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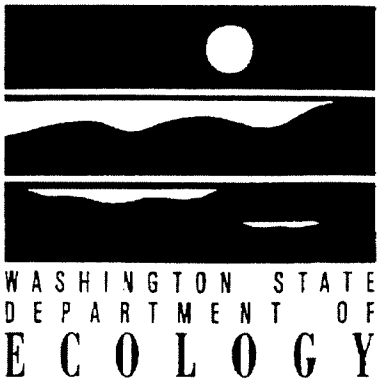

PROGRESS REPORT NO. 1
PEND OREILLE RIVER WATER QUALITY STUDY

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ABSTRACT

A study was conducted by the Washington State Department of Ecology to address water quality concerns of the Pend Oreille River between Albeni Falls and Box Canyon dams. Five stations were sampled every three weeks between July and November 1988. Water quality is generally good and well below the threshold of eutrophic conditions. Phytoplankton species were typical of oligotrophic to mesotrophic waters. Periphyton concentrations were well below nuisance levels for aesthetic impairment. Macrophytes are responsible for water quality violations for pH and total dissolved gases during the peak of the growing season. There was no significant difference between sample stations for nutrients, suggesting macrophyte occurrence and sediments do not elevate instream nutrient loads. Brackett Creek, Skookum Creek, and South Fork Lost Creek exceeded Class A water quality standards for fecal coliform.

1.0 INTRODUCTION.

A three-state coordinated study of the Clark Fork/Pend Oreille River drainage basin has been initiated to address interstate and local water quality concerns. The 26,000 square-mile drainage basin of the Pend Oreille River extends into Washington, Idaho, and Montana, and crosses into Canada. Both Montana and Idaho are conducting studies to address problems in their portion of the drainage basin. Congress has authorized funding through Section 525 of the Clean Water Act to evaluate problems within the basin for a multi-year coordinated interstate project.

In Washington, the Pend Oreille River (Figure 1) between Albeni Falls Dam (r.m. 90) and Box Canyon Dam (r.m. 34) is a slow-moving, relatively flat reach with a worsening Eurasian water milfoil problem. The spread of milfoil and the trophic condition of the Washington reach are of great concern to the local community. Upstream nutrient discharges are suspected of exacerbating the milfoil problem. The present study will characterize trophic conditions within the reach and evaluate significant sources of external and internal nutrient loading to the river.

A separate ongoing program aimed at control of milfoil is being funded jointly by the Army Corps of Engineers, Washington Department of Ecology, and local sources. Pertinent results of that study will be incorporated into the present study to evaluate macrophytes' influence on the trophic status of the reach. Additional work within the Washington reach includes a Bonneville Power Administration funded study to assess fishery improvement opportunities; a baseline study of fisheries and water quality funded by Rust International, the parent company to the Ponderay Newsprint Mill; and the University of Idaho is performing a study of fish, wildlife, and recreational characteristics of Box Canyon Reservoir for the Pend Oreille County Public Utility District.

2.0 OBJECTIVES

- Evaluate trophic conditions within the river system, including identification of limiting nutrients and characterization of current trophic status.
- Develop a seasonal nutrient and water budget for the reach from Albeni Falls Dam to Box Canyon Dam (r.m. 90 to r.m. 34).
- Characterize external loading sources, including comparison of local tributaries, non-point and point sources.
- Evaluate potential internal loading of nutrients from macrophytes and sediments.

3.0 METHODS

3.1 SEASONAL RIVER AND TRIBUTARY SAMPLING

Representative indicator parameters (Table 1) were sampled in the river water column at five selected stations (Figure 1). Three cross-channel samples were taken at each station. Collections at three-week intervals were initiated in July 1988 and continued through the growing season until November 1988.

Routine sampling of index tributaries and point sources and random sampling of other inputs were also conducted to characterize the seasonal distribution of external nutrient and hydraulic sources.

3.2 TRIBUTARY INVENTORIES

Complete inventories of tributaries were conducted in August, September, and October 1988 in order to quantify the role of local surface water inputs in the overall hydraulic and nutrient loading regime.

3.3 MACROPHYTES, PERIPHYTON, AND PHYTOPLANKTON

Samples of macrophyte and periphyton tissue were collected at stations 2, 3, 4, and 5. Duplicate samples were collected at each station. Macrophyte nutritional analyses were performed on the second one-inch segment of *Myriophyllum spicatum* (Eurasian water milfoil) samples (Gerloff, 1975). Analyses of total organic carbon, total N, and total P were performed (Table 7).

Periphyton samples were collected from natural substrate located at a water depth of approximately 0.5 meter. Periphyton was scraped from within a 13 cm^2 circle using a brush and rinsed into a collection bottle (Welch *et al.*, 1988). Each sample was a composite of three separate 13 cm^2 scrapings. The composite periphyton samples were thoroughly mixed and diluted to one liter with de-ionized distilled water before aliquoting for individual analyses, which included chlorophyll *a*, total organic carbon, total N, and total P.

Samples for phytoplankton and periphyton enumeration and biovolume estimation were preserved with Lugol's solution and stored in the dark prior to analysis. All of the samples were analyzed by Aquatic Analysts, Inc., Portland, Oregon.

3.4 QUALITY ASSURANCE/QUALITY CONTROL

Laboratory precision and accuracy were tracked by routinely submitting blind field replicates and blanks. The quality assurance/quality control (QA/QC) samples represented greater than five percent of the total number of samples for each constituent. QC was monitored throughout the study by comparing observed laboratory precision (estimated as the standard deviation of blind field replicates) to target estimates of precision for each parameter (Table 1). All target control limits for precision were met. Analytical accuracy was checked by blind field blanks and analysis of Environmental Protection Agency (EPA) reference standards. Evaluation of external quality assurance samples revealed no bias for any laboratory determinations.

Analytical precision (defined as the pooled standard deviation of blind field replicates) were generally as good or better than reported performance for the method used (APHA, 1985). Phosphorus analysis precision was ± 2 ug P/L for both soluble reactive P and total P. Nitrogen analysis precision was ± 3 ug N/L for nitrate+ nitrite and ammonia, and ± 16 ug N/L for total N.

4.0 RESULTS

4.1 IN-RIVER SAMPLING

The results of water quality determinations are summarized in Table 2. All water quality data are listed in Appendix A. Water quality was well below the threshold indicative of eutrophic conditions (Table 2). Nutrient concentrations suggest a tendency toward nitrogen limitation, although both nitrogen and phosphorus may be limiting (Figures 3 and 4). Concentrations of total N and total P showed no significant differences ($L < 0.05$) between stations within the study area, which suggests that internal nutrient loading from macrophyte beds or sediments

does not significantly increase the river load (Figures 3 and 4). Dissolved oxygen and pH were in violation of Water Quality Standards in 33 and 31 percent of all measurements, respectively. Dissolved oxygen levels were consistently above the Class A standard at stations 2 through 5 for July, August, and ranged from 91 to 164 percent of saturation throughout the study (Appendix A). Nearshore surface concentrations from weed bed locations were consistently the highest found and probably were due to macrophyte and algal productivity. There was a general lack of stratification for the reach, likely due to presence of current and lack of deep pools.

4.2 TRIBUTARY SAMPLING

River discharge was lower than normal during the study period, averaging 13,100 cfs at Newport (r.m. 88.2) and 13,500 cfs below the Box Canyon Dam (r.m. 38.7). For comparison, the average annual flow at Newport is 25,500 cfs, average July through November flow is 19,100 cfs, and the seven-day low flow with a recurrence interval of once every ten years (7Q10) is 4,500 cfs (Williams and Pearson, 1985). Precipitation for the study period totaled 7.61 inches, with two-thirds occurring in November. Normal precipitation for this period is 9.16 inches.

The water budget for the study area is dominated by inflow from upstream sources (Figure 2, Table 3). The highest flows typically occur during May and June at peak snowmelt runoff (Figure 7). Water quality sampling conducted July through November 1988 coincided with seasonally low discharge rates and expected maximum biological activity in the river.

Local tributary and ground water inflow was estimated based on observed differences in discharge between the Box Canyon Dam (r.m. 38.7) and Newport (r.m. 88.2) gages, corrected for evaporation and precipitation. A net positive inflow of water is predicted for the study period (Figure 2). However, the uncertainty surrounding the estimated inflow is relatively large as a result of the high ratio of upstream inflow to local inflows within the reach. The water budget for the reach suggests a net input of approximately 457 ± 941 cfs from local sources (Table 3 and Figure 2).

Twenty-two tributaries, including the Newport Waste Treatment Plant (WTP) were identified in the inventory of local inflows within the study area. The average total discharge from the local tributaries (97 ± 15 cfs; Table 3) was less than the mean predicted from the water budget. This suggests that a net ground water inflow may occur within the reach. However, the measured tributary discharge is within the confidence limits of the water budget estimation.

Total N and total P concentrations and loads are presented in Tables 4 and 5. Inputs of total N and total P from tributaries within the study area accounted for less than four percent of the total river loading. Dry weather, low flow conditions for the study period probably minimized tributary N and P inputs from non-point sources. The Newport WTP, Calispell Creek, and Trimble Creek represent the three largest local nutrient inputs within the study area. The Newport WTP contributes eight percent of the total N load and approximately half of the total P load from local inputs. Calispell Creek contributes approximately half of the total N load and 18 percent of the local total P load. Trimble Creek contributes approximately 20 percent of the local total N load and six percent of the local total P load.

The Newport WTP is the only permitted NPDES source within the reach, with the Ponderay Newsprint Mill expected to start discharging in December 1989. Total N concentrations in the Newport WTP effluent are approximately 20 times higher and total P concentrations are about 200 times higher than the average from the local creeks in the study area. The Newport WTP is currently discharging approximately 50 percent of the permissible load for this facility (Ecology, 1985). Therefore, at the 0.5 mgd permitted design flow, total N and total P loads

would approximately double. Permitted loads from the Newport WTP would then constitute less than one percent of the total N load and about ten percent of the total P budget (including upstream sources) at the 7Q10 low river flow.

Fecal coliform densities and loads are summarized in Table 6. Brackett Creek, Skookum Creek, and South Fork Lost Creek exceeded Class A water quality standards for fecal coliform levels. The ratio of fecal coliform to fecal streptococci bacteria suggest that human sources may be contributing to the observed elevations. In addition to the three creeks mentioned above, human sources are also suggested at the main stem of Lost Creek. It should be noted there are uncertainties that exist with the fecal coliform to fecal streptococci ratio, due to differential die off rates. Long travel times from their source can lead to erroneous results, but in general the ratio can be viewed as an indicator.

4.3 MACROPHYTES, PERIPHYTON, AND PHYTOPLANKTON

Nuisance growths of Eurasian water milfoil occupy a major portion of the shallow embayments and shoreline areas of the Pend Oreille River below r.m. 72. Migration of Eurasion water milfoil upstream from r.m. 72 is also occurring at a rate of approximately six miles per year, probably due to boating activities (Water, 1988).

Pend Oreille County initiated a Milfoil Control Program in 1984 aimed at reducing areal coverage and density of milfoil beds and slowing upstream migration. Control practices currently focus on rotavation as a removal technique. The distribution of areal macrophyte coverage in the river is well known based on annual mapping surveys, the most recent of which was conducted in August 1988 (Water, 1988).

The nutritional status of Eurasian water milfoil and resident periphyton communities was evaluated by collecting duplicate samples from stations 2, 3, 4, and 5 (Figure 1). The results of macrophyte and periphyton analyses are summarized in Table 7. In general, both macrophytes and periphyton appear to be deficient in nitrogen, which suggests that increased nitrogen loads from upstream sources could stimulate growth. However, macrophytes in the Pend Oreille River probably derive most of their N and P supplies from sediments through the root systems, due to the relatively low water column levels of these nutrients (Collins *et al.*, 1985).

Milfoil colonization and spread has been attributed to increasing nutrients in the river. The work by Determan (1986) found that nutrient concentrations have remained relatively constant and that no upward trend was present but milfoil has increased. This is not unexpected given the results from studies by Bole and Allan (1978) using milfoil and hydrilla. They found uptake of P was mostly, if not all, from the sediments when the overlaying water contained 15 ug P/L (mean study concentration 9.6 ug P/L). At 500 ug P/L (hypereutrophic), milfoil used largely sediment P; but at 2,000 ug P/L, sediment P uptake decreased and uptake of water-P increased.

Substrate differences have also been found to affect macrophyte species composition and distribution and seems to be related to sediment organic content. Barko (1985) found growth of milfoil and *hydrilla* in 40 natural sediments had wide variation, but in general was uniformly diminished in sediments with high organic content and in sand. In short, the production of milfoil is regulated by habitat substrate. Nuisance growths are not necessarily due to human environmental alterations. Where habitat and sufficient substate nutrients exist, plant growth will occur.

Periphyton concentrations generally were well below nuisance levels for aesthetic impairment (Welch *et al.*, 1988). This finding is consistent with the low nutrient levels in the water column and the low current velocities throughout the nearshore areas of the river, since periphyton biomass is generally related to both nutrient concentrations and current velocity (Horner and Welch, 1981). Periphyton levels from r.m. 39 to 72 appear to be limited by nitrogen, which is also consistent with total N:P ratios in the water column. This suggests that periphyton growths could be stimulated by increased nitrogen levels in the river.

Phytoplankton community structure was indicative of unpolluted waters. The predominant phytoplankton species observed (Appendix D) were *Rhodomonas minuta* (cryptomonad) and the diatoms *cocconeis disculus* and *Fragilaria construens*. All three are commonly found in northwest lakes and rivers ranging from oligotrophic to eutrophic conditions (Sweet, 1987). The general composition of phytoplankton present are indicative of oligotrophic to mesotrophic water quality, which is consistent with the generally low (Table 2) nutrient and chlorophyll *a* concentrations in the water column.

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Table 1. Pend Oreille River water quality study: summary of sampling and analytical methods.

Parameter	Analytical Method	Method Reference(1)	Target Precision (ug/L)	Sample Collection Method(2) River	Tribs
Temperature	Thermistor	--	--	1	2
pH	Field Probe	SM423	--	1	2
Dissolved Oxygen	Field Probe	SM421F	--	1	2
Turbidity	Nephelometer	SM214A	--	3	4
Total Suspended Solids	Gravimetric	SM209C	--	3	4
Sp. Conductance	Field Probe	SM205	--	1	2
Alkalinity	Titration	SM403	--	3	4
Soluble Reactive P	Ascorbic Acid	EPA 365.3	1	5	4
Particulate P	Persulfate Digest, Ascorbic Acid	EPA 365.3	--	5	4
Total P	Persulfate Digest, Ascorbic Acid	EPA 365.3	2	5	4
Ammonia N	Phenate	SM417C	5	5	4
Nitrate + Nitrite N	Cadmium Reduction	SM418C	5	5	4
Total N	Persulfate Digest, Cadmium Reduction	D'Elia et al, 1977	10	5	4
Chlorophyll a	Trichromatic	SM1002G	--	3	--
Biovolume	Invert Scope	SM1002F	--	4	--
Fecal Coliform	Membrane Filter	SM909C	--	4	4
Fecal Streptococci	Membrane Filter	SM910B	--	4	4
Total Organic Carbon	Ascarite Trap	PSEP	--	6	--

FOOTNOTES:

1) SM: Standard Methods for the Examination of Water and Wastewater, 16th ed., APHA-AWWA-WPCF, 1985.
   EPA: Methods for Chemical Analysis of Water and Wastes. EPA 600/4-79-020. D'Elia, C.F., P.A. Steadler, and N. Corwin, 1977. Determination of total N in aqueous samples using persulfate digestion. Limn. Ocean. 22:760-764.
   PSEP: Puget Sound Estuary Program, Puget Sound Protocols, Tetra Tech, 1986.

2) Code for sampling method during each sampling event:
   1: Minimum of three cross-channel readings below water surface. Stations 2-5 included depth profiles at 1-5 m intervals.
   2: Single mid-channel reading at time of sampling.
   3: Minimum of two cross-channel grab samples.
   4: Single mid-channel grab sample.
   5: Three cross-channel grab samples below surface at stations 1-3, two cross-channel below surface grabs and 5 m depth grab at station 4, and one grab each from 0.5 m, 5 m and 10 m at station 5.
   6: Periphyton samples were collected from natural substrate located at a water depth of approximately 0.5 meter. Periphyton was scraped from within a 13 cm^2 circle using a brush and rinsed into a collection bottle.

Table 2. Summary of water quality determinations. Summary statistics represent all river stations and sampling events

Parameter	Units	Mean		Standard Error	Number of Samples	Water Quality Criteria/Standards: State Class A Standards(2)	Water Quality Criteria/Standards: Reservoir Eutrophication Criteria(6)
Temperature	deg C	16.4	+/-	0.5	91	<18.0	--
pH	Std Units	8.22	+/-	0.04	91	6.5-8.5	--
Alkalinity	mg CaCO3/L	71.9	+/-	0.5	63	--	--
Dissolved Oxygen	mg/L	9.5	+/-	0.1	90	>8.0	--
Dissolved Oxygen	% saturation	105	+/-	1	90	<110%(3)	--
Turbidity	NTU	1.3	+/-	0.1	53	<5 (4)	--
Total Suspended Solids	mg/L	0.7	+/-	0.1	70	--	--
Specific Conductance	umho/cm @ 25C	162.7	+/-	0.7	86	--	--
Secchi Disk Depth	meters	4.5	+/-	0.2	14	--	1.5-2
Light Extinction	meters^-1	0.314	+/-	0.008	9	--	--
Soluble Reactive P	ug P/L	4.8	+/-	0.3	100	--	--
Total Soluble P	ug P/L	4.5	+/-	0.2	82	--	--
Total P	ug P/L	9.6	+/-	0.2	101	--	20-30
Ammonia N	ug N/L	11.9	+/-	1.1	94	--	--
Nitrate + Nitrite N	ug N/L	<10	+/-	<10	94	--	--
Total N	ug N/L	82.3	+/-	3.7	102	--	--
Total N:P Ratio	unitless wt/wt	8.9	+/-	0.5	101	--	--
Active Chlorophyll a	ug/L	1.8	+/-	0.1	68	--	6-10
Phytoplankton Biovolume	mm3/m3	185	+/-	32	17	--	5,000
Fecal Coliform	CFU/100mL(1)	0.7		2.2	24	100, 200(5)	--
Fecal Streptococci	CFU/100mL	0.6		2.4	29	--	--

1) CFU = Colony forming unit
2) Washington Administrative Code Chapter 173-201
3) <110% refers to total dissolved gases
4) <5 NTU increase over background
5) Geometric mean and upper 10%tile are given in place of mean and standard error, respectively.
6) After Welch, 1980

Table 3. Summary of discharge rates during the July-November study period.

