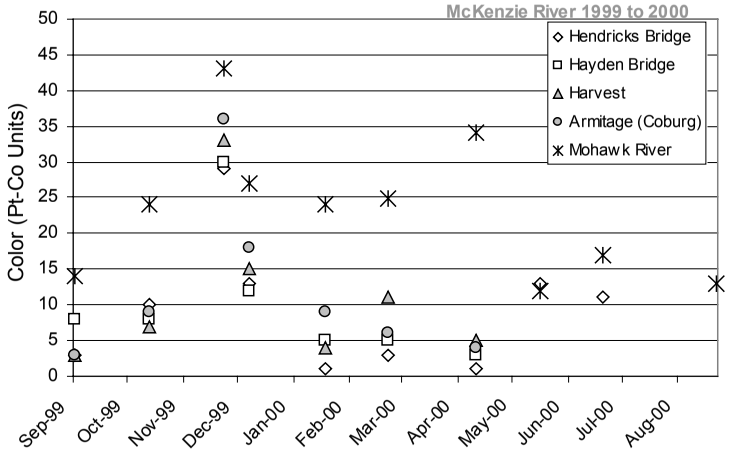

Figure 3.31 McKenzie River Color

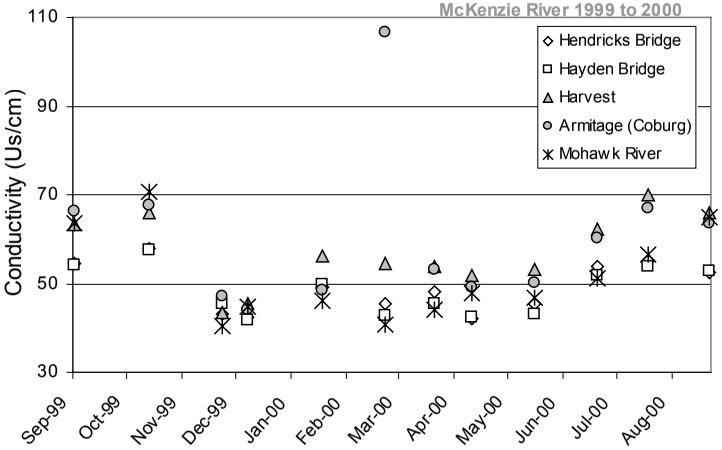

Figure 3.32 McKenzie River Conductivity

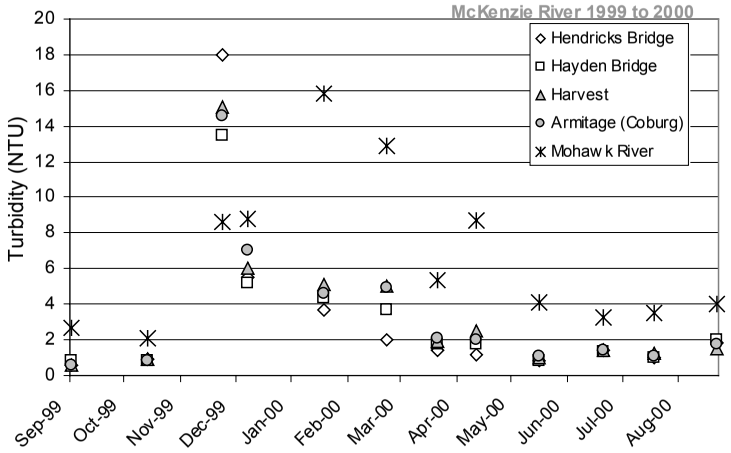

Figure 3.33 McKenzie River Turbidity

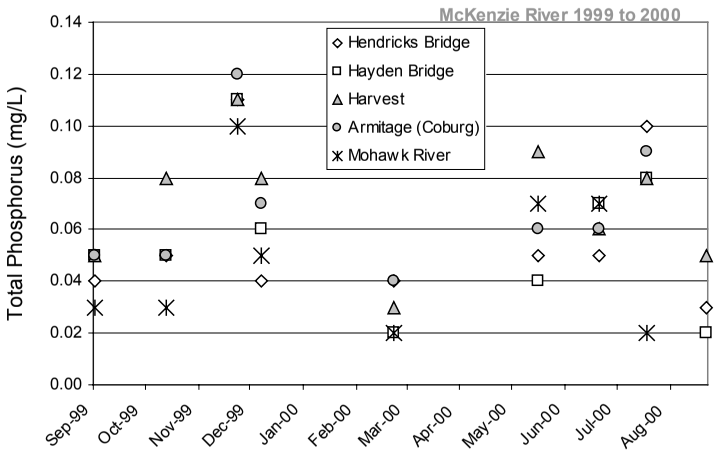

Figure 3.34 McKenzie River Total Phosphorus

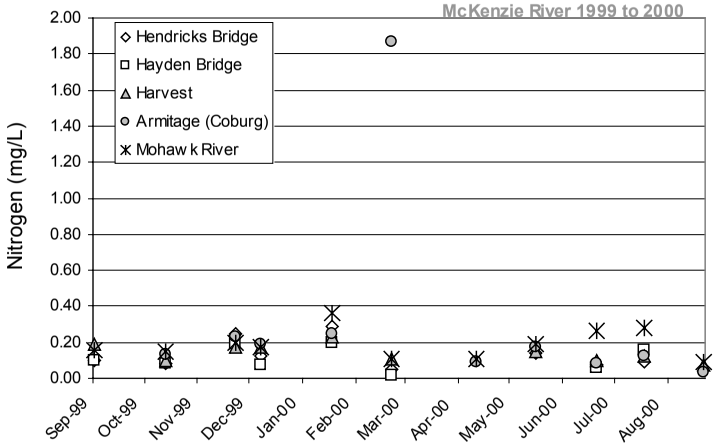

Figure 3.35 McKenzie River Nitrogen

Table 3.4 Willamette River Water Chemistry

Station	Date	pH	Temp. (C)	Color (Pt-Co Units)	Conduc-tivity (μS/cm)	Turbidity (NTU)	Ammonia (mg/L)	Nitrate + Nitrite (mg/L)	ortho-Phosphate (mg/L)	Total Phos-phorus (mg/L)	Total Kjeldahl Nitrogen (mg/L)
Harrisburg	09/07/99	7.6	15.0	10	63	1	0.01	0.08	0.02	0.05	0.16
Cartney	09/07/99	7.6	15.0	7	61	1	0.01	0.09	0.02	0.05	0.23
Peoria	09/07/99	7.4	15.5	10	124	4	0.02	0.03	0.05	0.08	0.17
Corvallis	09/07/99	7.5	16.0	10	81	2	0.02	0.17	0.01	0.05	0.18
Long Tom River	09/07/99	7.4	15.5	5	71	1	0.01	0.15	0.02	0.03	0.17
Harrisburg	10/19/99	7.7	12.5	8	64	1	ND [<0.03]	0.19	ND [<0.02]	0.06	0.21
Cartney	10/19/99	7.7	12.0	6	59	1	ND [<0.03]	0.20	ND [<0.02]	0.04	0.15
Peoria	10/19/99	7.7	13.0	14	114	2	ND [<0.03]	ND [<0.01]	0.02	0.06	0.13
Corvallis	10/19/99	7.7	12.0	25	77	4	ND [<0.03]	0.14	0.02	0.05	0.19
Long Tom River	10/19/99	7.8	13.0	95	69	29	0.03	0.24	0.05	0.04	0.22
Harrisburg	11/29/99	7.2	9.0	29	53	13	0.04	0.12	0.06	0.12	0.22
Cartney	11/29/99	7.3	9.0	27	49	13	0.04	0.13	0.06	0.12	0.29
Peoria	11/29/99	7.3	9.0	37	55	22	0.05	0.20	0.07	0.12	0.38
Corvallis	11/29/99	7.4	9.5	46	53	38	0.06	0.24	0.09	0.12	0.28
Long Tom River	11/29/99	7.5	10.0	100	62	77	0.20	0.80	0.23	0.11	0.42
Harrisburg	12/13/99	6.5	8.0	25	55	11	0.03	0.12	0.04	0.08	0.22
Cartney	12/13/99	6.7	7.5	26	53	10	0.03	0.13	0.03	0.07	0.15
Peoria	12/13/99	6.7	8.0	31	67	10	0.05	0.20	0.04	0.06	0.16
Corvallis	12/13/99	6.8	8.0	29	60	12	0.05	0.22	0.04	0.07	0.16
Long Tom River	12/13/99	7.0	8.0	67	86	46	0.05	0.64	0.05	0.08	0.43

Note: ND=non-detect; FQA=failed quality assurance

(Continued on next page)

Table 3.4 Continued

Station	Date	pH	Temp. (C)	Color (Pt-Co Units)	Conduc-tivity (μS/cm)	Turbidity (NTU)	Ammonia (mg/L)	Nitrate + Nitrite (mg/L)	ortho-Phosphate (mg/L)	Total Phos-phorus (mg/L)	Total Nitrogen (mg/L)
Harrisburg	01/24/00	5.0	6.0	21	55	13				FQA	0.51
Cartney	01/24/00	6.1	6.5	20	56	14				FQA	0.39
Peoria	01/24/00	6.3	6.0	28	70	18				FQA	0.52
Corvallis	01/24/00	6.3	6.5	32	73	27				FQA	0.54
Long Tom River	01/24/00	6.3	6.0	62	59	39				FQA	1.05
Harrisburg	02/28/00	5.5	8.0	25	56	13				0.05	0.27
Cartney	02/28/00	5.8	8.0	25	53	13				ND	0.28
Peoria	02/28/00	5.8	8.5	35	69	17				0.02	0.39
Corvallis	02/28/00	6.0	8.5	39	62	21				0.04	0.43
Long Tom River	02/28/00	6.0	9.0	68	68	35				0.04	0.67
Harrisburg	03/27/00	6.1	9.0	ND [<10 Pt-Co]	53	5				ND	ND
Cartney	03/27/00	6.0	9.0	ND [<10 Pt-Co]	60	4				ND	ND
Peoria	03/27/00	6.0	9.0	ND [<10 Pt-Co]	70	4				ND	0.03
Corvallis	03/27/00	6.1	9.0	ND [<10 Pt-Co]	67	5				ND	0.14
Long Tom River	03/27/00	6.1	10.0	21	114	11				ND	0.99
Harrisburg	04/17/00	5.9	9.5	17	55	5				ND	0.11
Cartney	04/17/00	6.0	10.0	20	54	6				ND	0.07
Peoria	04/17/00	6.2	10.5	10	88	4				ND	0.07
Corvallis	04/17/00	6.0	10.0	23	61	8				0.01	0.15
Long Tom River	04/17/00	7.0	10.0	16	54	6				0.01	0.18
Harrisburg	05/22/00	6.3	12.0	10	60	2				0.12	0.26
Cartney	05/22/00	6.3	14.0	11	53	2				0.04	0.24
Peoria	05/22/00	6.1	15.5	13	84	4				ND	0.26
Corvallis	05/22/00	6.1	14.0	11	64	2				0.05	0.29
Long Tom River	05/22/00	6.7	17.0	24	101	48				0.03	0.77

Note: ND=non-detect

(Continued on next page)

Table 3.4 Continued

Station	Date	pH	Temp. (C)	Color (Pt-Co Units)	Conduc-tivity (μS/cm)	Turbidity (NTU)	Ammonia (mg/L)	Nitrate + Nitrite (mg/L)	ortho-Phosphate (mg/L)	Total Phos-phorus (mg/L)	Total Nitrogen (mg/L)
Harrisburg	06/26/00	6.5	17.0	13	60	2				0.06	0.22
Cartney	06/26/00	6.5	17.5	ND [<10 Pt-Co]	61	2				0.06	0.24
Peoria	06/26/00	6.6	16.0	10	125	3				0.10	0.23
Corvallis	06/26/00	6.7	16.5	14	77	2				0.08	0.32
Long Tom River	06/26/00	6.7	17.5	13	62	3				0.07	0.29
Harrisburg	07/24/00	6.5	17.0	ND [<10 Pt-Co]	79	2				0.04	0.30
Cartney	07/24/00	6.5	18.0	ND [<10 Pt-Co]	62	3				0.06	0.37
Peoria	07/24/00	6.5	16.0	ND [<10 Pt-Co]	115	3				0.02	0.36
Corvallis	07/24/00	7.1	17.5	14	77	4				0.01	0.49
Long Tom River	07/24/00	7.2	17.0	ND [<10 Pt-Co]	61	3				0.02	0.46
Harrisburg	08/28/00	6.6	15.0	ND [<10 Pt-Co]	63	2				0.02	0.18
Cartney	08/28/00	6.7	15.0	ND [<10 Pt-Co]	62	3				ND	0.21
Peoria	08/28/00	6.4	16.0	12	108	14				0.10	0.56
Corvallis	08/28/00	6.8	15.5	ND [<10 Pt-Co]	77	3				0.02	0.19
Long Tom River	08/28/00	6.0	15.0	ND [<10 Pt-Co]	62	3				0.03	0.21

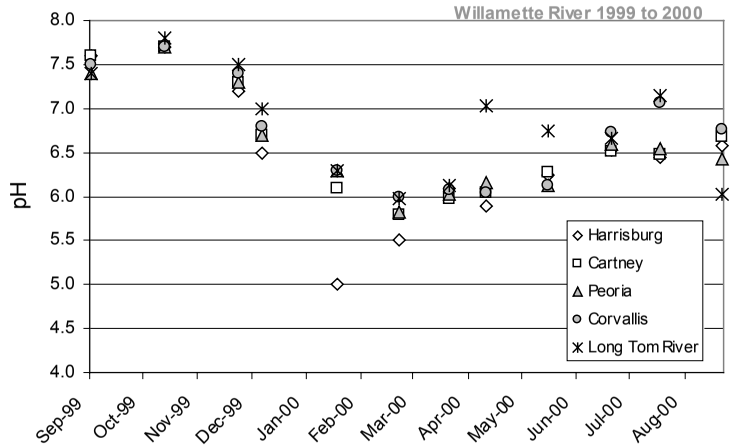

Figure 3.36 Willamette River pH

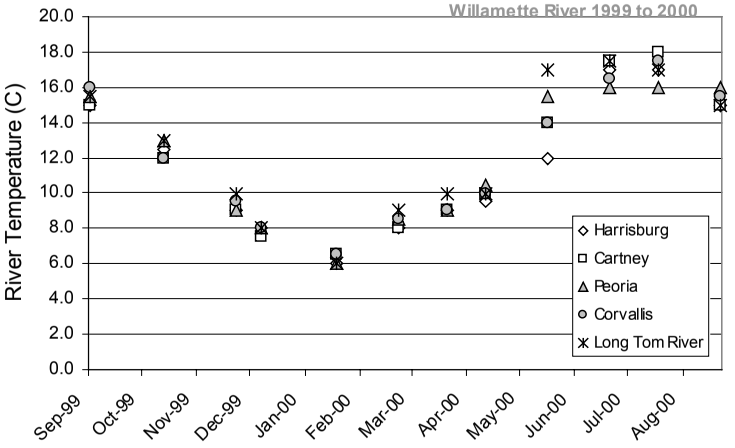

Figure 3.37 Willamette River Temperature

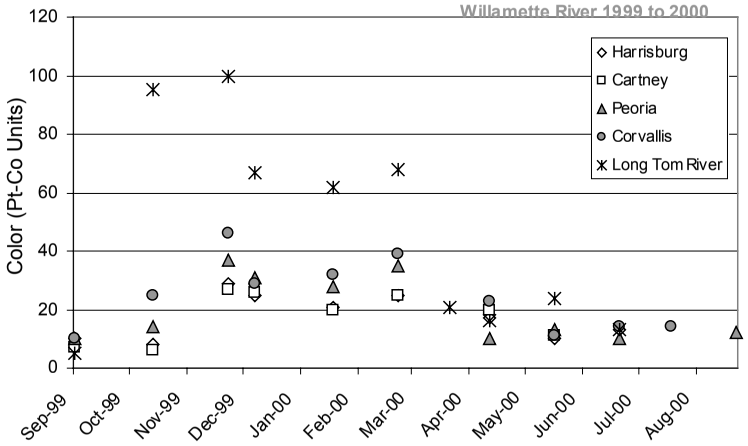

Figure 3.38 Willamette River Color

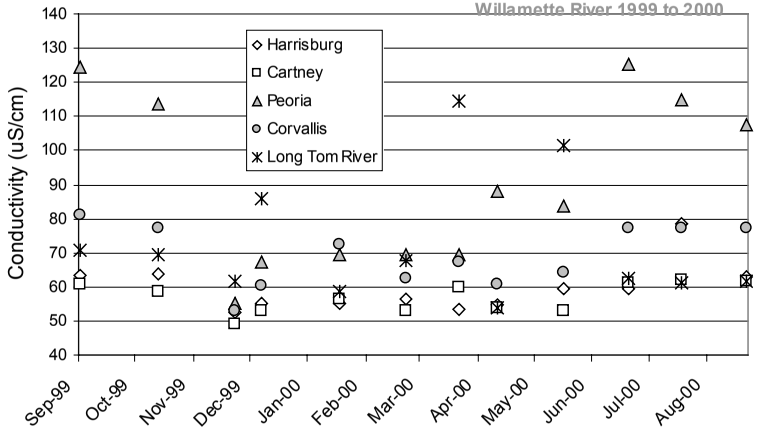

Figure 3.39 Willamette River Conductivity

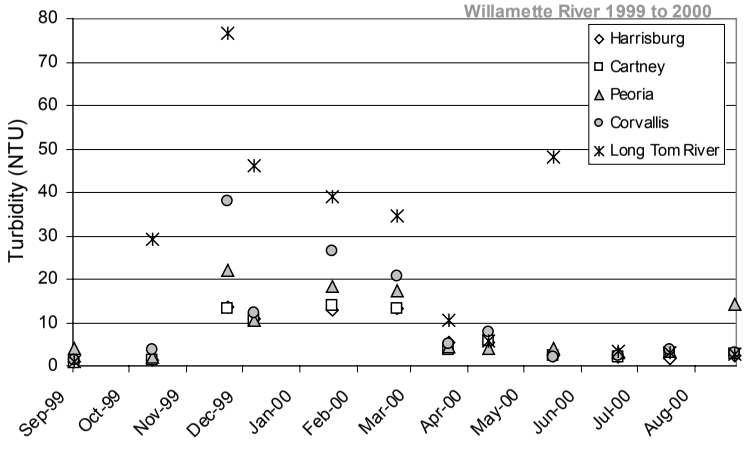

Figure 3.40 Willamette River Turbidity

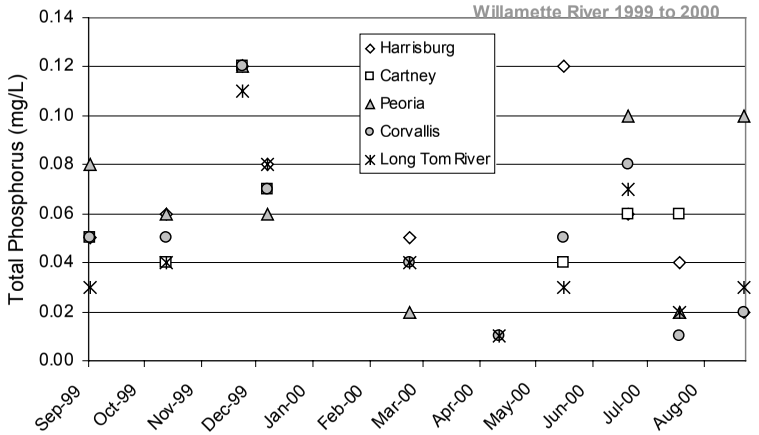

Figure 3.41 Willamette River Total Phosphorus

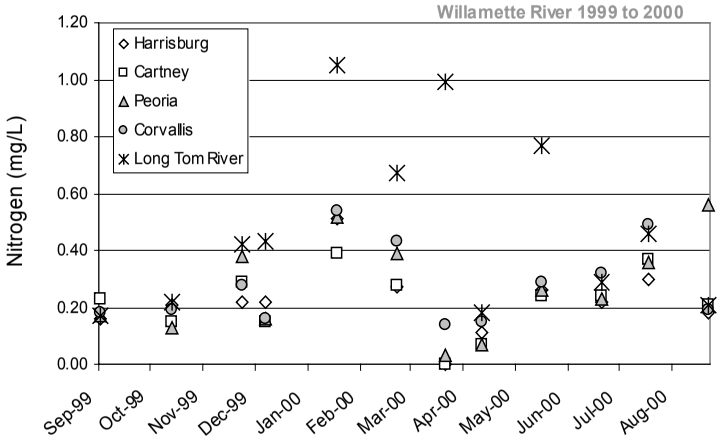

Figure 3.42 Willamette River Nitrogen

3.5 Effluent Chemistry

Samples of effluent were taken by local mill personnel and shipped overnight on ice to the NCASI West Coast Regional Center in Corvallis, Oregon, for analysis. The New Augusta mill sample was a composite; the remaining mills collected grab samples. The value reported for phytosterols is the sum for four analytes: campesterol, stigmasterol, β-sitosterol, and stigmatanol. The value reported for resin acids is the sum for ten analytes: pimaric acid, sandrocopimaric acid, isopimaric acid, palustric acid, dehydroacietic acid, abietic acid, neoabieteic acid, 14-chlorodehydroabietic acid, 12-chlorodehydroabeitic acid, and dichlorodehydroabietic acid. The phytosterol non-detect column and the resin acids non-detect column report how many out of the total components measured were non-detects.

Table 3.5 Mill Effluent Analysis for the Codorus Creek Facility Located in Spring Grove, Pennsylvania

Date	Color (PCU)	Tannin/ Lignin (mg/L)	Conduc-tivity (μS/cm)	Turbidity (NTU)	TSS (mg/L)	BOD (mg/L)	COD (mg/L)	TOC (mg/L)	Total P (mg/L)	Phyto-sterols (μg/L)	Phyto-sterols: non-detects	Resin Acids (μg/L)	Resin Acids: non-detects
10/04/99	270	7.6	2130	2	2.2	5.3	173	62.3	0.09	2.8	2/4		10/10
04/17/00	345	7.9	2430	3	4.0	4.0	175	45.2	0.01	ND	4/4		10/10
04/23/00	293	15.4	2003				162	44.8					
04/30/00	262	4.2					238	49.1					
05/07/00	295	7.6					165	51.9					
06/12/00	293	6.2	1955	5	10.0	4.0	220	48.7	0.27	1.4	3/4	1.7	9/10
08/07/00	231	3.1	1808	5	3.0	4.0	138	45.3	0.03	41.0	0/4		10/10

Note: ND=non-detect

Table 3.6 Mill Effluent Analysis for the Leaf River Facility Located in New Augusta, Mississippi

Date	Color (PCU)	Tannin/ Lignin (mg/L)	Conduc-tivity (μS/cm)	Turbidity (NTU)	TSS (mg/L)	BOD (mg/L)	COD (mg/L)	TOC (mg/L)	Total P (mg/L)	Phyto-sterols (μg/L)	Phyto-sterols: non-detects	Resin Acids (μg/L)	Resin Acids: non-detects
10/04/99	618	16.5	2340	5	6.0	4.8	345	105.2	0.53	6.3	1/4	21.5	7/10
01/31/00	1248	39.3	2725	21	30.2	13.5	648	213.3		28.5	1/4	518.8	3/10
05/22/00	612	22.2	2230	5	8.6	4.6	319	91.4		9.4	1/4	28.8	4/10
08/21/00	505	15.2	2475	3	3.6		325	133.0	0.38	ND	4/4	6.8	7/10

Note: ND=non-detect

Table 3.7 Mill Effluent Analysis for the McKenzie River Facility Located in Springfield, Oregon

Date	Color (PCU)	Tannin/ Lignin (mg/L)	Conduc-tivity (uS/cm)	Turbidity (NTU)	TSS (mg/L)	BOD (mg/L)	COD (mg/L)	TOC (mg/L)	Total P (mg/L)	Phyto-sterols (ug/L)	Phyto-sterols: non-detects	Resin Acids (ug/L)	Resin Acids: non-detects
11/29/99	216	28.1	1520	18	21.3	18.0	152		0.64				
12/06/99								33.9		10.9	0/4	136.6	8/10
08/21/00	153	18.0	1285	12	20.2		142	62.0	0.33	22.7	0/4	1.4	9/10

Table 3.8 Mill Effluent Analysis for the Willamette River Facility Located near Halsey, Oregon

Date	Color (PCU)	Tannin/ Lignin (mg/L)	Conduc-tivity (uS/cm)	Turbidity (NTU)	TSS (mg/L)	BOD (mg/L)	COD (mg/L)	TOC (mg/L)	Total P (mg/L)	Phyto-sterols (ug/L)	Phyto-sterols: non-detects	Resin Acids (ug/L)	Resin Acids: non-detects
09/07/99	1152	42.1	3240	18	8.5		492	155.5		68.1	0/4	2.1	8/10
07/24/00	621	22.4	2910	9	8.8	12.9	380	86.1		40.7	0/4		10/10
08/28/00	714	30.6	3160	11	13.4	15.1	367	154.0	0.80	53.1	0/4		10/10

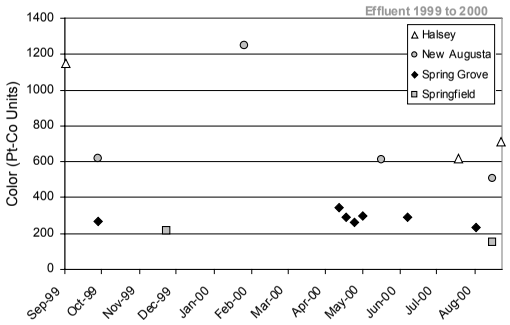

Figure 3.43 Mill Effluent Color

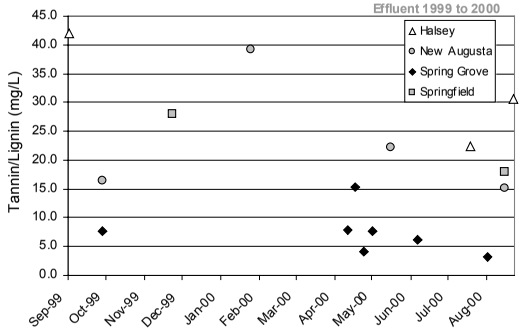

Figure 3.44 Mill Effluent Tannin/Lignin

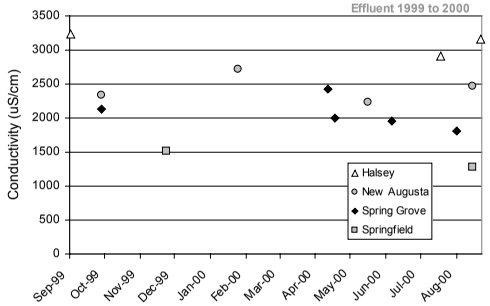

Figure 3.45 Mill Effluent Conductivity

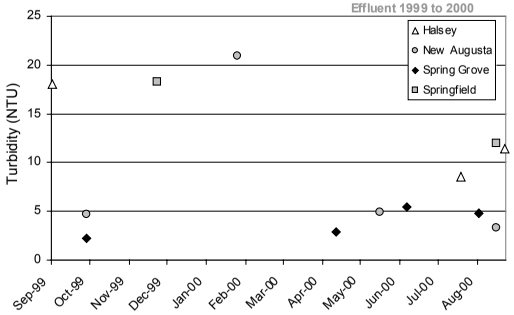

Figure 3.46 Mill Effluent Turbidity

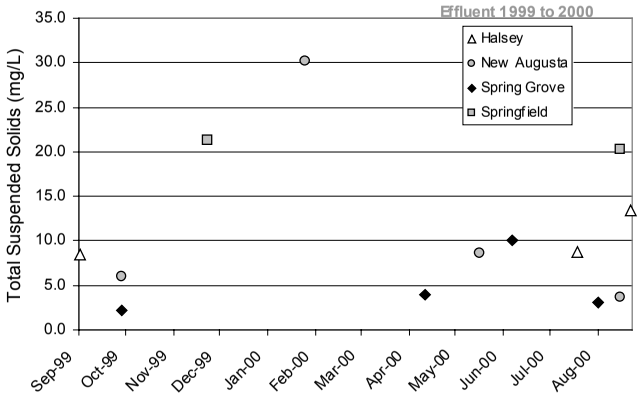

Figure 3.47 Mill Effluent TSS

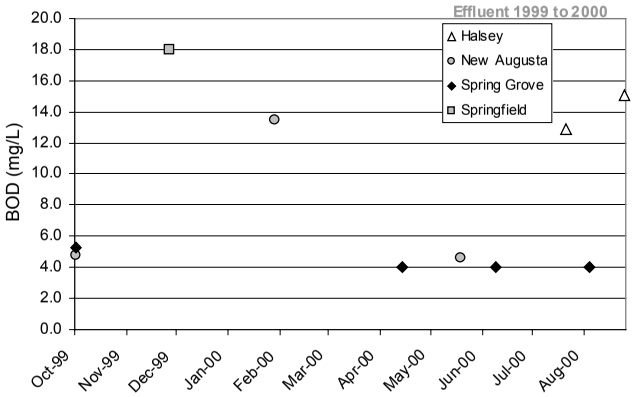

Figure 3.48 Mill Effluent 5d BOD

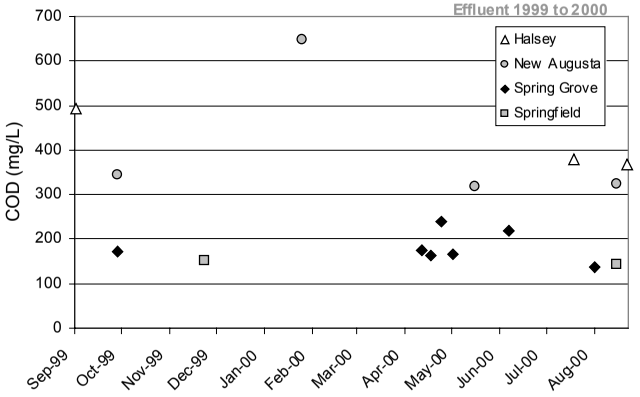

Figure 3.49 Mill Effluent COD

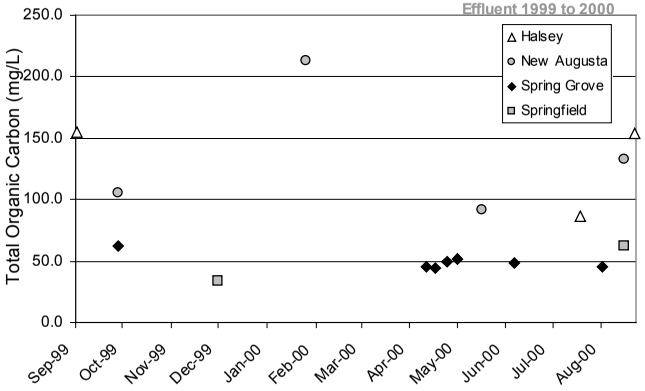

Figure 3.50 Mill Effluent TOC

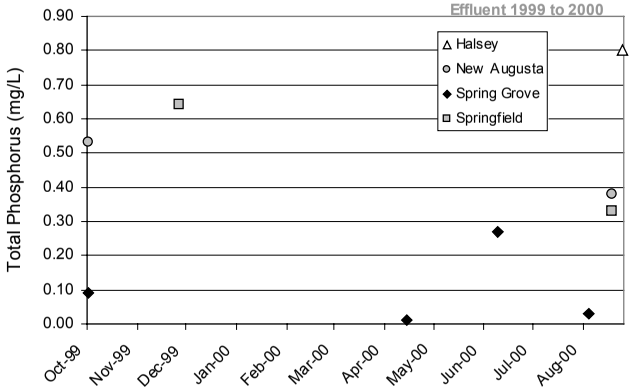

Figure 3.51 Mill Effluent Total Phosphorus

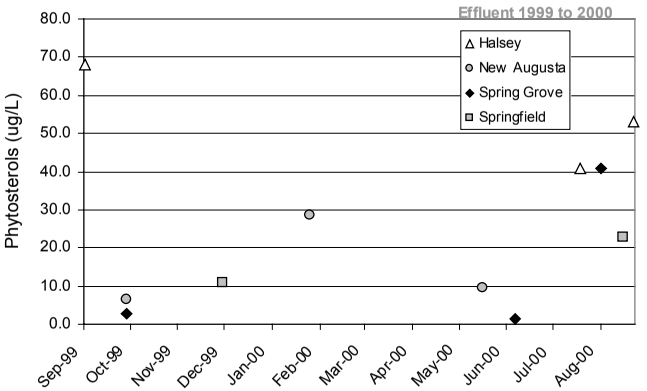

Figure 3.52 Mill Effluent Phytosterols

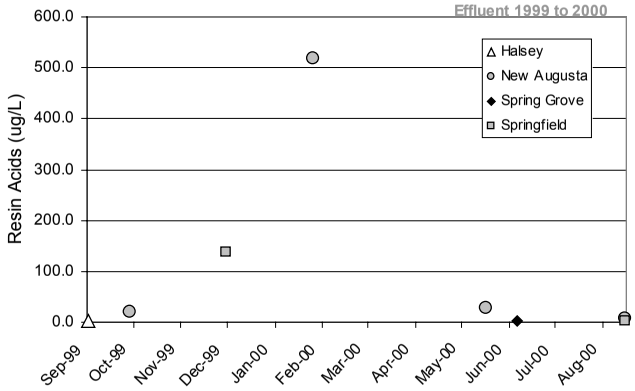

Figure 3.53 Mill Effluent Resin Acids

3.6 Effluent Bioassays

Samples of effluent were taken by local mill personnel. The New Augusta mill sample was a composite; the remaining were grab samples. The samples were shipped overnight on ice to the NABF in Anacortes, WA, for echinoderm and bivalve chronic assays, and to the Southeastern Aquatic Biology Facility in New Bern, NC, for ceriodaphnia and fathead minnow chronic bioassays. Assays were performed within seven days of sampling. The LTRWS local mill locations were Spring Grove, PA, for Codorus Creek; New Augusta, MS, for the Leaf River; Springfield, OR, for the McKenzie River; and near Halsey, OR, for the Willamette River.

