Research Technical Completion Report

MIDDLE SNAKE RIVER PRODUCTIVITY AND NUTRIENT ASSESSMENT 1994

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Idaho Department of Health and Welfare
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Table of Contents

List of Figures

List of Tables

List of Appendix Tables

ABSTRACT

In 1994, the University of Idaho conducted a third year of research on a portion of the water quality-limited section of the Middle Snake River from Milner dam downstream to King Hill. This study emphasized the highly productive shallow Crystal Springs Reach (RM 599.5 - 601.3) rich in aquatic macrophyte development. In research during 1992 and 1993, the Crystal Springs Reach (CSR) was determined to be the most productive reach in the water quality-limited section. In the 1994 study described herein, we emphasized relationships in these plant beds and between the plants, water quality variables, and sediments.

The dense aquatic macrophyte community was dominated by *Potamogeton pectinatus*, *P. crispus*, and *Ceratophyllum demersum*. Associated with the rooted macrophytes were luxuriant growths of the attached filamentous green algae *Hydrodictyon*, *Enteromorpha*, and *Cladophora* that formed dense mats on the water surface. Dry biomass levels for this plant community exceeded densities of 3,000 g/m^2 with mean cross-river transect levels of 1,000 g/m^2 common. Macrophyte biomass was greatest in areas of low water velocity, (<0.3 fps), water depths <1.5 m, sediment total nitrogen levels of ~ 0.40%, sediment total phosphorus levels of 1,000 - 1,200 µg/g, and sediment organic matter of 3 - 4%. These conditions dominated CSR, especially below aquaculture effluent discharges. Sediment nutrient levels for total Kjeldahl nitrogen (TKN) were up to ten times greater than those determined in other macrophyte-rich river systems (Pend Oreille River, Washington and Bow River, Alberta). Sediment total phosphorus (TP) concentrations were also high, with transect means of 1,200 - 1,800 µg/g below aquaculture discharges. Minimum and maximum thresholds of sediment N and P were related to aquatic macrophyte biomass densities.

This reach of the Middle Snake River is classified as eutrophic based on chlorophyll *a* concentrations, dissolved nitrogen and phosphorus concentrations, dense aquatic macrophyte growths, and sediment nutrient levels.

INTRODUCTION

Study Purpose

The Middle Snake River from Milner Dam downstream to King Hill (Figure 1) has been listed as water quality-limited since 1990 under the Idaho Clean Water Standards by the Idaho Department of Welfare, Division of Environmental Quality (IDHW). This reach is the receiving waters for numerous point and non-point sources throughout its course. Dey and Minshall (1992) reviewed and summarized past studies on the Middle Snake River. They documented historic conditions in the river while recent effluent loading and river water quality studies by Brockway and Robison (1992) documented present loading rates of point and non-point pollutants to this reach of the Snake River. The net effect of these uses has been a visible decline in water quality and an apparent increased productivity (increased floating and attached algae and rooted aquatic plants) in the river. The drought conditions that continued for nine years through 1994 have exacerbated this excessive biotic production in the river.

Increasing public awareness and sensitivity to water quality problems and the increasing demands by different user groups on regional water resources have brought this river reach and its water quality problems to the forefront. The need for sound management decisions has highlighted the necessity for additional information regarding sediment and nutrient loading and its effects on this reach of the Middle Snake River, specifically on the most degraded section from River Mile (RM) 615 downstream to RM 581 (Twin Falls downstream to Upper Salmon Falls Dam). Consequently, IDHW and the US Environmental Protection Agency (USEPA), Region 10, began a study in 1992 as an effort to determine the relationship between the nutrients and sediments entering this 34-mile reach of the Snake River and the river's current level of plant productivity. This research will contribute to the development of the Mid-Snake Nutrient Management Plan to better control productivity and improve water quality in the reach. The 1992 and 1993 work was reported in Falter and Carlson (1994) and Falter et al (1995), respectively, while this present report describes work carried out in 1994.