Location	Discharge (cfs) Mean	+/-	S.E.
RIVER WATER BUDGET, JULY-NOVEMBER 1988			
Pend Oreille River at Newport (1) (r.m. 88.2)	13,095	+/-	655
Pend Oreille River below Box Canyon Dam (1) (r.m. 38.7)	13,483	+/-	674
Evaporation (2)	91	+/-	45
Precipitation (3)	22	+/-	4
Net Local Inflow (4)	457	+/-	941
TRIBUTARY INVENTORY			
Newport WTP	0.4		--
Big Muddy Ck	0.8	+/-	0.2
Brackett Ck	0.2	+/-	0.1
Calispell Ck	25.5	+/-	15.1
Cedar Ck	2.3	+/-	0.6
Cee Cee Ah Ck	3.3	+/-	0.5
Cusick Ck	0.1	+/-	0.0
Davis Ck	3.3	+/-	0.8
Gardiner Ck	0.3	+/-	0.0
Indian Ck	2.1	+/-	0.3
Kent Ck	0.2	+/-	0.2
LeClerc Ck	26.0	+/-	2.3
Little Muddy Ck	0.8	+/-	0.2
Lost Ck	1.4	+/-	0.2
Marshall Ck	0.8	+/-	0.1
Middle Ck	1.4	+/-	0.1
Mill Ck	2.3	+/-	0.3
Ruby Ck	3.2	+/-	0.3
Skookum Ck	10.1	+/-	1.2
S. Fork Lost Ck	0.5	+/-	0.2
Tacoma Ck	9.6	+/-	1.6
Trimble Ck	1.6	+/-	0.8
TOTAL MEASURED TRIBUTARY INPUT	96	+/-	15

1) Provisional USGS data
2) Calculated from meteorological data (Linsley et al., 1975) from Spokane WSO AP (NOAA, 1988)
3) NOAA climatological data for Newport and Boundary Dam (NOAA, 1988).
4) Difference between Box Canyon Dam (r.m. 38.7) and Newport (r.m. 88.2) discharge corrected for evaporation and precipitation.

Table 4. Summary of total N concentrations and loads, July-November, 1988.

LOCATION	Total N (ug N/L) Mean +/- S.E.	Total N (Kg N/day) Mean +/- S.E.
RIVER		
Pend Oreille River at Newport (r.m. 88.2)	84 +/- 9	2,686 +/- 315
Pend Oreille River at Ione (r.m. 38.7)	93 +/- 12	3,075 +/- 432
TRIBUTARY INVENTORY		
Newport WTP	4,850 +/- 1,190	4.509 +/- 1.106
Big Muddy Ck	61 +/- 18	0.117 +/- 0.046
Brackett Ck	102 +/- 21	0.050 +/- 0.016
Calispell Ck	488 +/- 63	30.471 +/- 18.461
Cedar Ck	29 +/- 4	0.159 +/- 0.044
Cee Cee Ah Ck	32 +/- 7	0.253 +/- 0.067
Cusick Ck	112 +/- 14	0.035 +/- 0.004
Davis Ck	190 +/- 26	1.516 +/- 0.424
Gardiner Ck	25 +/- 0	0.021 +/- 0.001
Indian Ck	41 +/- 16	0.216 +/- 0.087
Kent Ck	173 +/- 41	0.091 +/- 0.083
LeClerc Ck	50 +/- 9	3.180 +/- 0.632
Little Muddy Ck	22 +/- 2	0.040 +/- 0.013
Lost Ck	62 +/- 17	0.211 +/- 0.061
Marshall Ck	48 +/- 10	0.089 +/- 0.019
Middle Ck	29 +/- 4	0.097 +/- 0.015
Mill Ck	36 +/- 6	0.207 +/- 0.044
Ruby Ck	88 +/- 16	0.685 +/- 0.145
Skookum Ck	79 +/- 18	1.949 +/- 0.495
S. Fork Lost Ck	38 +/- 10	0.049 +/- 0.021
Tacoma Ck	56 +/- 12	1.318 +/- 0.358
Trimble Ck	2,800 +/- 1,586	10.960 +/- 8.281
FLOW WEIGHTED AVERAGE TRIBUTARY INPUT	221 +/- 347	56 +/- 20
NET RIVER INCREASE (r.m. 88.2-38.7)	9.4 +/- 15.1	389 +/- 535

Table 5. Summary of total P concentrations and loads, July-November, 1988.

LOCATION	Total P (ug P/L) Mean +/- S.E.	Total P (Kg P/day) Mean +/- S.E.
RIVER		
Pend Oreille River at Newport (r.m. 88.2)	9.6 +/- 0.5	307 +/- 23
Pend Oreille River at Ione (r.m. 38.7)	10.2 +/- 0.4	337 +/- 21
TRIBUTARY INVENTORY		
Newport WTP	5,660 +/- 226	5.262 +/- 0.210
Big Muddy Ck	12.0 +/- 0.9	0.023 +/- 0.006
Brackett Ck	17.5 +/- 2.9	0.009 +/- 0.003
Calispell Ck	32.4 +/- 3.1	2.024 +/- 1.213
Cedar Ck	11.2 +/- 1.2	0.062 +/- 0.017
Cee Cee Ah Ck	14.0 +/- 1.3	0.112 +/- 0.021
Cusick Ck	36.6 +/- 2.2	0.011 +/- 0.001
Davis Ck	31.6 +/- 8.7	0.253 +/- 0.093
Gardiner Ck	18.4 +/- 0.4	0.016 +/- 0.001
Indian Ck	8.9 +/- 0.9	0.046 +/- 0.008
Kent Ck	13.5 +/- 0.5	0.007 +/- 0.006
LeClerc Ck	8.6 +/- 1.4	0.549 +/- 0.100
Little Muddy Ck	7.4 +/- 0.9	0.014 +/- 0.004
Lost Ck	11.5 +/- 0.8	0.039 +/- 0.005
Marshall Ck	7.1 +/- 1.8	0.013 +/- 0.003
Middle Ck	15.0 +/- 1.0	0.050 +/- 0.005
Mill Ck	16.7 +/- 1.1	0.095 +/- 0.015
Ruby Ck	28.8 +/- 1.7	0.225 +/- 0.027
Skookum Ck	22.7 +/- 2.8	0.562 +/- 0.095
S. Fork Lost Ck	15.6 +/- 2.1	0.020 +/- 0.007
Tacoma Ck	39.6 +/- 2.9	0.926 +/- 0.171
Trimble Ck	175.3 +/- 79	0.686 +/- 0.461
FLOW WEIGHTED AVERAGE TRIBUTARY INPUT	25 +/- 17	11 +/- 1
NET RIVER INCREASE (r.m. 88.2-38.7)	0.6 +/- 0.6	29 +/- 31
WATER QUALITY CRITERIA		
Tributary eutrophication (EPA, 1986)	50 --	-- --
Reservoir eutrophication (Welch, 1980)	25 --	-- --

Table 6. Summary of fecal coliform loads, July-November, 1988.

LOCATION	Fecal Coliform (CFU/100mL) Geo. Mean	Fecal Coliform (CFU/100mL) Upper 10%tile	Fecal Coliform (bill.CFU/day) Geo. Mean	Fecal Coliform (bill.CFU/day) Upper 10%tile	FC:FS Ratio
RIVER					
Pend Oreille River at Newport (r.m. 88.2)	0.7	2.5	224	801	--
Pend Oreille River at Ione (r.m. 38.7)	0.4	1.2	132	396	--
TRIBUTARY INVENTORY					
Newport WTP	76	422*	0.7	3.9	--
Big Muddy Ck	11	53	0.2	1.0	0.5
Brackett Ck	45	315*	0.2	1.5	0.3
Calispell Ck	19	143	11.9	89.2	2.0
Cedar Ck	3	18	0.2	1.0	0.4
Cee Cee Ah Ck	6	25	0.5	2.0	0.2
Cusick Ck	61	193	0.2	0.6	0.4
Davis Ck	57	137	4.6	11.0	0.5
Gardiner Ck	3	10	0.0	0.1	0.1
Indian Ck	1	3	0.1	0.2	0.1
Kent Ck	4	4	0.0	0.0	0.1
LeClerc Ck	2	12	1.3	7.6	0.3
Little Muddy Ck	3	22	0.1	0.4	0.4
Lost Ck	64	161	2.2	5.5	2.6
Marshall Ck	0	1	0.0	0.0	0.0
Middle Ck	2	3	0.1	0.1	0.4
Mill Ck	0	1	0.0	0.1	0.0
Ruby Ck	2	6	0.2	0.5	0.1
Skookum Ck	111*	504*	27.5	125.0	3.6
S. Fork Lost Ck	98	1,300*	1.3	16.9	1.9
Tacoma Ck	43	104	10.1	24.3	0.7
Trimble Ck	11	13	0.4	0.5	0.1
TOTAL MEASURED TRIBUTARY INPUT	--	--	61	288	--
NET RIVER INCREASE (r.m. 88.2-38.7)	-0.3	-1.3	-92	-405	--
WATER QUALITY CRITERIA					
Class A Standard(a)	100	200	--	--	--
SOURCE INDICATOR (after Geldrich, 1976)					
human	--	--	--	--	>4
unknown	--	--	--	--	0.6 - 4
non-human	--	--	--	--	<0.6

* Violates Water Quality Standards

(a) Fecal coliform organisms shall not exceed a geometric mean value of 100 organisms/100 mL, with not more than 10 percent of samples exceeding 200 organisms/100 mL.

Table 7. Summary of macrophyte and periphyton nutritional status, August 1988.

PARAMETER	UNITS	Mean	+/-	Std Error	No. of Samples	WATER QUALITY/NUTRITIONAL CRITERIA: Critical Nutritional(1) Concentration	Nitrogen Limitation	Aesthetic Nuisance(2)
MACROPHYTES								
Total Organic C	% of dry wt	27	+/-	1.4	8	--	--	--
Total N	% of dry wt	0.34	+/-	0.04	8	0.75	--	--
Total P	% of dry wt	0.28	+/-	0.02	8	0.07	--	--
Total N:P	unitless wt/wt	1.2	+/-	0.2	8	--	<7	--
PERIPHYTON								
Chlorophyll a	mg/m2	18	+/-	4	8	--	--	>100-150
Total N:P	unitless wt/wt	1.1	+/-	0.2	8	--	<7	--

1) Gerloff, 1975
2) Welch et al., 1988

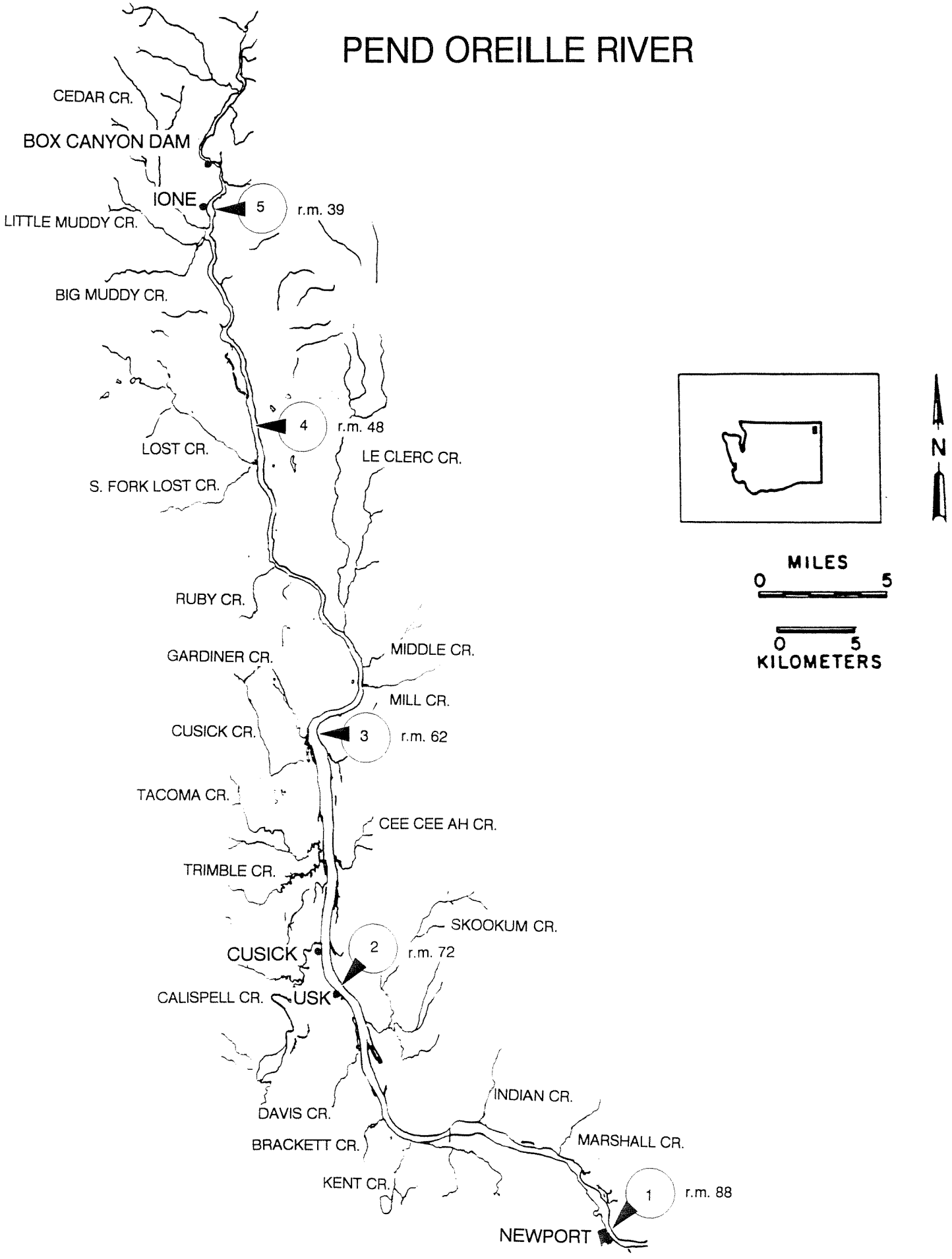

Figure 1. Water Quality Monitoring Stations.

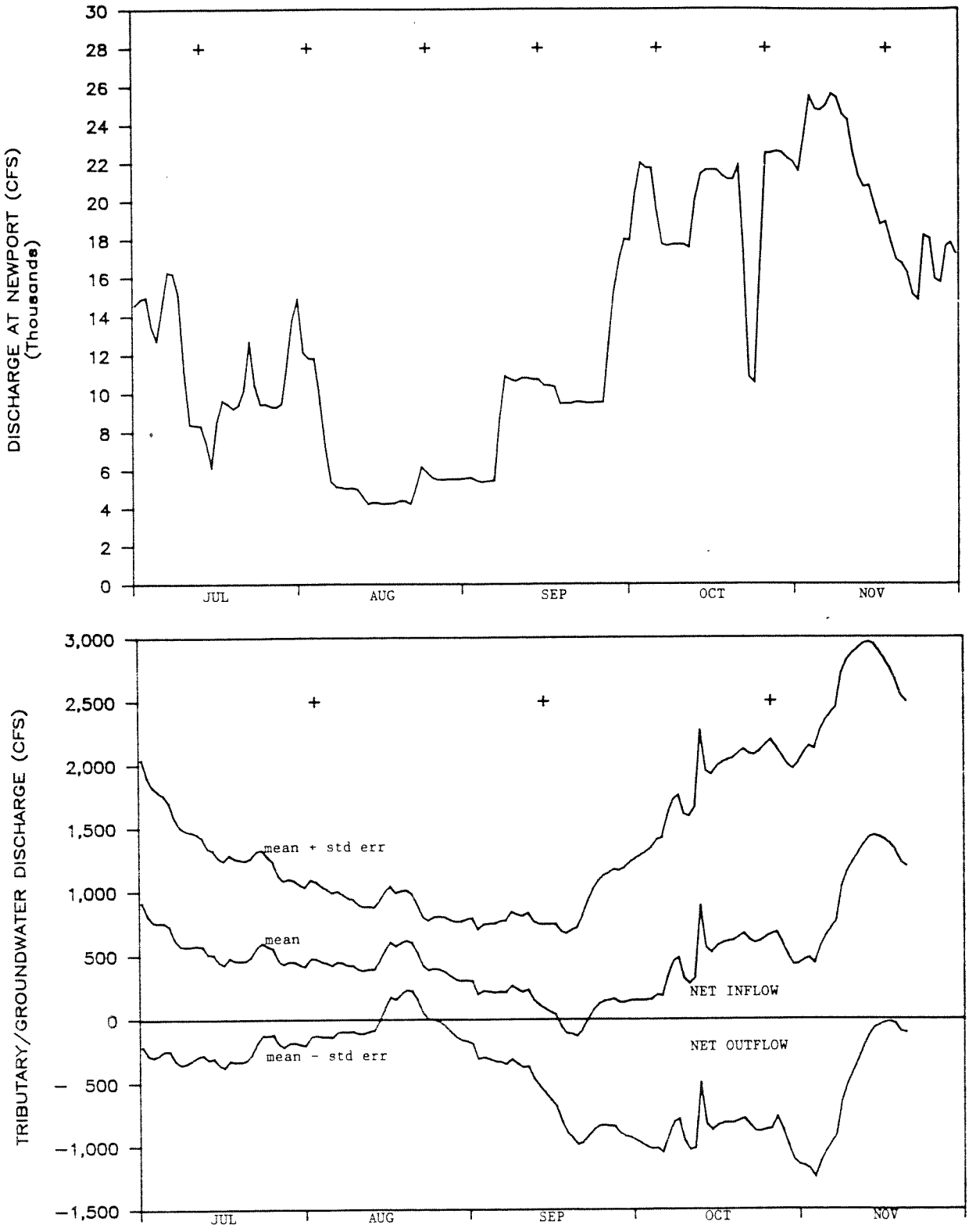

Figure 2. Pend Oreille River and local tributary discharge during the July-November, 1988 study period. Sampling events are indicated by (+).