Table 3.9 Effluent IC25 (% v/v) for the LTRWS Mills

Spring Grove, PA

Date	Echinoderm[a] (Fertilization)	Bivalve[b] (Normal Development)	Ceriodaphnia (Reproduction)	Fathead Minnow (Growth)
10/04/99	>70	39		
04/17/00		37.2		
04/23/00				
04/30/00				
05/07/00				
06/12/00	>70	45.5	>100	>100
08/07/00	>70	58.2	>100	>100

New Augusta, MS

Date	Echinoderm[a] (Fertilization)	Bivalve[b] (Normal Development)	Ceriodaphnia (Reproduction)	Fathead Minnow (Growth)
10/04/99	29.2	12.2		
01/31/00	2.2	2.7		
05/22/00	>70	13.7	>100	>100
08/21/00	>70	16		

Springfield, OR

Date	Echinoderm[a] (Fertilization)	Bivalve[b] (Normal Development)	Ceriodaphnia (Reproduction)	Fathead Minnow (Growth)
11/29/99	18.9	13.9		
12/06/99				
08/21/00	>70	15.0	>100	>100

Halsey, OR

Date	Echinoderm[a] (Fertilization)	Bivalve[b] (Normal Development)	Ceriodaphnia (Reproduction)	Fathead Minnow (Growth)
9/07/99	1.8			
7/21/00			55.0	100
7/24/00	41.1	5.4	68.3	77.1
8/25/00				100
8/28/00	52.5	4.7		

[a] *Dendraster excentricus* or *Strongylocentrotus purpuratus*

[b] *Mytilus galloprovincialis*

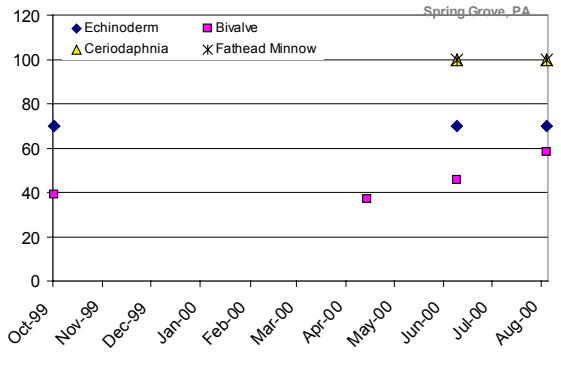

Figure 3.54 Spring Grove, PA, IC25s

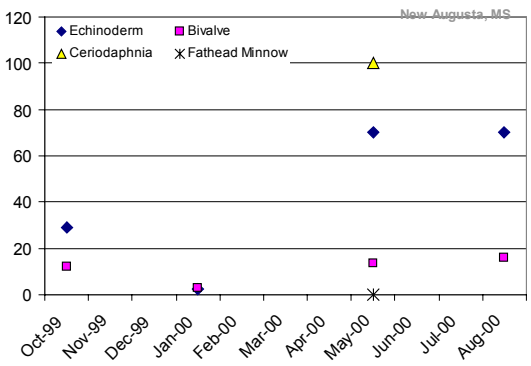

Figure 3.55 New Augusta, MS, IC25s

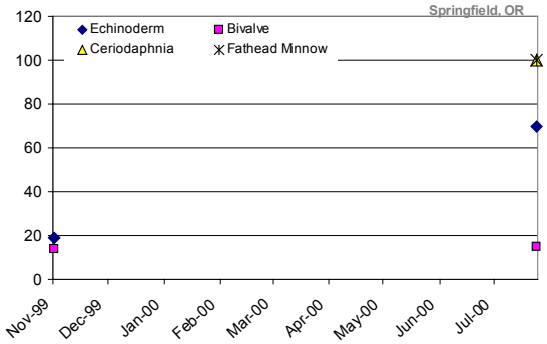

Figure 3.56 Springfield, OR, IC25s

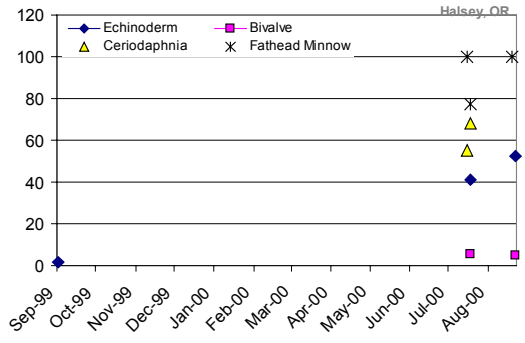

Figure 3.57 Halsey, OR, IC25s

3.7 Periphyton

Periphyton samples were taken quarterly for chlorophyll *a* and semi-annually for taxonomic evaluation on Codorus Creek, McKenzie River and Willamette River. Sampling was done by scraping and rinsing five cobble-size (7 to 13 cm in diameter) randomly selected rocks. Detached periphyton were rinsed into a container and the volume recorded. Rock surface area was estimated using the caliper method (Dudley, Arthurs, and Hall 2001). The Leaf River was sampled in the spring for chlorophyll *a* only. Sampling was done using an artificial substrate, oak plates, and exposed for five weeks with three replicates per site. Taxonomic evaluation was reduced to the diatom division only for the fall 1999 samples, but the spring 2000 samples had taxonomic evaluation for all divisions. Summaries for the fall 1999 diatom only evaluation are not presented in this compendium. All samples were split, with a portion field-filtered for pigment analysis and the other portion preserved with Lugol's Iodine for taxonomic analysis when needed. Samples were analyzed for chlorophyll *a* within 28 d using trichromatic methods (APHA 1998). Periphyton taxonomy was conducted by PhycoTech, Inc. (St. Joseph, MI).

The periphyton and benthic macroinvertebrates shared the same sampling sites, with Codorus Creek having seven sites, the McKenzie River having five sites, the Willamette River having seven sampling sites, and the Leaf River having six sites. Codorus Creek had four missing samples: the East Branch site was not sampled during September, 1999, due to flood waters; the Arsenal and Furnace sites were not sampled during May, 2000, due to sampling permit issues; and the taxonomic sample was lost for the Martin site for May, 2000. McKenzie River had two missing samples: the Hendricks site in September of 1999 was inaccessible due to low water; and Mohawk in January of 2000 due to high water. The Willamette River was not sampled during the winter of 2000, due to high water conditions. In addition, one sampling site on the Willamette, Whitely at RM176, was not sampled during the spring of 2000. There were no missing samples for the Leaf River.

Table 3.10 Codorus Creek Periphyton Summary, May 2000

	East Branch	Menges	USGS	Graybill
No. of Diatom Taxa	18	21	19	13
No. of Non-Diatom Taxa	8	14	8	6
No. of Divisions	3	4	3	3

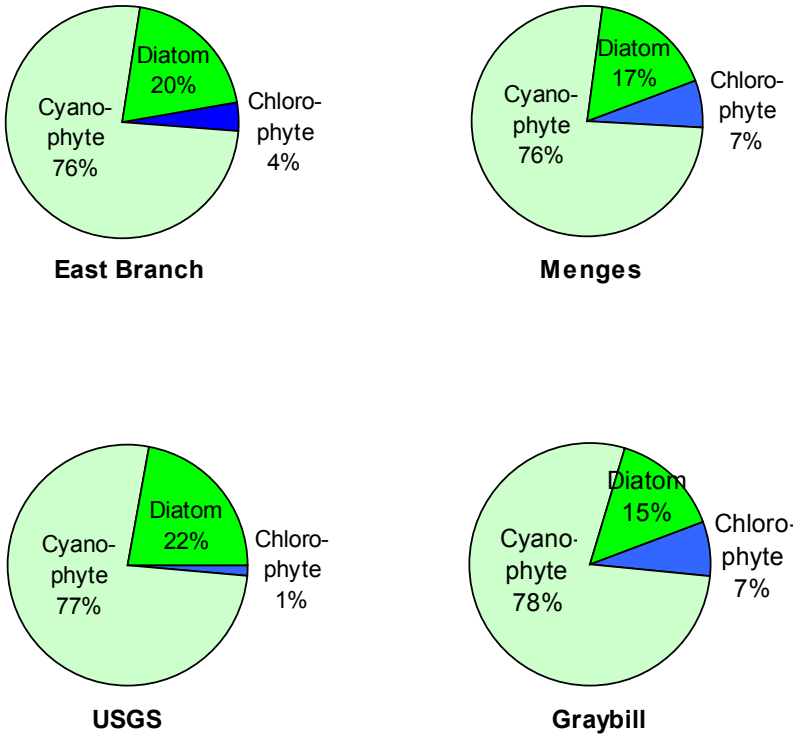

Figure 3.58 Codorus Creek Periphyton Distribution by Taxonomic Division (Excluding Divisions Contributing < 1%), May 2000

Table 3.11 McKenzie River Periphyton Summary, June 2000

	Hendricks RM22.4	Bellingers RM18.5	Mohawk RM14	Harvest RM10	Armitage RM6
No. of Diatom Taxa	9	13	20	16	15
No. of Non-Diatom Taxa	9	5	12	8	11
No. of Divisons	3	3	5	3	3

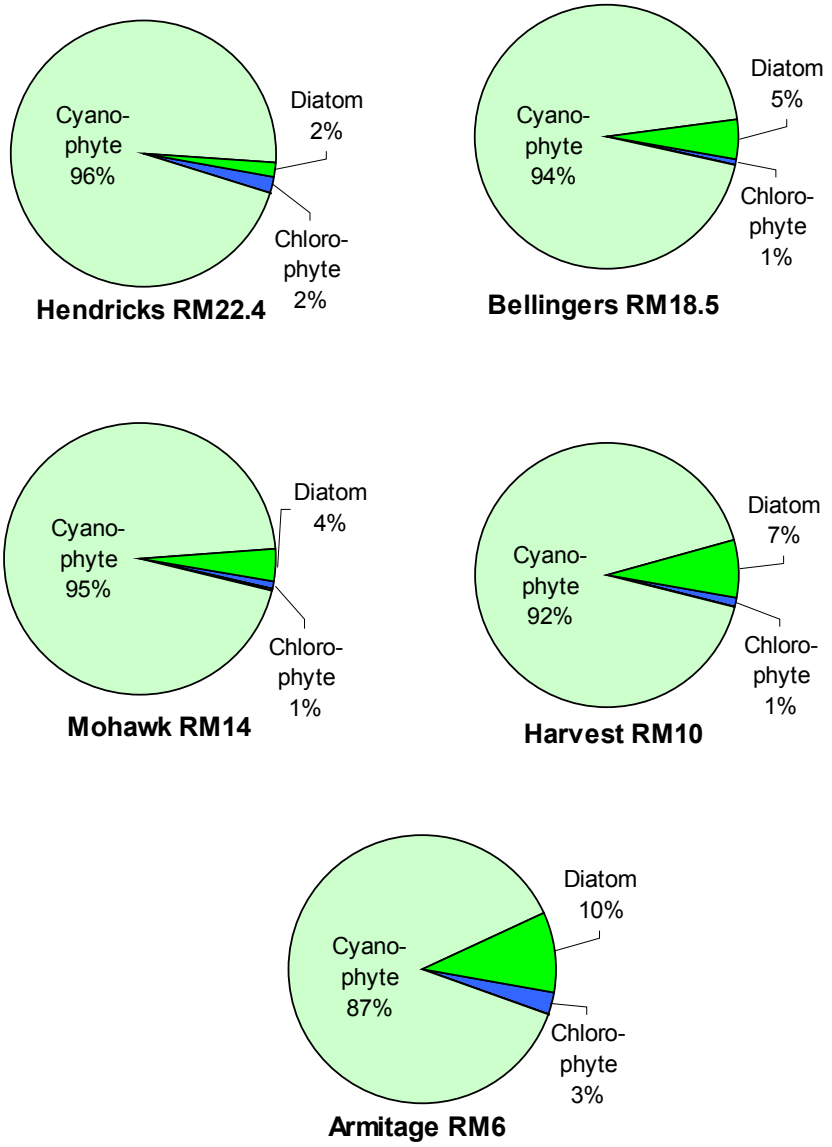

Figure 3.59 McKenzie River Periphyton Distribution by Taxonomic Division (Excluding Divisions Contributing <1%), June 2000

Table 3.12 Willamette River Periphyton Summary, May/June 2000

	Harrisburg RM160	Cartney RM156	Intake RM148	Snag Boat RM143.5	Willamette RM134	Corvallis RM128
No. of Diatom Taxa	21	20	18	14	16	11
No. of Non-Diatom Taxa	8	8	9	8	7	9
No. of Divisons	3	3	3	3	3	3

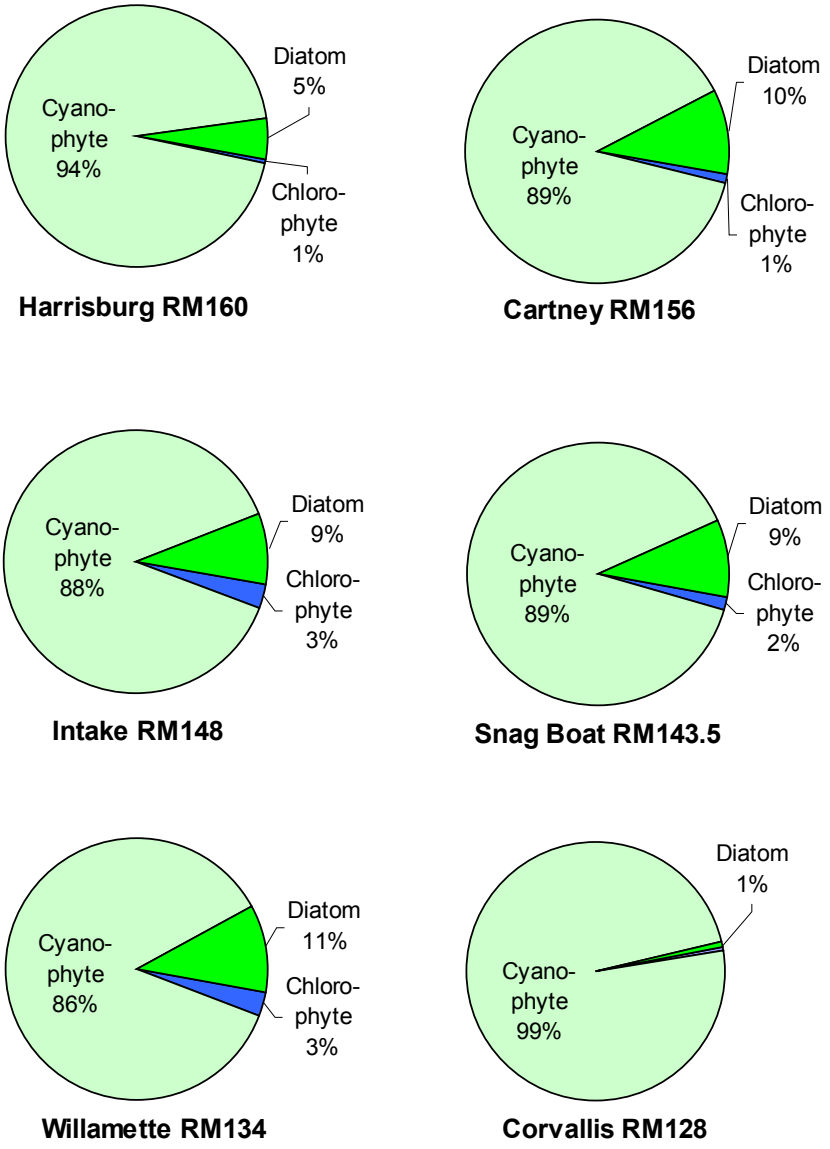

Figure 3.60 Willamette River Periphyton Distribution by Taxonomic Division (Excluding Divisions Contributing <1%), May/June 2000

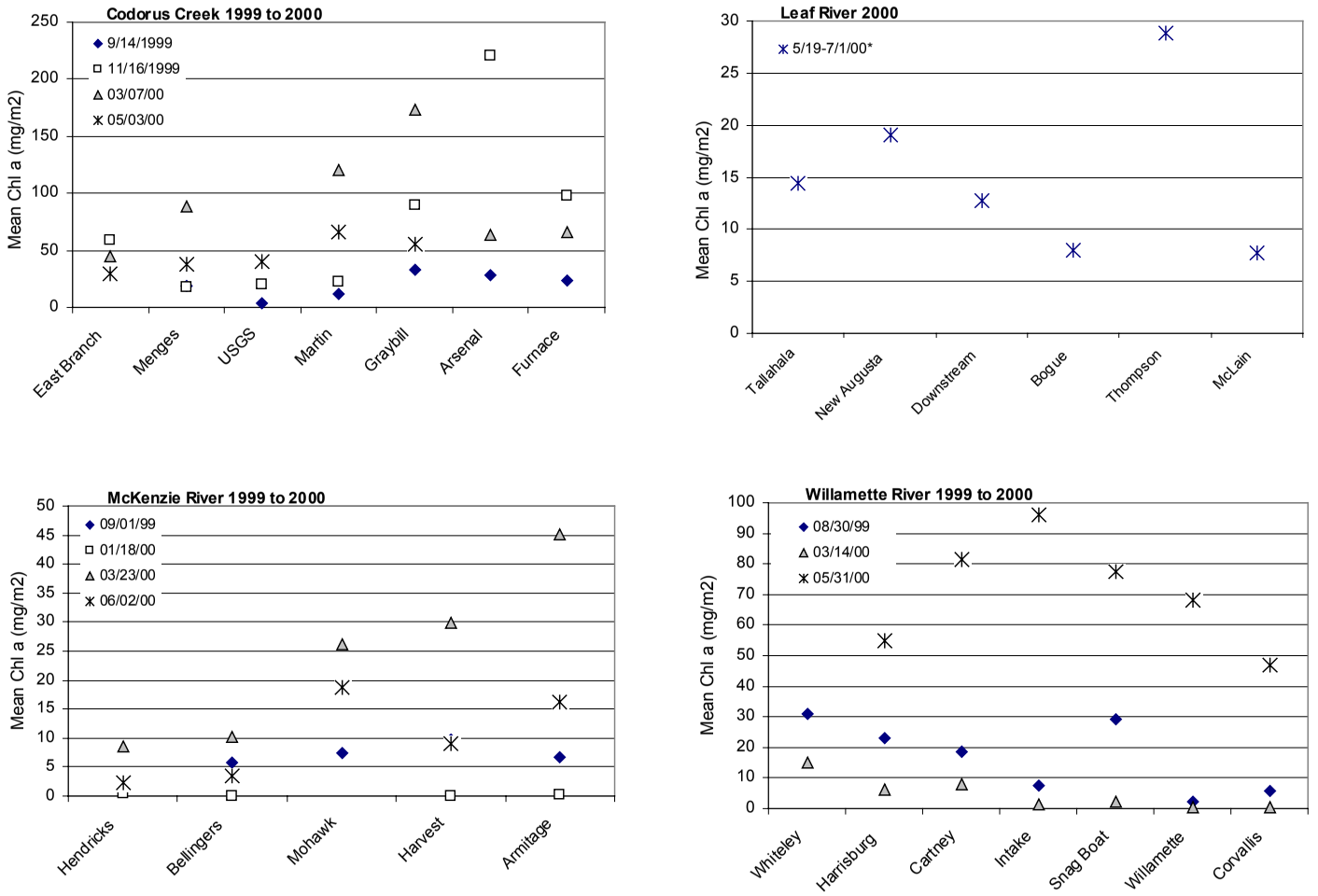

Figure 3.61 Mean Chlorophyll *a* (mg/m^2) LTRWS Rivers for Study Year 1999 to 2000

3.8 Benthic Macroinvertebrates

Benthic macroinvertebrates were collected quarterly on Codorus Creek, McKenzie River and Willamette River for biomass and taxonomic evaluation. The September 1999 samples for the McKenzie and Willamette were obtained using a Surber sampler; all remaining samples were collected using a Hess sampler. All samples collected for Codorus Creek used a Hess sampler. McKenzie, Willamette and Codorus each had five replicates done per site. The Leaf River samples were collected once during the sampling period covered in this bulletin, using Hester-Dendy plates exposed for five weeks, with three replicates per site. All data were normalized to area (1 m^2). Samples were preserved in 10% buffered formalin and shipped to Benthix Consulting for taxonomic evaluation. Samples were then returned, in 10% buffered formalin, to NABF, Anacortes, Washington, for biomass assays.

The benthic macroinvertebrate sampling sites were the same as the periphyton sampling sites, with Codorus Creek having seven sites, the McKenzie River having five sites, the Willamette River having seven sampling sites and the Leaf River having six sites. Codorus Creek had three missing samples: the East Branch site was not sampled during September, 1999, due to flood waters, and the Arsenal and Furnace sites were not sampled during May, 2000, due to sampling permit issues. McKenzie River had two missing samples: Hendricks in September of 1999, the site was inaccessible due to low water, and Mohawk in January of 2000, due to high water. The Willamette River had one missing sampling date, winter of 2000, due to high water conditions no macroinvertebrate sampling was done on this river. There were no missing samples for the Leaf River.

3.8.1 *Codorus Creek Benthic Macroinvertebrates*

Table 3.13 Codorus Creek Benthic Macroinvertebrate Taxa List by Sampling Site for September 1999 through June 2000

Order	Family	Genus	Species	Furnace	Arsenal	Graybill	Martin	USGS	Menges	East Brar
Amphipoda	Gammaridae	Gammarus	x	✓	✓	✓	✓	✓	✓	
Coleoptera	Elmidae	Ancyronyx	variegatus			✓	✓	✓		✓
		Dubiraphia	vittata	✓	✓	✓	✓	✓		✓
		Macronychus	glabratus			✓	✓	✓		✓
		Microcylloepus	pusillus	✓						
		Optioservus	x	✓	✓	✓	✓	✓	✓	✓
			ovalis			✓			✓	✓
		Oulimnius	latiusculus	✓					✓	
		Stenelmis	x	✓	✓	✓	✓	✓	✓	✓
	Hydrophilidae	Berosus	x				✓			
	Psephenidae	Psephenus	herricki	✓	✓	✓	✓	✓	✓	✓
	Ptilodactylidae	Anchytarsus	bicolor							✓
Decapoda	Cambaridae	x	x	✓	✓	✓		✓		
Diptera	Ceratopogonidae	Bezzia	x			✓	✓	✓	✓	✓
		Culicoides	x	✓		✓		✓		✓
		Mallochohelea	x						✓	
		Probezzia	x							✓
	Chironomidae	Ablabesmyia	mallochi	✓	✓	✓	✓	✓	✓	✓
		Brillia	flavifrons			✓		✓	✓	✓
		Cardiocladius	x	✓	✓		✓	✓	✓	✓
		Chaetocladius	x							✓
		Chironomus	x	✓		✓	✓	✓		✓
		Cladotanytarsus	mancus gr.		✓			✓		✓
			vanderwulpi gr. A		✓	✓				✓
			vanderwulpi gr. B						✓	✓
		Clinotanypus	x					✓		
		Conchapelopia	fasciata gr.	✓			✓		✓	
		Corynoneura	x	✓	✓	✓	✓	✓	✓	✓
		Cricotopus	x	✓	✓	✓	✓	✓	✓	✓
			bicinctus	✓	✓	✓	✓	✓	✓	✓
			sp. B	✓						
			cf. sylvestris			✓	✓	✓		
			trifascia	✓	✓	✓	✓	✓	✓	✓
			sp. C	✓	✓	✓		✓	✓	✓
		Cricotopus/Orthocladius	x	✓	✓	✓	✓	✓	✓	✓
		Cryptochironomus	cf. blarina	✓	✓	✓	✓	✓	✓	✓
		Diamesa	x	✓		✓			✓	✓
		Diamesa/Sympotthastia	x	✓	✓	✓	✓	✓	✓	✓
		Dicrotendipes	fumidus	✓	✓	✓	✓	✓	✓	✓
			neomodestus	✓	✓	✓	✓	✓		
			nervosus		✓		✓	✓		
			simpsoni				✓			
		Diplocladius	cultriger						✓	✓
		Doncricotopus	bicaudatus			✓	✓	✓	✓	✓
		Eukiefferiella	claripennis gr.	✓	✓	✓	✓	✓	✓	✓
			coerulescens gr.							✓
			devonica gr.			✓			✓	✓
			pseudomontana gr.	✓				✓	✓	
		Glyptotendipes	x				✓			
		Hayesomyia	senata			✓	✓			
		Heleniella	x							✓
		Helopelopia	cornuticaudata			✓				
		Heterotrissocladius	marcidus						✓	✓
			subpilosus			✓				
		Hydrobaenus	x	✓	✓	✓	✓	✓	✓	✓
		Limnophyes	x	✓						
		Lopescladius	x							✓
		Meropelopia	flavifrons				✓			
		Micropsectra	x	✓		✓	✓	✓	✓	✓
		Microtendipes	pedellus gr.	✓		✓	✓	✓	✓	✓

(Continued on next page)

Table 3.13 Continued

Order	Family	Genus	Species	Furnace	Arsenal	Graybill	Martin	USGS	Menges	East Branch
Diptera	Chironomidae	Nanocladius	crassicornis	✓		✓	✓	✓		
			distinctus	✓	✓	✓	✓	✓	✓	
			spiniplenus	✓		✓	✓	✓	✓	✓
		Natarsia	baltimoreus			✓		✓	✓	
		Nilotanypus	fimbriatus	✓	✓	✓	✓	✓	✓	
		Nimbocera	x	✓	✓	✓	✓	✓	✓	✓
		Orthocladius	x	✓	✓	✓	✓	✓	✓	✓
			ashei	✓		✓				
			ashei/rivicola	✓	✓	✓			✓	✓
			ashei/rivicola	✓		✓			✓	✓
			carlatus				✓		✓	
			lignicola				✓			
			mallochi	✓		✓		✓	✓	✓
			cf. rivicola		✓	✓				
			rivulorum	✓					✓	
			sp. A		✓	✓	✓	✓	✓	✓
			sp. B							✓
		Pagastia	x			✓		✓	✓	✓
		Parakiefferiella	x	✓	✓	✓	✓	✓	✓	✓
		Paralauterborniella	nigrohalterale							✓
		Parametriocnemus	x	✓	✓	✓	✓	✓	✓	✓
		Paratanytarsus	x	✓	✓		✓	✓	✓	✓
			inopertus gr.			✓	✓			
			penicillatus gr.						✓	
		Paratendipes	cf. albimanus			✓		✓	✓	✓
		Phaenopsectra	obediens gr.	✓	✓		✓	✓		✓
			punctipes gr.		✓	✓		✓	✓	✓
		Polypedilum	aviceps			✓		✓	✓	✓
			flavum	✓	✓	✓	✓	✓	✓	✓
			fallax				✓			✓
			illinoense gr.	✓	✓	✓	✓	✓	✓	✓
			cf. scalaenum	✓	✓	✓	✓	✓	✓	✓
			sp. C							✓
		Potthastia	gaedii gr.					✓	✓	✓
			longimana gr.	✓	✓		✓			✓
		Procladius	x	✓				✓		
		Pseudochironomus	x					✓		
		Rheocricotopus	robacki	✓	✓	✓	✓	✓		✓
		Rheotanytarsus	x	✓	✓	✓	✓	✓	✓	✓
		Smittia	x	✓						
		Stempellinella	x	✓				✓	✓	✓
		Stenochironomus	poecilopterus					✓		
			x			✓	✓	✓	✓	✓
		Stilocladius	x						✓	✓
		Sublettea	coffmani						✓	✓
		Sympotthastia	x							✓
		Synorthocladius	semivirens	✓	✓	✓	✓	✓	✓	✓
		Tanytarsus	curticornis gr.		✓	✓		✓	✓	✓
			gregarius & lugens g		✓			✓	✓	
			pallidicornis & aculeatus	✓	✓	✓	✓	✓	✓	✓
			sp. D	✓	✓	✓	✓	✓		✓
			sp. E		✓		✓	✓	✓	
			sp. G	✓	✓	✓	✓	✓	✓	✓
		Thienemanniella	x	✓	✓	✓	✓	✓	✓	✓
		Thienemannimyia	x	✓	✓	✓	✓	✓	✓	✓
		Tvetenia	bavarica gr.	✓	✓	✓	✓	✓	✓	✓
			discoloripes gr.			✓				
		Zavrelimyia	x							✓
		Krenosmittia	x							✓
	Empididae	Chelifera	x		✓	✓	✓	✓	✓	✓
		Clinocera	x	✓	✓	✓	✓		✓	✓
		Hemerodromia	x	✓	✓	✓	✓	✓	✓	✓
	Muscidae	x	x							✓
	Psychodidae	Pericoma	x			✓	✓			