Background Information

Historically the Middle Snake River has been receiving wastewaters from agricultural run-off, aquaculture effluents, wastewater treatment plant returns, and numerous other point and non-point sources. The operations of numerous hydro-projects on the river and subsequent demands for out-of-channel water uses have greatly altered the hydrological regime of the river. These factors have all acted in concert to exacerbate the present conditions of noticeably poor water quality and reduced habitat for several indigenous cold-water biota (Dey and Minshall 1992).

Recently there has been a growing emphasis on improving water quality in the Middle Snake River. This includes problem assessment and, as a consequence of the Mid-Snake Nutrient Management Plan, the development of voluntary nutrient management plans from individual industries targeting the Middle Snake River. Current research efforts on the Middle Snake River have focused on documenting water quality conditions and identifying in-stream impacts of pollution loading. Brockway and Robison (1992) updated nutrient and sediment loading to the Middle Snake River from known major sources. MacMillan (1992) reviewed water quality status and provided an early emphasis on aquatic macrophyte development in the river. Projects funded by public and private sources have greatly increased the information available regarding the Middle Snake River. The basic questions of river response to these loadings, however, remain unanswered, especially sediment distribution, sediment nutrient content, plant bed processing of water column and sediment nutrients, and nutrient content of the aquatic macrophytes.

The Middle Snake River from RM 581 to 615 is considered to be eutrophic (Falter and Carlson 1994; Falter et al. 1995; Minshall et al 1993; and Royer et al 1995). This classification was based on the high concentrations of dissolved nitrogen and phosphorus, high planktonic chlorophyll *a* concentrations and algal cell densities, high sediment total phosphorus and total Kjeldahl nitrogen (TKN) concentrations, and the high aquatic macrophyte and associated filamentous algae densities. Aquatic macrophyte biomass in several areas of the river commonly exceeded 1,000 g/m^2, well above densities considered nuisance levels by both the Idaho Department of Environmental Quality and the Washington Department of Ecology standards (Coots and Williams 1991).

Recent research in the Middle Snake River has emphasized nutrient and sediment concentrations in the river and resulting impacts on primary productivity, benthic habitats, and benthic fauna (Falter et al 1995; Minshall et al 1993; and Royer et al 1995). Recent literature focusing on nutrient sources for rooted aquatic vegetation concurs that the sediments are the primary source of phosphorus, nitrogen, and other nutrients for *Potamogeton*, *Elodea*, and *Myriophyllum* (Carignan and Kalff 1980a; Graneli and Solander 1988; Barko et al. 1991; Chambers et al. 1991; Rattray et al. 1991). Conversely, current literature agrees that *Ceratophyllum*, and the filamentous algal epiphytes with their lack of roots, typically derive the majority of their nutrients from the water column (Carignan and Kalff 1980b; Howard-Williams and Allanson 1981; Millner et al. 1982; Kennedy and Gunkel 1987; Madsen and Adams 1988). These epiphytic plants are commonly found in association with the rooted macrophytes of the Middle Snake River. The opportunistic nature of aquatic macrophytes makes the plant : nutrient interaction even more complex since *Potamogeton* and *Myriophyllum* have also been shown to sometimes utilize nutrients from the water column (Nichols and Keeney 1976; Best and Mantai 1978; Howard-Williams 1981). Falter and Carlson (1994) and Falter et al. (1995) have suggested that low sediment TKN and phosphorus concentrations may sometimes be limiting to aquatic macrophyte biomass in the Middle Snake River. It has also been shown that soluble reactive phosphorus (SRP) was negatively correlated to macrophyte biomass (Falter and Carlson 1994), probably as a result of SRP uptake by dense aquatic macrophyte beds (AMB). This latter relationship was not as evident in 1993 work on the Snake River (Falter et al. 1995) but had been earlier shown by Howard-Williams (1981) where a rooted *Potamogeton pectinatus* community removed large amounts of soluble N and P from the water column. Their analyses showed most nutrient removal attributable to uptake by the filamentous green algae community growing on the *P. pectinatus* substrate. Howard-Williams (1981) found that uptake by the filamentous algal mats and subsequent deposition in bottom sediments was the principle route of nutrient flow from the water column to sediments.