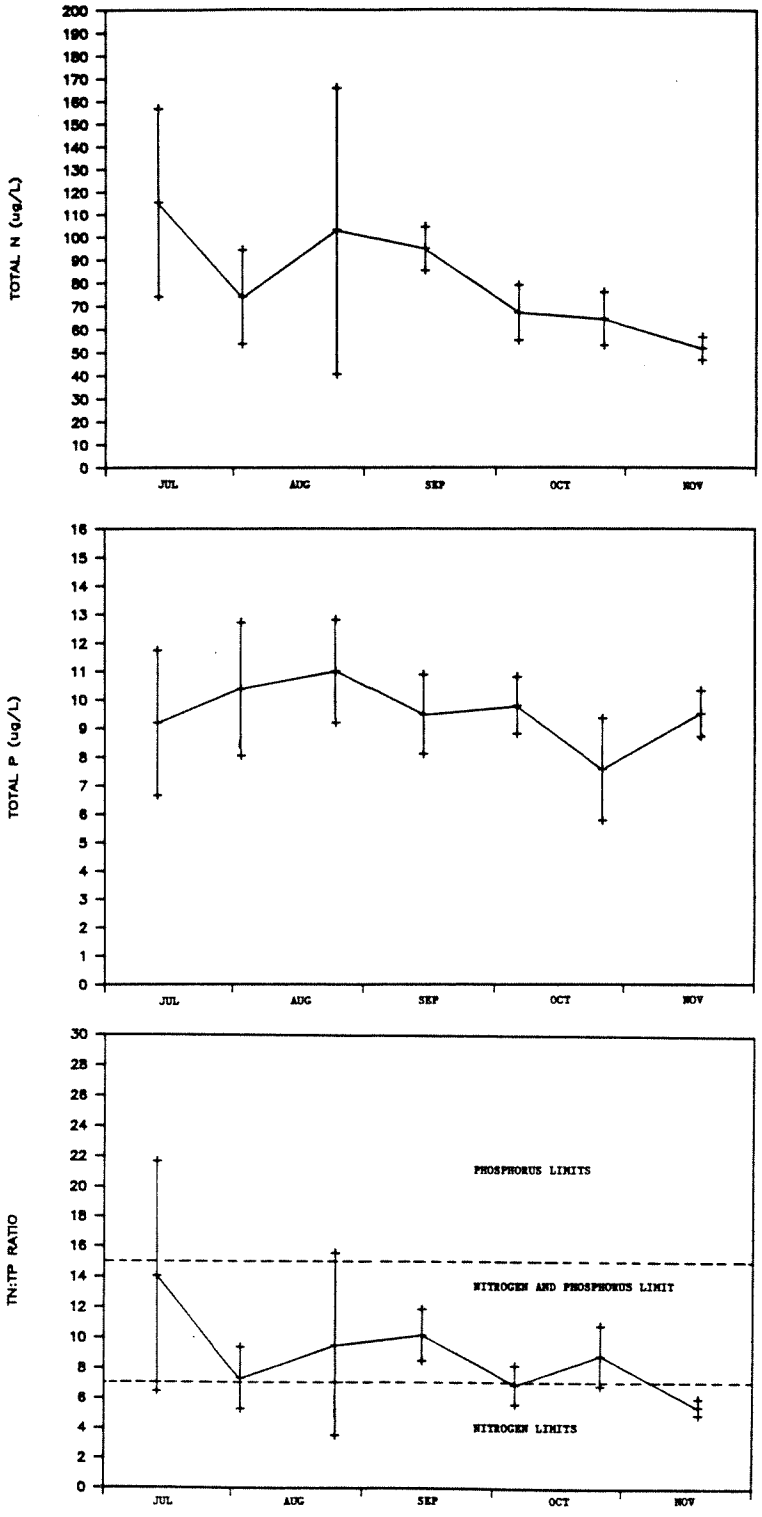

Figure 3. Summary of total N, total P, and total N:P ratios by sampling event during July-November, 1988. Means ± standard deviations are shown for each sampling event combining data from all stations.

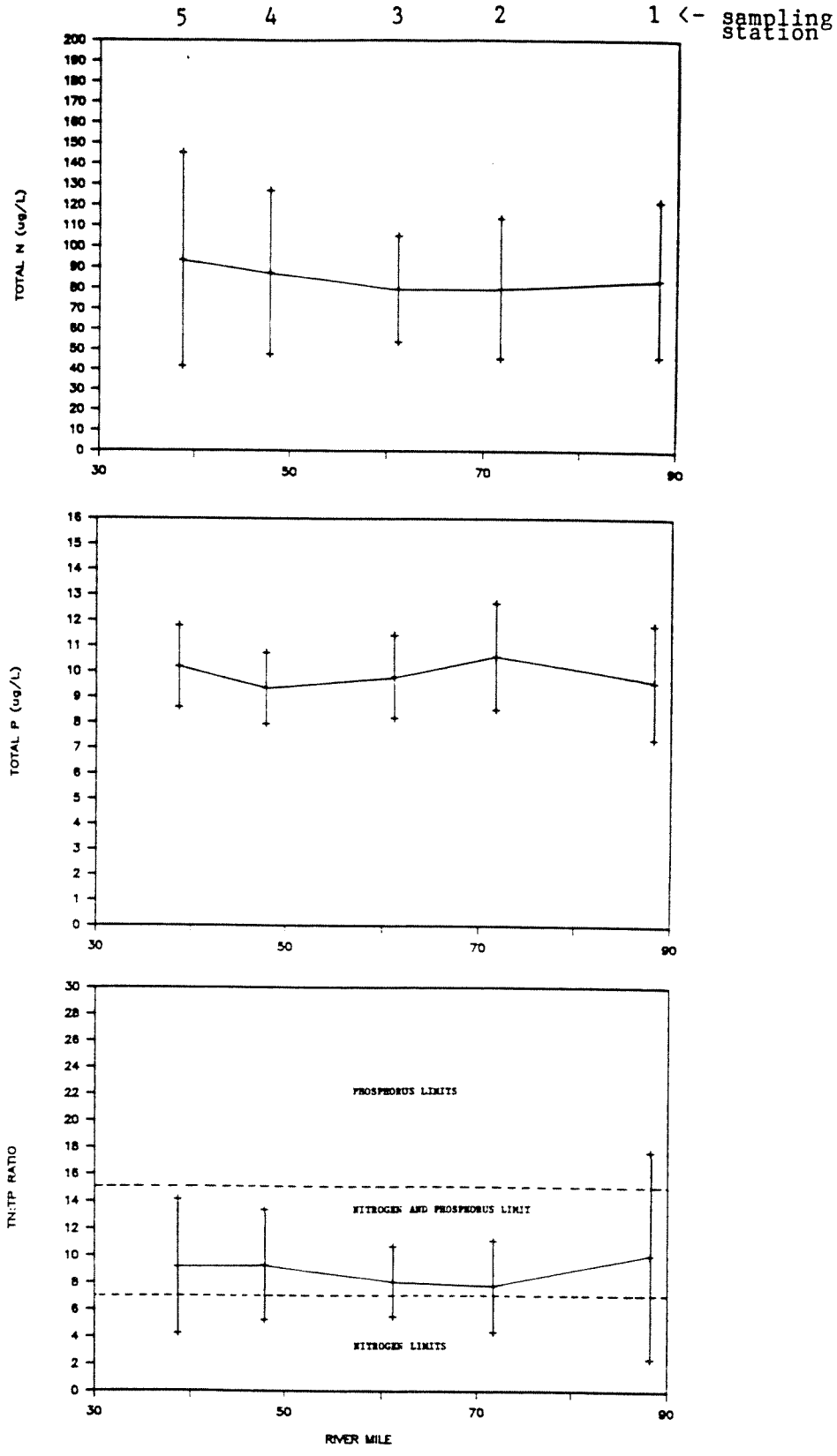

Figure 4. Summary of total N, total P, and total N:P ratios by sampling station during July-November, 1988. Means ± standard deviations are shown for each monitoring station combining data from all sampling events.

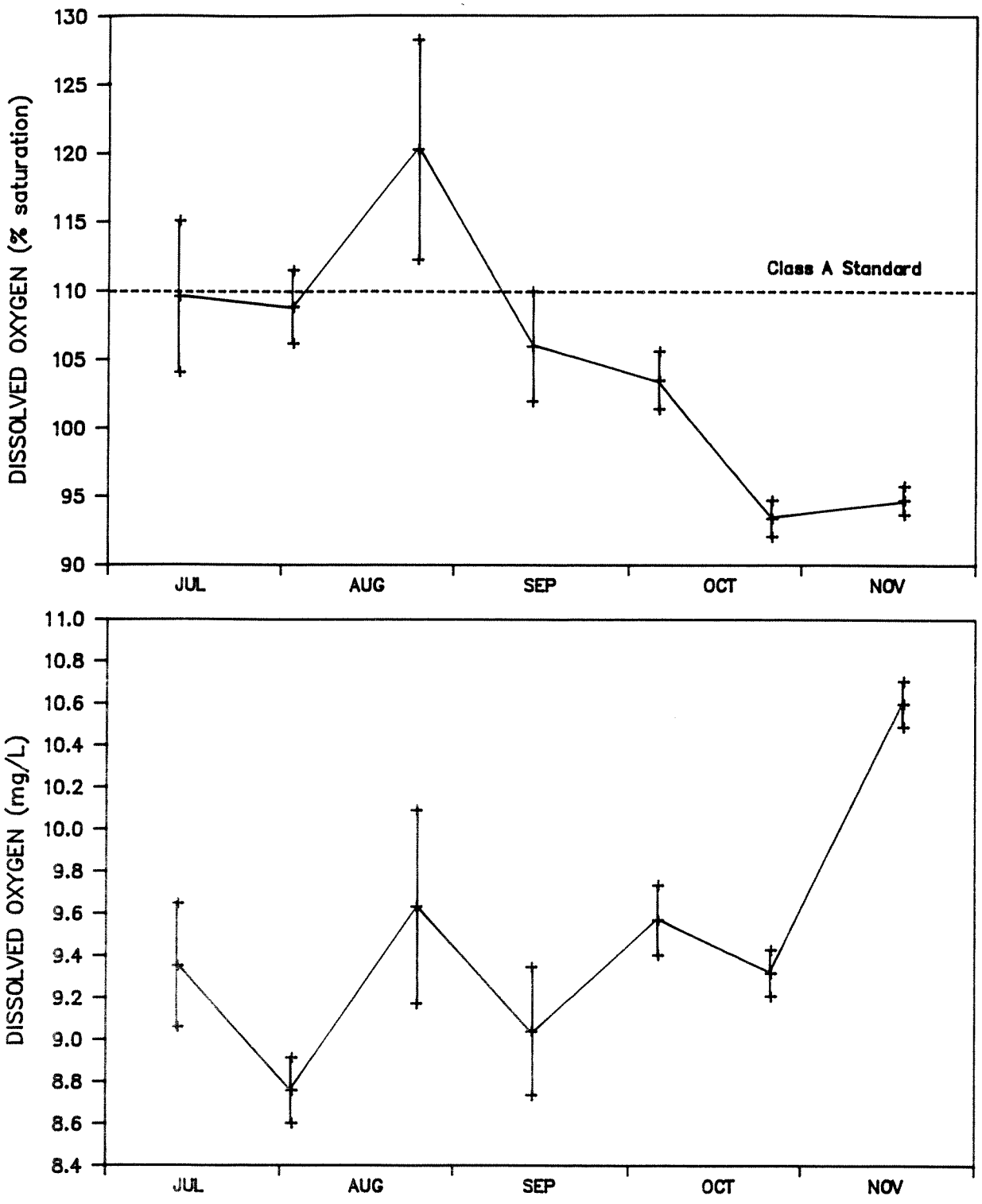

Figure 5. Summary of dissolved oxygen concentrations by sampling event July-November 1988.

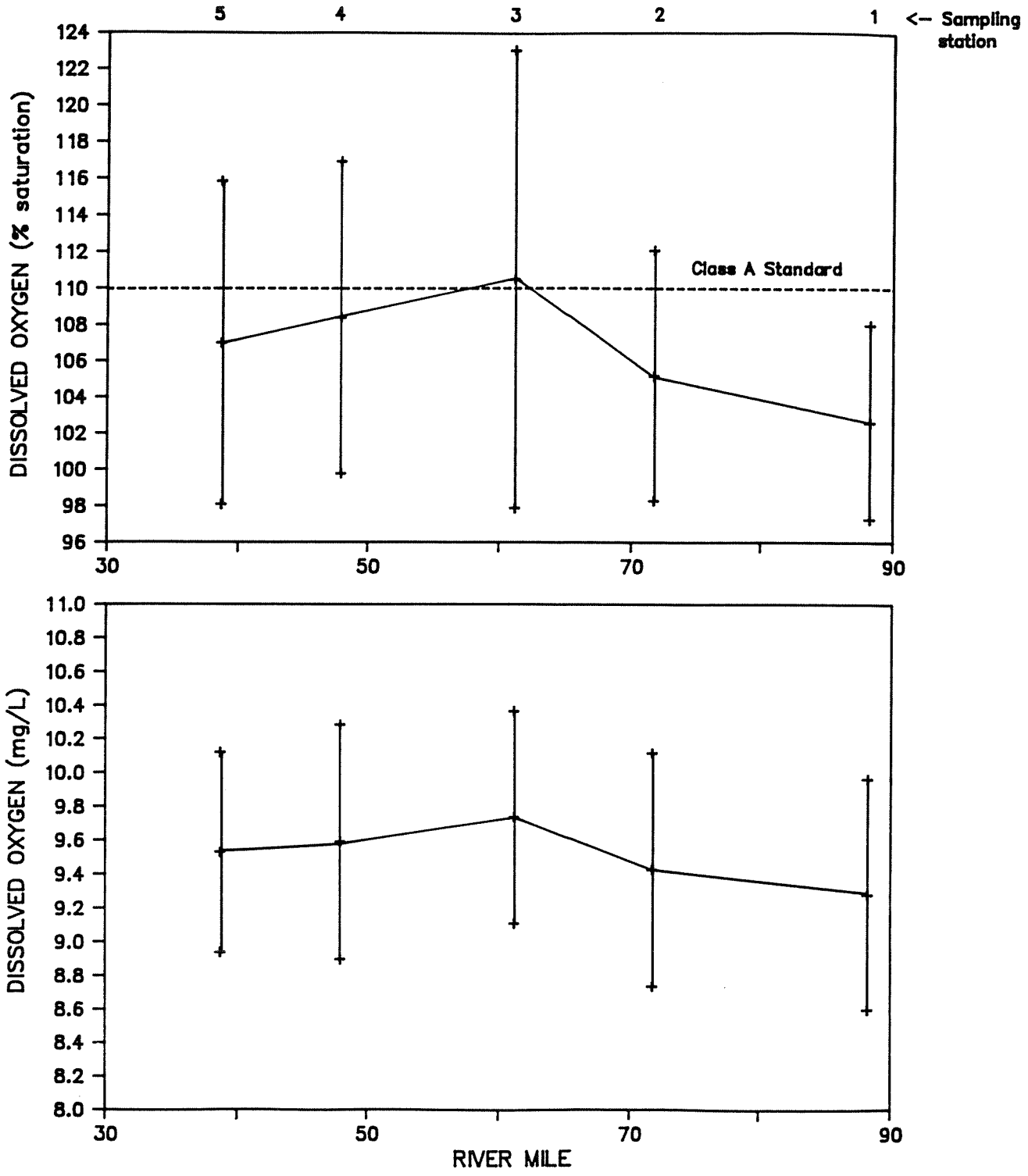

Figure 6. Summary of dissolved oxygen concentrations by river mile July-November 1988.

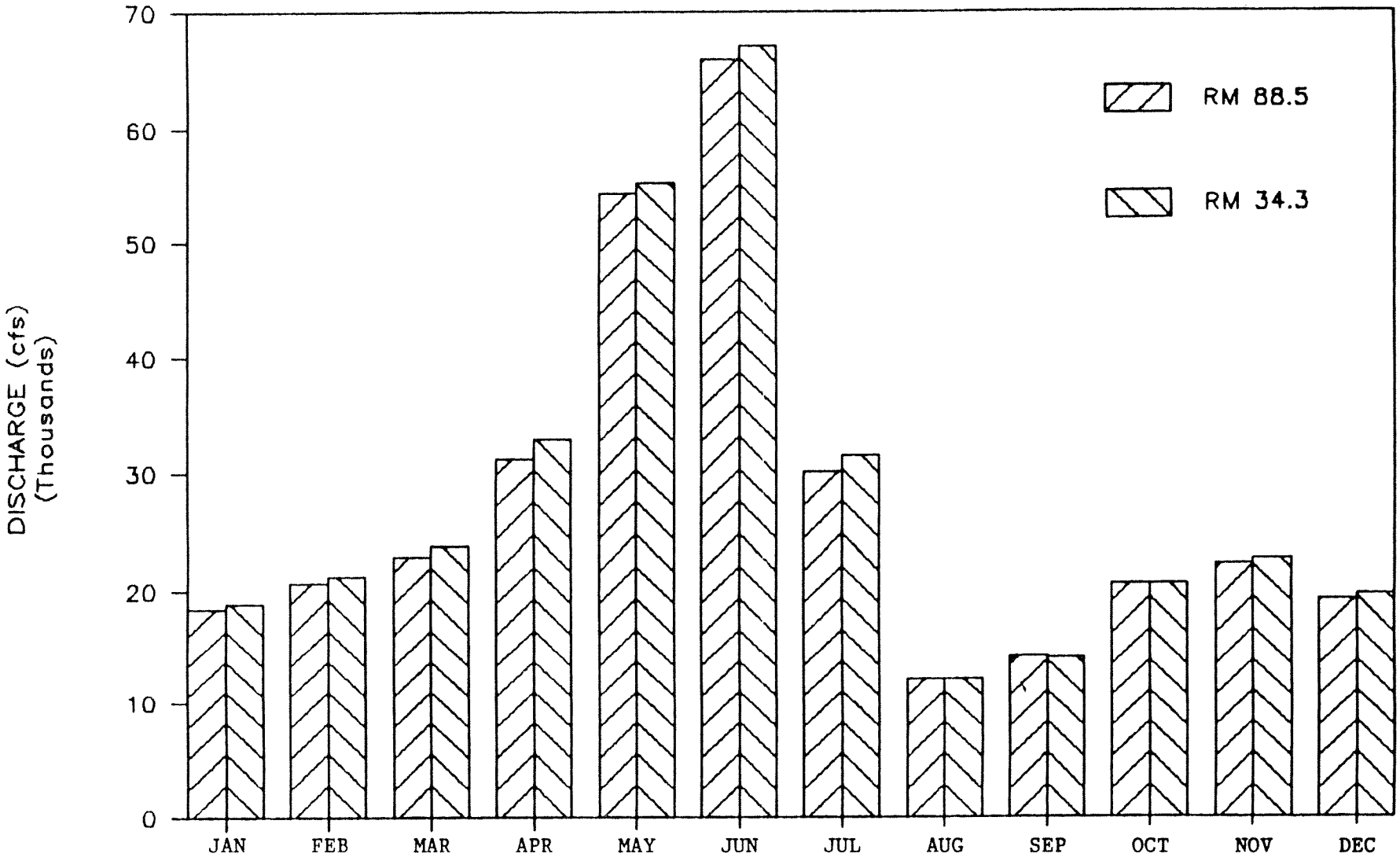

Figure 7. Average monthly discharge in the Pend Oreille River at Newport (r.m. 8.5) and below Box Canyon Dam (r.m. 34.3), 1953-1979 (Williams and Pearson, 1985).

APPENDICES

APPENDIX A

RESULTS OF CONVENTIONAL WATER QUALITY ANALYSES

Appendix A. Results of conventional Water Quality Analyses from the Pend Oreille River Survey of July-November 1988.