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Table 3.13 Continued

Order	Family	Genus	Species	Furnace	Arsenal	Graybill	Martin	USGS	Menges	East Bran
Diptera	Simuliidae	Prosimulium	x	✓	✓				✓	
		Simulium	x	✓	✓	✓	✓	✓	✓	✓
	Tabanidae	Chrysops	x			✓	✓	✓	✓	
		Tabanus	x			✓	✓			
	Tipulidae	Antocha	x	✓		✓	✓	✓	✓	✓
		Dicranota	x						✓	
		Limnophila	x	✓		✓	✓		✓	✓
		Pseudolimnophila	x			✓		✓		✓
		Tipula	x						✓	✓
Ephemeroptera	Baetidae	Acentrella	x			✓			✓	✓
		Baetis	x	✓	✓	✓		✓	✓	✓
	Caenidae	Caenis	x	✓	✓	✓	✓	✓	✓	✓
	Ephemerellidae	Attenella	x							✓
		Drunella	x			✓				
		Ephemerella	x			✓			✓	✓
		Serratella	x	✓					✓	✓
		x	x						✓	✓
	Ephemeridae	Ephemera	x					✓		✓
	Heptageniidae	Stenonema/Stenacron	x	✓	✓	✓	✓	✓	✓	✓
	Leptophlebiidae	x	x					✓	✓	✓
	Tricorythidae	Tricorythodes	x	✓	✓	✓	✓	✓	✓	
Gastropoda	Ancylidae	x	x	✓	✓	✓	✓	✓	✓	✓
	Physidae	Physella	x		✓		✓	✓	✓	
	Planorbidae	Gyraulus	x			✓	✓	✓		
Hemiptera	Gerridae	Metrobates	x					✓		
Hirudinea	Erpobdellidae	Mooreobdella	fervida	✓						
	Glossiphoniidae	Helobdella	stagnalis		✓					
			fusca	✓						
Hydracarina	x	x	x	✓	✓	✓	✓	✓	✓	✓
Hydroida	Hydridae	Hydra	x	✓	✓	✓	✓	✓	✓	
Isopoda	Asellidae	Caecidotea	x	✓	✓	✓	✓	✓	✓	
Lepidoptera	Pyralidae	Petrophila	x	✓	✓					
Megaloptera	Corydalidae	Corydalus	cornutus	✓		✓	✓			
	Corydalidae	Nigronia	serricornis					✓		
	Sialidae	Sialis	x			✓	✓	✓	✓	✓
Odonata	Coenagrionidae	Argia	x	✓	✓		✓	✓		
	Gomphidae	x	x	✓		✓				
Pelecypoda	Sphaeriidae	x	x	✓	✓	✓	✓	✓	✓	✓
Plecoptera	Capniidae	Allocapnia	x	✓	✓	✓				✓
	Leuctridae	Leuctra	x						✓	✓
	Nemouridae	Amphinemura	x			✓	✓			
	Nemouridae	Prostoia	x	✓		✓			✓	✓
	Perlidae	Perlesta	x			✓	✓			✓
		x	x			✓				
	Taeniopterygidae	Taeniopteryx	metequi	✓		✓			✓	✓
	x	x	x		✓	✓				✓
Trichoptera	Glossosomatidae	Anagapetus	x			✓				
		Glossosoma	x						✓	
		Protoptila	x			✓				
		x	x			✓				
	Hydropsychidae	Cheumatopsyche	x	✓	✓	✓	✓	✓	✓	✓
		Diplectrona	modesta	✓						
		Hydropsyche	type A	✓		✓	✓	✓	✓	
			type B	✓	✓	✓	✓	✓	✓	✓
		x	x	✓		✓	✓	✓	✓	✓
	Hydroptilidae	Hydroptila	x	✓	✓	✓	✓	✓	✓	✓
		Leucotrichia	pictipes	✓					✓	
		Ochrotrichia	x				✓			
	Leptoceridae	Ceraclea	x				✓			
		Oecetis	x				✓			
	Philopotamidae	Chimarra	x			✓	✓	✓	✓	✓
		Dolophilodes	x						✓	✓
	Polycentropodidae	Cernotina	x	✓				✓		✓
	Psychomyiidae	Psychomyia	flavida	✓	✓	✓	✓	✓		
	Uenoidae	Neophylax	x							✓
Tricladida	x	x	x	✓	✓	✓	✓	✓	✓	✓

Table 3.14 Codorus Creek Benthic Macroinvertebrate Community Summary, September 1999 through May 2000

Date	Site	Total # taxa	% EPT	% Chironomidae	% Diptera	Total Abundance (Count/site)
September 1999	Furnace	44	20.5	47.7	50.0	2163
September 1999	Arsenal	55	14.5	56.4	60.0	3750
September 1999	Graybill	49	18.4	49.0	57.1	6852
September 1999	Martin	45	20.0	48.9	55.6	13018
September 1999	USGS	60	18.3	51.7	56.7	1904
September 1999	Menges	71	21.1	56.3	66.2	3928
September 1999	East Branch[a]					
November 1999	Furnace	65	21.5	44.6	52.3	3612
November 1999	Arsenal	52	17.3	57.7	63.5	4105
November 1999	Graybill	72	18.1	51.4	66.7	11150
November 1999	Martin	56	14.3	57.1	64.3	11668
November 1999	USGS	69	14.5	62.3	69.6	3744
November 1999	Menges	68	25.0	47.1	58.8	3295
November 1999	East Branch	67	17.9	59.7	70.1	1051
March 2000	Furnace	69	11.6	60.9	68.1	5692
March 2000	Arsenal	52	5.8	65.4	73.1	1639
March 2000	Graybill	80	18.8	55.0	65.0	12697
March 2000	Martin	75	13.3	49.3	61.3	9956
March 2000	USGS	74	8.1	67.6	75.7	5644
March 2000	Menges	70	14.3	58.6	70.0	4415
March 2000	East Branch	78	15.4	61.5	73.1	5045
May 2000	Furnace[b]					
May 2000	Arsenal[b]					
May 2000	Graybill	83	19.3	51.8	60.2	8740
May 2000	Martin	56	17.9	53.6	58.9	5622
May 2000	USGS	74	8.1	67.6	75.7	5644
May 2000	Menges	70	14.3	58.6	70.0	4415
May 2000	East Branch	77	18.2	58.4	66.2	4270

[a] not sampled due to flood conditions
[b] not sampled due to permit concerns

Table 3.15 Codorus Creek Benthic Macroinvertebrate Biomass September 1999 through May 2000 (Means for 5 replicates)

Mean Dry Weight (g/m2)

	East Branch	Menges	USGS	Martin	Graybill	Arsenal	Furnace
09/16/99		1.6307	0.5308	5.0640	2.6342	2.3773	0.8240
11/18/99	0.7226	2.5128	1.1995	6.0584	12.1093	1.6109	1.6249
03/09/00	2.2107	2.8086	2.2642	7.1070	6.4944	1.0316	6.1574
05/04/00	1.4449	4.6570	2.9037	3.8826	4.0060		

Mean Ash-Free Dry Weight (g/m2)

	East Branch	Menges	USGS	Martin	Graybill	Arsenal	Furnace
09/16/99		1.2909	0.3884	4.4831	2.2791	1.9032	0.6653
11/18/99	0.3988	2.0021	0.6486	5.3214	11.2353	1.3257	1.2784
03/09/00	1.4781	2.0451	1.5681	5.6519	4.8986	0.6288	4.0398
05/04/00	0.8760	3.1740	1.8519	2.7063	2.6988		

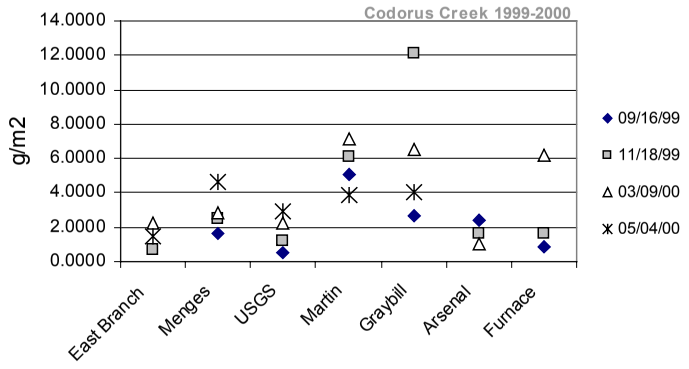

Figure 3.62 Codorus Creek Benthic Macroinvertebrate Mean Dry Biomass

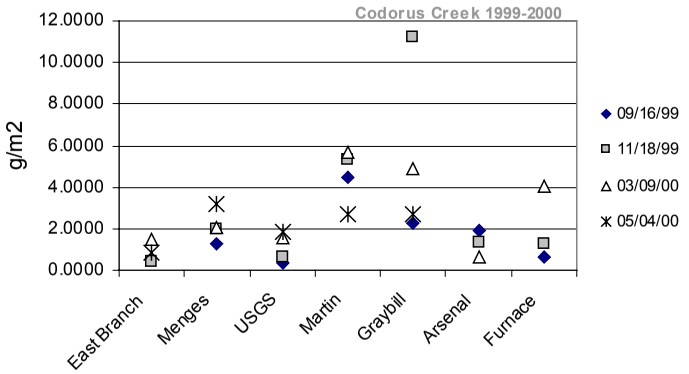

Figure 3.63 Codorus Creek Benthic Macroinvertebrate Mean Ash-Free Dry Biomass

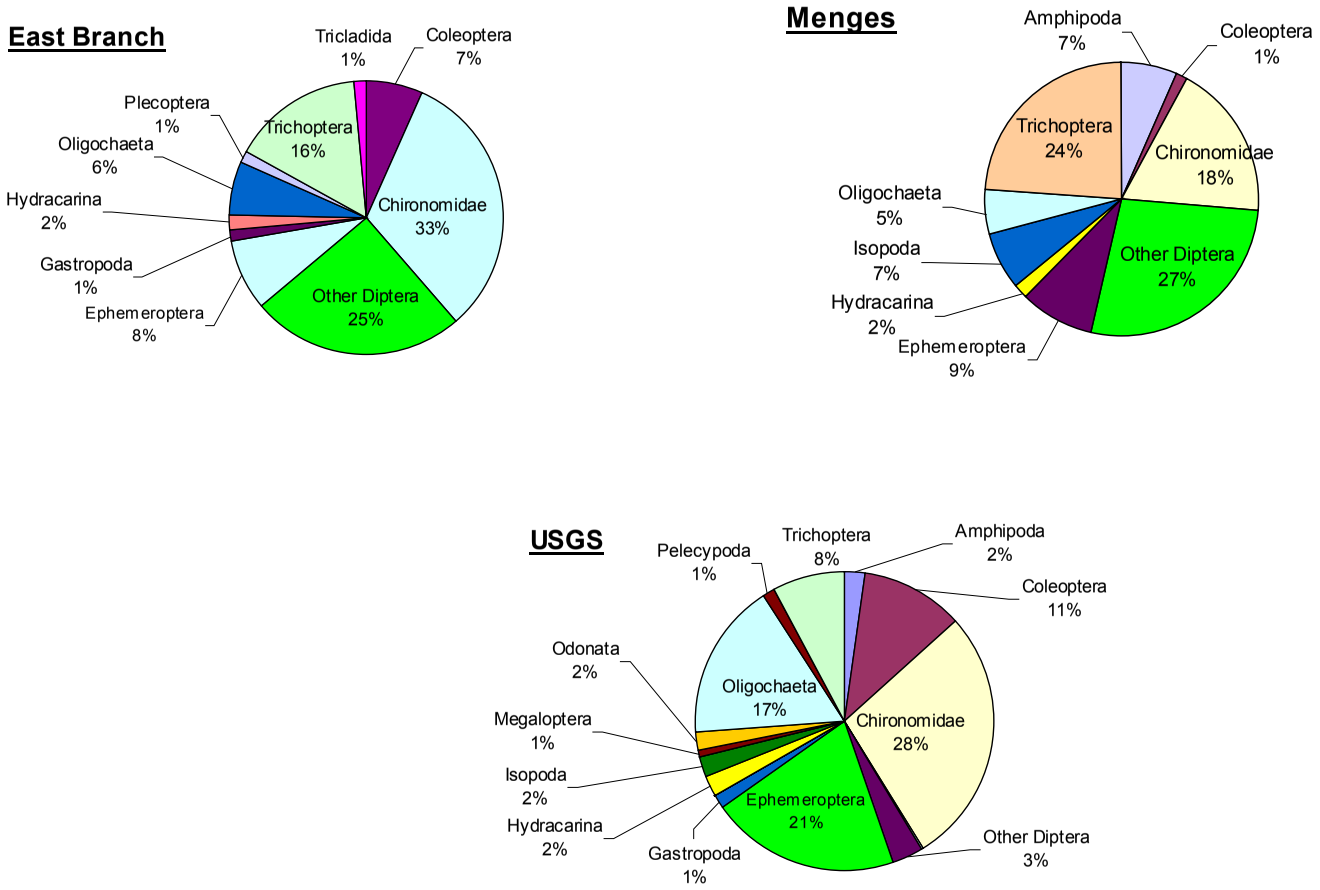

Figure 3.64 Benthic Macroinvertebrate Family Distribution by Percent Dry Weight for Codorus Creek Sampling Sites Upstream of Mill Discharge, Study Year 1999 to 2000 (Represents the sum of all replicates and seasonal samples for the entire study year for all families contributing to >1% of the total)

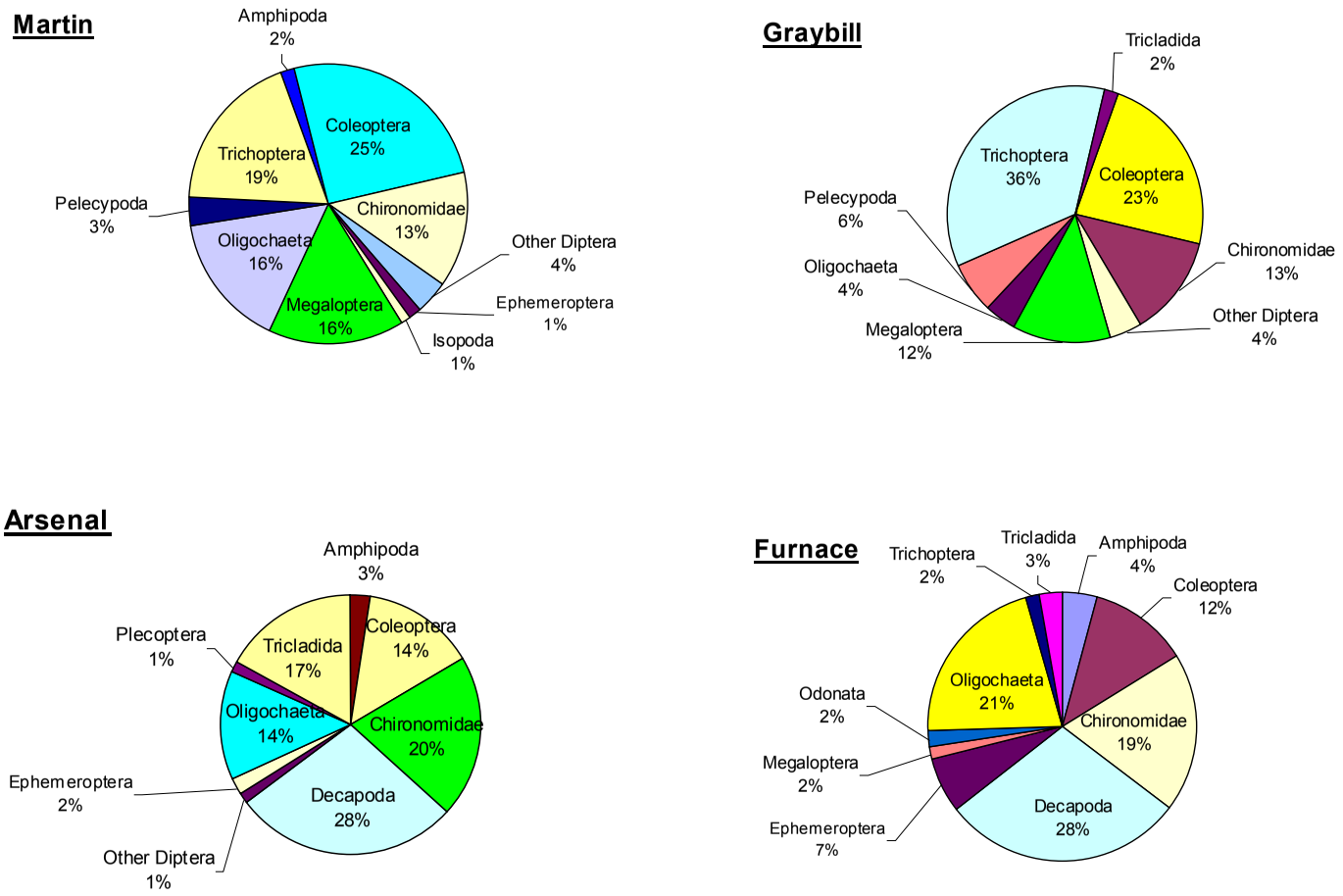

Figure 3.65 Benthic Macroinvertebrate Family Distribution by Percent Dry Weight for Codorus Creek Sampling Sites Downstream of Mill Discharge, Study Year 1999 to 2000 (Represents the sum of all replicates and seasonal samples for the entire study year for all families contributing to >1% of the total)

3.8.2 *Leaf River Benthic Macroinvertebrates*

Table 3.16 Leaf River Benthic Macroinvertebrate Taxa List by Sampling Site for May/July 2000

Order	Family	Genus	Species	Tallahalla	New Augusta	Downstream	Bogue	Thompson	McLain
Coleoptera	Elmidae	Ancyronyx	variegatus		✓				
		Macronychus	glabratus	✓	✓	✓	✓	✓	✓
		Stenelmis	x			✓			
Diptera	Ceratopogonidae	cf. Bezzia	x		✓				✓
	Chironomidae	Ablabesmyia	x		✓				✓
		Cladotanytarsus	sp. gr. A of Oliver						✓
		Corynoneura	x	✓	✓	✓	✓	✓	✓
		Cricotopus	x	✓		✓	✓	✓	✓
			bicinctus	✓				✓	
		Cricotopus/Orthocladius gr.			✓	✓	✓	✓	✓
		Cryptochironomus	cf. sorex						✓
		Dicrotendipes	neomodestus	✓	✓	✓	✓	✓	✓
		Hayesomyia	senata		✓				
		Nanocladius	crassicornis	✓	✓	✓	✓	✓	✓
			downesi		✓	✓	✓	✓	✓
			minimus						✓
		Nilotanypus	fimbriatus			✓			
		Nilothauma	x	✓	✓	✓	✓	✓	✓
		Nimbocera	x		✓			✓	✓
		Parakiefferiella	x						✓
		Pentaneura	x		✓				
		Polypedilum	flavum	✓	✓	✓	✓	✓	✓
			illinoense gr.				✓		✓
			scalaenum	✓	✓	✓	✓	✓	✓
		Pseudochironomus	x	✓	✓	✓	✓	✓	✓
		Rheocricotopus	robacki	✓		✓	✓	✓	✓
		Rheopelopia	x	✓	✓	✓	✓	✓	✓
		Rheotanytarsus	x	✓	✓	✓	✓	✓	✓
		Stelechomyia	perpulchra	✓	✓	✓	✓	✓	✓
		Stenochironomus	x	✓	✓	✓	✓	✓	✓
		Synorthocladius	semivirens	✓		✓			
		Tanytarsus	pallidicornis&aculeatus gr.	✓	✓	✓	✓	✓	✓
			sp. D	✓	✓	✓	✓	✓	✓
			sp. E						✓
			sp. H		✓	✓	✓	✓	✓
			sp. I	✓					
		Thienemanniella	x	✓	✓	✓	✓	✓	✓
		Thienemannimyia gr.	x	✓	✓	✓	✓	✓	✓
	Empididae	Hemerodromia	x	✓	✓	✓	✓	✓	✓
	Simuliidae	Simulium	x	✓	✓	✓	✓	✓	✓
Ephemeroptera	Baetidae	Baetis	x	✓	✓	✓	✓	✓	✓
	Caenidae	Caenis	x	✓	✓	✓		✓	✓
	Heptageniidae	Stenonema	exiguum	✓	✓	✓	✓	✓	✓
			integrum	✓	✓	✓	✓	✓	✓
			type A	✓	✓	✓	✓	✓	✓
		unknown	x	✓		✓	✓		
	Isonychiidae	Isonychia	x	✓	✓	✓	✓	✓	✓
	Leptohyphidae	Leptohyphyes	x	✓	✓	✓	✓	✓	✓
		Tricorythodes	x	✓	✓	✓	✓	✓	✓
Gastropoda	Ancylidae	x	x		✓	✓	✓		
Hydracarina	x	x	x	✓		✓	✓	✓	✓
Megaloptera	Corydalidae	Corydalus	cornutus	✓	✓	✓	✓	✓	✓
Odonata	Calopterygidae	Hetaerina	vulnerata					✓	
	Coenagrionidae	Argia	x		✓				
	Corduliidae	Neurocordulia	x	✓	✓			✓	✓
Plecoptera	Perlidae	Paragnetina	x	✓		✓	✓	✓	✓

(Continued on next page)

Table 3.16 Continued

Order	Family	Genus	Species	Tallahalla	New Augusta	Downstream	Bogue	Thompson	McLain
Trichoptera	Hydropsychidae	x	x	✓	✓	✓	✓	✓	✓
		Cheumatopsyche	x	✓	✓	✓	✓	✓	✓
		Hydropsyche	x	✓	✓	✓	✓	✓	✓
	Hydroptilidae	Hydroptila	x	✓	✓	✓	✓	✓	✓
		Mayatrichia	x						✓
		Oxyethira	x						✓
	Leptoceridae	Ceraclea	x	✓			✓	✓	✓
		Oecetis	x	✓	✓	✓	✓	✓	✓
	Philopotamidae	Wormaldia	x	✓	✓	✓	✓	✓	✓
	Polycentropodidae	Cyrnellus	fraternus		✓			✓	✓
		Neureclipsis	x	✓	✓	✓	✓	✓	✓
		Nictiophylax	x	✓	✓	✓	✓	✓	✓
Tricladida	x	x	x			✓			

Table 3.17 Leaf River Benthic Macroinvertebrate Community Summary, May/July 2000

Date	Site	Total # taxa	% EPT	% Chironomidae	% Diptera	Total Abundance (count/site)
July-00	Tallahalla	45	68.3%	30.7%	30.9%	1930
July-00	New Augusta	48	86.1%	12.7%	12.9%	2695
July-00	Downstream	48	71.1%	25.6%	25.9%	1441
July-00	Bogue	45	79.4%	18.9%	19.8%	3858
July-00	Thompson	48	56.2%	41.1%	42.2%	2710
July-00	McLain	56	62.3%	34.9%	36.5%	2037

Table 3.18 Leaf River Benthic Macroinvertebrate Biomass May/July 2000 (Means for 5 replicates)

	Mean Weight (g/m2)	
	Dry Weight	Ash Free Dry Weight
Tallahalla	2.3161	1.5982
New Augusta	3.6832	2.5432
Downstream	2.6035	1.9702
Bogue	4.7488	3.8660
Thompson	3.3975	2.2305
McLain	2.6649	1.8161

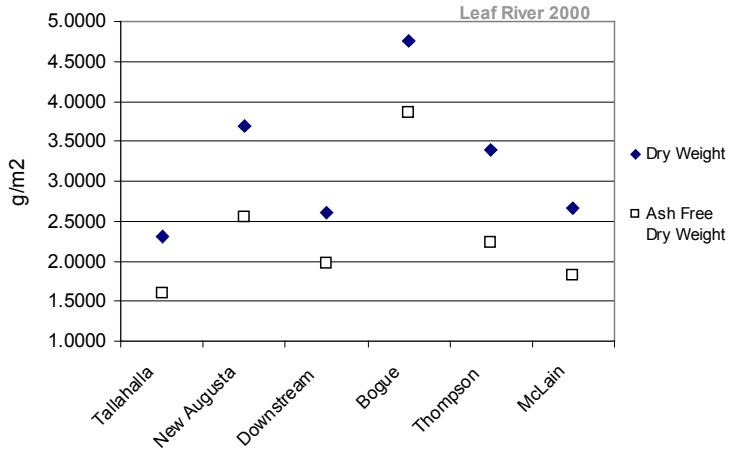

Figure 3.66 Leaf River Benthic Macroinvertebrate Mean Biomass, May/July 2000: Dry and Ash Free Dry Weight

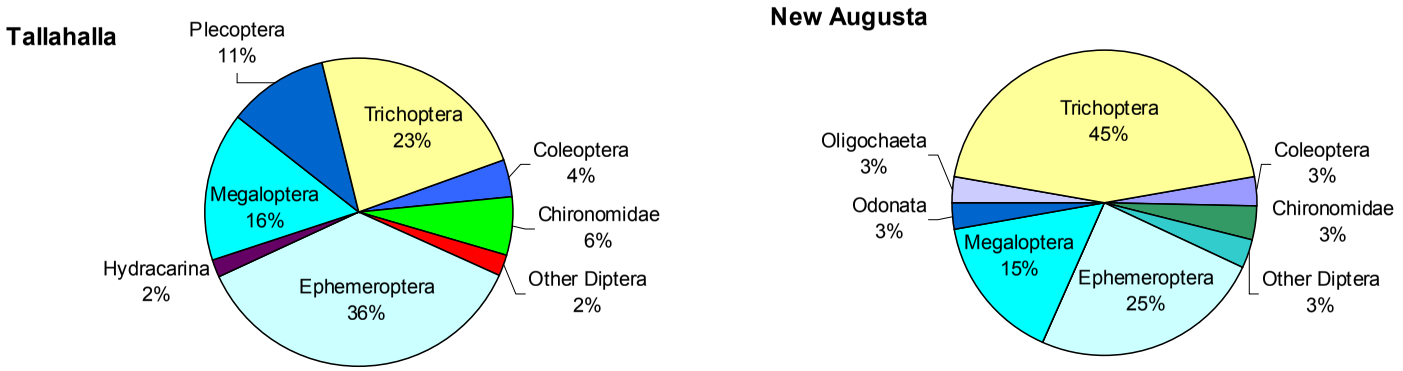

Figure 3.67 Benthic Macroinvertebrate Family Distribution by Percent Dry Weight for the Leaf River Sampling Sites Upstream of Mill Discharge, July 2000 (Represents the sum of all replicates for all families contributing to >1% of the total)

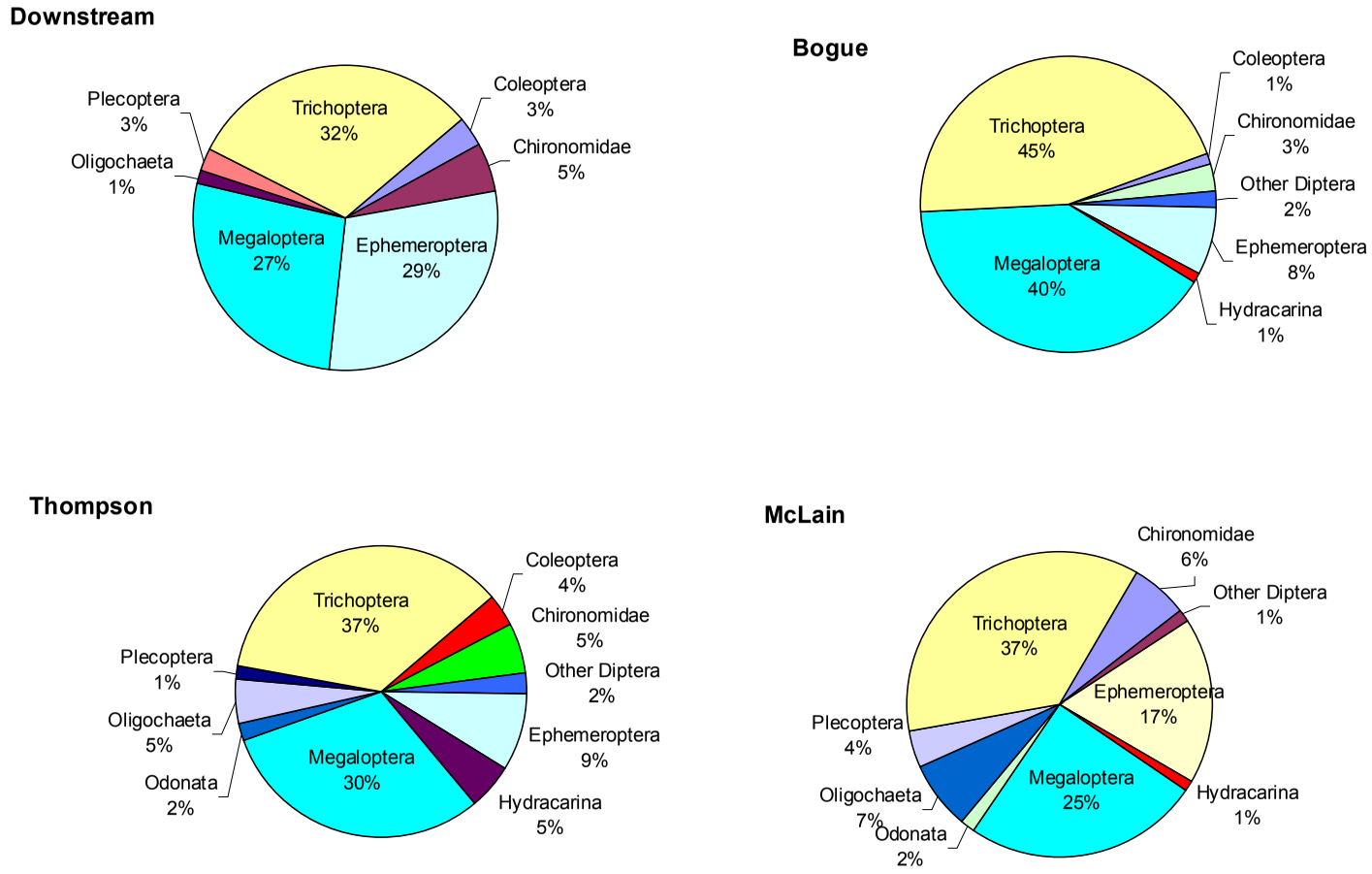

Figure 3.68 Benthic Macroinvertebrate Family Distribution by Percent Dry Weight for the Leaf River Sampling Sites Downstream of Mill Discharge, July 2000 (Represents the sum of all replicates for all families contributing to >1% of the total)