Station	Sub-Station	Depth (m)	Date	Secchi Disk Depth (m)	Light Extinction (m^-1)	Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%sat)	pH (S.U.)	Sp. Conductance (umho/cm@25C)
1	A	0	16-Nov-88			7.5	10.4	93.6%	7.9	167
1	B	0	16-Nov-88			7.5	10.6	95.0%	7.9	166
1	C	0	16-Nov-88			7.5	10.5	94.4%	8.0	166
2	A	0	16-Nov-88			7.4	10.8	96.7%	7.9	165
2	B	0	16-Nov-88			7.4	10.7	95.7%	7.9	166
2	C	0	16-Nov-88			7.4	10.6	95.4%	7.9	164
2	C	1	16-Nov-88			7.4	10.6	95.4%	7.9	165
2	C	2	16-Nov-88			7.4	10.7	95.8%	7.9	165
2	C	3	16-Nov-88			7.4	10.7	95.8%	7.9	165
3	A	0	16-Nov-88	4.9		7.1	10.5	93.8%	7.9	166
3	B	0	16-Nov-88			7.3	10.5	94.2%	7.9	166
3	B	1	16-Nov-88			7.3	10.5	93.7%	7.9	165
3	B	2	16-Nov-88			7.3	10.4	93.3%	7.9	165
3	B	3	16-Nov-88			7.3	10.4	93.3%	7.9	166
3	B	4	16-Nov-88			7.3	10.4	93.2%	7.9	165
3	C	0	16-Nov-88			7.0	10.5	93.1%	7.9	165
4	A	0	16-Nov-88	4.6		7.2	10.8	96.2%	8.0	164
4	A	1	16-Nov-88			7.2	10.7	95.4%	8.0	166
4	A	2	16-Nov-88			7.3	10.7	95.5%	8.0	166
4	A	4	16-Nov-88			7.3	10.7	96.0%	8.0	165
4	A	6	16-Nov-88			7.3	10.7	95.8%	8.0	165
4	A	8	16-Nov-88			7.3	10.7	95.7%	8.0	165
4	A	10	16-Nov-88			7.3	10.7	95.8%	8.0	165
4	A	12	16-Nov-88			7.3	10.7	96.1%	8.0	166
4	B	0	16-Nov-88			7.2	10.7	95.4%	8.0	165
5	A	0	16-Nov-88			7.0	10.6	94.2%	8.0	165
5	A	2	16-Nov-88			7.1	10.6	94.0%	8.0	165
5	A	4	16-Nov-88			7.1	10.6	94.1%	8.0	165
5	A	6	16-Nov-88			7.1	10.6	94.0%	8.0	165
5	A	8	16-Nov-88			7.1	10.6	94.1%	8.0	164
5	A	10	16-Nov-88			7.1	10.6	94.0%	8.0	165
5	A	12	16-Nov-88			7.1	10.7	95.5%	8.0	164
1	A	0	25-Oct-88			12.1	9.4	94.9%	8.0	164
1	B	0	25-Oct-88			12.2	9.4	94.9%	8.0	162
1	C	0	25-Oct-88			12.2	9.4	94.7%	8.0	162
2	A	0	25-Oct-88			12.1	9.3	93.6%	8.0	158
2	B	0	25-Oct-88			12.1	9.3	93.4%	8.0	169
2	B	5	25-Oct-88			12.1	9.3	93.4%	8.1	168
2	C	0	25-Oct-88			12.0	9.3	93.7%	8.0	156
3	A	0	26-Oct-88	4.1		11.9	9.3	92.9%	7.7	163
3	B	0	26-Oct-88			11.7	9.2	91.4%	7.6	162
3	B	5	26-Oct-88			11.7	9.1	91.3%	7.6	161
3	C	0	26-Oct-88			11.6	9.1	90.5%	7.6	161
4	A	0	26-Oct-88	5.2		11.6	9.4	93.6%	7.4	167
4	A	2	26-Oct-88			11.7	9.4	93.2%	7.5	157
4	A	4	26-Oct-88			11.7	9.3	92.8%	7.5	157
4	A	6	26-Oct-88			11.7	9.3	92.8%	7.5	157
4	A	8	26-Oct-88			11.7	9.3	92.7%	7.5	157
4	B	0	26-Oct-88			11.7	9.5	94.7%	7.3	157
5	A	0	27-Oct-88			11.3	9.4	93.1%	8.3	163

FOOTNOTES:
Station 1 samples were taken at Newport (r.m. 88).
Station 2 samples were taken at the Usk Bridge (r.m. 72).
Station 3 samples were taken at the river bend (r.m. 62).
Station 4 samples were taken at Lost Creek (r.m. 48).
Station 5 samples were taken at Ione (r.m. 39).

Station 1 substations were from approximate quarter points across the channel from right to left bank at A, B, and C. Stations 2 through 5 were sampled at two to three substations in the thalweg at 1 m. up to 18 m. depth intervals. NS denotes nearshore sample.

Appendix A. (continued)

Station	Sub-Station	Depth (m)	Date	Secchi Disk Depth (m)	Light Extinction (m^-1)	Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%sat)	pH (S.U.)	Sp. Conductance (umho/cm@25C)
1	A	0	05-Oct-88			14.8	9.5	102.1%	8.2	161
1	B	0	05-Oct-88			14.9	9.5	102.4%	8.2	160
1	C	0	05-Oct-88			14.9	9.5	101.9%	8.3	161
2	A	0	05-Oct-88			15.0	9.4	100.9%	8.2	162
2	B	0	05-Oct-88			15.0	9.4	101.3%	8.2	162
2	B	1	05-Oct-88			15.1	9.4	101.8%	8.2	162
2	B	2	05-Oct-88			15.1	9.4	101.3%	8.2	162
2	B	3	05-Oct-88			15.1	9.4	101.3%	8.2	162
2	B	4	05-Oct-88			15.1	9.4	101.3%	8.3	162
2	B	5	05-Oct-88			15.1	9.4	101.3%	8.2	160
2	C	0	05-Oct-88			15.1	9.5	102.0%	8.2	161
2	NS	0	05-Oct-88			15.0	8.9	95.5%	7.7	163
3	A	0	05-Oct-88	4.6	0.342	15.5	9.6	104.0%	8.2	160
3	B	0	05-Oct-88			15.4	9.5	103.4%	8.3	159
3	B	1	05-Oct-88			15.4	9.6	104.5%	8.3	160
3	B	2	05-Oct-88			15.4	9.6	104.6%	8.3	160
3	B	3	05-Oct-88			15.4	9.6	104.3%	8.3	160
3	B	4	05-Oct-88			15.4	9.6	104.5%	8.3	160
3	B	5	05-Oct-88			15.4	9.6	104.6%	8.3	160
3	C	0	05-Oct-88			15.3	9.7	104.7%	8.3	160
3	NS	0	05-Oct-88			15.4	10.9	118.9%*	8.5	159
4	A	0	05-Oct-88	4.6	0.301	15.5	10.1	109.9%	8.2	161
4	A	1	05-Oct-88			15.4	9.8	106.0%	8.3	161
4	A	2	05-Oct-88			15.3	9.7	105.6%	8.3	160
4	A	3	05-Oct-88			15.3	9.7	105.1%	8.3	160
4	A	4	05-Oct-88			15.3	9.7	105.2%	8.3	160
4	A	5	05-Oct-88			15.3	9.7	105.2%	8.3	160
4	A	6	05-Oct-88			15.3	9.7	104.9%	8.3	160
4	A	7	05-Oct-88			15.3	9.7	104.8%	8.3	160
4	A	8	05-Oct-88			15.3	9.7	104.9%	8.3	160
4	A	9	05-Oct-88			15.3	9.7	104.9%	8.3	160
4	A	10	05-Oct-88			15.2	9.7	104.5%	8.3	159
4	B	0	05-Oct-88			15.4	9.6	104.4%	8.2	159
4	NS	0	05-Oct-88			15.5	10.4	113.6%*	8.4	159
5	A	0	05-Oct-88			15.4	9.5	103.4%	8.2	159
5	A	2	05-Oct-88			15.3	9.5	103.5%	8.2	159
5	A	5	05-Oct-88			15.3	9.5	103.3%	8.3	160
5	A	10	05-Oct-88			15.3	9.6	103.4%	8.3	159
5	A	15	05-Oct-88			15.3	9.5	103.0%	8.3	159
1	A	0	13-Sep-88			18.5	8.6	100.0%	7.9	165
1	B	0	13-Sep-88			18.6	8.6	100.6%	8.0	165
1	C	0	13-Sep-88			18.6	8.7	100.9%	8.0	165
2	A	0	13-Sep-88			19.0	9.0	106.1%	8.1	163
2	A	1	13-Sep-88			18.9	9.1	106.4%	8.1	163
2	A	2	13-Sep-88			18.9	9.1	106.5%	8.1	164
2	A	3	13-Sep-88			18.9	9.0	105.2%	8.1	164
2	A	4	13-Sep-88			18.8	9.0	105.3%	8.1	164
2	B	0	13-Sep-88			19.0	9.1	106.6%	8.0	164
2	C	0	13-Sep-88			18.8	9.0	104.9%	8.0	163
2	NS	0	13-Sep-88			19.1	10.0	117.6%*	8.0	163
3	A	0	13-Sep-88	4.6	0.319	19.4	9.4	110.9%*	8.1	162
3	B	0	13-Sep-88			19.5	9.3	110.4%*	8.1	157
3	B	1	13-Sep-88			19.2	9.4	111.1%*	8.2	161
3	B	2	13-Sep-88			19.1	9.5	111.2%*	8.2	162
3	B	3	13-Sep-88			19.1	9.5	111.7%*	8.2	162
3	B	4	13-Sep-88			19.0	9.5	111.5%*	8.2	162
3	C	0	13-Sep-88			19.0	9.9	115.8%*	8.3	160
3	NS	0	13-Sep-88			20.5	12.2	147.5%*	8.7*	154
4	A	0	13-Sep-88	6.1	0.327	19.1	9.0	106.3%	8.1	161
4	A	1	13-Sep-88			18.9	9.1	106.6%	8.2	161
4	A	2	13-Sep-88			18.9	9.1	106.4%	8.2	161
4	A	3	13-Sep-88			18.7	9.1	106.4%	8.2	161

* Indicates violation of Water Quality Standard

Appendix A. (continued)

Station	Sub-Station	Depth (m)	Date	Secchi Disk Depth (m)	Light Extinction (m^-1)	Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%sat)	pH (S.U.)	Sp. Conductance (umho/cm@25C)
4	A	4	13-Sep-88			18.6	9.1	106.4%	8.2	161
4	A	5	13-Sep-88			18.5	9.1	106.2%	8.2	161
4	A	6	13-Sep-88			18.4	9.2	106.3%	8.2	161
4	A	7	13-Sep-88			18.4	9.1	106.0%	8.2	161
4	A	8	13-Sep-88			18.4	9.2	106.1%	8.2	161
4	A	9	13-Sep-88			18.4	9.1	105.7%	8.2	161
4	B	0	13-Sep-88			18.9	9.1	106.5%	8.1	162
4	NS	0	13-Sep-88			19.1	10.9	127.9%*	8.4	156
5	A	0	13-Sep-88			19.1	9.0	106.2%	8.2	160
5	A	1	13-Sep-88			18.7	8.9	103.6%	8.1	160
5	A	2	13-Sep-88			18.6	8.9	103.1%	8.1	160
5	A	4	13-Sep-88			18.6	8.9	103.6%	8.1	160
5	A	6	13-Sep-88			18.6	8.9	103.7%	8.1	161
5	A	8	13-Sep-88			18.6	8.9	103.9%	8.1	159
5	A	10	13-Sep-88			18.7	9.0	104.5%	8.1	161
5	A	12	13-Sep-88			18.7	9.0	104.3%	8.1	159
5	A	14	13-Sep-88			18.6	8.9	104.2%	8.1	160
1	A	0	24-Aug-88			20.4	9.0	108.8%	8.2	181
1	B	0	24-Aug-88			20.5	9.1	109.8%	8.4	180
1	C	0	24-Aug-88			20.6	9.1	110.9%*	8.5	183
2	A	0	24-Aug-88			21.1	9.6	117.2%*	8.5	181
2	B	0	24-Aug-88			21.2	9.5	117.2%*	8.5	179
2	C	0	24-Aug-88			21.2	9.6	117.3%*	8.6*	177
2	NS	0	25-Aug-88			22.8	11.2	142.3%*	8.9*	165
3	A	0	24-Aug-88	4.6	0.306	23.2	10.2	130.8%*	8.8*	175
3	B	0	24-Aug-88			23.0	10.3	131.4%*	8.9*	176
3	B	1	24-Aug-88			22.2	10.5	131.5%*	8.9*	169
3	B	2	24-Aug-88			21.2	10.4	127.3%*	8.9*	164
3	B	3	24-Aug-88			21.7	10.3	128.1%*	8.9*	160
3	B	4	24-Aug-88			21.6	10.3	128.0%*	8.9*	158
3	C	0	24-Aug-88			23.2	10.7	136.4%*	9.0*	169
3	NS	0	25-Aug-88			22.2	12.6	158.3%*	8.9*	165
4	A	0	24-Aug-88	4.9		23.3	9.1	117.1%*	8.8*	172
4	A	1	24-Aug-88			21.6	9.8	120.7%*	8.8*	165
4	A	2	24-Aug-88			20.9	9.8	119.7%*	8.8*	160
4	A	3	24-Aug-88			20.8	9.8	119.8%*	8.8*	159
4	A	4	24-Aug-88			20.7	9.9	120.1%*	8.8*	152
4	A	5	24-Aug-88			20.6	9.9	119.7%*	8.8*	157
4	B	6	24-Aug-88			20.8	10.1	122.5%*	8.7*	157
4	B	7	24-Aug-88			20.7	9.9	120.1%*	8.8*	156
4	B	8	24-Aug-88			20.7	9.8	119.6%*	8.8*	157
4	B	9	24-Aug-88			20.6	9.9	119.8%*	8.8*	156
4	B	10	24-Aug-88			20.6	9.9	119.7%*	8.8*	156
4	C	0	24-Aug-88			24.4	9.8	128.4%*	8.8*	158
4	NS	0	25-Aug-88			22.8	12.5	158.2%*	9.1*	164
5	A	0	24-Aug-88			24.0	9.5	124.0%*	8.6*	167
5	A	1	24-Aug-88			21.6	9.7	120.1%*	8.8*	164
5	A	2	24-Aug-88			21.3	9.7	119.1%*	8.8*	161
5	A	3	24-Aug-88			21.2	9.6	118.3%*	8.8*	159
5	A	4	24-Aug-88			21.1	9.6	118.0%*	8.8*	159
5	A	5	24-Aug-88			21.0	9.6	118.0%*	8.8*	157
5	A	6	24-Aug-88			21.0	9.6	117.6%*	8.8*	158
5	A	7	24-Aug-88			20.9	9.6	117.1%*	8.8*	157
5	A	8	24-Aug-88			20.9	9.6	116.7%*	8.8*	157
5	A	10	24-Aug-88			20.9	9.6	117.0%*	8.8*	157
5	A	12	24-Aug-88			20.7	9.5	115.1%*	8.8*	157
5	A	14	24-Aug-88			20.7	9.4	114.8%*	8.8*	157
5	A	16	24-Aug-88			20.7	9.4	114.8%*	8.8*	153
5	A	18	24-Aug-88			20.7	9.4	114.8%*	8.8*	157
5	NS	0	25-Aug-88			23.1	12.8	164.0%*	9.1*	166

*Indicates violation of Water Quality Standards

Appendix A. (continued)

Station	Sub-Station	Depth (m)	Date	Secchi Disk Depth (m)	Light Extinction (m^-1)	Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%sat)	pH (S.U.)	Sp. Conductance (umho/cm@25C)
1	A	0	02-Aug-88			20.8	8.9	108.6%	8.4	162
1	B	0	02-Aug-88			21.0	8.6	105.2%	8.4	161
1	C	0	02-Aug-88			21.0	8.6	105.3%	8.5	159
2	A	0	02-Aug-88			21.5	8.7	107.5%	8.3	158
2	B	0	02-Aug-88			21.5	8.5	104.9%	8.0	159
2	B	1	02-Aug-88			21.5	8.6	106.0%	8.3	158
2	B	2	02-Aug-88			21.5	8.6	105.9%	8.4	157
2	B	3	02-Aug-88			21.5	8.6	105.9%	8.4	155
2	C	0	02-Aug-88			21.6	8.7	107.2%	8.5	157
3	A	0	02-Aug-88	4.3	0.282	21.8	8.7	108.6%	8.5	157
3	B	0	02-Aug-88			21.7	8.8	109.3%	8.6*	154
3	B	1	02-Aug-88			21.7	8.8	109.0%	8.6*	153
3	B	2	02-Aug-88			21.6	8.8	108.9%	8.6*	153
3	B	3	02-Aug-88			21.6	8.8	109.0%	8.5	152
3	B	4	02-Aug-88			21.6	8.8	109.0%	8.5	152
3	C	0	02-Aug-88			21.6	8.9	110.1%*	8.6*	
4	A	0	02-Aug-88	4.3	0.348	22.3	8.7	109.6%	8.6*	152
4	A	1	02-Aug-88			22.1	8.7	108.9%	8.6*	152
4	A	2	02-Aug-88			21.9	8.7	108.8%	8.6*	152
4	A	3	02-Aug-88			21.9	8.7	108.4%	8.6*	151
4	A	4	02-Aug-88			21.8	8.7	108.1%	8.6*	151
4	A	5	02-Aug-88			21.8	8.7	107.8%	8.6*	150
4	A	6	02-Aug-88			21.8	8.7	107.8%	8.6*	150
4	A	7	02-Aug-88			21.8	8.7	107.8%	8.6*	150
4	B	0	02-Aug-88			22.3	8.7	109.5%	8.6*	152
5	A	0	02-Aug-88			22.3	9.1	114.2%*	8.7*	151
5	A	2	02-Aug-88			22.7	8.9	113.2%*	8.7*	151
5	A	4	02-Aug-88			22.4	8.9	112.6%*	8.7*	149
5	A	6	02-Aug-88			22.4	8.9	112.6%*	8.6*	148
5	A	8	02-Aug-88			22.4	8.9	112.3%*	8.6*	148
5	A	10	02-Aug-88			22.4	8.9	112.2%*	8.6*	147
1	B	0	13-Jul-88			18.4			8.4	
2	B	0	13-Jul-88			17.7	9.0	102.3%	8.5	
3	B	1	13-Jul-88	2.7	0.315	19.0	9.5	111.0%*	8.5	
3	B	2	13-Jul-88			19.0	9.4	110.5%*	8.5	
3	B	3	13-Jul-88			19.0	9.4	110.1%*	8.5	
3	B	4	13-Jul-88			19.0	9.4	110.0%	8.6*	
4	B	1	13-Jul-88	3.0	0.283	19.9	9.7	115.6%*	8.6*	
4	B	2	13-Jul-88			19.9	9.3	111.6%*	8.6*	
4	B	3	13-Jul-88			19.8	9.2	110.2%*	8.6*	
4	B	4	13-Jul-88			19.8	9.3	110.8%*	8.6*	
4	B	5	13-Jul-88			19.7	9.3	110.2%*	8.6*	
4	B	6	13-Jul-88			19.7	9.2	110.1%*	8.6*	
4	B	7	13-Jul-88			19.7	9.2	110.1%*	8.6*	
4	B	8	13-Jul-88			19.7	9.2	110.1%*	8.6*	

*Indicates violation of Water Quality Standards

APPENDIX B

RESULTS OF ALKALINITY, TURBIDITY, TOTAL SUSPENDED SOLIDS, FECAL COLIFORM FECAL STREPTOCOCCI, NUTRIENTS, CHLOROPHYLL A, AND PHYTOPLANKTON

Appendix B. Results of alkalinity, turbidity, total suspended solids, fecal coliform, fecal streptococci, nutrients, chlorophyll a, and phytoplankton from the Pend Oreille River Survey of July-November 1988.