3.8.3 *McKenzie River Benthic Macroinvertebrates*

Table 3.19 McKenzie River Benthic Macroinvertebrate Taxa List by Sampling Site for September 1999 through June 2000

Order	Family	Genus	Species	Armitage RM6	Harvest RM10	Mohawk RM14	Bellinger RM18.5	Hendricks RM22.4
Amphipoda	Gammaridae	Gammarus	x	✓	✓	✓		
		x	x			✓		✓
Coleoptera	Dytiscidae	Oreodytes	x	✓			✓	
		Uvarus	x	✓	✓			
	Elmidae	Cleptelmis	x	✓	✓	✓	✓	✓
		Heterlimnius	x	✓		✓	✓	
		Narpus	x	✓	✓	✓	✓	✓
		Optioservus	x	✓	✓	✓	✓	✓
		Stenelmis	x	✓				✓
		x	x	✓	✓	✓	✓	✓
		Zaitzevia	x	✓	✓	✓	✓	✓
	Lampyridae	x	x	✓				
Diptera	Ceratopogonidae	Bezzia	x	✓				
		Probezzia	x		✓			✓
		x	x	✓	✓		✓	✓
	Chironomidae	Boreochlus	x	✓				
		Brillia	x		✓			
			flavifrons	✓	✓	✓	✓	✓
		Cardiocladius	x	✓	✓	✓		✓
		Chaetocladius	x				✓	
		Chironomini	x	✓				
		Cladotanytarsus	vanderwulpi gr. A	✓			✓	✓
			vanderwulpi gr. B	✓			✓	✓
			vanderwulpi gr. C		✓	✓	✓	✓
		Conchapelopia	fasciata gr.	✓	✓			
		Corynoneura	x	✓	✓	✓	✓	✓
		Cricotopus	x	✓	✓	✓	✓	✓
			bicinctus		✓			
			sp. B	✓	✓	✓		✓
			trifascia			✓		
			sp. C	✓	✓	✓	✓	✓
		Cricotopus/Orthocladius	x	✓	✓	✓	✓	✓
		Cryptochironomus	cf. sorex		✓			
		Demicryptochironomus	x	✓	✓		✓	✓
		Diamesa	x	✓				
		Eukiefferiella	brehmi gr.		✓	✓		✓
			claripennis gr. type	✓	✓	✓	✓	✓
			coerulescens gr.	✓	✓	✓	✓	
			devonica gr.		✓	✓	✓	✓
			pseudomontana gr.	✓	✓	✓	✓	✓
		Euryhapsis	x		✓	✓	✓	✓
		Heleniella	x	✓	✓	✓	✓	✓
		Heterotrissocladius	marcidus gr.	✓	✓	✓		✓
		Hydrobaenus	x	✓				
		Krenosmittia	x		✓		✓	✓
		Limnophyes	x	✓	✓			
		Lopescladius	x				✓	✓
		Micropsectra	x	✓	✓	✓	✓	✓
		Microtendipes	pedellus gr.	✓				
			rydalensis		✓		✓	✓
		Monodiamesa	x	✓		✓		
		Nanocladius	rectinervis	✓	✓	✓	✓	✓
		Nilotanypus	fimbriatus	✓	✓	✓	✓	✓
		Nimbocera	x	✓				
		Orthocladiinae	x		✓			✓

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Table 3.19 Continued

Order	Family	Genus	Species	Armitage RM6	Harvest RM10	Mohawk RM14	Bellinger RM18.5	Hendricks RM22.4
Diptera	Chironomidae	Orthocladius	x	✓	✓	✓		✓
			ashei				✓	✓
			ashei/rivicola	✓	✓	✓	✓	✓
			carlatus	✓	✓			
			curtiseta	✓	✓	✓	✓	✓
			mallochi	✓	✓	✓		✓
			cf. rivicola	✓	✓	✓	✓	✓
			rivulorum	✓	✓	✓	✓	✓
		Pagastia	x	✓	✓	✓	✓	✓
			partica	✓	✓	✓	✓	✓
		Paracladopelma	undine	✓	✓	✓	✓	
			winnelli		✓			
		Parakiefferiella	x	✓	✓	✓	✓	
		Parametriocnemus	x	✓	✓	✓	✓	✓
		Paratanytarsus	x	✓	✓		✓	
			tenellulus gr.		✓			
		Parorthocladius	x	✓		✓		✓
		Pentaneura	x	✓	✓	✓	✓	✓
		Phaenopsectra	obediens gr.	✓	✓	✓		
		Polypedilum	x	✓				✓
			aviceps	✓	✓	✓	✓	✓
			fallax	✓				✓
			illinoense gr.			✓		
			laetum	✓	✓		✓	
			cf. scalaenum	✓		✓	✓	
			tritum	✓	✓	✓	✓	✓
		Potthastia	gaedii gr	✓	✓	✓	✓	✓
			longimana gr.			✓		
		Procladius	x	✓	✓			
		Rheocricotopus	eminellobus	✓	✓	✓	✓	✓
			robacki	✓	✓	✓		✓
		Rheopelopia	perda	✓	✓	✓		
		Rheotanytarsus	x	✓	✓	✓	✓	✓
		Robackia	demeijerei	✓	✓	✓	✓	✓
		Stempellina	x	✓	✓	✓	✓	✓
		Sublettea	coffmani	✓	✓	✓	✓	
		Synorthocladius	semivirens	✓	✓	✓	✓	✓
		Tanytarsus	x		✓			
			curticornis gr.	✓	✓	✓	✓	✓
			pallidicornis & aculeatus	✓	✓	✓	✓	✓
		Thienemannia	x	✓			✓	
		Thienemanniella	x	✓	✓	✓	✓	✓
		Thienemannimyia	x	✓	✓	✓	✓	✓
		Tvetenia	bavarica gr.	✓	✓	✓	✓	✓
		x	x			✓		
	Dolichopodidae	x	x		✓			
	Empididae	Chelifera	x	✓	✓	✓	✓	✓
		Hemerodromia	x	✓	✓	✓	✓	✓
		Trichoclinocera	x	✓	✓		✓	✓
	Simuliidae	Prosimulium	x				✓	✓
		Simulium	x		✓		✓	✓
		x	x		✓			✓
	Tanyderidae	Protanyderus	x			✓	✓	✓
		x	x				✓	✓
	Tipulidae	Antocha	x	✓	✓	✓	✓	✓

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Table 3.19 Continued

Order	Family	Genus	Species	Armitage RM6	Harvest RM10	Mohawk RM14	Bellinger RM18.5	Hendricks RM22.4
Diptera	Tipulidae	Cryptolabis	x				✓	
		Dicranota	x	✓	✓		✓	✓
		Gonomyia	x		✓			
		Hexatoma	x					✓
		Limnophila	x					✓
		Tipula	x					✓
		x	x					✓
	x	x	x	✓				✓
Ephemeroptera	Baetidae	Acentrella	x	✓	✓	✓	✓	✓
		Baetis	x	✓	✓	✓	✓	✓
		Diphetor	x		✓	✓	✓	✓
		x	x	✓	✓	✓	✓	✓
	Ephemerellidae	Attenella	x	✓	✓		✓	✓
		Drunella	x	✓	✓	✓	✓	✓
		Epeorus	x	✓	✓	✓	✓	✓
		Ephemerella	x	✓	✓	✓	✓	✓
			aurivilli	✓	✓	✓	✓	✓
			inermis	✓	✓	✓	✓	✓
		Eurylophella	x	✓				✓
		Serratella	type A	✓	✓	✓	✓	
			type B			✓	✓	
		Timpanoga	hecuba	✓			✓	
		x	x	✓	✓	✓	✓	✓
	Heptageniidae	Heptagenia	x	✓	✓	✓	✓	✓
		Leptophlebia	x	✓	✓		✓	✓
		Leucrocuta	x	✓	✓	✓	✓	✓
		Rhithrogena	x		✓	✓	✓	✓
		x	x	✓	✓	✓	✓	✓
	Leptophlebiidae	Paraleptophlebia	x	✓	✓	✓	✓	✓
			type B	✓	✓	✓	✓	✓
		x	x		✓	✓	✓	
	Tricorythidae	Tricorythodes	x	✓	✓	✓	✓	
Gastropoda	Ancylidae	x	x			✓		
	Hydrobiidae	Amnicola	x	✓	✓	✓		
	Physidae	Physella	x		✓	✓		
	Planorbidae	Gyraulus	x		✓			✓
		Vorticifex	effusa			✓		✓
	Pleuroceridae	Juga	plicifera	✓	✓	✓	✓	
			x	✓				
	x	x	x			✓		
Hemiptera	Corixidae	x	x			✓		
Hydracarina	x	x	x	✓	✓	✓	✓	✓
Hydroida	Hydridae	Hydra	x	✓	✓	✓	✓	
Oligochaeta	x	x	x	✓	✓	✓	✓	✓
Pelecypoda	Sphaeriidae	x	x	✓	✓	✓	✓	✓
	x	x	x					✓
Plecoptera	Capniidae	Capnia	x	✓	✓		✓	✓
	Chloroperlidae	Alloperla	x				✓	
		Suwallia	x	✓	✓	✓	✓	✓
		Sweltsa	x	✓	✓		✓	✓
		x	x	✓	✓	✓	✓	✓
	Leuctridae	Despaxia	augusta				✓	✓
	Nemouridae	Malenka	x		✓		✓	
		x	x					✓
		Zapada	cinctipes		✓	✓		✓

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Table 3.19 Continued

Order	Family	Genus	Species	Armitage RM6	Harvest RM10	Mohawk RM14	Bellinger RM18.5	Hendricks RM22.4
Plecoptera	Perlidae	Calineuria	californica	✓	✓	✓	✓	✓
		Claassenia	sabulosa	✓	✓	✓	✓	✓
		Doroneuria	baumanni					✓
		Eccoptura	xanthenes	✓				
		Hesperoperla	pacifica	✓				✓
		x	x	✓	✓	✓	✓	✓
	Perlodidae	Cascadoperla	trictura		✓		✓	✓
		Cultus	x	✓	✓	✓		✓
		Isoperla	x	✓	✓	✓	✓	✓
			type A	✓	✓	✓	✓	✓
			type B				✓	✓
		Skwala	x	✓	✓	✓	✓	✓
		x	x	✓	✓	✓	✓	✓
	Pteronarcyidae	Pteronarcys	californica		✓			✓
			x					✓
	Taeniopterygidae	Taenionema	x			✓		
		x	x		✓			
	x	x	x			✓	✓	✓
Trichoptera	Brachycentridae	Amiocentrus	aspilus			✓		✓
		Brachycentrus	occidentalis	✓		✓	✓	
			x	✓	✓	✓	✓	✓
	Glossosomatidae	Glossosoma	x	✓	✓	✓	✓	✓
		x	x		✓	✓		✓
	Goeridae	Goera	archaon		✓			
		Goera	x			✓		
	Hydropsychidae	Arctopsyche	grandis		✓	✓		
		Cheumatopsyche	x		✓	✓		
		Hydropsyche	x	✓	✓	✓	✓	✓
		x	x	✓	✓	✓		✓
	Hydroptilidae	Hydroptila	x	✓	✓			
		Ochrotrichia	x					✓
		x	x		✓	✓	✓	✓
	Lepidostomatidae	Lepidostoma	x	✓	✓	✓	✓	✓
	Leptoceridae	Mystacides	alafimbriata	✓				
	Limnephilidae	Dicosmoecus	gilvipes	✓	✓	✓	✓	
			x	✓		✓	✓	✓
		Ecclisocosmoecus	scylla					✓
		Onocosmoecus	unicolor			✓		✓
		Pseudostenophylax	edwardsi	✓				✓
		x	x	✓	✓		✓	✓
	Philopotamidae	Wormaldia	x					✓
	Rhyacophilidae	Himalopsyche	phryganea		✓		✓	✓
		Rhyacophila	arnaudi		✓			
			sp. B	✓	✓			✓
			type A				✓	
			type C					✓
			x		✓	✓	✓	✓
	x	x	x				✓	
Tricladida	x	x	x	✓	✓	✓	✓	✓

Table 3.20 McKenzie River Benthic Macroinvertebrate Community Summary, September 1999 through June 2000

Date	Site	Total # taxa	% EPT	% Chironomidae	% Diptera	Total Abundance (count/site)
September1999	Armitage RM6	62	5.10	65.50	66.90	2852
September1999	Harvest RM10	75	8.28	64.62	65.45	4237
September1999	Mohawk RM14	64	9.45	58.34	58.87	5439
September1999	Bellinger RM18.5	47	26.63	58.25	61.19	1600
September1999	Hendricks RM22.4	no sample				
January2000	Armitage RM6	43	85.90	7.10	7.40	674
January2000	Harvest RM10	42	91.85	3.95	5.23	1166
January2000	Mohawk RM14	no sample				
January2000	Bellinger RM18.5	28	96.97	1.84	2.24	759
January2000	Hendricks RM22.4	38	96.63	2.50	2.76	2283
March2000	Armitage RM6	68	25.30	64.90	66.40	2760
March2000	Harvest RM10	91	25.52	55.99	56.57	9695
March2000	Mohawk RM14	54	26.04	35.61	36.92	1609
March2000	Bellinger RM18.5	64	45.50	51.69	52.54	3308
March2000	Hendricks RM22.4	80	34.95	62.27	63.10	6544
June2000	Armitage RM6	79	11.80	73.00	74.00	6704
June2000	Harvest RM10	58	23.49	72.33	73.20	2631
June2000	Mohawk RM14	88	17.05	58.84	60.28	7087
June2000	Bellinger RM18.5	78	31.50	37.39	41.15	2022
June2000	Hendricks RM22.4	103	45.45	29.54	46.12	6744

Table 3.21 McKenzie River Benthic Macroinvertebrate Biomass Ash-Free Dry Weights (for 5 replicates) September 1999 through June 2000

	Mean Dry Wt (g/m2)				
	Hendricks RM22.4	Bellinger RM18.5	Mohawk RM14	Harvest RM10	Armitage RM6.0
9/2/1999		0.0904	0.2129	0.0904	0.0560
1/19/2000	1.1584	0.5188		1.2921	0.8802
3/24/2000	3.6840	2.9672	1.1958	1.7714	2.1798
06/02/00	4.7477	2.2840	4.5588	5.2623	2.0481

	Mean Ash Free Dry Weight (g/m2)				
	Hendricks RM22.4	Bellinger RM18.5	Mohawk RM14	Harvest RM10	Armitage RM6.0
9/2/1999		1.5169	1.6936	0.7462	0.3223
1/19/2000	0.5519	0.1381		0.5379	0.4014
3/24/2000	2.3442	0.1124	0.0420	0.0659	0.1149
06/02/00	0.3046	0.1327	0.2738	0.3478	0.1112

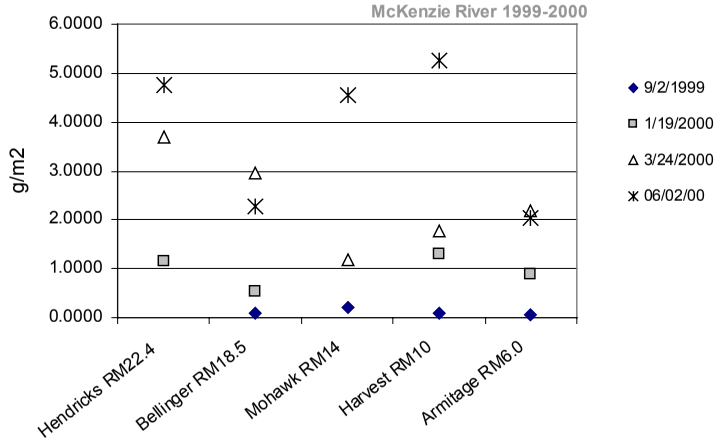

Figure 3.69 McKenzie River Benthic Macroinvertebrate Mean Dry Biomass

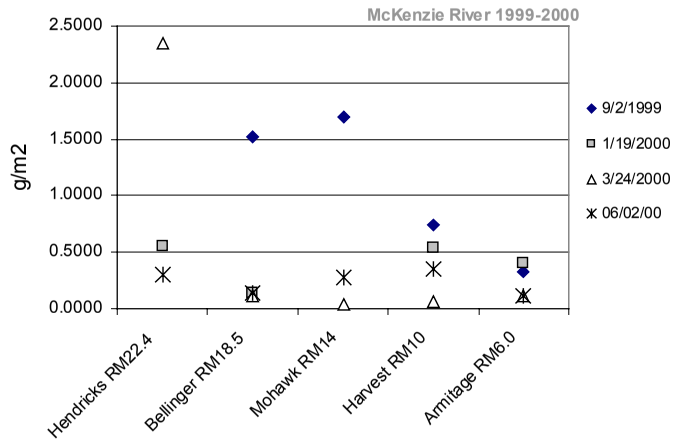

Figure 3.70 McKenzie River Benthic Macroinvertebrate Mean Ash-Free Dry Biomass

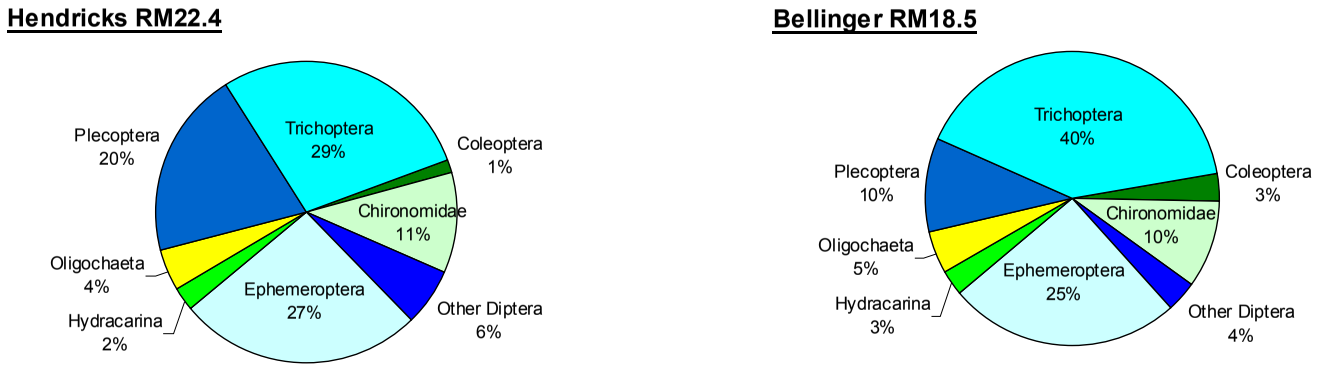

Figure 3.71 Benthic Macroinvertebrate Family Distribution by Percent Dry Weight for McKenzie River Sampling Sites Upstream of Mill Discharge, Study Year 1999 to 2000 (Represents the sum of all replicates and seasonal samples for the entire study year for all families contributing to >1% of the total)

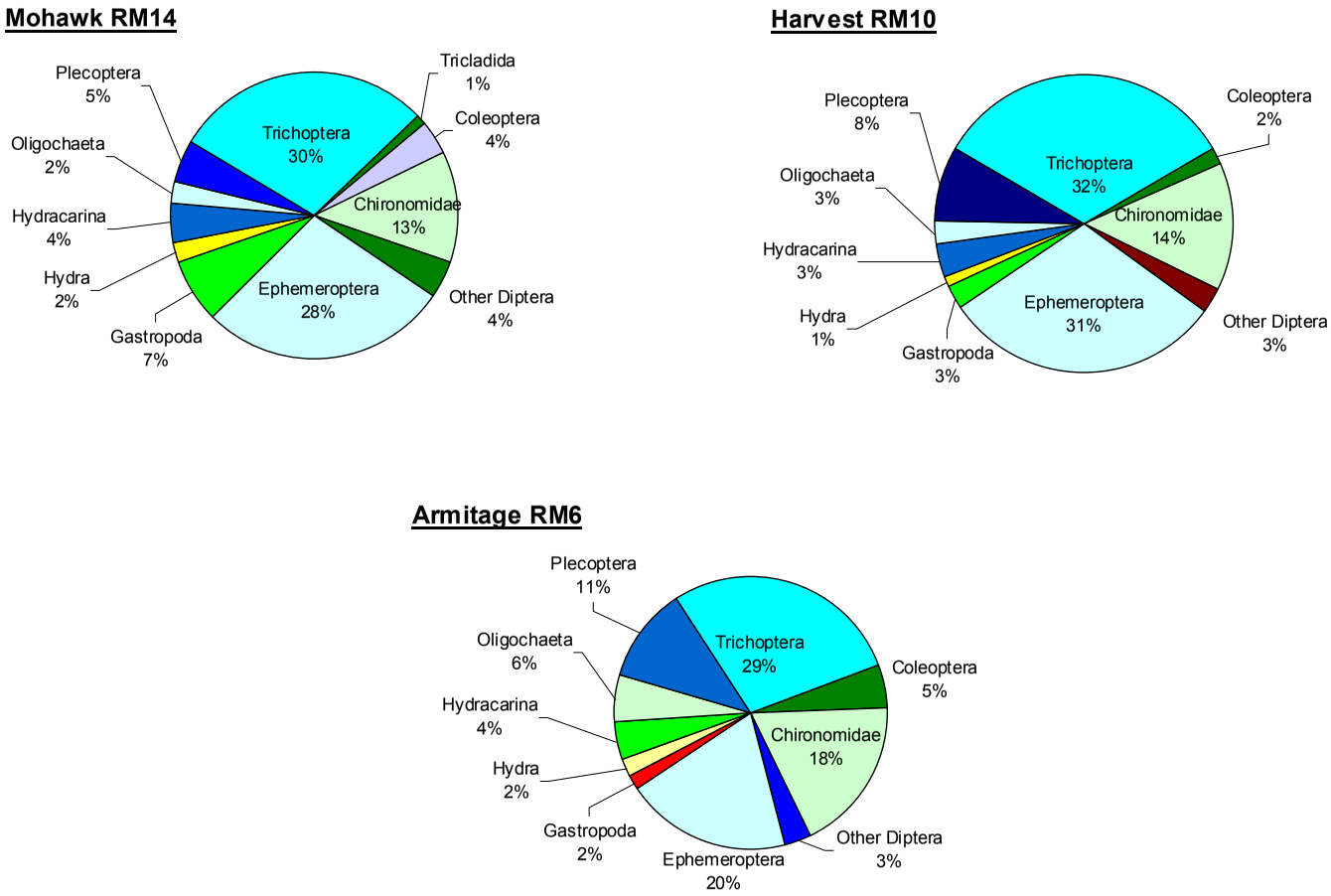

Figure 3.72 Benthic Macroinvertebrate Family Distribution by Percent Dry Weight for McKenzie River Sampling Sites Downstream of Mill Discharge, Study Year 1999 to 2000 (Represents the sum of all replicates and seasonal samples for the entire study year for all families contributing to >1% of the total)

3.8.4 *Willamette River Benthic Macroinvertebrates*

Table 3.22 Willamette River Benthic Macroinvertebrate Taxa List by Sampling Site for September 1999 through June 2000

Order	Family	Genus	Species	RM128	RM134	RM143.5	RM148	RM156	RM160	RM176
Amphipoda	Gammaridae	Gammarus	x	✓	✓	✓	✓	✓	✓	✓
		x	x	✓	✓	✓	✓	✓	✓	
Coleoptera	Curculionidae	x	x				✓			
	Dytiscidae	Oreodytes	x					✓	✓	✓
		Uvarus	x	✓	✓		✓	✓	✓	
		x	x	✓	✓	✓	✓	✓	✓	
	Elmidae	Atractelmis	wawona							✓
		Dubiraphia	x	✓						
		Heterlimnius	x	✓						✓
		Narpus	x		✓		✓	✓	✓	
		Optioservus	x	✓	✓	✓	✓	✓	✓	✓
		Ordobrevia	x		✓					✓
		Stenelmis	x				✓	✓		✓
		Zaitzevia	x				✓			✓
	Melyridae	Endeodes	x						✓	
		x	x	✓						
	x	x	x	✓	✓	✓	✓	✓	✓	
Diptera	Ceratopogonidae	Probezzia	x			✓				
	Chironomidae	Brillia	flavifrons	✓		✓				
		Cardiocladius	x		✓	✓	✓	✓	✓	✓
			albiplumus				✓		✓	
		Cladotanytarsus	vanderwulpi gr. B	✓	✓	✓	✓	✓	✓	
		Conchapelopia	fasciata gr.	✓		✓	✓	✓	✓	
		Corynoneura	x	✓	✓	✓	✓	✓	✓	✓
		Cricotopus	x	✓	✓	✓	✓	✓	✓	
			bicinctus	✓	✓	✓	✓	✓	✓	
			sp. B	✓	✓	✓	✓	✓	✓	✓
			cf. sylvestris			✓				
			sp. C	✓	✓	✓	✓	✓	✓	✓
		Cricotopus/Orthocladius	x	✓	✓	✓	✓	✓	✓	✓
		Cryptochironomus	cf. sorex	✓	✓		✓			
		Demicryptochironomus	x	✓	✓	✓	✓	✓	✓	
		Dicrotendipes	fumidus		✓	✓		✓		
		Eukiefferiella	claripennis gr. type		✓	✓		✓	✓	✓
			coerulescens gr.					✓	✓	✓
			devonica gr.		✓		✓			
			pseudomontana gr.	✓	✓	✓	✓	✓	✓	✓
		Euryhapsis	x		✓		✓	✓	✓	
		Heleniella	x			✓	✓	✓		
		Heterotrissocladius	marcidus gr.				✓			
		Limnophyes	x	✓			✓			
		Micropsectra	x	✓	✓	✓	✓	✓	✓	✓
		Microtendipes	pedellus gr.				✓			
		Nanocladius	crassicornis	✓	✓	✓	✓	✓	✓	✓
			distinctus	✓	✓	✓				
			rectinervis	✓	✓	✓	✓	✓	✓	✓
		Nilotanypus	fimbriatus			✓		✓	✓	
		Nimbocera	x	✓		✓	✓	✓		
		Orthocladius	x	✓	✓	✓	✓	✓	✓	
			ashei		✓		✓	✓		
			ashei/rivicola	✓	✓	✓	✓	✓	✓	✓
			carlatus			✓				✓
			curtiseta	✓					✓	
			mallochi	✓	✓	✓	✓	✓	✓	

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Table 3.22 Continued

Order	Family	Genus	Species	RM128	RM134	RM143.5	RM148	RM156	RM160	RM176
Diptera	Chironomidae	Orthocladius	cf. rivicola	✓	✓	✓	✓	✓	✓	
			rivulorum	✓	✓	✓	✓	✓	✓	
		Pagastia	partica				✓	✓	✓	
		Paracladopelma	undine	✓				✓		
		Parakiefferiella	x	✓	✓	✓	✓		✓	
		Paratanytarsus	x	✓	✓	✓	✓	✓	✓	✓
			tenellulus gr.				✓		✓	
		Pentaneura	x	✓	✓	✓	✓	✓	✓	
		Phaenopsectra	obediens gr.	✓	✓	✓		✓	✓	
		Polypedilum	aviceps	✓	✓	✓	✓	✓	✓	✓
			fallax						✓	
			illinoense gr.	✓		✓				
			laetum	✓	✓	✓	✓	✓	✓	
			cf. scalaenum	✓	✓				✓	
			sp. C of Epler					✓		
			tritum	✓	✓		✓	✓	✓	
		Potthastia	gaedii gr	✓	✓	✓	✓	✓	✓	✓
			longimana gr.		✓					
		Pseudosmittia	x	✓			✓		✓	✓
		Rheocricotopus	eminellobus			✓			✓	✓
			robacki	✓	✓		✓	✓	✓	✓
		Rheotanytarsus	x	✓	✓	✓	✓	✓	✓	✓
		Robackia	demeijerei	✓	✓	✓	✓	✓	✓	
		Stempellinella	x					✓	✓	
		Sublettea	coffmani			✓			✓	✓
			coffmani							
			coffmani							
			coffmani							
		Synorthocladius	semivirens	✓	✓	✓	✓	✓	✓	✓
		Tanytarsus	x		✓	✓	✓	✓	✓	✓
			curticornis gr.	✓	✓	✓	✓	✓	✓	
			gregarius & lugens g	✓						
			pallidicornis & aculeatus	✓	✓	✓	✓	✓	✓	✓
			sp. D				✓			
			sp. G	✓				✓		
		Thienemanniella	x	✓	✓	✓	✓	✓	✓	✓
		Thienemannimyia	x	✓	✓	✓	✓	✓	✓	✓
		Tvetenia	bavarica gr.		✓			✓		
			discoloripes gr.	✓	✓	✓	✓	✓	✓	✓
		x	x		✓					
	Dolichopodidae	x	x	✓						✓
	Empididae	Chelifera	x					✓	✓	✓
		Hemerodromia	x	✓	✓	✓	✓	✓	✓	✓
	Ephydridae	x	x		✓					
	Simuliidae	Parasimulium	x				✓	✓		
		Simulium	x	✓	✓	✓	✓	✓	✓	✓
			bivittatum					✓		
		x	x	✓						
	Tanyderidae	Protanyderus	x		✓		✓	✓		✓
		x	x		✓					
	Tipulidae	Antocha	x	✓	✓	✓	✓	✓	✓	✓
		Tipula	x							✓

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Table 3.22 Continued

Order	Family	Genus	Species	RM128	RM134	RM143.5	RM148	RM156	RM160	RM176
Ephemeroptera	Baetidae	Acentrella	x	✓	✓	✓	✓	✓	✓	
		Baetis	x	✓	✓	✓	✓	✓	✓	✓
		Diphetor	x						✓	
		x	x			✓				
	Caenidae	Caenis	x		✓					
	Ephemerellidae	Attenella	x					✓	✓	
		Drunella	x		✓		✓		✓	
		Epeorus	x		✓	✓		✓	✓	✓
		Ephemerella	x	✓	✓	✓	✓	✓	✓	✓
			aurivilli				✓	✓	✓	
			inermis	✓	✓	✓	✓	✓	✓	
			infrequens					✓		
		Serratella	x		✓					
			type A	✓	✓	✓	✓	✓	✓	✓
		x	x	✓	✓	✓	✓	✓	✓	
	Heptageniidae	Heptagenia	x		✓	✓	✓	✓	✓	✓
		Leucrocuta	x	✓	✓	✓	✓	✓	✓	
		Rhithrogena	x	✓	✓	✓	✓	✓	✓	✓
		Stenonema/Stenacron	x	✓	✓	✓	✓	✓		✓
		x	x	✓	✓	✓	✓	✓	✓	✓
	Leptophlebiidae	Paraleptophlebia	x	✓			✓	✓	✓	✓
		x	x	✓	✓	✓	✓	✓	✓	
	Tricorythidae	Tricorythodes	x	✓	✓	✓	✓	✓	✓	✓
	x	x	x	✓				✓		
Gastropoda	Hydrobiidae	Amnicola	x	✓	✓	✓			✓	✓
	Planorbidae	Gyraulus	x		✓			✓		✓
	Pleuroceridae	Juga	plicifera	✓						✓
		Juga	x							✓
Hemiptera	Corixidae	Graptocorixa	x					✓		
		Trichocorixa	x		✓					
Hydracarina	x	x	x	✓	✓	✓	✓	✓	✓	✓
Hydroida	Hydridae	Hydra	x	✓	✓	✓	✓	✓	✓	✓
Isopoda	x	x	x						✓	
Lepidoptera	Pyralidae	Petrophila	x	✓			✓	✓	✓	✓
Megaloptera	Corydalidae	x	x						✓	
Oligochaeta	x	x	x	✓	✓	✓	✓	✓	✓	
Pelecypoda	Sphaeriidae	x	x	✓	✓		✓			✓
	x	x	x	✓						
Plecoptera	Chloroperlidae	Plumiperla	x						✓	
		Suwallia	x					✓	✓	
		x	x						✓	
	Perlidae	Claassenia	sabulosa	✓	✓			✓	✓	
		x	x				✓	✓	✓	
	Perlodidae	Isogenoides	x	✓	✓	✓	✓	✓	✓	
		Isoperla	x	✓	✓	✓	✓	✓	✓	
			type A		✓		✓	✓	✓	✓
		Skwala	x				✓	✓		
		x	x	✓		✓	✓	✓	✓	
	x	x	x			✓	✓			
Rhynchobdellida	x	x	x	✓						

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Table 3.22 Continued

Order	Family	Genus	Species	RM128	RM134	RM143.5	RM148	RM156	RM160	RM176
Trichoptera	Brachycentridae	Brachycentrus	x			✓	✓	✓	✓	
			occidentalis		✓				✓	
	Glossosomatidae	Glossosoma	x	✓	✓	✓	✓	✓	✓	✓
		Protoptila	x	✓						
		x	x	✓					✓	
	Goeridae	Goera	archaon	✓			✓			✓
	Hydropsychidae	Cheumatopsyche	x	✓	✓	✓	✓	✓	✓	✓
		Hydropsyche	x	✓	✓	✓	✓	✓	✓	✓
		x	x	✓	✓	✓	✓	✓	✓	✓
	Hydroptilidae	Hydroptila	x	✓		✓	✓			✓
		Leucotrichia	pictipes		✓			✓	✓	
		Ochrotrichia	x			✓				
		x	x	✓	✓	✓	✓			
	Lepidostomatidae	Lepidostoma	x	✓			✓	✓	✓	✓
	Leptoceridae	Mystacides	alafimbriata	✓						✓
	Limnephilidae	Dicosmoecus	x	✓						✓
		Limnephilus	x	✓						
		Onocosmoecus	unicolor					✓		
		x	x							✓
	Psychomyiidae	Psychomyia	x			✓				✓
		Rhyacophila	x			✓				
			sp. B					✓		
	Uenoidae	x	x	✓						
	x	x	x	✓				✓		
Tricladida	x	x	x	✓	✓				✓	✓

Table 3.23 Willamette River Benthic Macroinvertebrate Community Summary, September 1999 through June 2000

Date	Site	Total # taxa	% EPT	% Chironomidae	% Diptera	Total Abundance (count/site)
September1999	Corvallis RM128	45	27.98	34.24	36.01	847
September1999	Willamette RM134	53	43.44	44.66	47.16	2127
September1999	Snag Boat RM143.5	50	28.18	54.89	56.63	1494
September1999	Intake RM148	47	26.83	64.67	66.20	2426
September1999	Cartney RM156	51	32.69	58.00	58.64	1719
September1999	Harrisburg RM160	54	21.53	65.69	69.20	1737
September1999	Whitely RM176	53	10.21	38.16	46.78	1009
March2000	Corvallis RM128	18	18.82	37.65	38.82	85
March2000	Willamette RM134	28	32.91	39.24	41.77	79
March2000	Snag Boat RM143.5	32	3.49	86.83	87.10	372
March2000	Intake RM148	33	14.43	81.52	82.53	395
March2000	Cartney RM156	39	27.07	56.39	58.27	266
March2000	Harrisburg RM160	41	28.24	65.28	65.97	432
March2000	Whitely RM176	54	21.53	65.69	69.20	148
May2000	Corvallis RM128	79	11.48	69.81	69.93	4174
May2000	Willamette RM134	67	7.90	86.75	87.03	4686
May2000	Snag Boat RM143.5	58	10.05	84.38	84.76	5998
May2000	Intake RM148	76	17.89	65.79	66.00	6848
May2000	Cartney RM156	81	22.86	63.25	63.56	7532
May2000	Harrisburg RM160	71	6.04	80.20	80.61	6147

Table 3.24 Willamette River Mean Benthic Macroinvertebrate Biomass Ash-Free Dry Weights (for 5 replicates) September 1999 through June 2000

	Mean Biomass Dry Wt (g/m2)						
	Corvallis RM128	Willamette RM134	Snag Boat RM143.5	Intake RM148	Cartney RM156	Harrisburg RM160	Whitley RM176
9/1/1999	1.6396	0.6523	0.3950	0.5242	0.3806	0.4411	0.7892
03/21/00	0.4316	0.5498	0.5130	0.5586	0.7219	0.7384	1.5728
06/02/00	67.4781	1.6040	3.9584	2.4051	2.8698	1.4147	

	Mean Ash Free Dry Weight (g/m2)						
	Corvallis RM128	Willamette RM134	Snag Boat RM143.5	Intake RM148	Cartney RM156	Harrisburg RM160	Whitley RM176
9/1/1999	0.9826	0.5272	0.3330	0.3785	0.3305	0.4013	0.5425
03/21/00	0.1456	0.1598	0.1726	0.2323	0.3265	0.3772	0.7256
06/02/00	30.1233	0.9998	3.4505	1.5616	1.9842	0.9100	

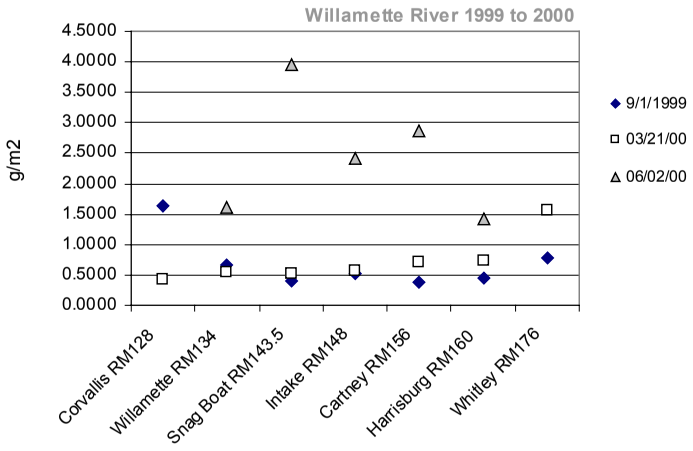


Figure 3.73 Willamette River Benthic Macroinvertebrate Mean Dry Biomass (excluding Corvallis, 6/00)

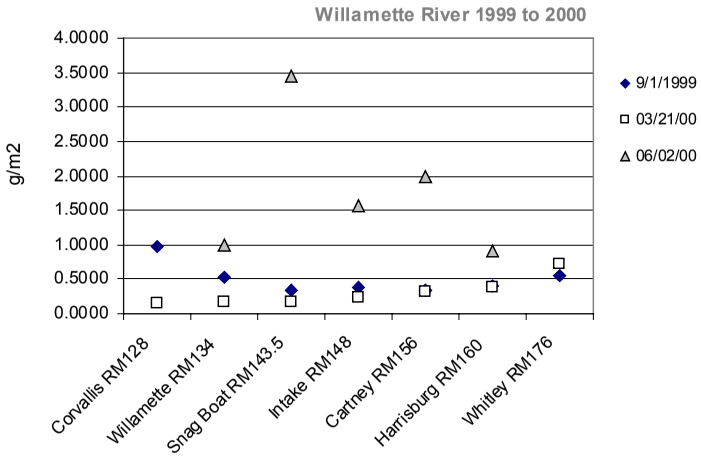
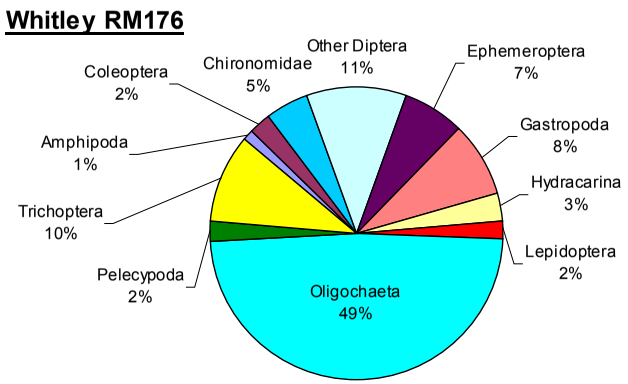
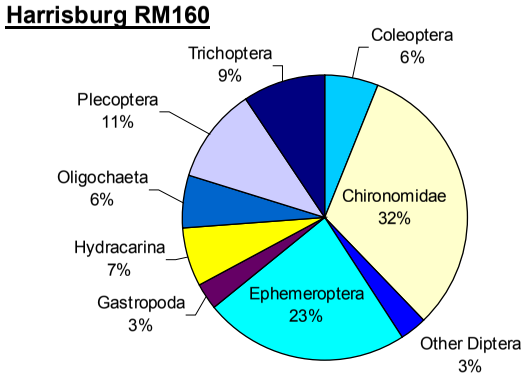
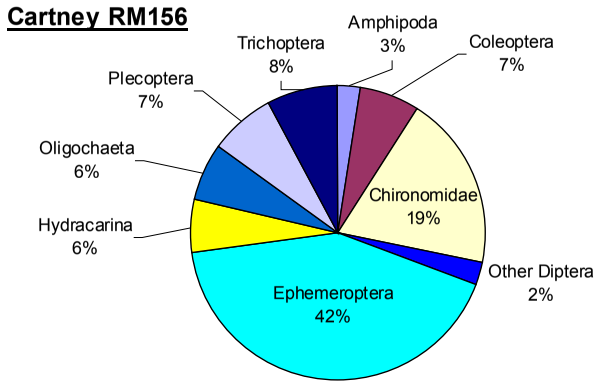


Figure 3.74 Willamette River Benthic Macroinvertebrate Mean Ash-Free Dry Biomass (excluding Corvallis, 6/00)







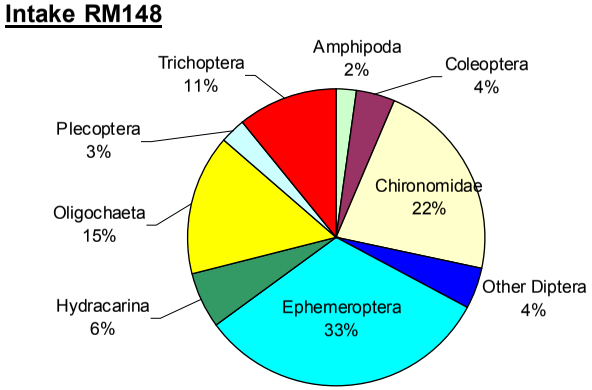


Figure 3.75 Benthic Macroinvertebrate Family Distribution by Percent Dry Weight for Willamette River Sampling Sites Upstream of Mill Discharge, Study Year 1999 to 2000 (Represents the sum of all replicates and seasonal samples for the entire study year for all families contributing to >1% of the total)

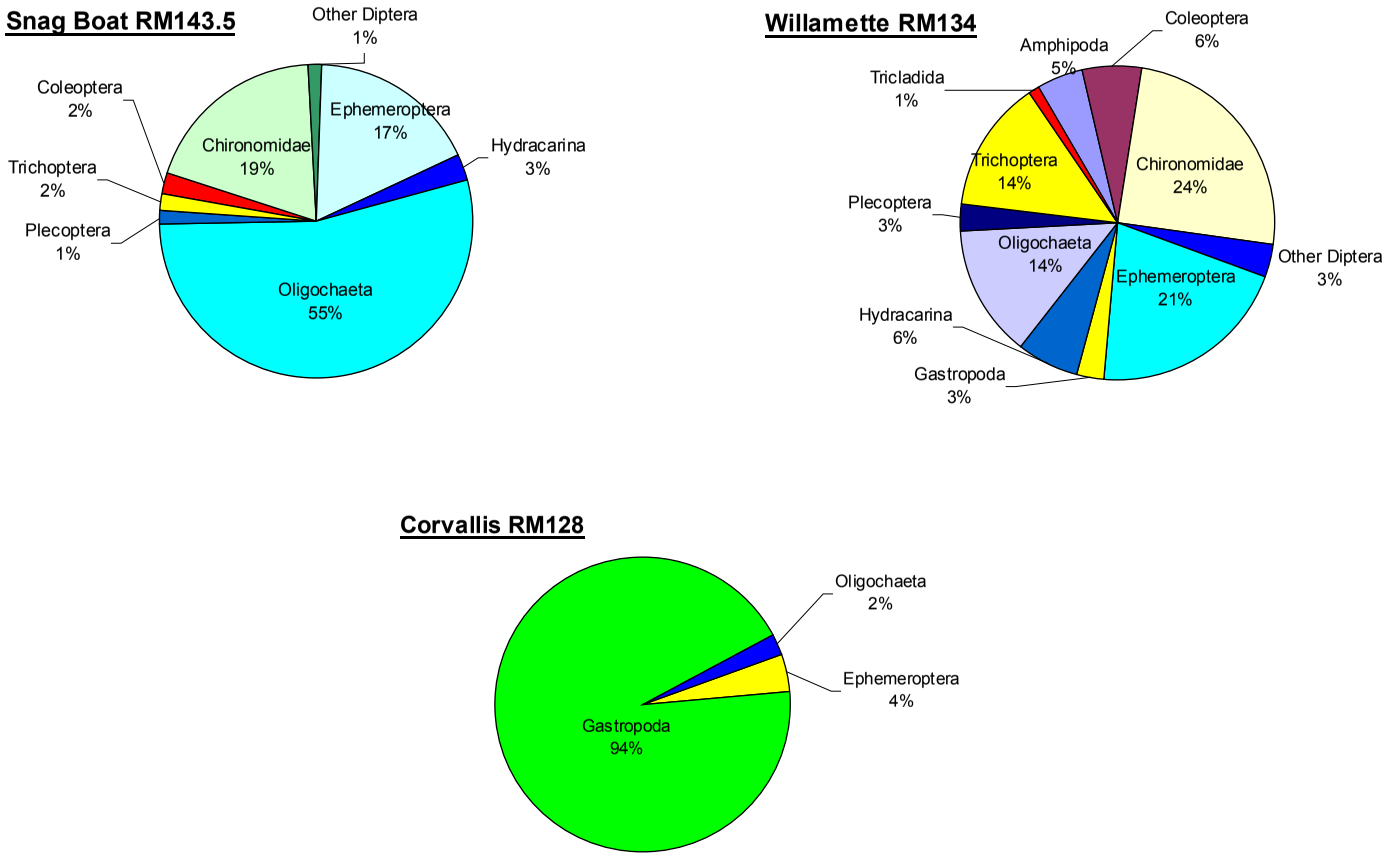


Figure 3.76 Benthic Macroinvertebrate Family Distribution by Percent Dry Weight for Willamette River Sampling Sites Downstream of Mill Discharge, Study Year 1999 to 2000 (Represents the sum of all replicates and seasonal samples for the entire study year for all families contributing to >1% of the total)

3.9 Fish

Fish on Codorus Creek, McKenzie River, and Willamette River were sampled under a three-year research agreement with Western Washington University (WWU) in Bellingham, Washington, that began in 1998. The experimental design provided by WWU examined different habitats along the LTRWS area for fish communities. Sampling was done on a quarterly basis using electrofishing techniques. All fish sampling was done by WWU personnel, along with one or more NCASI personnel. When time and conditions allowed, fish were identified, weighed, measured on site and returned to the river. Otherwise, they were frozen and transported back to WWU for later examination.

Codorus Creek, a wadeable stream, had a design that called for backpack electrofishing at each of the established NCASI macroinvertebrate and periphyton Codorus Creek sites, along with one added site, Indian Rock Dam, for a total of eight sampling sites. Shocking was done in three runs of approximately 600 s each. The data were not normalized to shock time. There were five missing samples for September 1999; East Branch was not sampled due to high water conditions; and the four downstream sites (Graybill, Indian Rock Dam, Arsenal, and Furnace) were not sampled due to equipment failure.

For the McKenzie and Willamette Rivers, both large fast moving rivers, the design focused on boat electrofishing at different areas within the LTRWS area at or near the NCASI macroinvertebrate and periphyton sites. The McKenzie River had five sampling sites and the Willamette River had six sampling sites for boat electrofishing. Boat electrofishing was done as two runs of approximately 250 m each. Supplemental nearshore backpack electrofishing was included at sites where the bank was accessible; there were four sites for the McKenzie and four sites for the Willamette. Backpack electrofishing data are available only for the September 1999 sampling date. Backpack electrofishing was done as three runs of approximately 600 s each. Data in this compendium were not normalized for time or distance. The winter 1999 sampling event for the Oregon rivers was postponed to January 2000 due to flood waters; at that time the water was still too high to sample the McKenzie but the Willamette sites were sampled.

The Leaf River, a wide, unregulated river, had a design that sampled for fish annually during the autumn, the historically low flow season. The experimental design called for boat electroshocking of 30 min per site at five sites, two upstream and three downstream of the mill effluent outfall. However, 1999 had record low flow due to drought conditions; consequently, sampling occurred at only three of the five sites, one upstream (New Augusta) and two downstream (Thompson and McLain). Sampling on the Leaf was conducted with the assistance of the Mississippi Department of Wildlife, Fisheries, and Parks. All fish were identified, weighed, and measured on site, and returned to the river.

3.9.1 *Codorus Creek Fish*

Table 3.25 Codorus Creek: East Branch Backpack Electrofishing Data Summary for November 1999 to June 2000

EAST BRANCH	Sampling Date/# of runs =	09/10/99	ot sampled			11/19/99	3 runs			03/11/00	3 runs			06/04/00	3 runs		
		Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)
Trouts:																	
Rainbow Trout	*Salmo gairdneri*						0.00			5	35.71	231.20	140.00		0.00		
Brown Trout	*Salmo trutta Linnaeus*						0.00				0.00				0.00		
Carps and Minnows:																	
Central Stone Roller	*Campostoma anomalum*					3	1.39	69.00	2.48		0.00				0.00		
Rosy sided Dace	*Clinostomus funduloides*					1	0.46	67.00	2.80		0.00				0.00		
Satinfin Shiner	*Cyprinella analostanus*						0.00				0.00				0.00		
Spotfin Shiner	*Cyprinella spilopterus*						0.00				0.00				0.00		
Cyprinidae	*Cyprinidae*					101	46.76	45.02	1.19		0.00				0.00		
Common Carp	*Cyprinus carpio Linnaeus*						0.00				0.00				0.00		
Cutlips Minnow	*Exoglossum maxillingua*					1	0.46	47.00	0.94		0.00			4	2.60	65.50	3.84
Common Shiner	*Luxilus cornutus*					1	0.46	75.00	3.42		0.00			12	7.79	78.08	5.42
Golden Shiner	*Notemigonus crysoleucas*						0.00				0.00				0.00		
Spottail Shiner	*Notropis hudsonius*						0.00				0.00			3	1.95	61.00	2.67
Swallowtail shiner	*Notropis procne*					1	0.46	60.00	1.71		0.00			3	1.95	70.00	3.95
Rosey Faced Shiner	*Notropis rubellus*						0.00				0.00				0.00		
Bluntnose Minnow	*Pimephales notatus*						0.00				0.00			2	1.30	83.50	7.30
Blacknose Dace	*Rhinichthys atratulus*					25	11.57	53.64	1.51		0.00			31	20.13	51.67	1.50
Longnose Dace	*Rhinichthys cataractae*					3	1.39	59.33	1.97		0.00			13	8.44	67.54	3.95
Creek Chub	*Semotilus atromaculatus*					15	6.94	51.87	7.34		0.00			38	24.68	56.50	2.30
Fallfish	*Semotilus corporalis*						0.00				0.00			1	0.65	137.00	34.63
Suckers:																	
White Sucker	*Catostomus commersoni*					24	11.11	62.38	3.04	7	50.00	117.00	18.43	24	15.58	71.50	3.63
Northern Hogsucker	*Hypentelium nigricans*					1	0.46	88.00	7.46	2	14.29	150.50	40.00		0.00		
Bullheads and Catfish:																	
Yellow Bullhead	*Ameiurus natalis*						0.00				0.00				0.00		
Killifishes:																	
Banded Killifish	*Fundulus diaphanus*						0.00				0.00				0.00		
Sunfishes:																	
Rock Bass	*Ambloplites rupestris*						0.00				0.00				0.00		
Redbreast Sunfish	*Lepomis auritus*						0.00				0.00				0.00		
Green Sunfish	*Lepomis cyanellus*						0.00				0.00				0.00		
Pumpkinseed	*Lepomis gibbosus*						0.00				0.00				0.00		
Bluegill	*Lepomis macrochirus*						0.00				0.00				0.00		
Redear Sunfish	*Lepomis microlophus*						0.00				0.00				0.00		
Smallmouth Bass	*Micropterus dolomieui*						0.00				0.00				0.00		
Largemouth Bass	*Micropterus salmoides*						0.00				0.00				0.00		
Perches:																	
Greenside Darter	*Etheostoma blennioides*						0.00				0.00			6	3.90	56.00	2.02
Tesselated Darter	*Etheostoma olmstedi*					40	18.52	39.55	0.60		0.00			17	11.04	48.24	1.15
Banded Darter	*Etheostoma zonale*						0.00				0.00				0.00		
Shield Darter	*Percina peltata*						0.00				0.00				0.00		
Sculpins:																	
Mottled Sculpin	*Cottus bairdi*						0.00				0.00				0.00		
n (total individuals)=						216				14				154			

Table 3.26 Codorus Creek: Menges Backpack Electrofishing Data Summary for September 1999 to June 2000

MENGES	Sampling Date/# of runs =	09/10/99		3 runs		11/19/99		3 runs		03/11/00		3 runs		06/04/00		3 runs	
		Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)
Trouts:																	
Rainbow Trout	*Salmo gairdneri*		0.00				0.00				0.00				0.00		
Brown Trout	*Salmo trutta Linnaeus*	15	29.41	192.47	137.38	27	39.13	171.74	54.98	12	37.50	175.30	67.10	10	30.30	69.90	4.32
Carps and Minnows:																	
Central Stone Roller	*Campostoma anomalum*	2	3.92	92.00	8.53		0.00				0.00				0.00		
Rosy sided Dace	*Clinostomus funduloides*		0.00				0.00				0.00				0.00		
Satinfin Shiner	*Cyprinella analostanus*		0.00				0.00				0.00				0.00		
Spotfin Shiner	*Cyprinella spilopterus*		0.00				0.00				0.00				0.00		
Cyprinidae	*Cyprinidae*	3	5.88	44.00	0.46	3	4.35	55.67	2.37		0.00				0.00		
Common Carp	*Cyprinus carpio Linnaeus*		0.00				0.00				0.00				0.00		
Cutlips Minnow	*Exoglossum maxillingua*		0.00				0.00				0.00				0.00		
Common Shiner	*Luxilus cornutus*		0.00				0.00				0.00				0.00		
Golden Shiner	*Notemigonus crysoleucas*		0.00				0.00				0.00				0.00		
Spottail Shiner	*Notropis hudsonius*	1	1.96	78.00	3.53		0.00				0.00				0.00		
Swallowtail shiner	*Notropis procne*		0.00				0.00				0.00				0.00		
Rosey Faced Shiner	*Notropis rubellus*		0.00				0.00				0.00				0.00		
Bluntnose Minnow	*Pimephales notatus*		0.00				0.00				0.00				0.00		
Blacknose Dace	*Rhinichthys atratulus*		0.00			5	7.25	30.80	0.28		0.00				0.00		
Longnose Dace	*Rhinichthys cataractae*	2	3.92	50.00	1.00	1	1.45	79.00	5.65		0.00			1	3.03	85.00	7.64
Creek Chub	*Semotilus atromaculatus*		0.00				0.00				0.00				0.00		
Fallfish	*Semotilus corporalis*		0.00				0.00				0.00				0.00		
Suckers:																	
White Sucker	*Catostomus commersoni*	12	23.53	220.08	132.94	14	20.29	86.21	14.87		0.00				0.00		
Northern Hogsucker	*Hypentelium nigricans*	1	1.96	326.00	425.00		0.00				0.00				0.00		
Bullheads and Catfish:																	
Yellow Bullhead	*Ameiurus natalis*		0.00				0.00				0.00				0.00		
Killifishes:																	
Banded Killifish	*Fundulus diaphanus*		0.00				0.00				0.00				0.00		
Sunfishes:																	
Rock Bass	*Ambloplites rupestris*		0.00				0.00				0.00				0.00		
Redbreast Sunfish	*Lepomis auritus*		0.00			1	1.45	100.00	16.93	18	56.25	84.50	11.11	3	9.09	55.33	3.61
Green Sunfish	*Lepomis cyanellus*	14	27.45	58.36	4.20	10	14.49	74.00	8.53		0.00			17	51.52	77.24	10.15
Pumpkinseed	*Lepomis gibbosus*		0.00				0.00				0.00				0.00		
Bluegill	*Lepomis macrochirus*	1	1.96	102.00	20.57	3	4.35	63.33	6.21		0.00			2	6.06	84.00	10.92
Redear Sunfish	*Lepomis microlophus*		0.00				0.00				0.00				0.00		
Smallmouth Bass	*Micropterus dolomieui*		0.00				0.00				0.00				0.00		
Largemouth Bass	*Micropterus salmoides*		0.00				0.00				0.00				0.00		
Perches:																	
Greenside Darter	*Etheostoma blennioides*		0.00				0.00				0.00				0.00		
Tesselated Darter	*Etheostoma olmstedi*		0.00			4	5.80	44.00	0.91	1	3.13	60.00	2.49		0.00		
Banded Darter	*Etheostoma zonale*		0.00				0.00			1	3.13	54.00			0.00		
Shield Darter	*Percina peltata*		0.00				0.00				0.00				0.00		
Sculpins:																	
Mottled Sculpin	*Cottus bairdi*		0.00			1	1.45	115.00	22.95		0.00				0.00		
n (total individuals)=		51				69				32				33			

Table 3.27 Codorus Creek: USGS Backpack Electrofishing Data Summary for September 1999 to June 2000

USGS	Sampling Date/# of runs =	09/10/99		3 runs		11/19/99		3 runs		03/12/00		3 runs		06/04/00		3 runs	
		Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)
Trouts:																	
Rainbow Trout	*Salmo gairdneri*		0.00				0.00				0.00				0.00		
Brown Trout	*Salmo trutta Linnaeus*		0.00				0.00				0.00			2	4.35	293.50	297.50
Carps and Minnows:																	
Central Stone Roller	*Campostoma anomalum*		0.00				0.00				0.00				0.00		
Rosy sided Dace	*Clinostomus funduloides*	3	3.06	62.33	1.99		0.00				0.00				0.00		
Satinfin Shiner	*Cyprinella analostanus*		0.00				0.00				0.00			1	2.17	82.00	6.38
Spotfin Shiner	*Cyprinella spilopterus*		0.00				0.00				0.00				0.00		
Cyprinidae	*Cyprinidae*		0.00			55	23.11	52.02	1.44	21	22.83		0.46		0.00		
Common Carp	*Cyprinus carpio Linnaeus*		0.00			1	0.42	218.00	131.00		0.00				0.00		
Cutlips Minnow	*Exoglossum maxillingua*		0.00				0.00				0.00				0.00		
Common Shiner	*Luxilus cornutus*		0.00				0.00				0.00				0.00		
Golden Shiner	*Notemigonus crysoleucas*		0.00				0.00			1	1.09	84.00	4.74		0.00		
Spottail Shiner	*Notropis hudsonius*	6	6.12	75.83	3.79	8	3.36	55.13	1.33	10	10.87	64.20	3.11	2	4.35	83.00	5.91
Swallowtail shiner	*Notropis procne*	16	16.33	56.63	1.36	6	2.52	52.17	1.30	46	50.00	61.22	2.53	7	15.22	66.00	2.82
Rosey Faced Shiner	*Notropis rubellus*		0.00				0.00				0.00				0.00		
Bluntnose Minnow	*Pimephales notatus*		0.00				0.00				0.00				0.00		
Blacknose Dace	*Rhinichthys atratulus*		0.00			9	3.78	56.67	2.20		0.00				0.00		
Longnose Dace	*Rhinichthys cataractae*		0.00			26	10.92	67.23	3.36		0.00			2	4.35	84.00	6.83
Creek Chub	*Semotilus atromaculatus*		0.00			1	0.42	130.00	24.00	2	2.17	141.00	52.93	2	4.35	95.50	11.97
Fallfish	*Semotilus corporalis*		0.00				0.00				0.00				0.00		
Suckers:																	
White Sucker	*Catostomus commersoni*	1	1.02	70.00	2.58	12	5.04	92.42	7.79	1	1.09	235.00	195.00	1	2.17	140.00	31.00
Northern Hogsucker	*Hypentelium nigricans*		0.00				0.00				0.00				0.00		
Bullheads and Catfish:																	
Yellow Bullhead	*Ameiurus natalis*		0.00				0.00				0.00				0.00		
Killifishes:																	
Banded Killifish	*Fundulus diaphanus*		0.00				0.00				0.00				0.00		
Sunfishes:																	
Rock Bass	*Ambloplites rupestris*		0.00				0.00				0.00				0.00		
Redbreast Sunfish	*Lepomis auritus*		0.00				0.00				0.00				0.00		
Green Sunfish	*Lepomis cyanellus*	46	46.94	77.30	12.90	17	7.14	75.12	8.24	7	7.61	98.43	22.90	19	41.30	97.32	23.04
Pumpkinseed	*Lepomis gibbosus*		0.00				0.00				0.00				0.00		
Bluegill	*Lepomis macrochirus*	1	1.02	64.00	4.46		0.00				0.00				0.00		
Redear Sunfish	*Lepomis microlophus*		0.00				0.00				0.00				0.00		
Smallmouth Bass	*Micropterus dolomieui*		0.00				0.00				0.00				0.00		
Largemouth Bass	*Micropterus salmoides*	5	5.10	58.20	2.50	8	3.36	55.00	2.26	1	1.09	63.00	2.98	1	2.17	109.00	13.00
Perches:																	
Greenside Darter	*Etheostoma blennioides*		0.00				0.00				0.00				0.00		
Tessellated Darter	*Etheostoma olmstedi*	20	20.41	47.30	0.93	95	39.92	57.45	1.89	3	3.26	61.67	2.77	9	19.57	59.00	2.06
Banded Darter	*Etheostoma zonale*		0.00				0.00				0.00				0.00		
Shield Darter	*Percina peltata*		0.00				0.00				0.00				0.00		
Sculpins:																	
Mottled Sculpin	*Cottus bairdi*		0.00				0.00				0.00				0.00		
n (total individuals)=		98				238				92				46			