Station	Sub-Station	Depth (m)	Date	Alkalinity (mgCaCO3/L)	Turbidity (NTU)	Total Suspended Solids (mg/L)	Fecal Coliform (CFU/100mL)	Fecal Streptococci (CFU/100mL)	Soluble Reactive Phosphorus (ugP/L)	Total Soluble Phosphorus (ugP/L)	Total Phosphorus (ugP/L)	Nitrate +Nitrite Nitrogen (ugN/L)	Ammonia Nitrogen (ugN/L)	Total Nitrogen (ugN/L)	Chlorophyll a (ug/L)	Total N:P Ratio (wt/wt)	Phytoplankton Biovolume (um3/mL)
1	A	0	17-Nov-88	78		1.30	0	0	3 E	5 E	11	7 U	25	62	2 E	6	
1	B	0	17-Nov-88	78		0.60			3 E	6	9	7 U	10 U	58	2 E	6	
1	C	0	17-Nov-88						3 E	9	10	7 U	10 U	56		5	
2	A	0	17-Nov-88	78		0.62	0	1	3 E	10	10	7 U	5 E	53	1 E	5	
2	B	0	17-Nov-88	78		0.07			3 E	5 E	10	7 U	5 E	46 E	2 E	5	
2	C	0	17-Nov-88						3 E	7	10	7 U	6 E	56		6	
3	A	0	17-Nov-88	78		0.00	0	0	2 E	3 E	9	7 U	10 U	47 E	1 E	5	
3	B	0	17-Nov-88	78		0.80			3 E	3 E	9	7 U	10 U	51	2 E	6	
3	C	0	17-Nov-88						3 E	4 E	9	7 U	10 U	44 E		5	
4	A	0	17-Nov-88	77		0.09	1	0	4 E	4 E	10	7 U	10 U	49 E	2 E	5	
4	A	5	17-Nov-88	77		0.38			3 E	3 E	9	7 U	10 U	51	2 E	5	
4	B	0	17-Nov-88			0.02			4 E	3 E	8	7 U	14	51		6	
5	A	0	17-Nov-88	79		0.51	1	1	3 E	5 E	9	7 U	10 U	46 E	2 E	5	
5	A	5	17-Nov-88	78		0.57			4 E	3 E	9	7 U	10 U	56	3 E	6	
5	A	10	17-Nov-88			0.27			3 E	3 E	11	7 U	10 U	54		5	
1	A	0	25-Oct-88	77	1.3	0.64	5	3	6	5 E	10	7 U	14	61	2 E	6	118,000
1	B	0	25-Oct-88	76	1.1	1.07			5 E	4 E	11	7 U	10 U	72	2 E	7	
1	C	0	25-Oct-88						5 E	8	11	7 U	4 E	67		6	
2	A	0	25-Oct-88	73	1.7	0.97	2	6	8	6	7	7 U	8 E	74	2 E	10	
2	B	0	25-Oct-88	74	1.4	0.00			6	7	7	7 U	9 E	71	2 E	10	
2	C	0	25-Oct-88						3 E	5	7	7 U	10 U	80		11	
3	A	0	26-Oct-88	75	1.4	1.40	1	1	4 E	4 E	7	7 U	3 E	72	2 E	10	120,000
3	B	0	26-Oct-88	75	1.2	0.00			4 E	7	6	7 U	10 U	63	2 E	11	
3	C	0	26-Oct-88						2 E	7	7	7 U	10 U	64		10	
4	A	0	26-Oct-88	73	1.3	0.31	0	2	4 E	4 E	6	7 U	10 U	53	2 E	9	
4	A	5	26-Oct-88	73	1.2	0.93			3 E	7	7	7 U	10 U	66	1 E	10	
4	B	0	26-Oct-88						5	8	6	7 U	10 U	34 E		6	
5	A	0	27-Oct-88	75	4.0	8.40	16	3	4 E	2 E	16	7 U	10 U	63	2 E	4	
5	B	0	27-Oct-88	75	4.5	9.65			4 E	2 E	17	7 U	10 U	64	3 E	4	
5	C	0	27-Oct-88		4.7	12.00			4 E	2 E	18	7 U	10 U	87		5	
1	A	0	05-Oct-88	74	1.5	2.10	0	0	4 E	3 E	11	7 U	12	77	2 E	7	94,900
1	B	0	05-Oct-88	73	1.7	2.40			4 E	3 E	11	7 U	13	64	2 E	6	
1	C	0	05-Oct-88						4 E	4 E	11	7 U	11	66		6	
2	A	0	05-Oct-88	74	1.4	0.73	2	1	4 E	3 E	10	7 U	5 E	65	3 U	6	
2	B	0	05-Oct-88	74	1.3	1.44			7	3 E	11	7 U	5 E	69	1 E	6	
2	C	0	05-Oct-88						5 E	3 E	9	7 U	9 E	62		7	
3	A	0	05-Oct-88	74	1.4	2.00	0	5	4 E	3 E	9	7 U	14	74	1 E	8	82,600
3	B	0	05-Oct-88	73	1.0	1.44			5	3 E	11	7 U	8 E	77	1 E	7	
3	C	0	05-Oct-88						4 E	3 E	8	7 U	16	69		8	
4	A	0	05-Oct-88	74	1.0	1.10	1	2	5 E	3 E	8	7 U	12	56	1 E	7	
4	A	5	05-Oct-88	73	1.0	1.51			7	3 E	10	7 U	28	85		9	
4	B	0	05-Oct-88						7	2 E	9	7 U	13	31 E	1 E	3	
5	A	0	05-Oct-88	73	1.0	1.11	1	1	6	3 E	9	7 U	20	72	1 E	8	335,000
5	A	5	05-Oct-88	73	1.1	1.20			9	3 E	9	7 U	20	73	1 E	8	
5	A	10	05-Oct-88						8	3 E	10	7 U	21	71		7	

CFU = colony forming unit

DATA QUALIFIERS:
U = below detection limit; detection limit is reported
E = below detection limit; estimated value is reported

FOOTNOTES:
Station 1 samples were taken at Newport (r.m. 88)
Station 2 samples were taken at the Usk Bridge (r.m. 72)
Station 3 samples were taken at the river bend (r.m. 62)
Station 4 samples were taken at Lost Creek (r.m. 48)
Station 5 samples were taken at Ione (r.m. 39)

Station 1 substations were taken from approximate quarter points across the channel from right to left bank at A, B, and C. Stations 2 through 5 were sampled at two to three substations in the thalweg at 1 m. up to 18 m. depth intervals. NS denotes nearshore sample.

Appendix B. (continued)

Station	Sub-Station	Depth (m)	Date	Alkalinity (mgCaCO3/L)	Turbidity (NTU)	Total Suspended Solids (mg/L)	Fecal Coliform (CFU/100mL)	Fecal Streptococci (CFU/100mL)	Soluble Reactive Phosphorus (ugP/L)	Total Soluble Phosphorus (ugP/L)	Total Phosphorus (ugP/L)	Nitrate +Nitrite Nitrogen (ugN/L)	Ammonia Nitrogen (ugN/L)	Total Nitrogen (ugN/L)	Chlorophyll a (ug/L)	Total N:P Ratio (wt/wt)	Phytoplankton Biovolume (um3/mL)
1	A	0	13-Sep-88	73	1.8	0.37	2	0	3 E	4 E	8	7 U	13	112	3 E	13	177,000
1	B	0	13-Sep-88	73	2.0	1.43			3 E	5 E	8	7 U	17	88	2 E	10	
1	C	0	13-Sep-88						3 E	4 E	11	7 U	16	112		11	
2	A	0	13-Sep-88	72	1.4	0.69	1	0	3 E	6	10	7 U	11	102	2 E	11	
2	B	0	13-Sep-88	73	2.2	0.66			3 E	3 E	10	7 U	7 E	84	2 E	9	
2	C	0	13-Sep-88						3 E	7	8	7 U	7 E	83		10	
3	A	0	13-Sep-88	72	1.1	0.00	1	0	4 E	8	9	7 U	8 E	97	1 E	11	251,000
3	B	0	13-Sep-88	72	2.1	1.40			3 E	5 E	8	7 U	16	96	1 E	12	
3	C	0	13-Sep-88						5 E	5	10	7 U	13	88		9	
4	A	0	13-Sep-88	71	1.1	0.18	0	0	3 E	4	9	7 U	66	84	1 E	9	
4	A	5	13-Sep-88	72	1.3	0.00			7	4 E	10	7 U	10 U	104		11	
4	B	0	13-Sep-88						8	3 E	8	7 U	7 E	104	2 E	12	
5	A	0	13-Sep-88	71	1.4	0.55	0	0	3 E	3 E	14	7 U	5 E	87	2 E	6	150,000
5	A	5	13-Sep-88	71	1.5	0.63			5	6	11	7 U	6 E	92	1 E	9	
5	A	10	13-Sep-88						5 E	6	9	7 U	8 E	94		11	
1	A	0	24-Aug-88	68	1.4	1.08		0	2 E	7	14	7 U	10 U	181	1 E	13	33,100
1	B	0	24-Aug-88		0.8	0.88			2 E	6	10	7 U	10 U	160	1 E	16	
1	C	0	24-Aug-88								9			24 E		3	
2	A	0	24-Aug-88	67	1.5	1.24		0	6	7	13	7 U	10 U	45 E	3 U	3	
2	B	0	24-Aug-88		1.2	0.90			2 E	8	14	7 U	10 U	63	2 E	5	
2	C	0	24-Aug-88						2 E		11	7 U	10 U	184		17	
3	A	0	24-Aug-88	66	0.7	0.00		1	7	6	13	7 U	10 U	23 E	1 E	2	130,000
3	B	0	24-Aug-88		0.7	0.04			2 E	4 E	9	7 U	10 U	75	1 E	9	
3	C	0	24-Aug-88						2 E		12	7 U	10 U	119		10	
4	A	0	24-Aug-88	66	0.6	0.00		0	3 E	4 E	9	7 U	10 U	170	1 E	19	
4	A	5	24-Aug-88		0.9	0.51			3 E	6	12	7 U	10 U	150	3 U	13	
4	B	0	24-Aug-88						3 E		9			24 E		3	
5	A	0	24-Aug-88	66	0.8	0.63		0	3 E	6	10	7 U	10 U	25 E	1 E	2	76,600
5	B	0	24-Aug-88		0.9	0.60			2 E	5	12	7 U	10 U	143	1 E	12	
5	C	0	24-Aug-88								10			163		17	
1	A	0	02-Aug-88	72	1.2	0.66	2	1	5 U		11	7 U	10 U	48 E		4	178,000
1	B	0	02-Aug-88	72		0.26			4 E		10	7 U	5 E	64	1 E	6	
1	C	0	02-Aug-88						3 E		10	7 U	10 U	64	1 E	6	
2	A	0	02-Aug-88	71	1.4	0.00	0	1	2 E		16	7 U	10 U	64	2 E	4	
2	B	0	02-Aug-88	70		0.00			3 E		9	7 U	10 U	68	2 E	8	
2	C	0	02-Aug-88						5 U		8	7 U	10 U	48 E		6	
3	A	0	02-Aug-88	70	1.0	0.00	1	1	5 U		14	7 U	84	90	2 E	7	170,000
3	B	0	02-Aug-88	70		0.61			3 E		9	7 U	10 U	79	1 E	9	
3	C	0	02-Aug-88						3 E		8	7 U	10 U	71		9	
4	A	0	02-Aug-88	69	1.2	0.16	1	1	5 U		10	7 U	10 U	102	1 E	10	
4	A	5	02-Aug-88	69		0.56			5 U		10	7 U	10 U	95		9	
4	B	0	02-Aug-88						3 E		9	7 U	4 E	56	1 E	6	
5	A	0	02-Aug-88	68	1.5	0.28	0	0	5 U		14	7 U	21	118	2 E	9	45,500
5	A	5	02-Aug-88	69		1.40			5 U		10	7 U	10 U	55		6	
5	B	0	02-Aug-88						5 U		8	7 U	10 E	91	2 E	11	
1	A	0	13-Jul-88	65	2.7	0.71			13	2 E	8		10 U	77		10	
1	B	0	13-Jul-88	67	1.2	0.51			13	4 E	8	7 U	10 U	102	4	13	310,000
1	C	0	13-Jul-88						17	3 E	3 E	7 U		94	3 E	38	
2	A	0	13-Jul-88	67	1.4	0.14			11	4 E	12	7 U	10 U	117	3	10	
2	B	0	13-Jul-88	67	0.8	0.92			11	2 E	9	7 U	10 U	113	3 E	12	
2	C	0	13-Jul-88						17	3 E	11			110		10	
3	A	0	13-Jul-88	67	1.5	0.89			3 E	4 E		7 U	10 U	111	2 E		
3	B	0	13-Jul-88	67	2.3	1.00			3 E	3 E	10	7 U	10 U	117	2 E	12	546,000
3	C	0	13-Jul-88						4 E	4 E	10			102		11	
4	A	0	13-Jul-88	67	1.6	0.96			13	6	13	7 U	10 U	141	2 E	11	
4	B	0	13-Jul-88	67	1.3	1.09			3 E	3 E	8	7 U	7 E	101	3 E	13	
4	C	5	13-Jul-88						14	2 E	8			110		15	
5	A	0	13-Jul-88	67	0.8	1.94			5 E	4 E	12	7 U	10 U	71	4	6	321,000
5	A	5	13-Jul-88	67	1.4	2.11			4 E	4 E	11	7 U	10 U	258	3 E	24	
5	B	0	13-Jul-88						8	4 E	9			109		13	

APPENDIX C

RESULTS OF DISSOLVED OXYGEN, PH, SPECIFIC CONDUCTANCE, TURBIDITY, TOTAL SUSPENDED SOLIDS, FECAL COLIFORM, FECAL STREPTOCOCCI, AND NUTRIENTS

Appendix C. Results of dissolved oxygen, pH, specific conductance, turbidity, total suspended solids, fecal coliform, fecal streptococci, and nutrients from tributaries of the Pend Oreille River study of July-November 1988.

Station	Date	Flow (cfs)	Temperature (deg C)	Dissolved Oxygen (mg/L)	pH (S.U.)	Specific Conductance (umho/cm@25C)	Turbidity (NTU)	Total Suspended Solids (mg/L)	Fecal Coliform (CFU/100mL)	Fecal Streptococci (CFU/100mL)	Soluble Reactive Phosphorus (ugP/L)	Total Soluble Phosphorus (ugP/L)	Total Phosphorus (ugP/L)	Nitrate +Nitrite Nitrogen (ugN/L)	Ammonia Nitrogen (ugN/L)	Total Nitrogen (ugN/L)
Big Muddy Ck	03-Aug-88	0.66	14.5	10.8	8.9	180	1.4	0	23	28	16	12	14	7	11	71
Big Muddy Ck	14-Sep-88	0.54	12.5	9.7	7.8	197	0.7	0.27	43	81	17	14	12	12	18	53
Big Muddy Ck	27-Oct-88	0.51	2.7	13.3	8.2	177	1.6	0	3	12	11	9	10	7 U	10 U	18 E
Big Muddy Ck	17-Nov-88	1.4	2.7	13.0	7.8	155	0.9	0	4	10	14	20	13	9	10 U	103
Brackett Ck	25-Oct-88	0.29	6.9	11.8	7.7	118	1.4	0	13	25	11	23	13	7 U	13	72
Brackett Ck	04-Aug-88	0.12	15.5	10.0	7.4	147	0.9	0.28	249	732	22	21	23	26	10 U	142
Brackett Ck	14-Sep-88	0.19	9.6	10.3	7.4	162	1.3	0	26	496	18	18	17	13	16	92
Calispel Ck	13-Jul-88		19.0	8.3	8.2			2.63	18	45			32			309
Calispel Ck	02-Aug-88	11	22.0	10.0	8.8	77	2.6	0.76	48	24	10	19	34	7 U	30	448
Calispel Ck	24-Aug-88	5	23.4	11.9	9.6	107		1.44		1			25			308
Calispel Ck	14-Sep-88	21	15.8	11.0	9.1	88	4	2.33	109	27	6	26	35	7 U	58	727
Calispel Ck	06-Oct-88	-12	13.3	13.6	9.4	81	0.6	1.76	60	12	8	18	32	7 U	23	688
Calispel Ck	25-Oct-88	34	9.1	17.7	9.5	96	2	0.7	2	0	8	14	22	7 U	16	487
Calispel Ck	17-Nov-88	94	2.3	11.6	7.5	78		1.82	2	6	16	25	47	7 U	3 E	452
Cedar Ck	14-Sep-88	1.2	13.6	9.2	7.6	268	0.4	0.49	1	46	9	10	13	12	16	36 E
Cedar Ck	27-Oct-88	3.1	3.9	12.7	8.3	223	1.5	0	1	6	9	6	11	4 E	10 U	50 U
Cedar Ck	03-Aug-88	2.5	16.9	9.9	8.1	221	0.5	0.04	15	15	11	13	9	5 E	10 U	50 U
Cee Cee Ah Ck	03-Aug-88	4.3	12.6	11.2	7.0	72	1.5	1.68	15	48	12	14	14	7 U	10 U	50 U
Cee Cee Ah Ck	15-Sep-88	2.8	11.1	10.2	7.3	82	0.6	3.27	8	195	24	16	16	2 E	30	45 E
Cee Cee Ah Ck	27-Oct-88	2.7	5.0	12.2	7.8	86	1.9	0.56	1	8	12	10	12	7 U	10 U	50 U
Cusick Ck	04-Aug-88	0.12	14.5	10.2	7.7	292	0.5	0	132	204	30	28	32	14	10 U	86
Cusick Ck	14-Sep-88	0.13	13.6	9.6	7.8	336	1	3.24	75	373	36	32	39	5 E	38	135
Cusick Ck	27-Oct-88	0.13	2.0	12.8	8.4	313	2.4	0	22	50	23	38	38	4 E	10 U	114
Davis Ck	04-Aug-88	1.7	17.7	8.1	6.6	116	2.8	1.8	88	109	22	27	48	7 U	4 E	241
Davis Ck	14-Sep-88	3.8	12.1	8.2	7.3	114	2.5	1.48	82	255	17	19	29	7 U	20	166
Davis Ck	25-Oct-88	4.3	7.3	10.7	7.5	113	1.7	1.06	26	90	10	17	18	7 U	11	162
Gardiner Ck	03-Aug-88	0.32	9.8	11.8	8.0	355	1.6	2.42	8	41	23	17	19	8	10 U	50 U
Gardiner Ck	14-Sep-88	0.36	9.0	10.5	7.9	353	0.8	1.31	3	61	25	21	18	17	39	50 U
Gardiner Ck	27-Oct-88	0.36	3.3	12.8	8.4	351	1.4	1.14	1	20	20	18	19	8	10 U	50 U
Indian Ck	02-Aug-88	2.7	11.0	11.4	6.9	96	1.3	0	1	9	8	6	8	30	13	57
Indian Ck	15-Sep-88	2	9.5	10.7	7.6	96	0.5	1.09	2	30	16	10	11	78	6	57
Indian Ck	27-Oct-88	1.7	5.8	12.4	8.0	95	1.7	0.76	0	2	9	6	9	66	10 U	10 E
Kent Ck	04-Aug-88	0.03	11.8	5.6	6.8	254	1.7	0.45	4	49	12	7	13	100	10 U	132
Kent Ck	26-Oct-88	0.4	6.5	9.8	7.4	288	1.1	0	4	31	13	16	14	15	10 U	213
LeClerc CK	03-Aug-88	37	12.2	11.7	8.0	146	0.5	0.48	6	17	9	9	15	24	4 E	25 E
LeClerc Ck	25-Aug-88	24	12.8	10.6	8.1	168		0.26					4			87
LeClerc Ck	15-Sep-88	25	10.7	10.7	7.8	154	0.4	0.85	0	74	10	14	7	49	7 E	57
LeClerc Ck	06-Oct-88	23	9.3	11.6	8.0	146	1.7	0.6	8	25	13	6	9	235	11	35 E
LeClerc Ck	27-Oct-88	25	6.7	12.1	8.4	154	1.7	0	0	4	7	8	8	40	10 U	40 E
LeClerc Ck	17-Nov-88	22	6.1	12.1	8.0	147	4.1	0.3	5	5	11	13	9	52	5 E	56
Little Muddy Ck	03-Aug-88	0.57	15.6	10.4	8.0	234	0.9	0	14	13	12	13	6	7 U	10 U	50 U
Little Muddy Ck	14-Sep-88	0.21	13.4	9.4	7.9	283	0.5	0.31	10	126	14	14	9	5 E	24	18 E
Little Muddy Ck	27-Oct-88	0.93	2.7	13.1	8.3	237	2.5	0	0	8	10	6	6	7 U	10 U	50 U
Little Muddy Ck	17-Nov-88	1.3	3.3	12.8	7.9	198	0.6	0	1	2	12	15	9	7 U	10 U	19 E
Lost Ck	03-Aug-88	1.6	18.5	10.2	8.0	107	0.8	0	61	96	18	15	11	7 U	10 U	83
Lost Ck	14-Sep-88	1.1	14.7	9.4	7.6	115	0.6	0.13	135	54	15	15	13	7 U	30	73
Lost Ck	27-Oct-88	1.5	1.7	13.5	8.3	99	1.9	0	32	7	10	8	10	7 U	10 U	29 E

CFU = colony forming unit

DATA QUALIFIERS:
U = sample was below detection limit; detection limit reported
E = sample was below detection limit; estimated value reported

Appendix C. (continued)

Station	Date	Flow (cfs)	Temperature (deg C)	Dissolved Oxygen (mg/L)	pH (S.U.)	Specific Conductance (umho/cm@25C)	Turbidity (NTU)	Total Suspended Solids (mg/L)	Fecal Coliform (CFU/100mL)	Fecal Streptococci (CFU/100mL)	Soluble Reactive Phosphorus (ugP/L)	Total Soluble Phosphorus (ugP/L)	Total Phosphorus (ugP/L)	Nitrate +Nitrite Nitrogen (ugN/L)	Ammonia Nitrogen (ugN/L)	Total Nitrogen (ugN/L)
Marshall Ck	02-Aug-88	0.71	9.8	11.7	6.7	108	0.6	0.02	1	100	9	7	4 E	52	10 U	58
Marshall Ck	15-Sep-88	0.87	9.3	10.5	7.3	102	0.3	0	0	18	15	17	11	77	6	57
Marshall Ck	27-Oct-88	0.71	8.0	11.5	7.7	100	0.6	0	0	1	8	6	6	73	10 U	28 E
Middle Ck	03-Aug-88	1.5	10.6	12.0	7.7	73	1.5	0	1	30	17	20	14	7 U	4 E	50 U
Middle Ck	15-Sep-88	1.2	8.8	10.7	7.5	81	0.6	0.42	2	141	20	24	17	11	22	37 E
Middle Ck	27-Oct-88	1.4	2.4	13.3	7.9	77	3.8	0	2	2	14	11	15	7 U	10 U	25 E
Mill Ck	03-Aug-88	2.8	11.8	11.6	7.3	65	1.5	0.82	1	23	17	17	15	7 U	10 U	27 E
Mill Ck	15-Sep-88	1.7	9.4	10.6	7.4	73	0.7	0.49	0	109	26	28	19	11	10 U	47 E
Mill Ck	27-Oct-88	2.5	2.2	13.4	7.9	72	3.3	0	0.5	14	14	15	16	7 U	10 U	35 E
Muddy Bay Ck	27-Oct-88	4.1	9.9	5.7	7.6	256	4.7	2	1	0	7	9	27	7 U	8 E	164
Muddy Bay Ck	17-Nov-88	4.3	4.8	7.9	7.4	238	4.7	4.42	1	3	12	10	35	15	10 U	198
Newport STP	13-Jul-88	0.36	19	8.3	7.0		3.9		593	330			6,500			6,000
Newport STP	02-Aug-88	0.44	20	7.1	7.3		2.1		14,400	1,920			5,100			3,400
Newport STP	24-Aug-88	0.50	20	9.1	7.5		2.5		360	0			5,400			7,700
Newport STP	13-Sep-88	0.62	18	8.1	7.4		1.6		240	70			6,300			1,300
Newport STP	05-Oct-88	0.56	16	6.4	7.6		3.0		20	200			5,000			810
Newport STP	25-Oct-88	0.59	15	6.9	7.8		2.7		0	22			5,300			5,600
Newport STP	17-Nov-88	0.54	13	4.3	7.8		4.7		0	17			6,000			9,200
Ruby Ck	13-Jul-88	4	15.2	9.6	8.1			0.53	0	74			26			125
Ruby Ck	03-Aug-88	3.3	16.1	10.1	7.8	94	2.2	0.84	2	64	27	28	32	7 U	10 U	103
Ruby Ck	14-Sep-88	2.4	11.5	10.1	7.7	109	1.9	5.64	1	134	28	29	32	2 E	35	68
Ruby Ck	27-Oct-88	3.1	1.3	14.1	8.0	97	1.8	0	6	12	23	23	26	7 U	10 U	54
Skookum Ck	13-Jul-88	16	13.5	10.8	7.6			2.1	161	539			13			102
Skookum Ck	02-Aug-88	10	13.8	11.6	7.4	205	2.6	0.34	350	320	19	15	32	14	10 U	53
Skookum Ck	24-Aug-88	9	15.9	11.5	7.9	240		0		30			22			170
Skookum Ck	13-Sep-88	7.6	11.6	11.6	7.8	205	1.8	0.69	175	75	12	14	17	7 U	10 U	80
Skookum Ck	06-Oct-88	11	9.9	12.0	7.9	197	2	1.9	135	53	15	12	20	7 U	18	53
Skookum Ck	27-Oct-88	11	5.0	13.9	8.3	202	4.1	4.44	10	17	14	12	24	7 U	10 U	26 E
Skookum Ck	17-Nov-88	6.2	3.4	13.5	7.8	193	0.7	6.4	131	9	15	14	31	10	10 U	66
S. Fork Lost Ck	03-Aug-88	0.87	15.9	10.3	7.9	82	1.6	0	167	161	17	16	13	7 U	10 U	32 E
S. Fork Lost Ck	14-Sep-88	0.44	14.5	9.2	7.5	109	0.6	0.04	528	250	17	19	20	3 E	27	57
S. Fork Lost Ck	27-Oct-88	0.28	1.8	13.5	8.1	98	1.5	0	10	4	17	16	14	7 U	10 U	50 U
Tacoma Ck	04-Aug-88	14	15.1	9.3	8.0	54	1.2	1.14	83	127	26	29	35	7 U	10 U	71
Tacoma Ck	24-Aug-88	5.6	18.4	9.2	7.4	76		0.12		42			38			6
Tacoma Ck	14-Sep-88	7.7	13.8	9.2	7.3	57	1.7	1.31	74	106	25	28	38	7 U	16	76
Tacoma Ck	06-Oct-88	8.6	9.4	9.8	7.4	56	3	1.62	56	90	28	23	36	7 U	15	39 E
Tacoma Ck	27-Oct-88	6.5	3.1	11.1	8.7	57	3.5	2.66	26	26	36	48	54	7 U	10 U	61
Tacoma Ck	17-Nov-88	15	2.0	12.2	7.3	57		0	16	44	32	40	36	7 U	8 E	85
Trimble Ck	04-Aug-88	2.4	19.5	10.8	9.3	118	34	29.44	12	198	14	33	254	7 U	6 E	4355
Trimble Ck	14-Sep-88	2.4	17.3	8.5	8.0	92	12	15.71	10	258	9	27	97	6 E	84	1184

CFU = colony forming unit

DATA QUALIFIERS:
U = sample was below detection limit; detection limit reported
E = sample was below detection limit; estimated value reported

APPENDIX D

PHYTOPLANKTON ANALYSIS

PHYTOPLANKTON SAMPLE ANALYSIS

SAMPLE: Pend Oreille R, Sta 1-B

SAMPLE DATE: 88-07-13

TOTAL DENSITY (#/ml): 510

TOTAL BIOVOLUME (cu.uM/ml): 309996

DIVERSITY INDEX: 4.42 *

	SPECIES	DENSITY	PCT	BIOVOL	PCT
1	Rhizosolenia eriensis	115	22.5	11553	3.7
2	Diatoma tenue elongatum	45	8.7	36621	11.8
3	Cyclotella stelligera	32	6.2	1753	0.6
4	Fragilaria construens	32	6.2	4283	1.4
5	Synedra radians	25	5.0	9178	3.0
6	Stephanodiscus astraea minutula	19	3.7	6692	2.2
7	Melosira granulata	19	3.7	52584	17.0
8	Cocconeis disculus	19	3.7	1434	0.5
9	Fragilaria pinnata	13	2.5	765	0.2
10	Fragilaria crotonensis	13	2.5	123141	39.7
11	Rhodomonas minuta	13	2.5	255	0.1
12	Cryptomonas erosa	13	2.5	6629	2.1
13	Navicula cascadensis	13	2.5	765	0.2
14	Nitzschia sp.	13	2.5	1530	0.5
15	Navicula pseudoscutiformis	6	1.2	1115	0.4
16	Nitzschia linearis	6	1.2	9714	3.1
17	Melosira varians	6	1.2	4143	1.3
18	Cyclotella ocellata	6	1.2	797	0.3
19	Nitzschia paleacea	6	1.2	625	0.2
20	Achnanthes minutissima	6	1.2	319	0.1
21	Achnanthes exigua	6	1.2	714	0.2
22	Nitzschia dissipata	6	1.2	1715	0.6
23	Nitzschia frustulum	6	1.2	765	0.2
24	Synedra rumpens	6	1.2	892	0.3
25	Asterionella formosa	6	1.2	4207	1.4
26	Synedra delicatissima	6	1.2	4207	1.4
27	Achnanthes sp.	6	1.2	765	0.2
28	Oocystis pusilla	6	1.2	2753	0.9
29	Amphora perpusilla	6	1.2	1058	0.3
30	Nitzschia acicularis	6	1.2	1785	0.6
31	Navicula anglica	6	1.2	2295	0.7
32	Unident. desmid	6	1.2	1052	0.3
33	Diploneis elliptica	6	1.2	1657	0.5
34	Nitzschia sp.	6	1.2	12238	3.9

* Values less than 1 indicate areas of heavy pollution, values from 1 to 3 areas of moderate pollution, and values exceeding 3 in clean water areas. (Wilhm, J.L., and T.C. Dorris, 1968)

PHYTOPLANKTON SAMPLE ANALYSIS

SAMPLE: Pend Oreille R, Sta 3-B

SAMPLE DATE: 88-07-13

TOTAL DENSITY (#/ml): 563

TOTAL BIOVOLUME (cu.uM/ml): 546029

DIVERSITY INDEX: 4.33

	SPECIES	DENSITY	PCT	BIOVOL	PCT
1	Rhodomonas minuta	118	20.9	2353	0.4
2	Rhizosolenia eriensis	62	11.0	6470	1.2
3	Melosira granulata	43	7.7	95343	17.5
4	Diatoma tenue elongatum	37	6.6	40118	7.3
5	Cocconeis disculus	31	5.5	2322	0.4
6	Fragilaria crotonensis	25	4.4	239223	43.8
7	Asterionella formosa	25	4.4	17706	3.2
8	Synedra radians	19	3.3	6686	1.2
9	Achnanthes minutissima	19	3.3	929	0.2
10	Nitzschia acicularis	12	2.2	19069	3.5
11	Fragilaria pinnata	12	2.2	1114	0.2
12	Fragilaria construens venter	12	2.2	1189	0.2
13	Fragilaria construens	12	2.2	1387	0.3
14	Amphora perpusilla	12	2.2	2055	0.4
15	Stephanodiscus astraea minutula	12	2.2	4334	0.8
16	Cymbella minuta	6	1.1	2291	0.4
17	Kephyrion-like	6	1.1	433	0.1
18	Elakatothrix gelatinosa	6	1.1	520	0.1
19	Stephanodiscus hantzschii	6	1.1	743	0.1
20	Nitzschia paleacea	6	1.1	607	0.1
21	Synedra ulna	6	1.1	12320	2.3
22	Anabaena flos-aquae	6	1.1	6191	1.1
23	Achnanthes hauckiana	6	1.1	297	0.1
24	Achnanthes linearis	6	1.1	817	0.1
25	Nitzschia sp.	6	1.1	743	0.1
26	Fragilaria vaucheria	6	1.1	1783	0.3
27	Quadrigula closterioides	6	1.1	297	0.1
28	Ceratium hirundinella	6	1.1	60673	11.1
29	Navicula cryptocephala veneta	6	1.1	588	0.1
30	Tabellaria fenestrata	6	1.1	14859	2.7
31	Ankistrodesmus falcatus	6	1.1	155	0.0
32	Synedra rumpens	6	1.1	867	0.2
33	Cyclotella ocellata	6	1.1	1548	0.3

PHYTOPLANKTON SAMPLE ANALYSIS

SAMPLE: Pend Oreille R, Sta 5A-0

SAMPLE DATE: 88-07-13

TOTAL DENSITY (#/ml): 589

TOTAL BIOVOLUME (cu.uM/ml): 320821

DIVERSITY INDEX: 4.39

	SPECIES	DENSITY	PCT	BIOVOL	PCT
1	Rhodomonas minuta	100	17.0	2003	0.6
2	Diatoma tenue elongatum	71	12.0	59550	18.6
3	Melosira granulata	53	9.0	74650	23.3
4	Nitzschia acicularis	35	6.0	80856	25.2
5	Fragilaria construens	29	5.0	11216	3.5
6	Cyclotella stelligera	24	4.0	1296	0.4
7	Cocconeis disculus	24	4.0	1767	0.6
8	Asterionella formosa	24	4.0	9072	2.8
9	Fragilaria pinnata	18	3.0	1060	0.3
10	Rhizosolenia eriensis	18	3.0	1679	0.5
11	Navicula cryptocephala	18	3.0	3269	1.0
12	Synedra delicatissima	18	3.0	11664	3.6
13	Anabaena flos-aquae	12	2.0	11782	3.7
14	Fragilaria crotonensis	12	2.0	19793	6.2
15	Achnanthes clevei	12	2.0	1767	0.6
16	Synedra radians	12	2.0	4241	1.3
17	Stephanodiscus astraea minutula	12	2.0	4124	1.3
18	Cyclotella ocellata	12	2.0	1473	0.5
19	Elakatothrix gelatinosa	12	2.0	1485	0.5
20	Caloneis hyalina	6	1.0	1296	0.4
21	Achnanthes lanceolata	6	1.0	1060	0.3
22	Fragilaria construens venter	6	1.0	283	0.1
23	Navicula pupula	6	1.0	1591	0.5
24	Cryptomonas erosa	6	1.0	3063	1.0
25	Nitzschia palea	6	1.0	1060	0.3
26	Amphora coffeiformes	6	1.0	560	0.2
27	Frustulia rhomboides	6	1.0	6362	2.0
28	Navicula minima	6	1.0	259	0.1
29	Oocystis pusilla	6	1.0	1272	0.4
30	Achnanthes minutissima	6	1.0	295	0.1
31	Ankistrodesmus falcatus	6	1.0	147	0.0
32	Synedra rumpens	6	1.0	825	0.3

PHYTOPLANKTON SAMPLE ANALYSIS

SAMPLE: Pend Oreille R, Sta 1

SAMPLE DATE: 88-08-01

TOTAL DENSITY (#/ml): 227

TOTAL BIOVOLUME (cu.uM/ml): 178435

DIVERSITY INDEX: 4.57

	SPECIES	DENSITY	PCT	BIOVOL	PCT
1	Fragilaria construens venter	28	12.3	3234	1.8
2	Cyclotella ocellata	22	9.9	2807	1.6
3	Fragilaria pinnata	20	8.6	2193	1.2
4	Achnanthes linearis	20	8.6	2594	1.5
5	Fragilaria construens	14	6.2	4087	2.3
6	Rhizosolenia eriensis	11	4.9	1067	0.6
7	Cocconeis disculus	8	3.7	632	0.4
8	Cyclotella stelligera	8	3.7	463	0.3
9	Fragilaria crotonensis	8	3.7	80151	44.9
10	Cymbella minuta	8	3.7	3116	1.7
11	Amphora perpusilla	6	2.5	932	0.5
12	Melosira granulata	6	2.5	46319	26.0
13	Achnanthes clevei	6	2.5	842	0.5
14	Synedra ulna	6	2.5	11173	6.3
15	Rhodomonas minuta	3	1.2	56	0.0
16	Closteriopsis longissima	3	1.2	999	0.6
17	Nitzschia acicularis	3	1.2	9432	5.3
18	Navicula cascadensis	3	1.2	168	0.1
19	Achnanthes minutissima	3	1.2	140	0.1
20	Navicula minima	3	1.2	124	0.1
21	Stephanodiscus hantzschii	3	1.2	337	0.2
22	Rhopalodia musculus	3	1.2	1263	0.7
23	Achnanthes exigua	3	1.2	314	0.2
24	Oocystis pusilla	3	1.2	606	0.3
25	Achnanthes lanceolata	3	1.2	505	0.3
26	Nitzschia paleacea	3	1.2	275	0.2
27	Nitzschia palea	3	1.2	505	0.3
28	Asterionella formosa	3	1.2	618	0.3
29	Stephanodiscus astraea minutula	3	1.2	983	0.6
30	Caloneis hyalina	3	1.2	618	0.3
31	Navicula radiosa	3	1.2	912	0.5
32	Achnanthes sp.	3	1.2	337	0.2
33	Gomphonema sp.	3	1.2	561	0.3
34	Ankistrodesmus falcatus	3	1.2	70	0.0

PHYTOPLANKTON SAMPLE ANALYSIS

SAMPLE: Pend Oreille R, Sta 3

SAMPLE DATE: 88-08-01

TOTAL DENSITY (#/ml): 202

TOTAL BIOVOLUME (cu.uM/ml): 169679

DIVERSITY INDEX: 4.29

	SPECIES	DENSITY	PCT	BIOVOL	PCT
1	Rhodomonas minuta	40	19.6	792	0.5
2	Cyclotella ocellata	18	8.9	2250	1.3
3	Fragilaria construens	18	8.9	3629	2.1
4	Melosira granulata	14	7.1	29700	17.5
5	Navicula cryptocephala	11	5.4	1998	1.2
6	Cocconeis disculus	11	5.4	810	0.5
7	Fragilaria construens venter	7	3.6	518	0.3
8	Amphora perpusilla	7	3.6	1195	0.7
9	Fragilaria crotonensis	7	3.6	48384	28.5
10	Achnanthes lanceolata	4	1.8	648	0.4
11	Melosira ambigua	4	1.8	6361	3.7
12	Cyclotella stelligera	4	1.8	198	0.1
13	Navicula pupula	4	1.8	972	0.6
14	Navicula pseudoscutiformis	4	1.8	630	0.4
15	Navicula tripunctata	4	1.8	4032	2.4
16	Oocystis parva	4	1.8	144	0.1
17	Rhizosolenia eriensis	4	1.8	684	0.4
18	Anabaena planctonica	4	1.8	36187	21.3
19	Synedra ulna	4	1.8	7164	4.2
20	Epithemia sorex	4	1.8	4104	2.4
21	Anabaena flos-aquae	4	1.8	7200	4.2
22	Navicula cryptocephala veneta	4	1.8	342	0.2
23	Asterionella formosa	4	1.8	5544	3.3
24	Synedra radians	4	1.8	1296	0.8
25	Fragilaria leptostauron	4	1.8	2650	1.6
26	Cocconeis placentula	4	1.8	1656	1.0
27	Navicula minima	4	1.8	158	0.1
28	Nitzschia frustulum	4	1.8	432	0.3