Table 3.28 Codorus Creek: Martin Backpack Electrofishing Data Summary for September 1999 to June 2000

MARTIN	Sampling Date/# of runs =	09/10/99		3 runs		11/19/99		3 runs		03/12/00		3 runs		06/04/00		3 runs	
		Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)
Trouts:																	
Rainbow Trout	*Salmo gairdneri*		0.00				0.00				0.00				0.00		
Brown Trout	*Salmo trutta Linnaeus*		0.00				0.00			1	0.52	263.00	210.00		0.00		
Carps and Minnows:																	
Central Stone Roller	*Campostoma anomalum*	4	10.53	71.25		1	2.00	118.00	17.92		0.00				0.00		
Rosy sided Dace	*Clinostomus funduloides*		0.00			1	2.00	68.00	2.24		0.00				0.00		
Satinfin Shiner	*Cyprinella analostanus*		0.00			3	6.00	76.67	4.12		0.00				0.00		
Spotfin Shiner	*Cyprinella spilopterus*	2	5.26	67.00	2.50	5	10.00	69.00	2.85	80	41.24	63.59	3.15	1	2.70	80.00	4.59
Cyprinidae	*Cyprinidae*		0.00			17	34.00	75.06	5.33		0.00				0.00		
Common Carp	*Cyprinus carpio Linnaeus*		0.00				0.00			3	1.55	584.33	2752.33		0.00		
Cutlips Minnow	*Exoglossum maxillingua*		0.00				0.00				0.00				0.00		
Common Shiner	*Luxilus cornutus*		0.00				0.00			6	3.09	87.17	8.49		0.00		
Golden Shiner	*Notemigonus crysoleucas*		0.00				0.00				0.00				0.00		
Spottail Shiner	*Notropis hudsonius*		0.00				0.00			29	14.95	55.41			0.00		
Swallowtail shiner	*Notropis procne*	1	2.63	68.00	1.95		0.00			6	3.09	44.50	0.79		0.00		
Rosey Faced Shiner	*Notropis rubellus*		0.00				0.00				0.00				0.00		
Bluntnose Minnow	*Pimephales notatus*		0.00				0.00			10	5.15	79.70	7.03		0.00		
Blacknose Dace	*Rhinichthys atratulus*		0.00				0.00			11	5.67	58.82	2.12	2	5.41	58.50	2.50
Longnose Dace	*Rhinichthys cataractae*		0.00				0.00			10	5.15	70.70	3.67	9	24.32	83.56	7.07
Creek Chub	*Semotilus atromaculatus*		0.00				0.00				0.00				0.00		
Fallfish	*Semotilus corporalis*		0.00				0.00				0.00				0.00		
Suckers:																	
White Sucker	*Catostomus commersoni*		0.00			2	4.00	182.50	129.58	16	8.25	148.50	108.36	4	10.81	309.50	344.50
Northern Hogsucker	*Hypentelium nigricans*		0.00				0.00				0.00				0.00		
Bullheads and Catfish:																	
Yellow Bullhead	*Ameiurus natalis*	11	28.95	78.45	4.30	7	14.00	172.43	82.53	1	0.52	190.00	110.00	6	16.22	208.00	121.83
Killifishes:																	
Banded Killifish	*Fundulus diaphanus*		0.00				0.00				0.00				0.00		
Sunfishes:																	
Rock Bass	*Ambloplites rupestris*		0.00				0.00				0.00				0.00		
Redbreast Sunfish	*Lepomis auritus*	5	13.16	110.60	29.47	1	2.00	127.00	39.55	4	2.06	133.50	53.50		0.00		
Green Sunfish	*Lepomis cyanellus*	15	39.47	83.80	12.81	11	22.00	91.27	14.75	15	7.73	110.40	29.61	14	37.84	115.07	31.21
Pumpkinseed	*Lepomis gibbosus*		0.00			2	4.00	68.50	5.67		0.00				0.00		
Bluegill	*Lepomis macrochirus*		0.00				0.00				0.00				0.00		
Redear Sunfish	*Lepomis microlophus*		0.00				0.00			1	0.52	57.00	3.00		0.00		
Smallmouth Bass	*Micropterus dolomieui*		0.00				0.00			1	0.52	81.00	5.60		0.00		
Largemouth Bass	*Micropterus salmoides*		0.00				0.00				0.00			1	2.70	111.00	15.00
Perches:																	
Greenside Darter	*Etheostoma blennioides*		0.00				0.00				0.00				0.00		
Tesselated Darter	*Etheostoma olmstedi*		0.00				0.00				0.00				0.00		
Banded Darter	*Etheostoma zonale*		0.00				0.00				0.00				0.00		
Shield Darter	*Percina peltata*		0.00				0.00				0.00				0.00		
Sculpins:																	
Mottled Sculpin	*Cottus bairdi*		0.00				0.00				0.00				0.00		
n (total individuals)=		38				50				194				37			

Table 3.29 Codorus Creek: Graybill Backpack Electrofishing Data Summary for November 1999 to June 2000

GRAYBILL	Sampling Date/# of runs =	09/10/99	ıot sampled			11/20/99	3 runs			03/12/00	3 runs			06/05/00	3 runs		
		Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)
Trouts:																	
Rainbow Trout	*Salmo gairdneri*						0.00				0.00				0.00		
Brown Trout	*Salmo trutta Linnaeus*						0.00				0.00				0.00		
Carps and Minnows:																	
Central Stone Roller	*Campostoma anomalum*						0.00				0.00				0.00		
Rosy sided Dace	*Clinostomus funduloides*						0.00				0.00				0.00		
Satinfin Shiner	*Cyprinella analostanus*						0.00				0.00				0.00		
Spotfin Shiner	*Cyprinella spilopterus*						0.00			12	33.33	66.83	3.95		0.00		
Cyprinidae	*Cyprinidae*						0.00				0.00				0.00		
Common Carp	*Cyprinus carpio Linnaeus*						0.00				0.00			1	2.44	540.00	2100.00
Cutlips Minnow	*Exoglossum maxillingua*						0.00				0.00				0.00		
Common Shiner	*Luxilus cornutus*						0.00				0.00				0.00		
Golden Shiner	*Notemigonus crysoleucas*					1	2.33	112.00	15.33		0.00				0.00		
Spottail Shiner	*Notropis hudsonius*					7	16.28	32.29	0.27		0.00			3	7.32	95.00	7.27
Swallowtail shiner	*Notropis procne*						0.00				0.00				0.00		
Rosey Faced Shiner	*Notropis rubellus*						0.00				0.00				0.00		
Bluntnose Minnow	*Pimephales notatus*					1	2.33	53.00	1.54		0.00				0.00		
Blacknose Dace	*Rhinichthys atratulus*					11	25.58	55.45	2.01		0.00				0.00		
Longnose Dace	*Rhinichthys cataractae*					7	16.28	68.86	3.79		0.00			1	2.44		
Creek Chub	*Semotilus atromaculatus*					1	2.33	156.00	40.00	7	19.44	106.86	21.45	2	4.88	123.00	37.00
Fallfish	*Semotilus corporalis*						0.00				0.00				0.00		
Suckers:																	
White Sucker	*Catostomus commersoni*					3	6.98	325.33	418.00	4	11.11	303.50	357.50	1	2.44	355.00	530.00
Northern Hogsucker	*Hypentelium nigricans*						0.00				0.00				0.00		
Bullheads and Catfish:																	
Yellow Bullhead	*Ameiurus natalis*					1	2.33	226.00	148.00		0.00			2	4.88	210.00	190.00
Killifishes:																	
Banded Killifish	*Fundulus diaphanus*						0.00				0.00				0.00		
Sunfishes:																	
Rock Bass	*Ambloplites rupestris*						0.00				0.00				0.00		
Redbreast Sunfish	*Lepomis auritus*					4	9.30	126.00	33.08	9	25.00	114.67	31.44	11	26.83	126.82	57.18
Green Sunfish	*Lepomis cyanellus*					7	16.28	91.86	17.62	3	8.33	79.67	9.53	20	48.78	93.25	18.66
Pumpkinseed	*Lepomis gibbosus*						0.00			1	2.78	120.00	32.00		0.00		
Bluegill	*Lepomis macrochirus*						0.00				0.00				0.00		
Redear Sunfish	*Lepomis microlophus*						0.00				0.00				0.00		
Smallmouth Bass	*Micropterus dolomieui*						0.00				0.00				0.00		
Largemouth Bass	*Micropterus salmoides*										0.00				0.00		
Perches:																	
Greenside Darter	*Etheostoma blennioides*						0.00				0.00				0.00		
Tesselated Darter	*Etheostoma olmstedi*						0.00				0.00				0.00		
Banded Darter	*Etheostoma zonale*						0.00				0.00				0.00		
Shield Darter	*Percina peltata*						0.00				0.00				0.00		
Sculpins:																	
Mottled Sculpin	*Cottus bairdi*						0.00				0.00				0.00		
n (total individuals)=						43				36				41			

Table 3.30 Codorus Creek: Indian Rock Backpack Electrofishing Data Summary for November 1999 to June 2000

INDIAN ROCK	Sampling Date/# of runs =	09/10/99	not sampled			11/20/99	3 runs			03/12/00	2 runs			06/05/00	3 runs		
		Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)
Trouts:																	
Rainbow Trout	*Salmo gairdneri*						0.00				0.00				0.00		
Brown Trout	*Salmo trutta Linnaeus*						0.00				0.00				0.00		
Carps and Minnows:																	
Central Stone Roller	*Campostoma anomalum*						0.00				0.00				0.00		
Rosy sided Dace	*Clinostomus funduloides*						0.00				0.00				0.00		
Satinfin Shiner	*Cyprinella analostanus*					1	1.25	64.00	2.52		0.00				0.00		
Spotfin Shiner	*Cyprinella spilopterus*						0.00			13	52.00	36.46	0.36	6	8.11	58.83	1.98
Cyprinidae	*Cyprinidae*					22	27.50	52.36	1.85		0.00				0.00		
Common Carp	*Cyprinus carpio Linnaeus*						0.00				0.00				0.00		
Cutlips Minnow	*Exoglossum maxillingua*						0.00				0.00				0.00		
Common Shiner	*Luxilus cornutus*						0.00				0.00				0.00		
Golden Shiner	*Notemigonus crysoleucas*						0.00				0.00				0.00		
Spottail Shiner	*Notropis hudsonius*					14	17.50	58.64	2.40		0.00				0.00		
Swallowtail shiner	*Notropis procne*						0.00			9	36.00	37.89	0.43	16	21.62	74.44	4.54
Rosey Faced Shiner	*Notropis rubellus*						0.00				0.00				0.00		
Bluntnose Minnow	*Pimephales notatus*						0.00				0.00			10	13.51	63.40	2.90
Blacknose Dace	*Rhinichthys atratulus*						0.00				0.00				0.00		
Longnose Dace	*Rhinichthys cataractae*						0.00				0.00				0.00		
Creek Chub	*Semotilus atromaculatus*						0.00				0.00				0.00		
Fallfish	*Semotilus corporalis*						0.00				0.00				0.00		
Suckers:																	
White Sucker	*Catostomus commersoni*					4	5.00	93.00	15.61		0.00			1	1.35	261.00	260.00
Northern Hogsucker	*Hypentelium nigricans*					1	1.25	201.00	83.00		0.00				0.00		
Bullheads and Catfish:																	
Yellow Bullhead	*Ameiurus natalis*					2	2.50	171.50	75.50		0.00			1	1.35	234.00	180.00
Killifishes:																	
Banded Killifish	*Fundulus diaphanus*						0.00				0.00				0.00		
Sunfishes:																	
Rock Bass	*Ambloplites rupestris*					1	1.25	149.00	61.00		0.00			2	2.70	185.00	158.00
Redbreast Sunfish	*Lepomis auritus*					18	22.50	98.89	22.12	1	4.00	163.00	100.00	6	8.11	110.50	42.18
Green Sunfish	*Lepomis cyanellus*					3	3.75	101.00	18.99		0.00			24	32.43	98.67	22.74
Pumpkinseed	*Lepomis gibbosus*						0.00			2	8.00	94.00	14.00		0.00		
Bluegill	*Lepomis macrochirus*						0.00				0.00				0.00		
Redear Sunfish	*Lepomis microlophus*						0.00				0.00				0.00		
Smallmouth Bass	*Micropterus dolomieui*						0.00				0.00				0.00		
Largemouth Bass	*Micropterus salmoides*						0.00				0.00				0.00		
Perches:																	
Greenside Darter	*Etheostoma blennioides*					1	1.25	76.00	3.51		0.00				0.00		
Tesselated Darter	*Etheostoma olmstedi*					12	15.00	58.42	2.00		0.00			8	10.81	57.88	2.00
Banded Darter	*Etheostoma zonale*						0.00				0.00				0.00		
Shield Darter	*Percina peltata*					1	1.25	59.00	1.73		0.00				0.00		
Sculpins:																	
Mottled Sculpin	*Cottus bairdi*						0.00				0.00				0.00		
n (total individuals)=						80				25				74			

Table 3.31 Codorus Creek: Arsenal Backpack Electrofishing Data Summary for November 1999 to June 2000

ARSENAL	Sampling Date/# of runs =	09/10/99	ıot sampled			11/20/99	2 runs			03/11/00	2 runs			06/05/00	3 runs		
		Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)
Trouts:																	
Rainbow Trout	*Salmo gairdneri*						0.00				0.00				0.00		
Brown Trout	*Salmo trutta Linnaeus*						0.00				0.00				0.00		
Carps and Minnows:																	
Central Stone Roller	*Campostoma anomalum*						0.00				0.00				0.00		
Rosy sided Dace	*Clinostomus funduloides*						0.00				0.00				0.00		
Satinfin Shiner	*Cyprinella analostanus*					2	1.67	27.50	0.32		0.00				0.00		
Spotfin Shiner	*Cyprinella spilopterus*					23	19.17	39.30	0.67	9	18.00	62.00	2.14		0.00		
Cyprinidae	*Cyprinidae*					16	13.33	26.85	0.16	7	14.00	36.71	0.37		0.00		
Common Carp	*Cyprinus carpio Linnaeus*					1	0.83	535.00	2355.00		0.00				0.00		
Cutlips Minnow	*Exoglossum maxillingua*						0.00				0.00				0.00		
Common Shiner	*Luxilus cornutus*						0.00				0.00				0.00		
Golden Shiner	*Notemigonus crysoleucas*						0.00				0.00				0.00		
Spottail Shiner	*Notropis hudsonius*						0.00			27	54.00	47.89	1.09		0.00		
Swallowtail shiner	*Notropis procne*						0.00			3	6.00	45.00	0.76	10	20.00	50.80	1.23
Rosey Faced Shiner	*Notropis rubellus*						0.00				0.00				0.00		
Bluntnose Minnow	*Pimephales notatus*						0.00				0.00				0.00		
Blacknose Dace	*Rhinichthys atratulus*						0.00				0.00				0.00		
Longnose Dace	*Rhinichthys cataractae*						0.00				0.00				0.00		
Creek Chub	*Semotilus atromaculatus*						0.00				0.00				0.00		
Fallfish	*Semotilus corporalis*						0.00				0.00				0.00		
Suckers:																	
White Sucker	*Catostomus commersoni*					1	0.83	92.00	9.29		0.00			4	8.00	365.50	578.75
Northern Hogsucker	*Hypentelium nigricans*						0.00				0.00				0.00		
Bullheads and Catfish:																	
Yellow Bullhead	*Ameiurus natalis*						0.00				0.00				0.00		
Killifishes:																	
Banded Killifish	*Fundulus diaphanus*					2	1.67	45.00	1.16	1	2.00	49.00	0.90		0.00		
Sunfishes:																	
Rock Bass	*Ambloplites rupestris*					8	6.67	68.63	8.69	3	6.00	126.67	46.77	17	34.00	124.94	49.28
Redbreast Sunfish	*Lepomis auritus*					31	25.83	48.16	4.55		0.00			12	24.00	99.50	35.88
Green Sunfish	*Lepomis cyanellus*						0.00				0.00			2	4.00	110.00	29.25
Pumpkinseed	*Lepomis gibbosus*						0.00				0.00			4	8.00	78.50	10.81
Bluegill	*Lepomis macrochirus*						0.00				0.00				0.00		
Redear Sunfish	*Lepomis microlophus*						0.00				0.00				0.00		
Smallmouth Bass	*Micropterus dolomieui*					2	1.67	100.00	29.79		0.00				0.00		
Largemouth Bass	*Micropterus salmoides*						0.00				0.00				0.00		
Perches:																	
Greenside Darter	*Etheostoma blennioides*						0.00				0.00				0.00		
Tesselated Darter	*Etheostoma olmstedi*					33	27.50	57.33	2.08		0.00			1	2.00	58.00	1.70
Banded Darter	*Etheostoma zonale*						0.00				0.00				0.00		
Shield Darter	*Percina peltata*					1	0.83	53.00	1.72		0.00				0.00		
Sculpins:																	
Mottled Sculpin	*Cottus bairdi*						0.00				0.00				0.00		
n (total individuals)=						120				50				50			

Table 3.32 Codorus Creek: Furnace Backpack Electrofishing Data Summary for November 1999 to June 2000

FURNACE	Sampling Date/# of runs =	09/10/99				not sampled				11/20/99				3 runs				03/11/00				3 runs				06/05/00				3 runs			
		Count	% of Total	Mean Total Length (mm)	Mean Weight (g)					Count	% of Total	Mean Total Length (mm)	Mean Weight (g)					Count	% of Total	Mean Total Length (mm)	Mean Weight (g)					Count	% of Total	Mean Total Length (mm)	Mean Weight (g)				
Trouts:																																	
Rainbow Trout	*Salmo gairdneri*										0.00								0.00								0.00						
Brown Trout	*Salmo trutta Linnaeus*										0.00								0.00								0.00						
Carps and Minnows:																																	
Central Stone Roller	*Campostoma anomalum*										0.00							1	0.83	89.00	7.99						0.00						
Rosy sided Dace	*Clinostomus funduloides*										0.00								0.00								0.00						
Satinfin Shiner	*Cyprinella analostanus*										0.00								0.00								0.00						
Spotfin Shiner	*Cyprinella spilopterus*									18	9.63	53.78	1.63					26	21.67	61.69	2.07						0.00						
Cyprinidae	*Cyprinidae*										0.00								0.00							2	4.35						
Common Carp	*Cyprinus carpio Linnaeus*										0.00								0.00								0.00						
Cutlips Minnow	*Exoglossum maxillingua*										0.00								0.00								0.00						
Common Shiner	*Luxilus cornutus*										0.00								0.00								0.00						
Golden Shiner	*Notemigonus crysoleucas*										0.00								0.00								0.00						
Spottail Shiner	*Notropis hudsonius*										0.00								0.00								0.00						
Swallowtail shiner	*Notropis procne*									8	4.28	59.00	1.80					25	20.83	54.44	1.48					3	6.52	48.67	1.00				
Rosey Faced Shiner	*Notropis rubellus*										0.00								0.00								0.00						
Bluntnose Minnow	*Pimephales notatus*										0.00							13	10.83	56.00	1.77					1	2.17	83.00	7.10				
Blacknose Dace	*Rhinichthys atratulus*										0.00								0.00								0.00						
Longnose Dace	*Rhinichthys cataractae*										0.00								0.00								0.00						
Creek Chub	*Semotilus atromaculatus*										0.00								0.00								0.00						
Fallfish	*Semotilus corporalis*										0.00								0.00								0.00						
Suckers:																																	
White Sucker	*Catostomus commersoni*									1	0.53	90.00	8.31					1	0.83	88.00	7.40						0.00						
Northern Hogsucker	*Hypentelium nigricans*									1	0.53	142.00	30.00						0.00								0.00						
Bullheads and Catfish:																																	
Yellow Bullhead	*Ameiurus natalis*									1	0.53	124.00	23.62						0.00								0.00						
Killifishes:																																	
Banded Killifish	*Fundulus diaphanus*										0.00								0.00								0.00						
Sunfishes:																																	
Rock Bass	*Ambloplites rupestris*										0.00								0.00								0.00						
Redbreast Sunfish	*Lepomis auritus*									13	6.95	69.38	7.52					3	2.50	59.33	4.44					3	6.52	52.33	2.33				
Green Sunfish	*Lepomis cyanellus*									41	21.93	72.17	8.48					21	17.50	65.95	6.55					25	54.35	84.84	12.92				
Pumpkinseed	*Lepomis gibbosus*									10	5.35	77.20	12.11					4	3.33	58.75	3.70						0.00						
Bluegill	*Lepomis macrochirus*									10	5.35	72.20	6.88						0.00								0.00						
Redear Sunfish	*Lepomis microlophus*										0.00								0.00								0.00						
Smallmouth Bass	*Micropterus dolomieui*									39	20.86	104.28	12.52					9	7.50	107.22	8.71						0.00						
Largemouth Bass	*Micropterus salmoides*										0.00								0.00							1	2.17	79.00	5.80				
Perches:																																	
Greenside Darter	*Etheostoma blennioides*									6	3.21	74.50	4.03						0.00							6	13.04	65.50	3.40				
Tesselated Darter	*Etheostoma olmstedi*									18	9.63	57.89	1.84					14	11.67	52.79	1.78					2	4.35	55.50	1.88				
Banded Darter	*Etheostoma zonale*									21	11.23	53.43	1.75					1	0.83	46.00	1.03					3	6.52	53.00	1.78				
Shield Darter	*Percina peltata*										0.00							2	1.67	69.50	2.96						0.00						
Sculpins:																																	
Mottled Sculpin	*Cottus bairdi*										0.00								0.00								0.00						
n (total individuals)=										**187**								**120**								**46**							

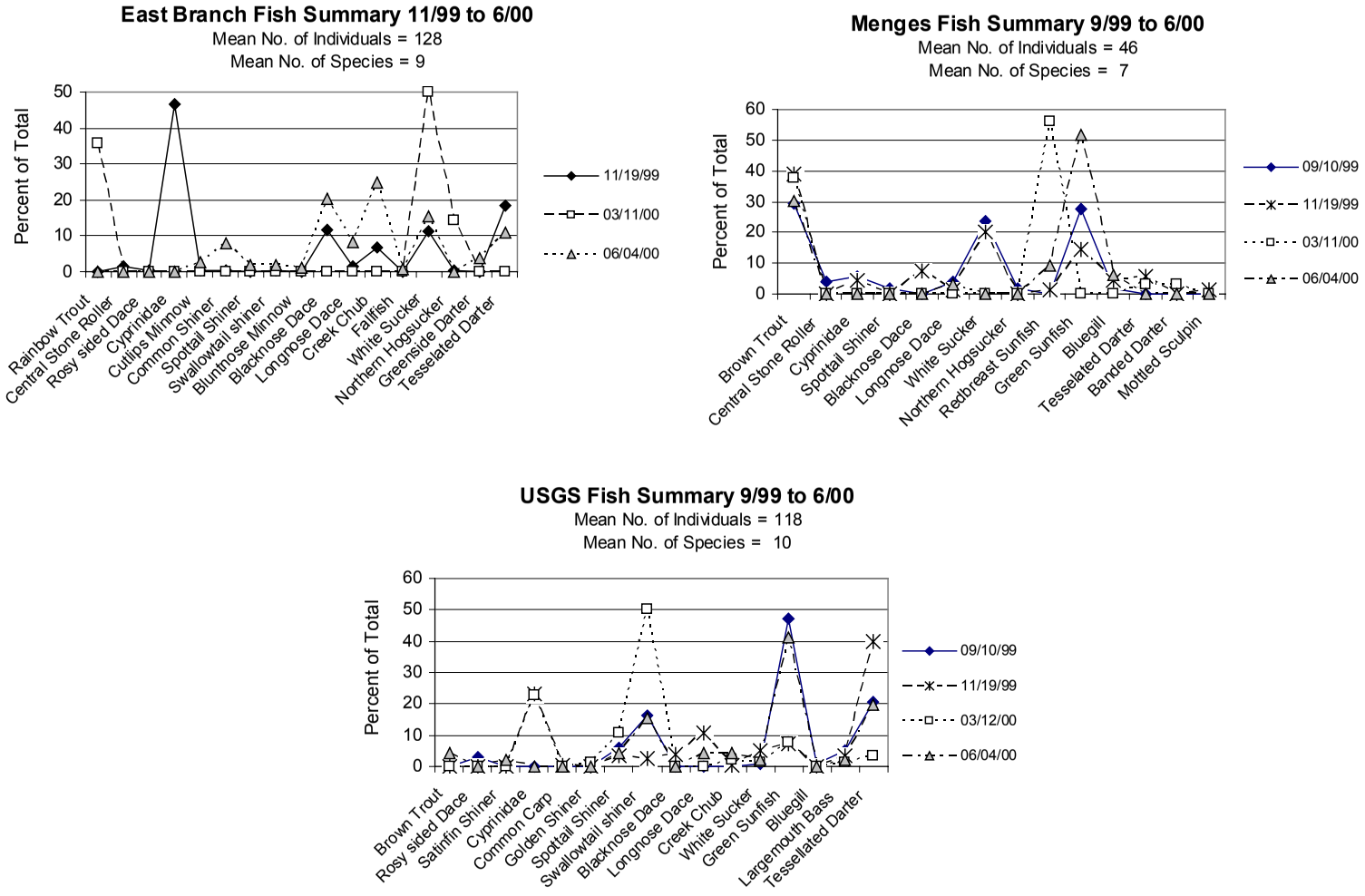


Figure 3.77 Percent Fish Distribution Upstream of Mill Discharge (East Branch, Menges, and USGS) Codorus Creek, 1999 to 2000

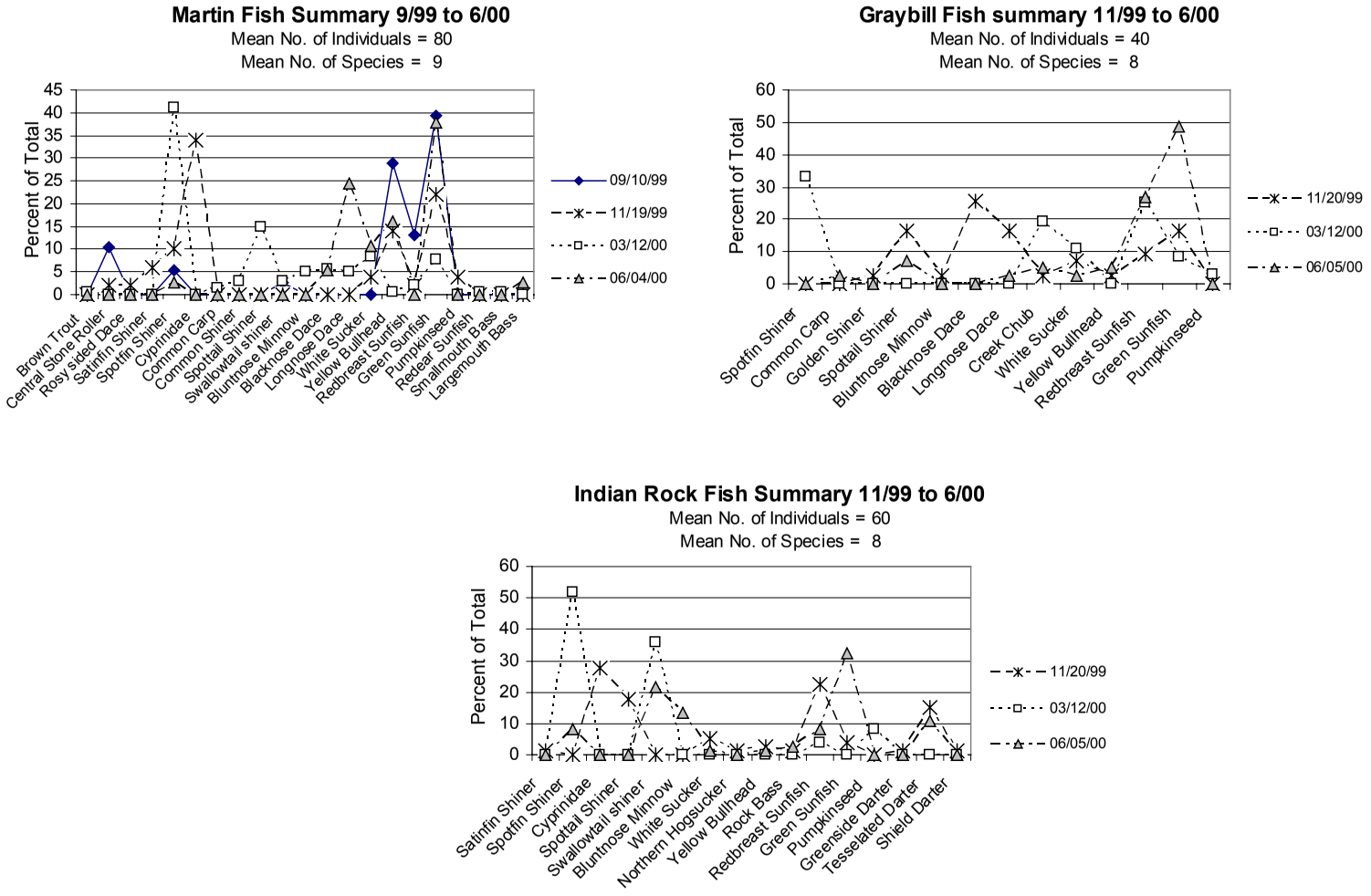


Figure 3.78 Percent Fish Distribution Downstream of Mill Discharge (Martin, Graybill, Indian Rock) Codorus Creek, 1999 to 2000