PHYTOPLANKTON SAMPLE ANALYSIS

SAMPLE: Pend Oreille R, Sta 5

SAMPLE DATE: 88-08-02

TOTAL DENSITY (#/ml): 188

TOTAL BIOVOLUME (cu.uM/ml): 45549

DIVERSITY INDEX: 4.19

	SPECIES	DENSITY	PCT	BIOVOL	PCT
1	Rhodomonas minuta	55	29.0	1094	2.4
2	Rhizosolenia eriensis	18	9.7	2026	4.4
3	Fragilaria construens venter	9	4.8	1894	4.2
4	Cyclotella stelligera	6	3.2	334	0.7
5	Elakatothrix gelatinosa	6	3.2	510	1.1
6	Fragilaria construens	6	3.2	1701	3.7
7	Cyclotella ocellata	6	3.2	759	1.7
8	Nitzschia paleacea	6	3.2	595	1.3
9	Diploneis elliptica	6	3.2	1580	3.5
10	Asterionella formosa	6	3.2	9355	20.5
11	Cymbella minuta	3	1.6	1124	2.5
12	Nitzschia frustulum	3	1.6	729	1.6
13	Navicula sp.	3	1.6	456	1.0
14	Ankistrodesmus falcatus	3	1.6	76	0.2
15	Cyclotella meneghiniana	3	1.6	1154	2.5
16	Achnanthes linearis	3	1.6	401	0.9
17	Navicula pupula	3	1.6	820	1.8
18	Melosira distans	3	1.6	1203	2.6
19	Fragilaria vaucheria	3	1.6	875	1.9
20	Synedra radians	3	1.6	1094	2.4
21	Cocconeis disculus	3	1.6	228	0.5
22	Scenedesmus denticulatus	3	1.6	547	1.2
23	Anabaena flos-aquae	3	1.6	9112	20.0
24	Achnanthes clevei	3	1.6	456	1.0
25	Nitzschia acicularis	3	1.6	851	1.9
26	Navicula cryptocephala	3	1.6	562	1.2
27	Achnanthes minutissima	3	1.6	152	0.3
28	Melosira granulata	3	1.6	1671	3.7
29	Achnanthes lanceolata	3	1.6	547	1.2
30	Anabaena sp.	3	1.6	3038	6.7
31	Gomphonema sp.	3	1.6	608	1.3

PHYTOPLANKTON SAMPLE ANALYSIS

SAMPLE: Pend Oreille R, Sta 1

SAMPLE DATE: 88-08-24

TOTAL DENSITY (#/ml): 199

TOTAL BIOVOLUME (cu.uM/ml): 33063

DIVERSITY INDEX: 4.24

	SPECIES	DENSITY	PCT	BIOVOL	PCT
1	Rhodomonas minuta	56	27.8	1111	3.4
2	Cocconeis disculus	15	7.6	1136	3.4
3	Cryptomonas erosa	13	6.3	6564	19.9
4	Cyclotella ocellata	13	6.3	1578	4.8
5	Stephanodiscus astraea minutula	8	3.8	2651	8.0
6	Fragilaria construens	8	3.8	848	2.6
7	Cyclotella stelligera	8	3.8	417	1.3
8	Synedra radians	5	2.5	1818	5.5
9	Achnanthes lanceolata	5	2.5	909	2.7
10	Navicula cascadensis	5	2.5	303	0.9
11	Navicula minima	5	2.5	222	0.7
12	Achnanthes minutissima	5	2.5	252	0.8
13	Navicula cryptocephala veneta	5	2.5	480	1.5
14	Ankistrodesmus falcatus	3	1.3	252	0.8
15	Nitzschia volcanica	3	1.3	404	1.2
16	Stephanodiscus hantzschii	3	1.3	303	0.9
17	Nitzschia frustulum	3	1.3	303	0.9
18	Fragilaria pinnata	3	1.3	151	0.5
19	Achnanthes clevei	3	1.3	379	1.1
20	Achnanthes peragalli	3	1.3	353	1.1
21	Cryptomonas sp.	3	1.3	1010	3.1
22	Amphora perpusilla	3	1.3	419	1.3
23	Cocconeis placentula	3	1.3	1161	3.5
24	Achnanthes linearis	3	1.3	333	1.0
25	Caloneis hyalina	3	1.3	555	1.7
26	Epithemia sorex	3	1.3	2878	8.7
27	Nitzschia sp.	3	1.3	303	0.9
28	Fragilaria construens venter	3	1.3	242	0.7
29	Navicula radiosa	3	1.3	821	2.5
30	Cyclotella meneghiniana	3	1.3	959	2.9
31	Navicula menisculus upsaliensis	3	1.3	518	1.6
32	Melosira ambigua	3	1.3	2974	9.0
33	Gomphonema angustatum	3	1.3	454	1.4

PHYTOPLANKTON SAMPLE ANALYSIS

SAMPLE: Pend Oreille R, Sta 3

SAMPLE DATE: 88-08-24

TOTAL DENSITY (#/ml): 180

TOTAL BIOVOLUME (cu.uM/ml): 130441

DIVERSITY INDEX: 4.77

	SPECIES	DENSITY	PCT	BIOVOL	PCT
1	Rhodomonas minuta	21	11.7	422	0.3
2	Cocconeis disculus	15	8.5	1152	0.9
3	Fragilaria construens venter	12	6.4	1476	1.1
4	Achnanthes minutissima	12	6.4	576	0.4
5	Fragilaria construens	10	5.3	3226	2.5
6	Achnanthes linearis	10	5.3	1267	1.0
7	Fragilaria crotonensis	8	4.3	87091	66.8
8	Cyclotella stelligera	8	4.3	422	0.3
9	Fragilaria pinnata	8	4.3	461	0.4
10	Cyclotella ocellata	6	3.2	720	0.6
11	Amphora perpusilla	6	3.2	956	0.7
12	Navicula minima	4	2.1	169	0.1
13	Anabaena flos-aquae	4	2.1	3840	2.9
14	Cryptomonas erosa	4	2.1	1997	1.5
15	Cymbella microcephala	4	2.1	204	0.2
16	Nitzschia acicularis	4	2.1	1075	0.8
17	Navicula cascadensis	4	2.1	230	0.2
18	Cryptomonas sp.	4	2.1	1536	1.2
19	Melosira granulata	4	2.1	7392	5.7
20	Cocconeis placentula	4	2.1	1766	1.4
21	Gomphonema acuminatum	2	1.1	3341	2.6
22	Synedra rumpens	2	1.1	269	0.2
23	Cymbella minuta	2	1.1	710	0.5
24	Gomphonema sp.	2	1.1	384	0.3
25	Unident. pennate diatom	2	1.1	336	0.3
26	Achnanthes lanceolata	2	1.1	346	0.3
27	Amphora ovalis	2	1.1	2220	1.7
28	Nitzschia frustulum	2	1.1	230	0.2
29	Rhizosolenia eriensis	2	1.1	182	0.1
30	Navicula decussis	2	1.1	369	0.3
31	Navicula cryptocephala	2	1.1	355	0.3
32	Nitzschia tryblionella	2	1.1	365	0.3
33	Fragilaria vaucheria	2	1.1	553	0.4
34	Achnanthes clevei	2	1.1	288	0.2
35	Nitzschia dissipata	2	1.1	516	0.4
36	Melosira italica	2	1.1	1809	1.4
37	Epithemia sorex	2	1.1	2189	1.7

PHYTOPLANKTON SAMPLE ANALYSIS

SAMPLE: Pend Oreille R, Sta 5

SAMPLE DATE: 88-08-24

TOTAL DENSITY (#/ml): 173

TOTAL BIOVOLUME (cu.uM/ml): 76628

DIVERSITY INDEX: 4.47

	SPECIES	DENSITY	PCT	BIOVOL	PCT
1	Rhodomonas minuta	26	14.8	512	0.7
2	Fragilaria construens	22	13.0	11460	15.0
3	Cocconeis disculus	13	7.4	960	1.3
4	Fragilaria pinnata	10	5.6	576	0.8
5	Cocconeis placentula	10	5.6	4414	5.8
6	Fragilaria crotonensis	6	3.7	26868	35.1
7	Navicula cryptocephala	6	3.7	1183	1.5
8	Navicula cryptocephala veneta	6	3.7	608	0.8
9	Navicula minima	6	3.7	281	0.4
10	Nitzschia frustulum	3	1.9	384	0.5
11	Cyclotella stelligera	3	1.9	176	0.2
12	Nitzschia sp.	3	1.9	384	0.5
13	Achnanthes minutissima	3	1.9	160	0.2
14	Cyclotella meneghiniana	3	1.9	1215	1.6
15	Cymbella minuta	3	1.9	1183	1.5
16	Navicula pseudoscutiformis	3	1.9	560	0.7
17	Navicula anglica	3	1.9	1151	1.5
18	Melosira granulata	3	1.9	3518	4.6
19	Fragilaria construens venter	3	1.9	154	0.2
20	Ankistrodesmus falcatus	3	1.9	320	0.4
21	Navicula cascadensis	3	1.9	192	0.3
22	Navicula sp.	3	1.9	480	0.6
23	Anabaena flos-aquae	3	1.9	6397	8.3
24	Fragilaria vaucheria	3	1.9	921	1.2
25	Kephyrion-like	3	1.9	224	0.3
26	Synedra ulna	3	1.9	6365	8.3
27	Stephanodiscus hantzschii	3	1.9	384	0.5
28	Diploneis elliptica	3	1.9	832	1.1
29	Stephanodiscus astraea minutula	3	1.9	1120	1.5
30	Epithemia sorex	3	1.9	3646	4.8

PHYTOPLANKTON SAMPLE ANALYSIS

SAMPLE: Pend Oreille R, Sta 1

SAMPLE DATE: 88-09-13

TOTAL DENSITY (#/ml): 230

TOTAL BIOVOLUME (cu.uM/ml): 177461

DIVERSITY INDEX: 4.76

	SPECIES	DENSITY	PCT	BIOVOL	PCT
1	Rhodomonas minuta	25	10.7	491	0.3
2	Cyclotella stelligera	18	8.0	1185	0.7
3	Fragilaria construens	18	8.0	5154	2.9
4	Fragilaria construens venter	12	5.3	736	0.4
5	Ankistrodesmus falcatus	12	5.3	614	0.3
6	Achnanthes minutissima	12	5.3	614	0.3
7	Anabaena flos-aquae	9	4.0	9204	5.2
8	Cocconeis disculus	9	4.0	690	0.4
9	Cyclotella ocellata	9	4.0	1151	0.6
10	Cocconeis placentula	9	4.0	4234	2.4
11	Fragilaria pinnata	6	2.7	368	0.2
12	Fragilaria vaucheria	6	2.7	2651	1.5
13	Cryptomonas erosa	6	2.7	3191	1.8
14	Amphora ovalis	6	2.7	3547	2.0
15	Achnanthes linearis	6	2.7	810	0.5
16	Synedra radians	6	2.7	2209	1.2
17	Navicula muralis	3	1.3	138	0.1
18	Melosira granulata	3	1.3	5062	2.9
19	Nitzschia sp.	3	1.3	368	0.2
20	Cryptomonas sp.	3	1.3	1227	0.7
21	Navicula minima	3	1.3	135	0.1
22	Dinobryon sertularia	3	1.3	368	0.2
23	Fragilaria brevistriata	3	1.3	506	0.3
24	Diploneis elliptica	3	1.3	798	0.4
25	Navicula cascadensis	3	1.3	184	0.1
26	Synedra delicatissima	3	1.3	2025	1.1
27	Nitzschia sp.	3	1.3	368	0.2
28	Nitzschia linearis	3	1.3	9351	5.3
29	Navicula rhynchocephala	3	1.3	905	0.5
30	Stephanodiscus astraea minutula	3	1.3	1074	0.6
31	Epithemia turgida	3	1.3	116432	65.6
32	Stephanodiscus hantzschii	3	1.3	368	0.2
33	Elakatothrix gelatinosa	3	1.3	258	0.1
34	Unident. pennate diatom	3	1.3	537	0.3
35	Amphora perpusilla	3	1.3	509	0.3

PHYTOPLANKTON SAMPLE ANALYSIS

SAMPLE: Pend Oreille R, Sta 3

SAMPLE DATE: 88-09-13

TOTAL DENSITY (#/ml): 393

TOTAL BIOVOLUME (cu.uM/ml): 251265

DIVERSITY INDEX: 3.36

	SPECIES	DENSITY	PCT	BIOVOL	PCT
1	Rhodomonas minuta	204	51.8	4071	1.6
2	Fragilaria construens	14	3.5	6217	2.5
3	Achnanthes minutissima	9	2.4	463	0.2
4	Stephanodiscus astraea minutula	9	2.4	3238	1.3
5	Navicula cryptocephala veneta	9	2.4	879	0.3
6	Achnanthes linearis	9	2.4	1221	0.5
7	Cocconeis disculus	9	2.4	694	0.3
8	Cryptomonas erosa	9	2.4	4811	1.9
9	Chroococcus minimus	9	2.4	259	0.1
10	Nitzschia paleacea	5	1.2	453	0.2
11	Oocystis parva	5	1.2	370	0.1
12	Melosira granulata	5	1.2	7632	3.0
13	Epithemia turgida	5	1.2	175543	69.9
14	Cyclotella ocellata	5	1.2	578	0.2
15	Melosira italica	5	1.2	4357	1.7
16	Achnanthes peragalli	5	1.2	648	0.3
17	Cymbella cesatii	5	1.2	856	0.3
18	Diploneis elliptica	5	1.2	1203	0.5
19	Pediastrum tetras	5	1.2	555	0.2
20	Navicula minima	5	1.2	204	0.1
21	Cryptomonas sp.	5	1.2	1850	0.7
22	Ankistrodesmus falcatus	5	1.2	116	0.0
23	Cymbella microcephala	5	1.2	245	0.1
24	Fragilaria vaucheria	5	1.2	1332	0.5
25	Anabaena planctonica	5	1.2	23248	9.3
26	Nitzschia frustulum	5	1.2	555	0.2
27	Achnanthes lanceolata	5	1.2	833	0.3
28	Nitzschia acicularis	5	1.2	1295	0.5
29	Fragilaria construens venter	5	1.2	222	0.1
30	Scenedesmus denticulatus	5	1.2	833	0.3
31	Epithemia sorex	5	1.2	5273	2.1
32	Amphora perpusilla	5	1.2	768	0.3
33	Nitzschia amphibia	5	1.2	444	0.2

PHYTOPLANKTON SAMPLE ANALYSIS

SAMPLE: Pend Oreille R, Sta 5

SAMPLE DATE: 88-09-13

TOTAL DENSITY (#/ml): 461

TOTAL BIOVOLUME (cu.uM/ml): 150250

DIVERSITY INDEX: 3.63

	SPECIES	DENSITY	PCT	BIOVOL	PCT
1	Rhodomonas minuta	186	40.3	3710	2.5
2	Fragilaria construens	38	8.3	15046	10.0
3	Cocconeis disculus	26	5.6	1919	1.3
4	Synedra ulna	26	5.6	50921	33.9
5	Cryptomonas erosa	19	4.2	9980	6.6
6	Ankistrodesmus falcatus	13	2.8	480	0.3
7	Melosira granulata	13	2.8	17592	11.7
8	Synedra rumpens	13	2.8	1791	1.2
9	Gomphonema gracile	6	1.4	1567	1.0
10	Nitzschia frustulum	6	1.4	768	0.5
11	Fragilaria construens venter	6	1.4	614	0.4
12	Cyclotella ocellata	6	1.4	800	0.5
13	Amphora perpusilla	6	1.4	1062	0.7
14	Stephanodiscus astraea minutula	6	1.4	2239	1.5
15	Tetraedron caudatum	6	1.4	256	0.2
16	Anabaena flos-aquae	6	1.4	6397	4.3
17	Melosira italica	6	1.4	12052	8.0
18	Oocystis parva	6	1.4	256	0.2
19	Diploneis elliptica	6	1.4	1663	1.1
20	Chroococcus minimus	6	1.4	90	0.1
21	Epithemia sorex	6	1.4	7293	4.9
22	Unident. green alga	6	1.4	960	0.6
23	Amphora ovalis	6	1.4	3698	2.5
24	Nitzschia innominata	6	1.4	307	0.2
25	Navicula tripunctata	6	1.4	7165	4.8
26	Navicula sp.	6	1.4	960	0.6
27	Navicula minima	6	1.4	281	0.2
28	Navicula cascadensis	6	1.4	384	0.3

PHYTOPLANKTON SAMPLE ANALYSIS

SAMPLE: Pend Oreille R, Sta 1

SAMPLE DATE: 88-10-05

TOTAL DENSITY (#/ml): 364

TOTAL BIOVOLUME (cu.uM/ml): 94858

DIVERSITY INDEX: 4.60

	SPECIES	DENSITY	PCT	BIOVOL	PCT
1	Fragilaria construens	47	12.9	9839	10.4
2	Rhodomonas minuta	35	9.7	705	0.7
3	Cocconeis disculus	23	6.4	1762	1.9
4	Fragilaria construens venter	23	6.4	2255	2.4
5	Fragilaria pinnata	23	6.4	1762	1.9
6	Cyclotella stelligera	18	4.8	969	1.0
7	Fragilaria brevistriata	12	3.2	1938	2.0
8	Cocconeis placentula	12	3.2	5403	5.7
9	Achnanthes minutissima	12	3.2	587	0.6
10	Achnanthes clevei	12	3.2	1762	1.9
11	Unident. pennate diatom	12	3.2	2055	2.2
12	Cyclotella ocellata	12	3.2	1468	1.5
13	Ankistrodesmus falcatus	12	3.2	294	0.3
14	Navicula pseudoscutiformis	12	3.2	2055	2.2
15	Asterionella formosa	6	1.6	10335	10.9
16	Melosira granulata	6	1.6	25839	27.2
17	Amphora perpusilla	6	1.6	975	1.0
18	Kephyrion-like	6	1.6	411	0.4
19	Scenedesmus quadricauda	6	1.6	1527	1.6
20	Achnanthes exigua	6	1.6	658	0.7
21	Stephanodiscus astraea minutula	6	1.6	2055	2.2
22	Aphanizomenon flos-aquae	6	1.6	3523	3.7
23	Navicula capitata	6	1.6	2819	3.0
24	Gomphonema angustatum	6	1.6	1057	1.1
25	Stephanodiscus hantzschii	6	1.6	705	0.7
26	Dinobryon bavaricum	6	1.6	720	0.8
27	Fragilaria vaucheria	6	1.6	1691	1.8
28	Gomphonema sp.	6	1.6	1174	1.2
29	Cyclotella meneghiniana	6	1.6	2232	2.4
30	Navicula pelliculosa	6	1.6	411	0.4
31	Anabaena flos-aquae	6	1.6	5872	6.2