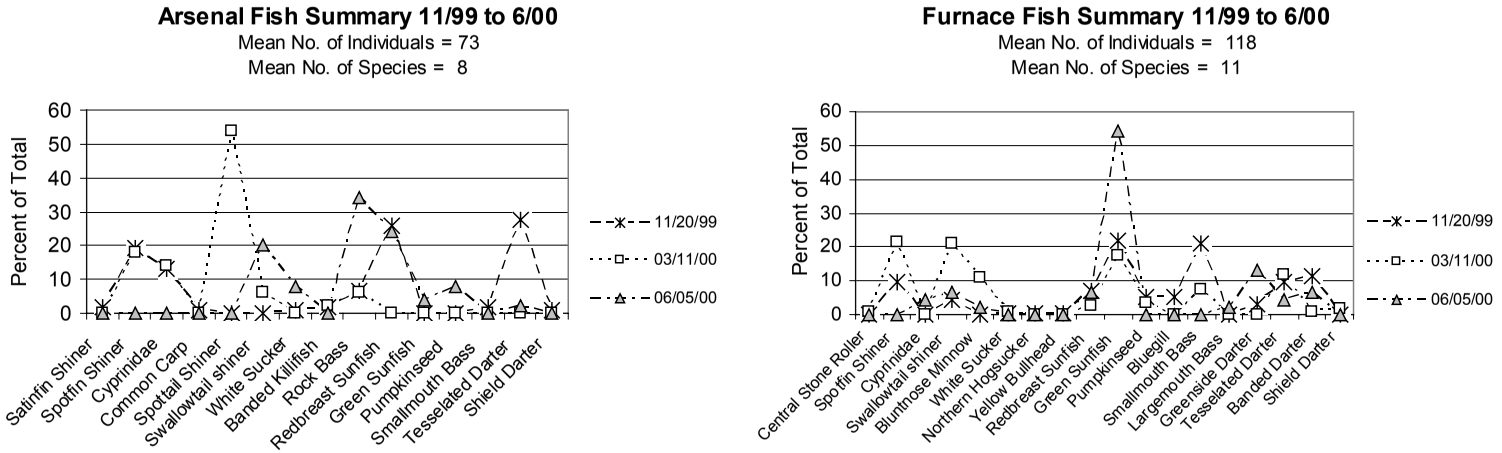


Figure 3.79 Percent Fish Distribution Downstream of Mill Discharge (Arsenal and Furnace), 1999 to 2000

3.9.2 *Leaf River Fish*

Table 3.33 Leaf River: Boat Electrofishing Data Summary for October, 1999

		Site: New Augusta				Site: Thompson				Site: McLain			
		Count	% of Total	Ave. Total Length (mm)	Ave. Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)
Alabama shad	*Alosa alabamae*	1	0.4	143.0	28.0	5	2.9	143.2	23.6	4	1.8	123.0	18.0
Skipjack herring	*Alosa chrysochloris*	1	0.4	249.0	98.0	0	0.0			0	0.0		
Shadow bass	*Ambloplites ariommus*	6	2.3	142.7	51.3	3	1.8	161.3	88.0	0	0.0		
Freshwater drum	*Aplodinotus grunniens*	10	3.8	399.7	521.3	0	0.0			0	0.0		
Quillback carpsucker	*Carpiodes cyprinus*	40	15.2	359.2	561.5	31	18.2	381.8	688.0	38	17.5	367.2	557.5
Highfin carpsucker	*Carpiodes velifer*	27	10.2	260.9	236.1	42	24.7	254.9	228.5	53	24.4	246.7	213.1
Blue sucker	*Cycleptus elongatus*	0	0.0			9	5.3	538.6	2018.3	6	2.8	511.2	1224.3
Blacktail shiner	*Cyprinella venusta*	12	4.5	72.9	3.9	7	4.1	69.6	1.4	30	13.8	71.6	2.1
Gizzard shad	*Dorosoma cepedianum*	7	2.7	295.9	278.3	1	0.6	269.0	198.0	4	1.8	260.8	180.0
Mooneye	*Hiodon tergisus*	0	0.0			1	0.6	242.0	140.0	0	0.0		
Blue catfish	*Ictalarus furcatus*	1	0.4	660.0	2903.0	0	0.0			0	0.0		
Channel catfish	*Ictalarus punctatus*	50	18.9	305.3	212.2	5	2.9	332.8	269.6	11	5.1	335.2	305.5
Smallmouth buffalo	*Ictiobus bubalus*	2	0.8	591.0	3561.0	0	0.0			0	0.0		
Spotted gar	*Lepisosteus oculatus*	1	0.4	600.0	na	0	0.0			2	0.9	537.5	515.0
Bluegill sunfish	*Lepomis macrochirus*	21	8.0	149.4	74.3	8	4.7	103.9	20.3	1	0.5	147.0	58.0
Longear sunfish	*Lepomis megalotis*	54	20.5	110.4	30.7	28	16.5	90.4	15.0	25	11.5	106.5	25.4
Redear sunfish	*Lepomis microlophus*	2	0.8	160.0	79.0	0	0.0			0	0.0		
Spotted bass	*Micropterus punctulatus*	7	2.7	142.1	65.4	10	5.9	166.4	57.0	4	1.8	205.5	116.0
Largemouth bass	*Micropterus salmoides*	1	0.4	290.0	280.0	1	0.6	257.0	198.0	1	0.5	322.0	350.0
Spotted sucker	*Minytrema melanops*	0	0.0			1	0.6	349.0	470.0	0	0.0		
River redhorse	*Moxostoma carinatum*	0	0.0			0	0.0			1	0.5	350.0	496.0
Blacktail redhorse	*Moxostoma poecilurum*	11	4.2	256.1	264.9	4	2.4	338.3	423.5	9	4.1	211.2	191.1
Striped mullet	*Mugil cephalus*	0	0.0			6	3.5	368.0	590.2	20	9.2	398.1	674.6
Emerald shiner	*Notropis atherinoides*	7	2.7	65.7	1.9	4	2.4	68.3	1.0	3	1.4	67.7	1.0
Longnose shiner	*Notropis longirostris*	0	0.0			0	0.0			1	0.5	52.0	1.0
Freckled darter	*Percina lenticula*	1	0.4	66.0	1.0	0	0.0			0	0.0		
Blackbanded darter	*Percina nigrofasciata*	1	0.4	na	na	0	0.0			1	0.5	62.0	1.0
Saddleback darter	*Percina ouachitae*	0	0.0			1	0.6	60.0	1.0	0	0.0		
Dusky darter	*Percina shumardi*	0	0.0			1	0.6	56.0	1.0	1	0.5	79.0	2.0
White crappie	*Pomoxis annularis*	1	0.4	310.0	398.0	1	0.6	200.0	98.0	2	0.9	266.5	230.0
Flathead catfish	*Pylodictis olivaris*	0	0.0			1	0.6	546.0	1769.0	0	0.0		
TOTAL		**264**				**170**				**217**			

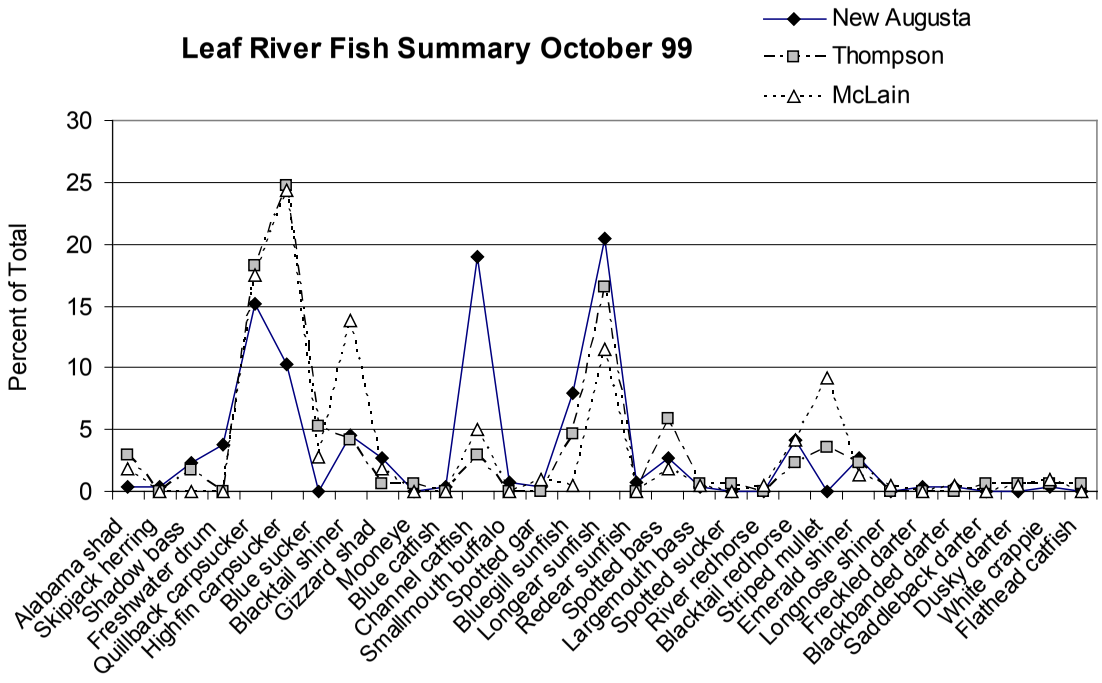


Figure 3.80 Leaf River Fish Distribution for October, 1999

3.9.3 *McKenzie River Fish*

Table 3.34 McKenzie River: Hendricks Boat Electrofishing Data Summary for September 1999 to June 2000

HENDRICKS Sampling Date =		09/04/99				03/26/00				05/25/00			
		Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)
Suckers (Catostomidae):													
Largescale sucker	*Castomus macrocheilus*	15	26.79	499.47	1219.6		0.00			3	10.71	460.67	1087.07
			0.00				0.00				0.00		
Sculpins (Cottidae):													
Slimy sculpin	*Cottus congnatus*		0.00				0.00				0.00		
Reticulate sculpin	*Cottus perplexus*	1	1.79	90.00	26.76		0.00				0.00		
Torrent sculpin	*Cottus rhotheus*	1	1.79	83.00	21.22	6	31.58	69.00	13.08	9	32.14	76.11	17.30
Sculpin	*Cottus*		0.00			1	5.26	65.00	10.54		0.00		
Carps and Minnows (Cyprinidae):													
Peamouth	*Mylocheilus caurinus*												
Northern pike minnow	*Ptychocheilus oregonensis*	2	3.57	328.00	347.50		0.00			1	3.57	307.00	305.00
Longnose dace	*Rhinichthys cataractae*	1	1.79	76.00	4.90		0.00				0.00		
Dace	*Rhinichthys*		0.00				0.00				0.00		
Redside shiner	*Richardsonius balteatus*		0.00				0.00				0.00		
Troutperch (Percopsidae):													
Trout perch/sand roller	*Percopsis omiscomaycus*		0.00				0.00				0.00		
Trout and Salmon (Salmonidae):													
Cutthroat trout	*Oncorhynchus clarki*	15	26.79	267.27	184.67	5	26.32	264.00	155.00	2	7.14	257.50	170.00
Rainbow trout, hatchery	*Oncorhynchus mykiss*	2	3.57	273.50	196.00		0.00				0.00		
Rainbow trout, wild	*Oncorhynchus mykiss*	7	12.50	239.28	210.70	2	10.53	327.50	352.50	11	39.29	240.27	177.91
Chinook salmon	*Oncorhynchus tshawytscha*	12	21.43	106.17	10.39		0.00			2	7.14	110.50	10.00
Mountain whitefish	*Prosopium williamsoni*		0.00			5	26.32	353.75	372.50		0.00		
n (Total Individuals)		56				19				28			

Table 3.35 McKenzie River: Bellingers Boat Electrofishing Data Summary for September 1999 to June 2000

BELLINGERS													
Sampling Date =		09/01/99				03/26/00				05/25/00			
		Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)
Suckers (Catostomidae):													
Largescale sucker	*Castomus macrocheilus*		0.00			4	18.18	281.75	530.59	5	22.73	492.00	1343.60
Sculpins (Cottidae):													
Slimy sculpin	*Cottus congnatus*	1	1.14	83.00	21.22		0.00				0.00		
Reticulate sculpin	*Cottus perplexus*		0.00				0.00				0.00		
Torrent sculpin	*Cottus rhotheus*	2	2.27	80.00	20.06		0.00			1	4.55	103.00	10.00
Sculpin	*Cottus*		0.00				0.00				0.00		
Carps and Minnows (Cyprinidae):													
Peamouth	*Mylocheilus caurinus*		0.00				0.00				0.00		
Northern pike minnow	*Ptychocheilus oregonensis*	3	3.41	316.30	280.67	1	4.55	176.00	46.00		0.00		
Longnose dace	*Rhinichthys cataractae*		0.00				0.00				0.00		
Dace	*Rhinichthys*		0.00				0.00				0.00		
Redside shiner	*Richardsonius balteatus*	3	3.41	115.00	17.92	1	4.55	116.00	9.00		0.00		
Troutperch (Percopsidae):													
Trout perch/sand roller	*Percopsis omiscomaycus*		0.00				0.00				0.00		
Trout and Salmon (Salmonidae):													
Cutthroat trout	*Oncorhynchus clarki*	26	29.55	246.50	135.35	3	13.64	247.33	126.67	5	22.73	252.60	142.20
Rainbow trout, hatchery	*Oncorhynchus mykiss*	5	5.68	244.40	135.60		0.00				0.00		
Rainbow trout, wild	*Oncorhynchus mykiss*	4	4.55	203.00	168.17	12	54.55	228.83	117.67	7	31.82	187.86	85.43
Chinook salmon	*Oncorhynchus tshawytscha*	40	45.45	91.98	8.56	1	4.55	153.00	34.15	1	4.55	88.00	4.85
Mountain whitefish	*Prosopium williamsoni*	4	4.55	218.75	98.70		0.00			3	13.64	324.33	323.33
n (Total Individuals)		88				22				22			

Table 3.36 McKenzie River: Mohawk Boat Electrofishing Data Summary for September 1999 to June 2000

MOHAWK													
Sampling Date =		09/01/99				03/26/00				05/25/00			
		Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)
Suckers (Catostomidae):													
Largescale sucker	*Castomus macrocheilus*	8	16.00	482.25	1009.75	10	35.71	481.70	1120.83	3	15.79	480.00	1182.30
Sculpins (Cottidae):													
Slimy sculpin	*Cottus congnatus*		0.00				0.00				0.00		
Reticulate sculpin	*Cottus perplexus*		0.00				0.00				0.00		
Torrent sculpin	*Cottus rhotheus*		0.00				0.00				0.00		
Sculpin	*Cottus*		0.00				0.00				0.00		
Carps and Minnows (Cyprinidae):													
Peamouth	*Mylocheilus caurinus*	1	2.00	343.00	350.00		0.00				0.00		
Northern pike minnow	*Ptychocheilus oregonensis*	7	14.00	218.86	131.92		0.00				0.00		
Longnose dace	*Rhinichthys cataractae*		0.00				0.00				0.00		
Dace	*Rhinichthys*		0.00				0.00				0.00		
Redside shiner	*Richardsonius balteatus*		0.00				0.00			1	5.26	91.00	8.00
Troutperch (Percopsidae):													
Trout perch/sand roller	*Percopsis omiscomaycus*		0.00				0.00				0.00		
Trout and Salmon (Salmonidae):													
Cutthroat trout	*Oncorhynchus clarki*	27	54.00	250.33	158.05	15	53.57	244.20	128.80	12	63.16	243.67	160.18
Rainbow trout, hatchery	*Oncorhynchus mykiss*		0.00				0.00				0.00		
Rainbow trout, wild	*Oncorhynchus mykiss*	2	4.00	302.50	252.50	1	3.57	132.00	18.00		0.00		
Chinook salmon	*Oncorhynchus tshawytscha*	3	6.00	113.00	12.32		0.00			1	5.26	97.00	7.00
Mountain whitefish	*Prosopium williamsoni*	2	4.00	128.50	17.20	2	7.14	290.50	207.71	2	10.53	336.00	402.15
n (Total Individuals)		50				28				19			

Table 3.37 McKenzie River: Harvest Boat Electrofishing Data Summary for September 1999 to June 2000

HARVEST													
Sampling Date =		09/05/99				03/26/00				05/25/00			
		Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)
Suckers (Catostomidae):													
Largescale sucker	*Castomus macrocheilus*	20	25.00	486.80	1041.85	6	28.57	494.17	1087.72	7	21.88	483.29	1163.39
Sculpins (Cottidae):													
Slimy sculpin	*Cottus congnatus*		0.00				0.00				0.00		
Reticulate sculpin	*Cottus perplexus*		0.00				0.00				0.00		
Torrent sculpin	*Cottus rhotheus*		0.00				0.00				0.00		
Sculpin	*Cottus*		0.00				0.00				0.00		
Carps and Minnows (Cyprinidae):													
Peamouth	*Mylocheilus caurinus*	1	1.25	300.00	298.00		0.00				0.00		
Northern pike minnow	*Ptychocheilus oregonensis*	4	5.00	367.00	457.00		0.00			1	3.13	397.00	681.00
Longnose dace	*Rhinichthys cataractae*		0.00				0.00				0.00		
Dace	*Rhinichthys*		0.00				0.00				0.00		
Redside shiner	*Richardsonius balteatus*		0.00			2	9.52	96.00	7.09		0.00		
Troutperch (Percopsidae):													
Trout perch/sand roller	*Percopsis omiscomaycus*		0.00				0.00				0.00		
Trout and Salmon (Salmonidae):													
Cutthroat trout	*Oncorhynchus clarki*	34	42.50	290.79	212.62	10	47.62	236.30	121.30	19	59.38	179.47	75.68
Rainbow trout, hatchery	*Oncorhynchus mykiss*	1	1.25	293.00	222.00		0.00				0.00		
Rainbow trout, wild	*Oncorhynchus mykiss*	6	7.50	165.33	99.50	1	4.76	134.00	16.50	1	3.13	391.00	635.00
Chinook salmon	*Oncorhynchus tshawytscha*		0.00				0.00			4	12.50	89.00	5.53
Mountain whitefish	*Prosopium williamsoni*	14	17.50	286.14	230.50	2	9.52	197.00	65.00		0.00		
n (Total Individuals)		80				21				32			

Table 3.38 McKenzie River: Armitage Boat Electrofishing Data Summary for September 1999 to June 2000

ARMITAGE													
Sampling Date =		09/04/99				03/25/00				05/25/00			
		Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)
Suckers (Catostomidae):													
Largescale sucker	*Castomus macrocheilus*	15	20.27	507.87	1192.53	3	10.00	486.33	1190.42	8	16.00	471.50	1170.45
Sculpins (Cottidae):													
Slimy sculpin	*Cottus congnatus*	1	1.35	59.00	7.99		0.00				0.00		
Reticulate sculpin	*Cottus perplexus*		0.00				0.00				0.00		
Torrent sculpin	*Cottus rhotheus*		0.00			1	3.33	101.00	37.22	4	8.00	86.75	29.57
Sculpin	*Cottus*		0.00				0.00				0.00		
Carps and Minnows (Cyprinidae):													
Peamouth	*Mylocheilus caurinus*		0.00				0.00				0.00		
Northern pike minnow	*Ptychocheilus oregonensis*	7	9.46	308.43	267.86		0.00			2	4.00	307.00	270.00
Longnose dace	*Rhinichthys cataractae*		0.00				0.00				0.00		
Dace	*Rhinichthys*	1	1.35	92.00			0.00				0.00		
Redside shiner	*Richardsonius balteatus*	4	5.41	121.50	15.16	3	10.00	101.00	6.15	1	2.00	115.00	17.00
Troutperch (Percopsidae):													
Trout perch/sand roller	*Percopsis omiscomaycus*		0.00			1	3.33	82.00	7.65		0.00		
Trout and Salmon (Salmonidae):													
Cutthroat trout	*Oncorhynchus clarki*	26	35.14	286.00	214.62	17	56.67	274.94	177.26	27	54.00	263.26	194.26
Rainbow trout, hatchery	*Oncorhynchus mykiss*		0.00				0.00				0.00		
Rainbow trout, wild	*Oncorhynchus mykiss*	4	5.41	282.75	338.75	5	16.67	260.60	179.79	1	2.00	145.00	28.00
Chinook salmon	*Oncorhynchus tshawytscha*		0.00				0.00			4	8.00	90.50	5.58
Mountain whitefish	*Prosopium williamsoni*	16	21.62	227.81	146.89		0.00			3	6.00	257.33	182.33
n (Total Individuals)		74				30				50			

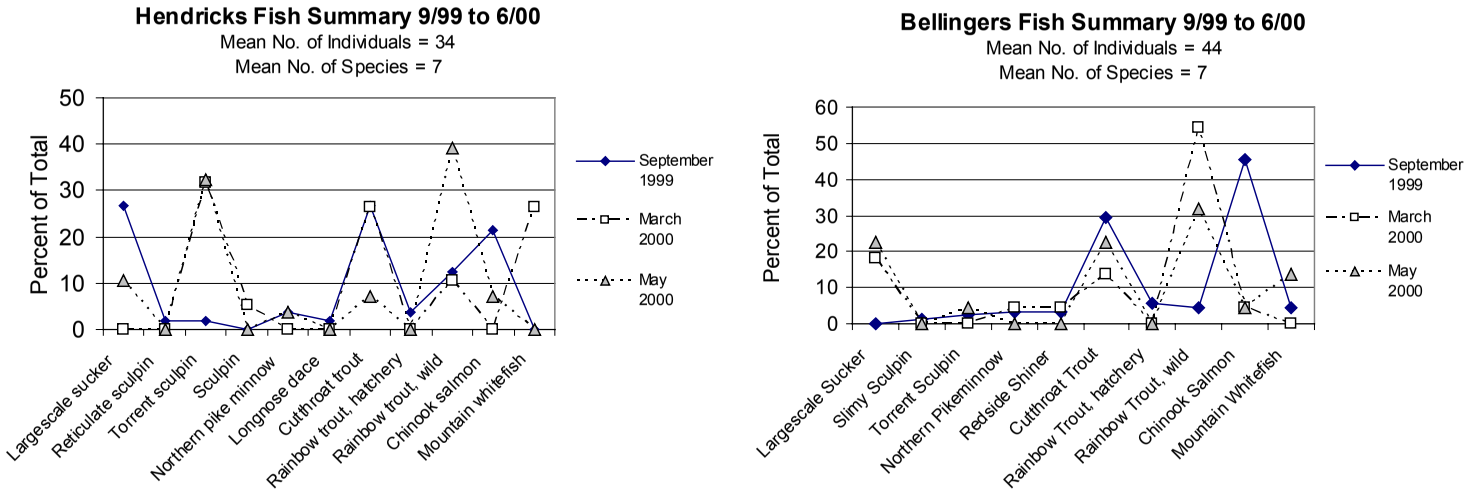


Figure 3.81 Percent Fish Distribution for Upstream Sites (Hendricks and Bellingers) McKenzie River, September 1999 to June 2000, Boat Electrofishing Samples

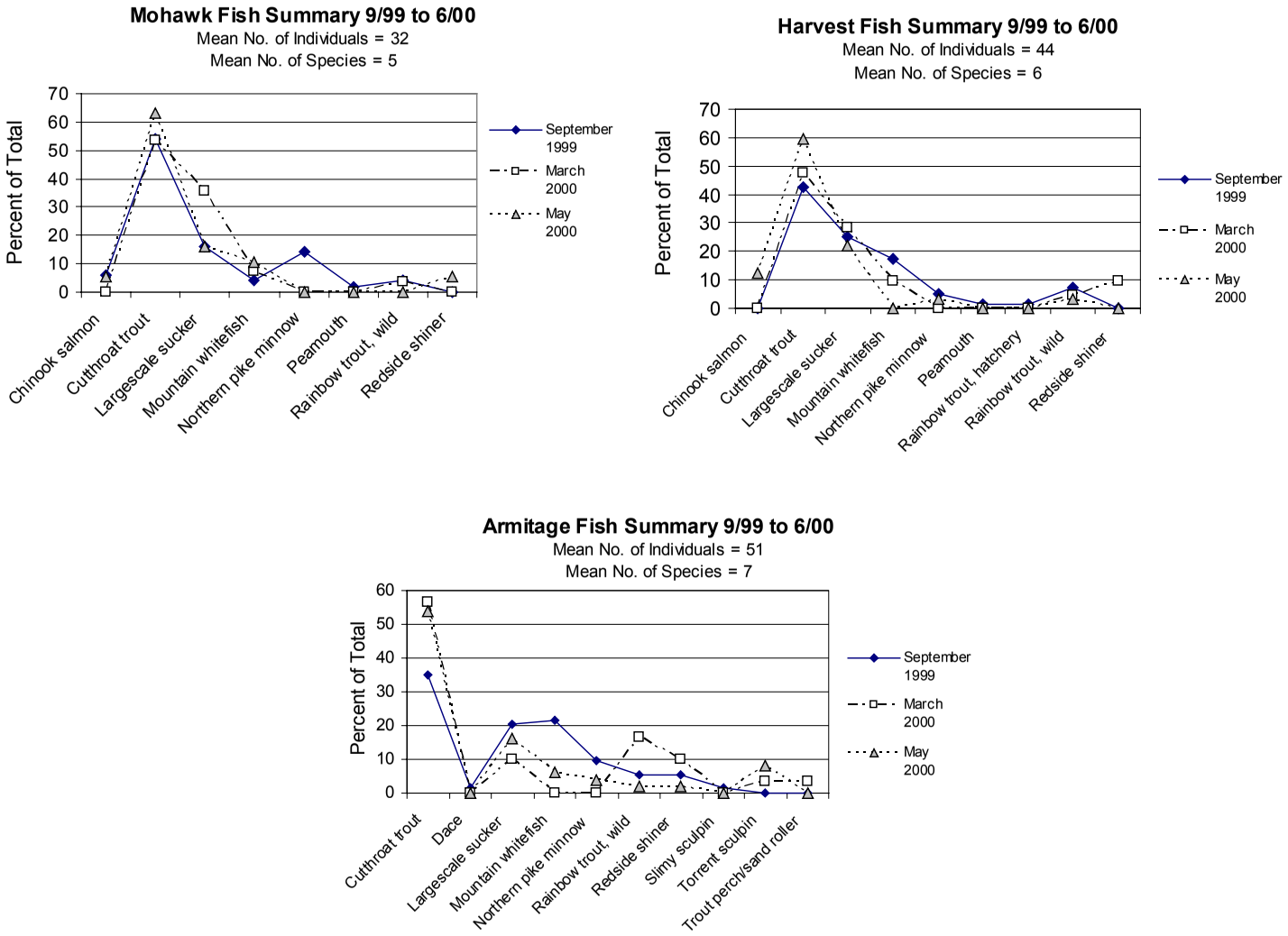


Figure 3.82 Percent Fish Distribution for Downstream Sites (Mohawk, Harvest and Armitage), McKenzie River, September 1999 to June 2000, Boat Electrofishing Samples

Table 3.39 McKenzie River: Backpack Electrofishing Data Summary for Fall 1999

MCKENZIE RIVER		HENDRICKS (RM 26.5)				BELLINGERS (RM 18.5)				HARVEST (RM 10)				ARMITAGE (RM 6)			
Sampling Date/# of runs =		09/01/99			3 Runs	09/01/99			3 Runs	09/01/99			3 Runs	09/02/99			3 Runs
		Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)
Sunfish (Centrarchidae):																	
Smallmouth bass	*Micropterus dolomieu*		0.00			1	1.54	72.00	5.14		0.00				0.00		
Sculpins (Cottidae):																	
Prickly sculpin	*Cottus asper*	1	1.22	125.00	22.64		0.00				0.00				0.00		
Paiute sculpin	*Cottus beldingi*	5	6.10	68.80	4.83	1	1.54	73.00	4.78	25	15.43	64.58	3.46	26	18.98	67.29	3.51
Reticulate sculpin	*Cottus perplexus*	13	15.85	64.38	3.62	21	32.31	58.67	3.02	48	29.63	65.70	3.78	12	8.76	63.67	3.24
Torrent sculpin	*Cottus rhotheus*	9	10.98	75.70	5.97	3	4.62	104.33	18.81	28	17.28	62.41	5.82	32	23.36	64.90	4.17
Sculpin		11	13.41	32.60	1.30	19	29.23	48.40	1.82	52	32.10	47.98	1.90	32	23.36	45.26	1.46
Carps and Minnows (Cyprinidae):																	
Northern pike minnow	*Ptychocheilus oregonensis*		0.00			1	1.54	165.00	38.10		0.00			1	0.73	112.00	11.09
Longnose dace	*Rhinichthys cataractae*		0.00				0.00				0.00			7	5.11	73.20	3.25
Leopard dace	*Rhinichthys falcatus*		0.00				0.00				0.00			1	0.73		3.42
Speckled dace	*Rhinichthys osculus*	2	2.44	47.00	0.98		0.00			3	1.85	69.00	3.86	13	9.49	58.90	2.04
Dace	*Rhinichthys*	2	2.44	42.00	0.67		0.00			4	2.47	58.00	1.42	9	6.57	58.67	1.98
Redside shiner	*Richardsonius balteatus*	13	15.85	71.33	3.60	2	3.08	71.00	3.59		0.00			4	2.92	85.67	5.80
Cyprinid		1	1.22		1.52		0.00				0.00				0.00		
Sticklebacks (Gasterosteidae)																	
Three spine stickleback	*Gasterosteus aculeatus*	1	1.22			4	6.15	45.67	0.96		0.00				0.00		
Lamprey (Petromyzontidae):																	
Western brook lamprey	*Lampetra richardsoni*	23	28.05	84.79	1.17	8	12.31	72.00	0.67	2	1.23	71.50	0.52		0.00		
Trout and Salmon (Salmonidae):																	
Salmonid		1	1.22	43.00	0.82	5	7.69	47.60	1.28		0.00				0.00		
n (Total Individuals)		82				65				162				137			

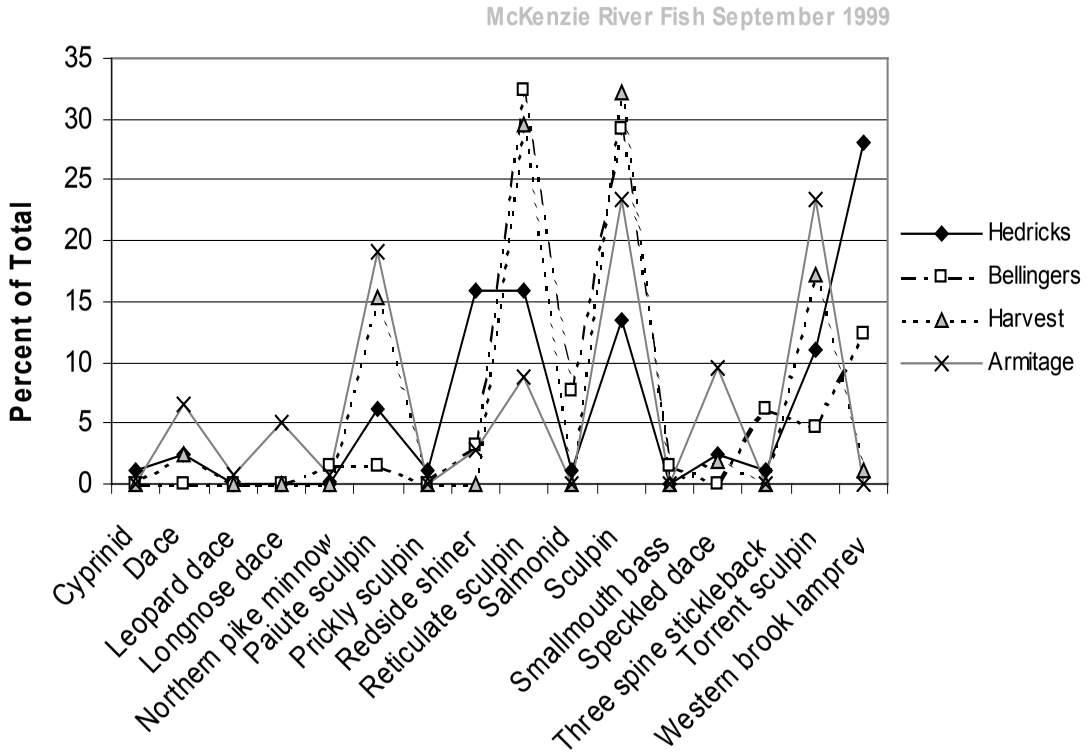


Figure 3.83 McKenzie River Fish Distribution for September, 1999, Backpack Electrofishing Samples

3.9.4 *Willamette River Fish*

Table 3.40 Willamette River: Harrisburg Boat Electrofishing Data Summary for 1999 to June 2000

HARRISBURG																
Sampling Date =		08/30/99				1/13/2000				03/25/00				05/25/00			
		Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)
Suckers (Catostomidae):																	
Largescale sucker	*Castomus macrocheilus*	12	63.16	398.25	661.19	15	65.22	491.07	1165.27	11	37.93	469.55	1052.45	9	32.14	381.22	639.41
Mountain sucker	*Castomus platyrhynchus*		0.00				0.00				0.00				0.00		
Sunfish (Centrarchidae):																	
Largemouth bass	*Micropterus salmoides*		0.00				0.00				0.00				0.00		
Sculpins (Cottidae):																	
Prickly sculpin	*Cottus asper*		0.00				0.00				0.00				0.00		
Mottled sculpin	*Cottus bairdi*	1	5.26	129.00	30.00		0.00				0.00				0.00		
Slimy sculpin	*Cottus congnatus*		0.00				0.00				0.00				0.00		
Sculpin	*Cottus*		0.00				0.00				0.00				0.00		
Carps and Minnows (Cyprinidae):																	
Chiselmouth	*Acrocheilus alutaceus*		0.00				0.00				0.00				0.00		
Common carp	*Cyprinus carpio*		0.00				0.00				0.00				0.00		
Peamouth	*Mylocheilus caurinus*		0.00				0.00				0.00			1	3.57	281.00	200.00
Northern pike minnow	*Ptychocheilus oregonensis*	2	10.53	205.50	67.50		0.00				0.00			2	7.14	102.00	9.75
Redside shiner	*Richardsonius balteatus*		0.00				0.00				0.00			6	21.43	101.00	12.02
Troutperch (Percopsidae):																	
Trout perch/sand roller	*Percopsis omiscomaycus*		0.00				0.00				0.00				0.00		
Trout and Salmon (Salmonidae):																	
Cutthroat trout	*Oncorhynchus clarki*	2	10.53	239.00	142.50		0.00			3	10.34	282.33	198.63	1	3.57	318.00	305.00
Rainbow trout, wild	*Oncorhynchus mykiss*		0.00				0.00			5	17.24	226.20	104.10		0.00		
Steelhead	*Oncorhynchus mykiss*		0.00				0.00				0.00				0.00		
Chinook salmon	*Oncorhynchus tshawytscha*		0.00				0.00			7	24.14	131.14	18.91	9	32.14	128.22	41.50
Mountain whitefish	*Prosopium williamsoni*	2	10.53	137.00	20.07	8	34.78	189.25	65.88	3	10.34	319.33	345.71		0.00		
Brook trout	*Salvelinus fotinalis*		0.00				0.00				0.00				0.00		
n (Total Individuals)		19				23				29				28			

Table 3.41 Willamette River: Cartney Boat Electrofishing Data Summary for 1999 to June 2000

CARTNEY													
Sampling Date =		08/31/99				03/25/00				05/24/00			
		Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)
Suckers (Catostomidae):													
Largescale sucker	*Castomus macrocheilus*	20	33.33	474.15	941.60	12	50.00	468.75	1071.16	20	74.07	438.45	861.62
Mountain sucker	*Castomus platyrhynchus*	1	1.67	108.00	11.60		0.00				0.00		
Sunfish (Centrarchidae):													
Largemouth bass	*Micropterus salmoides*		0.00				0.00				0.00		
Sculpins (Cottidae):													
Prickly sculpin	*Cottus asper*		0.00				0.00				0.00		
Mottled sculpin	*Cottus bairdi*		0.00				0.00				0.00		
Slimy sculpin	*Cottus congnatus*	1	1.67	63.00	2.23		0.00				0.00		
Sculpin	*Cottus*		0.00				0.00				0.00		
Carps and Minnows (Cyprinidae):													
Chiselmouth	*Acrocheilus alutaceus*		0.00				0.00				0.00		
Common carp	*Cyprinus carpio*		0.00				0.00				0.00		
Peamouth	*Mylocheilus caurinus*		0.00				0.00				0.00		
Northern pike minnow	*Ptychocheilus oregonensis*	2	3.33	332.00	315.00	1	4.17	451.00	908.00	4	14.81	225.00	106.25
Redside shiner	*Richardsonius balteatus*		0.00				0.00				0.00		
Troutperch (Percopsidae):													
Trout perch/sand roller	*Percopsis omiscomaycus*		0.00				0.00				0.00		
Trout and Salmon (Salmonidae):													
Cutthroat trout	*Oncorhynchus clarki*	5	8.33	283.80	204.00		0.00				0.00		
Rainbow trout, wild	*Oncorhynchus mykiss*		0.00			1	4.17	314.00	312.13		0.00		
Steelhead	*Oncorhynchus mykiss*		0.00				0.00				0.00		
Chinook salmon	*Oncorhynchus tshawytscha*	1	1.67	127.00	20.00		0.00			2	7.41	112.50	11.88
Mountain whitefish	*Prosopium williamsoni*	30	50.00	157.83	47.02	10	41.67	303.60	301.29	1	3.70	171.00	35.00
Brook trout	*Salvelinus fotinalis*		0.00				0.00				0.00		
n (Total Individuals)		60				24				27			

Table 3.42 Willamette River: Intake Boat Electrofishing Data Summary for 1999 to June 2000

INTAKE																	
Sampling Date =		08/31/99				1/15/2000				03/24/00				05/24/00			
		Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)
Suckers (Catostomidae):																	
Largescale sucker	*Castomus macrocheilus*	11	26.19	421.91	707.00	2	50.00	475.50	1234.31	25	83.33	443.46	835.97	17	60.71	398.00	828.65
Mountain sucker	*Castomus platyrhynchus*	1	2.38	130.00	18.00		0.00				0.00				0.00		
Sunfish (Centrarchidae):																	
Largemouth bass	*Micropterus salmoides*	2	4.76	120.00	25.00		0.00				0.00				0.00		
Sculpins (Cottidae):																	
Prickly sculpin	*Cottus asper*	3	7.14	143.67	37.33		0.00				0.00				0.00		
Mottled sculpin	*Cottus bairdi*		0.00				0.00				0.00				0.00		
Slimy sculpin	*Cottus congnatus*		0.00				0.00				0.00				0.00		
Sculpin	*Cottus*		0.00				0.00				0.00				0.00		
Carps and Minnows (Cyprinidae):																	
Chiselmouth	*Acrocheilus alutaceus*		0.00				0.00				0.00				0.00		
Common carp	*Cyprinus carpio*	1	2.38	565.00	2440.00		0.00				0.00				0.00		
Peamouth	*Mylocheilus caurinus*	1	2.38	130.00	15.00		0.00				0.00				0.00		
Northern pike minnow	*Ptychocheilus oregonensis*	9	21.43	241.33	176.73		0.00				0.00			6	21.43	280.17	324.42
Redside shiner	*Richardsonius balteatus*	14	33.33	83.00	6.43		0.00				0.00			4	14.29	101.75	9.85
Troutperch (Percopsidae):																	
Trout perch/sand roller	*Percopsis omiscomaycus*		0.00				0.00				0.00				0.00		
Trout and Salmon (Salmonidae):																	
Cutthroat trout	*Oncorhynchus clarki*		0.00				0.00			1	3.33	271.00	141.88		0.00		
Rainbow trout, wild	*Oncorhynchus mykiss*		0.00				0.00			4	13.33	291.75	177.34	1	3.57	226.00	120.00
Steelhead	*Oncorhynchus mykiss*		0.00				0.00				0.00				0.00		
Chinook salmon	*Oncorhynchus tshawytscha*		0.00				0.00				0.00				0.00		
Mountain whitefish	*Prosopium williamsoni*		0.00			2	50.00	300.00	225.00		0.00				0.00		
Brook trout	*Salvelinus fotinalis*		0.00				0.00				0.00				0.00		
n (Total Individuals)		42				4				30				28			

Table 3.43 Willamette River: Sam Daws Boat Electrofishing Data Summary for 1999 to June 2000

SAM DAWS																
Sampling Date =		08/31/99				1/15/2000				03/24/00				05/24/00			
		Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)
Suckers (Catostomidae):																	
Largescale sucker	*Castomus macrocheilus*	12	16.67	394.42	697.95	9	69.23	485.00	1103.47	20	36.36	406.20	749.79	26	100.00	448.12	736.39
Mountain sucker	*Castomus platyrhynchus*		0.00				0.00				0.00				0.00		
Sunfish (Centrarchidae):																	
Largemouth bass	*Micropterus salmoides*		0.00				0.00				0.00				0.00		
Sculpins (Cottidae):																	
Prickly sculpin	*Cottus asper*	6	8.33	120.50	24.59		0.00				0.00				0.00		
Mottled sculpin	*Cottus bairdi*		0.00				0.00				0.00				0.00		
Slimy sculpin	*Cottus congnatus*		0.00				0.00				0.00				0.00		
Sculpin	*Cottus*		0.00				0.00				0.00				0.00		
Carps and Minnows (Cyprinidae):																	
Chiselmouth	*Acrocheilus alutaceus*		0.00			2	15.38	109.00	8.00	10	18.18	122.80	10.60		0.00		
Common carp	*Cyprinus carpio*		0.00				0.00				0.00				0.00		
Peamouth	*Mylocheilus caurinus*		0.00				0.00				0.00				0.00		
Northern pike minnow	*Ptychocheilus oregonensis*	25	34.72	282.32	222.48		0.00			8	14.55	153.13	28.38		0.00		
Redside shiner	*Richardsonius balteatus*	19	26.39	93.79	8.17		0.00			14	25.45	119.57	11.71		0.00		
Troutperch (Percopsidae):																	
Trout perch/sand roller	*Percopsis omiscomaycus*	3	4.17	100.00	16.00		0.00				0.00				0.00		
Trout and Salmon (Salmonidae):																	
Cutthroat trout	*Oncorhynchus clarki*		0.00				0.00				0.00				0.00		
Rainbow trout, wild	*Oncorhynchus mykiss*		0.00			1	7.69	148.00	22.00	2	3.64	360.00	227.00		0.00		
Steelhead	*Oncorhynchus mykiss*		0.00				0.00				0.00				0.00		
Chinook salmon	*Oncorhynchus tshawytscha*		0.00				0.00			1	1.82	154.00	26.00		0.00		
Mountain whitefish	*Prosopium williamsoni*	6	8.33	207.17	99.17	1	7.69	162.00	30.00		0.00				0.00		
Brook trout	*Salvelinus fotinalis*	1	1.39	136.00	23.00		0.00				0.00				0.00		
n (Total Individuals)		72				13				55				26			

Table 3.44 Willamette River: Peoria Boat Electrofishing Data Summary for 1999 to June 2000

PEORIA

		Sampling Date =	09/02/99				1/13/2000				03/24/00				05/24/00			
			Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)
Suckers (Catostomidae):																		
Largescale sucker	*Castomus macrocheilus*		41	40.59	319.95	451.43	1	100.00	471.00	1021.50	26	83.87	439.23	809.46	24	48.98	435.29	907.45
Mountain sucker	*Castomus platyrhynchus*			0.00				0.00				0.00			2	4.08	205.00	95.00
Sunfish (Centrarchidae):																		
Largemouth bass	*Micropterus salmoides*			0.00				0.00				0.00				0.00		
Sculpins (Cottidae):																		
Prickly sculpin	*Cottus asper*		1	0.99	125.00	25.00		0.00				0.00				0.00		
Mottled sculpin	*Cottus bairdi*			0.00				0.00				0.00				0.00		
Slimy sculpin	*Cottus congnatus*			0.00				0.00				0.00				0.00		
Sculpin	*Cottus*			0.00				0.00			2	6.45	-	-		0.00		
Carps and Minnows (Cyprinidae):																		
Chiselmouth	*Acrocheilus alutaceus*			0.00				0.00			1	3.23	146.00	28.00	8	16.33	133.00	23.86
Common carp	*Cyprinus carpio*			0.00				0.00				0.00				0.00		
Peamouth	*Mylocheilus caurinus*			0.00				0.00				0.00				0.00		
Northern pike minnow	*Ptychocheilus oregonensis*		8	7.92	257.38	269.66		0.00				0.00			6	12.24	347.33	548.33
Redside shiner	*Richardsonius balteatus*		26	25.74	92.69	7.08		0.00			1	3.23	117.00	9.00	5	10.20	85.40	4.85
Troutperch (Percopsidae):																		
Trout perch/sand roller	*Percopsis omiscomaycus*			0.00				0.00				0.00				0.00		
Trout and Salmon (Salmonidae):																		
Cutthroat trout	*Oncorhynchus clarki*		1	0.99	206.00	60.00		0.00				0.00				0.00		
Rainbow trout, wild	*Oncorhynchus mykiss*			0.00				0.00				0.00				0.00		
Steelhead	*Oncorhynchus mykiss*			0.00				0.00				0.00				0.00		
Chinook salmon	*Oncorhynchus tshawytscha*		10	9.90	160.90	43.10		0.00				0.00			4	8.16	106.75	10.22
Mountain whitefish	*Prosopium williamsoni*		14	13.86	141.14	22.07		0.00			1	3.23	234.00	113.50		0.00		
Brook trout	*Salvelinus fotinalis*			0.00				0.00				0.00				0.00		
n (Total Individuals)			101				1				31				49			

Table 3.45 Willamette River: Willamette Park Boat Electrofishing Data Summary for 1999 to June 2000

WILLAMETTE PARK

		Sampling Date =	09/02/00				1/13/2000				03/24/00				05/24/00			
			Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)
Suckers (Catostomidae):																		
Largescale sucker	*Castomus macrocheilus*		22	29.33	468.00	921.00	1	16.67	424.00	113.00	39	79.59	433.00	853.02	40	83.33	389.00	733.00
Mountain sucker	*Castomus platyrhynchus*			0.00				0.00				0.00				0.00		
Sunfish (Centrarchidae):																		
Largemouth bass	*Micropterus salmoides*			0.00				0.00				0.00				0.00		
Sculpins (Cottidae):																		
Prickly sculpin	*Cottus asper*		2	2.67	129.00	36.00		0.00				0.00				0.00		
Mottled sculpin	*Cottus bairdi*			0.00				0.00				0.00				0.00		
Slimy sculpin	*Cottus congnatus*			0.00				0.00				0.00				0.00		
Sculpin	*Cottus*			0.00				0.00				0.00				0.00		
Carps and Minnows (Cyprinidae):																		
Chiselmouth	*Acrocheilus alutaceus*			0.00				0.00				0.00				0.00		
Common carp	*Cyprinus carpio*			0.00				0.00				0.00				0.00		
Peamouth	*Mylocheilus caurinus*		1	1.33	194.00	55.00		0.00				0.00				0.00		
Northern pike minnow	*Ptychocheilus oregonensis*		24	32.00	282.00	258.00		0.00				0.00			7	14.58	325.00	548.00
Redside shiner	*Richardsonius balteatus*		13	17.33	105.00	11.32		0.00				0.00				0.00		
Troutperch (Percopsidae):																		
Trout perch/sand roller	*Percopsis omiscomaycus*			0.00				0.00				0.00				0.00		
Trout and Salmon (Salmonidae):																		
Cutthroat trout	*Oncorhynchus clarki*		3	4.00	241.00	117.00		0.00				0.00				0.00		
Rainbow trout, wild	*Oncorhynchus mykiss*			0.00			1	16.67	140.00	21.00		0.00				0.00		
Steelhead	*Oncorhynchus mykiss*			0.00				0.00				0.00			1	2.08	169.00	78.00
Chinook salmon	*Oncorhynchus tshawytscha*			0.00				0.00			1	2.04	112.00	10.00		0.00		
Mountain whitefish	*Prosopium williamsoni*		10	13.33	148.00	34.00	4	66.67	157.00	29.00	9	18.37	197.00	75.00		0.00		
Brook trout	*Salvelinus fotinalis*			0.00				0.00				0.00				0.00		
n (Total Individuals)			75				6				49				48			

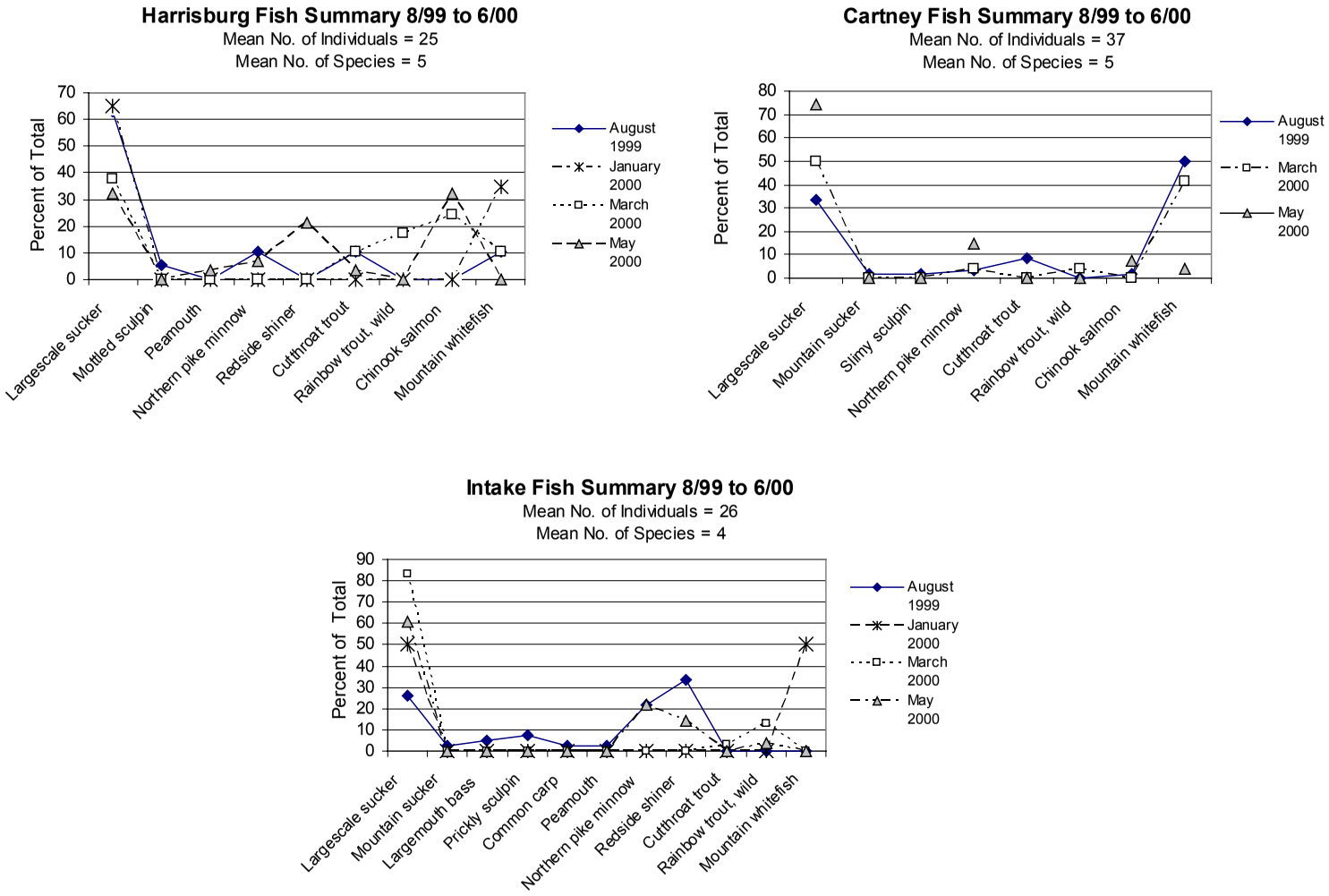


Figure 3.84 Percent Fish Distribution for Upstream Sites (Harrisburg, Cartney and Intake), Willamette River, September 1999 to June 2000, Boat Electrofishing

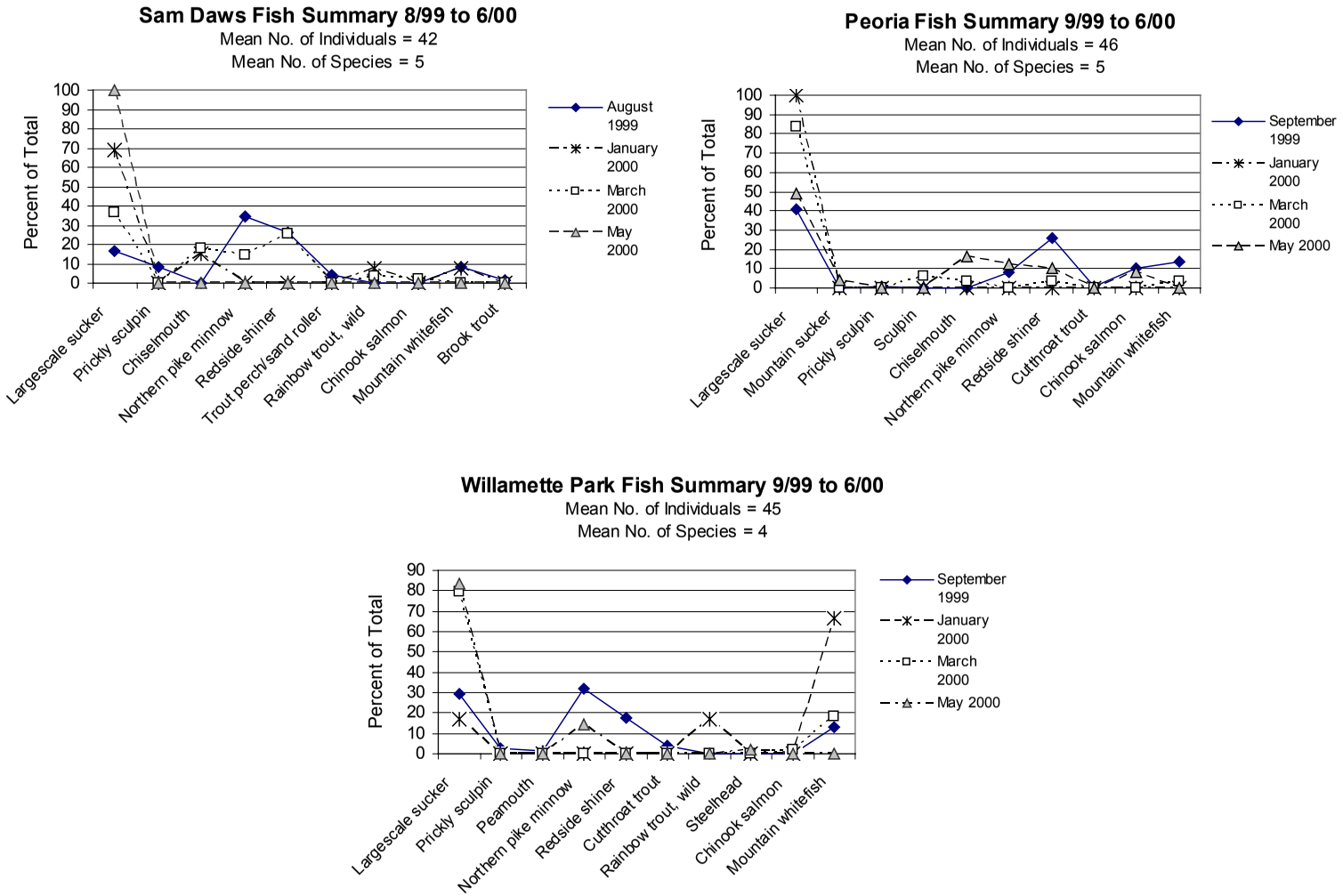


Figure 3.85 Percent Fish Distribution for Downstream Sites (Sam Daws, Peoria and Willamette Park), Willamette River, September 1999 to June 2000, Boat Electrofishing

Table 3.46 Willamette River: Backpack Electrofishing Data Summary for Fall 1999

WILLAMETTE RIVER		HARRISBURG (RM 160)				CARTNEY (RM 156)				SAM DAWS (RM 145)				NILLAMETTE PARK (RM 134			
Sampling Date/# of runs =		08/31/99			3 Runs	08/31/99			3 Runs	08/31/99			3 Runs	08/31/99			2 Runs
		Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)	Count	% of Total	Mean Total Length (mm)	Mean Weight (g)
Suckers (Catostomidae):																	
Largescale sucker	*Castomus macrocheilus*		0.00				0.00			8	1.67	51.60	1.10		0.00		
Sunfish (Centrarchidae):																	
Smallmouth bass	*Micropterus dolomieu*		0.00				0.00			2	0.42		1.91		0.00		
Sculpins (Cottidae):																	
Prickly sculpin	*Cottus asper*	1	0.40	144.00	46.21		0.00			1	0.21	61.00	2.21		0.00		
Mottled sculpin	*Cottus bairdi*		0.00				0.00				0.00			8	7.08	38.63	0.83
Paiute sculpin	*Cottus beldingi*	6	2.37	75.50	6.28		0.00				0.00			9	7.96	37.88	1.08
Slimy sculpin	*Cottus congnatus*		0.00				0.00				0.00			1	0.88	31.00	0.28
Shorthead sculpin	*Cottus confusus*		0.00				0.00				0.00			4	3.54	39.75	0.60
Reticulate sculpin	*Cottus perplexus*	46	18.18	67.78	4.61	4	1.02	77.25	6.35	1	0.21	75.00	5.24	12	10.62	39.09	6.96
Torrent sculpin	*Cottus rhotheus*	27	10.67	51.33	3.38	123	31.30	46.47	1.34		0.00			52	46.02	44.08	1.06
Sculpin		71	28.06	37.36	1.31	42	10.69	40.71	0.90	32	6.68	40.68	0.76	4	3.54	33.00	0.50
Carps and Minnows (Cyprinidae):																	
Blacknose dace	*Rhinichthys atratulus*		0.00			1	0.25	60.00	1.70		0.00				0.00		
Longnose dace	*Rhinichthys cataractae*	15	5.93	61.07	2.03	10	2.52	54.90	1.45		0.00				0.00		
Speckled dace	*Rhinichthys osculus*	7	2.77	52.86	1.52	18	4.53	46.50	1.06		0.00			4	3.54		0.48
Dace	*Rhinichthys*	62	24.51	43.26	0.97	190	47.86	46.05	1.05	6	1.25		1.58		0.00		
Redside shiner	*Richardsonius balteatus*	6	2.37	71.67	3.28		0.00				0.00			17	15.04		0.33
Cyprinid		1	0.40	68.00	3.42	1	0.25		2.08	54	11.27				0.00		
Lamprey (Petromyzontidae):																	
Western brook lamprey	*Lampetra richardsoni*	11	4.35	108.91	2.59	4	1.01	75.34	2.43	33	6.89	95.55	1.63	2.0	1.77	102.00	1.75
Fish:																	
Fish			0.00			4	1.01			342	71.40				0.00		
n (Total Individuals)		253				397				479				113			

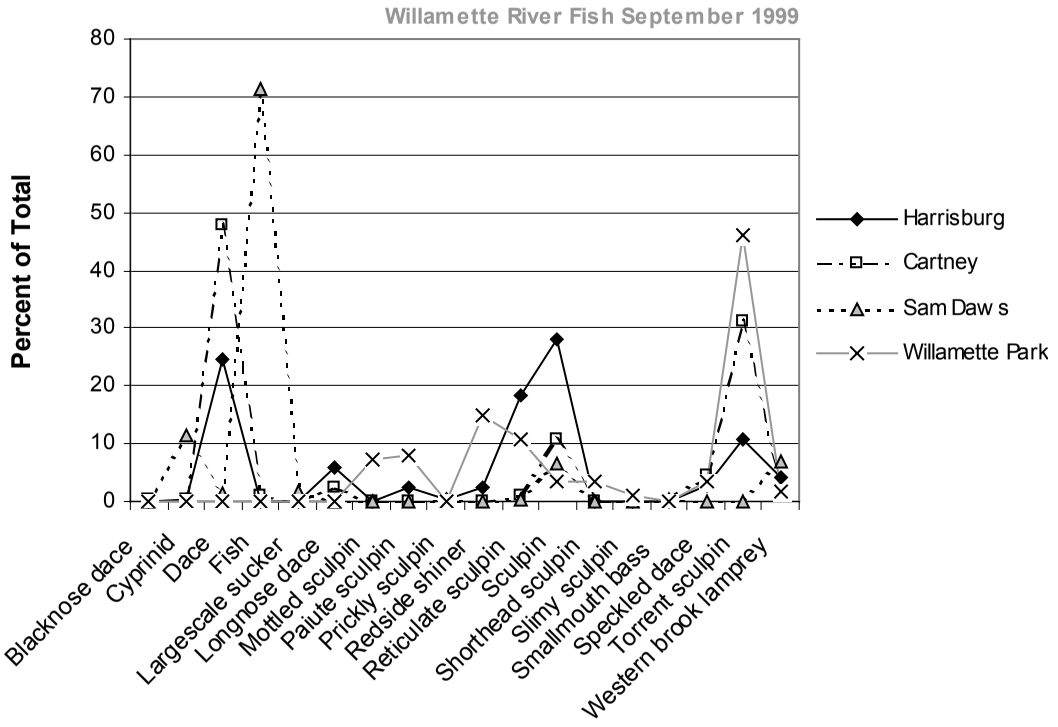


Figure 3.86 Willamette River Backpack Fish Distribution for September, 1999

4.0 SUMMARY AND CONCLUSIONS

This compendium characterizes the depth and extent of data collected in the LTRWS and provides a summary of monitoring parameters for the 1999 to 2000 study year. Additional reports will be issued for each study year over the course of the LTRWS. These data represent in part the information that will be utilized in addressing the overall study objective of fully assessing the potential for mill effluent effects on the aquatic community in effluent receiving waters.

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