PHYTOPLANKTON SAMPLE ANALYSIS

SAMPLE: Pend Oreille R, Sta 3

SAMPLE DATE: 88-10-05

TOTAL DENSITY (#/ml): 411

TOTAL BIOVOLUME (cu.uM/ml): 82644

DIVERSITY INDEX: 3.14

	SPECIES	DENSITY	PCT	BIOVOL	PCT
1	Rhodomonas minuta	138	33.7	2769	3.4
2	Navicula incomposita minor	126	30.6	26431	32.0
3	Stephanodiscus hantzschii	13	3.1	1510	1.8
4	Cocconeis disculus	13	3.1	944	1.1
5	Navicula cascadensis	13	3.1	755	0.9
6	Cocconeis placentula	13	3.1	5790	7.0
7	Cryptomonas erosa	8	2.0	4363	5.3
8	Nitzschia acicularis	8	2.0	2349	2.8
9	Fragilaria construens	8	2.0	10807	13.1
10	Ankistrodesmus falcatus	8	2.0	524	0.6
11	Sphaerocystis schroeteri	4	1.0	1175	1.4
12	Fragilaria construens venter	4	1.0	201	0.2
13	Navicula anglica	4	1.0	1510	1.8
14	Gomphonema angustatum	4	1.0	755	0.9
15	Anabaena flos-aquae	4	1.0	4195	5.1
16	Synedra parasitica	4	1.0	587	0.7
17	Fragilaria pinnata	4	1.0	252	0.3
18	Navicula minima	4	1.0	185	0.2
19	Amphora perpusilla	4	1.0	696	0.8
20	Dinobryon sertularia	4	1.0	1007	1.2
21	Cymbella tumida	4	1.0	10488	12.7
22	Synedra sp.	4	1.0	1175	1.4
23	Asterionella formosa	4	1.0	2769	3.4
24	Cymbella cesatii	4	1.0	776	0.9
25	Achnanthes clevei	4	1.0	629	0.8

PHYTOPLANKTON SAMPLE ANALYSIS

SAMPLE: Pend Oreille R, Sta 5

SAMPLE DATE: 88-10-05

TOTAL DENSITY (#/ml): 548

TOTAL BIOVOLUME (cu.uM/ml): 334988

DIVERSITY INDEX: 4.10

	SPECIES	DENSITY	PCT	BIOVOL	PCT
1	Rhodomonas minuta	169	30.9	3380	1.0
2	Cyclotella stelligera	70	12.8	3846	1.1
3	Stephanodiscus hantzschii	23	4.3	2797	0.8
4	Fragilaria construens venter	23	4.3	1398	0.4
5	Navicula cryptocephala	17	3.2	3234	1.0
6	Fragilaria construens	17	3.2	5227	1.6
7	Cocconeis disculus	17	3.2	1311	0.4
8	Navicula cascadensis	17	3.2	1049	0.3
9	Cocconeis placentula	12	2.1	5361	1.6
10	Achnanthes lanceolata	12	2.1	2098	0.6
11	Dinobryon sertularia	12	2.1	6293	1.9
12	Gomphonema angustatum	12	2.1	2098	0.6
13	Achnanthes linearis	12	2.1	1538	0.5
14	Cyclotella ocellata	12	2.1	1457	0.4
15	Navicula sp.	6	1.1	874	0.3
16	Nitzschia linearis	6	1.1	8880	2.7
17	Cymbella angustata	6	1.1	1136	0.3
18	Achnanthes exigua	6	1.1	653	0.2
19	Anabaena planctonica	6	1.1	29286	8.7
20	Anabaena flos-aquae	6	1.1	5827	1.7
21	Nitzschia dissipata	6	1.1	1567	0.5
22	Navicula pupula	6	1.1	1573	0.5
23	Rhizosolenia eriensis	6	1.1	554	0.2
24	Navicula cryptocephala veneta	6	1.1	554	0.2
25	Gyrosigma sp.	6	1.1	2913	0.9
26	Stephanodiscus astraea minutula	6	1.1	2039	0.6
27	Fragilaria pinnata	6	1.1	350	0.1
28	Epithemia turgida	6	1.1	221130	66.0
29	Fragilaria vaucheria	6	1.1	1678	0.5
30	Cryptomonas erosa	6	1.1	3030	0.9
31	Nitzschia acicularis	6	1.1	1632	0.5
32	Achnanthes minutissima	6	1.1	291	0.1
33	Cyclotella meneghiniana	6	1.1	2214	0.7
34	Navicula tripunctata	6	1.1	6526	1.9
35	Navicula menisculus upsaliensis	6	1.1	1195	0.4

PERIPHYTON SAMPLE ANALYSIS

SAMPLE: Pend Oreille R, Sta 2A

SAMPLE DATE: 88-08-25

TOTAL DENSITY (#/sq cm): 209036

TOTAL BIOVOL (cu uM/sq cm): 3.457998E+08

DIVERSITY INDEX: 4.05

	SPECIES	DENSITY	PCT	BIOVOL	PCT
1	Fragilaria construens	44420	21.2	15522160	4.5
2	Fragilaria construens venter	39194	18.7	2765544	0.8
3	Fragilaria pinnata	10452	5.0	627107	0.2
4	Nitzschia paleacea	10452	5.0	1024276	0.3
5	Cocconeis disculus	7839	3.7	587913	0.2
6	Epithemia turgida	7839	3.7	297484100	86.0
7	Achnanthes minutissima	7839	3.7	391942	0.1
8	Achnanthes minutissima	7839	3.7	391942	0.1
9	Fragilaria brevistriata	7839	3.7	1293409	0.4
10	Epithemia sorex	7839	3.7	8936281	2.6
11	Navicula pupula	7839	3.7	2116488	0.6
12	Amphora perpusilla	5226	2.5	867499	0.3
13	Oscillatoria sp.	5226	2.5	5225896	1.5
14	Nitzschia amphibia	2613	1.2	250843	0.1
15	Navicula cryptocephala	2613	1.2	483395	0.1
16	Navicula radiosa	2613	1.2	849208	0.2
17	Achnanthes clevei	2613	1.2	391942	0.1
18	Navicula cryptocephala veneta	2613	1.2	248230	0.1
19	Amphora ovalis	2613	1.2	1510284	0.4
20	Navicula cincta	2613	1.2	653237	0.2
21	Caloneis hyalina	2613	1.2	574849	0.2
22	Navicula gregaria	2613	1.2	457266	0.1
23	Cymbella sinuata	2613	1.2	365813	0.1
24	Fragilaria leptostauron	2613	1.2	480782	0.1
25	Nitzschia sinuata	2613	1.2	653237	0.2
26	Achnanthes lanceolata	2613	1.2	470331	0.1
27	Fragilaria capucina mesolepta	2613	1.2	666302	0.2
28	Cymbella angustata	2613	1.2	509525	0.1

PERIPHYTON SAMPLE ANALYSIS

SAMPLE: Pend Oreille R, Sta 3A

SAMPLE DATE: 88-08-25

TOTAL DENSITY (#/sq cm): 556051

TOTAL BIOVOL (cu uM/sq cm): 4.659351E+08

DIVERSITY INDEX: 3.95

	SPECIES	DENSITY	PCT	BIOVOL	PCT
1	Fragilaria construens venter	91720	16.5	16509560	3.5
2	Epithemia sorex	74522	13.4	111291700	23.9
3	Achnanthes minutissima	74522	13.4	4583124	1.0
4	Fragilaria construens	68790	12.4	55241010	11.9
5	Navicula cryptocephala veneta	28662	5.2	2722932	0.6
6	Synedra rumpens	22930	4.1	3210193	0.7
7	Navicula capitata	17197	3.1	10978860	2.4
8	Nitzschia paleacea	17197	3.1	3370703	0.7
9	Amphora perpusilla	17197	3.1	2854779	0.6
10	Achnanthes linearis	17197	3.1	2270065	0.5
11	Cocconeis disculus	17197	3.1	1715447	0.4
12	Fragilaria vaucheria	17197	3.1	6587317	1.4
13	Cocconeis placentula	11465	2.1	5273889	1.1
14	Navicula cryptocephala	11465	2.1	2121020	0.5
15	Fragilaria pinnata	11465	2.1	687899	0.1
16	Nitzschia frustulum	5732	1.0	687899	0.1
17	Fragilaria leptostauron	5732	1.0	3164333	0.7
18	Epithemia turgida	5732	1.0	217547900	46.7
19	Nitzschia dissipata	5732	1.0	1542039	0.3
20	Nitzschia amphibia	5732	1.0	550319	0.1
21	Navicula decussis	5732	1.0	1100638	0.2
22	Unident. green alga	5732	1.0	8598731	1.8
23	Achnanthes clevei	5732	1.0	859873	0.2
24	Nitzschia acicularis	5732	1.0	1605097	0.3
25	Navicula sp.	5732	1.0	859873	0.2

PERIPHYTON SAMPLE ANALYSIS

SAMPLE: Pend Oreille R, Sta 4A

SAMPLE DATE: 88-08-25

TOTAL DENSITY (#/sq cm): 667532

TOTAL BIOVOL (cu uM/sq cm): 9.129648E+08

DIVERSITY INDEX: 4.20

	SPECIES	DENSITY	PCT	BIOVOL	PCT
1	Fragilaria construens venter	138794	20.8	17787790	1.9
2	Fragilaria construens	105748	15.8	38492090	4.2
3	Achnanthes minutissima	52874	7.9	2643689	0.3
4	Fragilaria pinnata	33046	5.0	1982766	0.2
5	Achnanthes linearis	33046	5.0	4362086	0.5
6	Navicula capitata	26437	4.0	12689700	1.4
7	Epithemia sorex	26437	4.0	30138050	3.3
8	Epithemia turgida	19828	3.0	752459700	82.4
9	Achnanthes lanceolata	19828	3.0	3568979	0.4
10	Cocconeis disculus	19828	3.0	1487075	0.2
11	Amphora perpusilla	19828	3.0	8788016	1.0
12	Navicula minima	13218	2.0	581611	0.1
13	Fragilaria vaucheria	13218	2.0	3806911	0.4
14	Navicula decussis	13218	2.0	2537941	0.3
15	Fragilaria leptostauron	13218	2.0	2432193	0.3
16	Achnanthes exigua	13218	2.0	1480465	0.2
17	Stephanodiscus astraea minutula	6609	1.0	2313228	0.3
18	Navicula pupula	6609	1.0	1784490	0.2
19	Fragilaria brevistriata	6609	1.0	1090522	0.1
20	Cyclotella ocellata	6609	1.0	826153	0.1
21	Cymbella minuta	6609	1.0	2445412	0.3
22	Achnanthes clevei	6609	1.0	991383	0.1
23	Cocconeis placentula	6609	1.0	3040242	0.3
24	Navicula sp.	6609	1.0	1982766	0.2
25	Navicula radiosa	6609	1.0	2147997	0.2
26	Navicula cryptocephala	6609	1.0	1222706	0.1
27	Synedra rumpens	6609	1.0	925291	0.1
28	Nitzschia sp.	6609	1.0	793107	0.1
29	Navicula pseudoscutiformis	6609	1.0	1156614	0.1
30	Nitzschia frustulum	6609	1.0	793107	0.1
31	Nitzschia constricta	6609	1.0	3833348	0.4
32	Navicula anglica	6609	1.0	2379320	0.3

PERIPHYTON SAMPLE ANALYSIS

SAMPLE: Pend Oreille R, Sta 5A

SAMPLE DATE: 88-08-25

TOTAL DENSITY (#/sq cm): 609595

TOTAL BIOVOL (cu uM/sq cm): 2.82268E+09

DIVERSITY INDEX: 3.81

	SPECIES	DENSITY	PCT	BIOVOL	PCT
1	Epithemia sorex	119528	19.6	177141200	6.3
2	Fragilaria construens venter	107576	17.6	16936700	0.6
3	Fragilaria construens	77694	12.7	50904780	1.8
4	Epithemia turgida	59764	9.8	2494858000	88.4
5	Achnanthes minutissima	41835	6.9	2384593	0.1
6	Navicula cryptocephala veneta	29882	4.9	2838801	0.1
7	Fragilaria pinnata	23906	3.9	2510098	0.1
8	Caloneis hyalina	11953	2.0	3944439	0.1
9	Navicula cryptocephala	11953	2.0	2211277	0.1
10	Achnanthes lanceolata	11953	2.0	2151512	0.1
11	Achnanthes linearis	11953	2.0	2366664	0.1
12	Cymbella minuta	11953	2.0	4422553	0.2
13	Melosira varians	5976	1.0	3884675	0.1
14	Navicula pseudoscutiformis	5976	1.0	1045874	0.0
15	Cocconeis placentula	5976	1.0	2749155	0.1
16	Nitzschia dissipata	5976	1.0	1607658	0.1
17	Melosira granulata	5976	1.0	9861098	0.3
18	Nitzschia paleacea	5976	1.0	585689	0.0
19	Nitzschia frustulum	5976	1.0	717171	0.0
20	Amphora ovalis	5976	1.0	3454373	0.1
21	Nitzschia amphibia	5976	1.0	573737	0.0
22	Gomphonema gracile	5976	1.0	1464224	0.1
23	Amphora perpusilla	5976	1.0	992086	0.0
24	Melosira italica	5976	1.0	11259580	0.4
25	Achnanthes clevei	5976	1.0	896463	0.0
26	Oscillatoria sp.	5976	1.0	5976423	0.2
27	Cymbella tumida	5976	1.0	14941060	0.5

PHYTOPLANKTON SAMPLE ANALYSIS

SAMPLE: Pend Oreille R, Composite 3A-B

SAMPLE DATE: 88-10-25

TOTAL DENSITY (#/ml): 552

TOTAL BIOVOLUME (cu.uM/ml): 119688

DIVERSITY INDEX: 4.67

	SPECIES	DENSITY	PCT	BIOVOL	PCT
1	Rhodomonas minuta	98	17.7	1958	1.6
2	Achnanthes minutissima	56	10.1	5929	5.0
3	Cocconeis disculus	35	6.3	2622	2.2
4	Cyclotella ocellata	35	6.3	4370	3.7
5	Fragilaria pinnata	21	3.8	2102	1.8
6	Cocconeis placentula	21	3.8	9649	8.1
7	Scenedesmus quadricauda	21	3.8	3641	3.0
8	Achnanthes lanceolata	14	2.5	2517	2.1
9	Navicula cryptocephala	14	2.5	2587	2.2
10	Synedra radians	14	2.5	7552	6.3
11	Cyclotella stelligera	14	2.5	769	0.6
12	Achnanthes clevei	14	2.5	2098	1.8
13	Nitzschia paleacea	14	2.5	1370	1.1
14	Fragilaria construens venter	14	2.5	1007	0.8
15	Navicula minima	7	1.3	308	0.3
16	Stephanodiscus astraea minutula	7	1.3	2447	2.0
17	Navicula cryptocephala veneta	7	1.3	664	0.6
18	Asterionella formosa	7	1.3	3077	2.6
19	Navicula cascadensis	7	1.3	420	0.4
20	Fragilaria vaucheria	7	1.3	2014	1.7
21	Nitzschia frustulum	7	1.3	1678	1.4
22	Achnanthes linearis	7	1.3	9230	7.7
23	Achnanthes lewisiana	7	1.3	874	0.7
24	Fragilaria brevistriata	7	1.3	1154	1.0
25	Achnanthes exigua	7	1.3	783	0.7
26	Aphanizomenon flos-aquae	7	1.3	4195	3.5
27	Nitzschia dissipata	7	1.3	1881	1.6
28	Nitzschia sp.	7	1.3	839	0.7
29	Fragilaria crotonensis	7	1.3	11747	9.8
30	Fragilaria construens	7	1.3	2349	2.0
31	Navicula mutica	7	1.3	385	0.3
32	Nitzschia linearis	7	1.3	10656	8.9
33	Epithemia sorex	7	1.3	7971	6.7
34	Rhizosolenia eriensis	7	1.3	664	0.6
35	Nitzschia acicularis	7	1.3	1958	1.6
36	Melosira varians	7	1.3	4545	3.8
37	Dinobryon bavaricum	7	1.3	839	0.7
38	Stephanodiscus hantzschii	7	1.3	839	0.7

PHYTOPLANKTON SAMPLE ANALYSIS

SAMPLE: Pend Oreille R, Composite 1A-B

SAMPLE DATE: 88-10-26

TOTAL DENSITY (#/ml): 521

TOTAL BIOVOLUME (cu.uM/ml): 117533

DIVERSITY INDEX: 4.63

	SPECIES	DENSITY	PCT	BIOVOL	PCT
1	Rhodomonas minuta	108	20.7	2160	1.8
2	Fragilaria construens venter	32	6.1	5488	4.7
3	Fragilaria construens	25	4.9	6403	5.4
4	Synedra radians	25	4.9	9147	7.8
5	Fragilaria pinnata	25	4.9	2668	2.3
6	Navicula minima	19	3.7	838	0.7
7	Achnanthes minutissima	19	3.7	953	0.8
8	Cyclotella stelligera	19	3.7	1048	0.9
9	Stephanodiscus astraea minutula	19	3.7	6670	5.7
10	Achnanthes lanceolata	19	3.7	3430	2.9
11	Navicula cascadensis	19	3.7	1143	1.0
12	Ankistrodesmus falcatus	13	2.4	318	0.3
13	Cyclotella ocellata	13	2.4	1588	1.4
14	Cocconeis disculus	13	2.4	953	0.8
15	Aphanizomenon flos-aquae	13	2.4	7623	6.5
16	Amphora ovalis	6	1.2	3672	3.1
17	Dinobryon bavaricum	6	1.2	762	0.6
18	Nitzschia acicularis	6	1.2	1779	1.5
19	Synedra ulna	6	1.2	12641	10.8
20	Pinnularia sp.	6	1.2	2541	2.2
21	Gomphonema sp.	6	1.2	1270	1.1
22	Cyclotella meneghiniana	6	1.2	2414	2.1
23	Amphora perpusilla	6	1.2	1054	0.9
24	Tabellaria fenestrata	6	1.2	15245	13.0
25	Nitzschia dissipata	6	1.2	1709	1.5
26	Nitzschia linearis	6	1.2	9681	8.2
27	Kephyrion-like	6	1.2	445	0.4
28	Achnanthes sp.	6	1.2	762	0.6
29	Melosira granulata	6	1.2	3494	3.0
30	Navicula cryptocephala veneta	6	1.2	603	0.5
31	Fragilaria leptostauron	6	1.2	1169	1.0
32	Diploneis elliptica	6	1.2	1652	1.4
33	Stephanodiscus hantzschii	6	1.2	762	0.6
34	Cryptomonas erosa	6	1.2	3303	2.8
35	Nitzschia frustulum	6	1.2	762	0.6
36	Nitzschia paleacea	6	1.2	623	0.5
37	Dinobryon sertularia	6	1.2	762	0.6