The fine sediments on the river bottom are the crux of the macrophyte production in the Middle Snake River. Not only do they provide a very rich nutrient supply for macrophytes, but they also provide a suitable physical substrate for macrophytes to develop in shallower water. Anderson and Kalff (1988) identified fine organic sediments as a requirement for optimal macrophyte productivity. This is in agreement with literature reviewed by Nichols and Shaw (1986) and Barko et al. (1991). Falter and Carlson (1994) determined that much of the sediments in the Middle Snake River were high in nutrients and moderately high in organics, indicating enriched nutrient loading.

Exceptionally low flows through the 1986-1994 period have undoubtedly exacerbated the recent high levels of productivity in the Middle Snake River. These continuing drought conditions have further increased the potential for high productivity by increasing sedimentation and allowing for reduced scouring of accrued sediments. Though it has been shown that aquatic macrophyte biomass may be reduced by high water velocity (Chambers et al. 1991a), it is unlikely that at present loading rates of sediments and nutrients to the river, anything less than very high flows (certainly greater than the low mean summer flows of 1986-93) will greatly remove these accumulated sediment deposits and reduce aquatic macrophyte production in the established plant beds.

Study Area

The Crystal Springs Reach (CSR) is a short section of the Middle Snake River from River Mile (RM) 599.5 to 601.3 identified by Falter and Carlson (1994) as the most productive section of the river in their 1992 research. For that reason it was selected as the focal point for the continuation of that research in 1993 and 1994. The CSR was typified by turbid, high nutrient water, high aquatic macrophyte biomass (both rooted and epiphytic), extremely high planktonic algae blooms, and thick deposits of fine sediments. The river channel in that reach lies in a deeply incised canyon about 80 m below the Snake River Plain. The geology of the area is Banbury basalt of the Snake River group (Covington and Weaver 1990). Inputs to the Middle Snake River affecting this reach include the City of Twin Falls Wastewater Treatment facility (RM 609.9), upstream agricultural returns, and numerous aquaculture facilities.

The aquatic macrophyte community in the CSR is dominated by *Potamogeton pectinatus*, *P. crispus*, and *Ceratophyllum demersum* (Falter and Carlson 1994). Large mats of the filamentous algae *Hydrodictyon*, *Enteromorpha*, and *Cladophora* also grow in association with the flowering, mostly rooted, aquatic macrophyte growths. These dense plantbeds in the CSR and their relationships to the sediments, water quality, and sedimentation rates in the CSR were the principal focus of the 1994 study.

1994 Objectives:

1. a. Determine the suspended solids load of the Middle Snake River under existing conditions;
   b. Determine volume of sediments in the CSR;

2. Describe the sediments of the Middle Snake River, including particle size and stability, nutrient content, percentage organics, and distribution;

3. Determine root, shoot, and leaf nutrient content of the three dominant aquatic macrophyte species; and

4. Continue monitoring of aquatic macrophyte communities in the Middle Snake River, relating water column and sediment characteristics to plant biomass.

METHODS

In 1992 work, we expressed plant densities as dry weights per sample and as average density *within selected plantbeds*, based on non-random placement of sample clumps. In 1993 and 1994, we 1) established transects (2,5, and 7) on which sample sites were non-puposefully placed; and 2) randomly sampled areas between transects 2 and 7 in which series of random samples were taken. In 1994, three transects were established in the CSR starting at the upstream end and progressing downstream (Figure 1). The placement of water chemistry, sediment, and aquatic macrophyte samples at repeatable points on transects permitted between-year comparisons at specific sites and for correlation analyses between ecosystem variables. Transect 2 was established at RM 600.6 above the large aquatic macrophyte bed (AMB) areas in the lower half of the reach. Transects 5 and 7 were located in the lower portion of the reach at RM 600.2 and 600.0. Transects 5 and 7 correspond to the Crystal Springs upper and lower AMB sites used by Falter and Carlson (1994) and Falter et al. (1995) in the 1992 and 1993 work.

Sampling was conducted in April, May, June, July, August, October, and November, 1994. September was not sampled because of equipment failure. Transect 5 was sampled in April, but was replaced in all following months by an additional series of eight random samples ("Transect" R) taken between the upper and lower transects, 2 and 7.

	River Mile of Full Sampling Sites	**River Mile of Sediment Traps & Transects**
	--	600.9
Transect 2	600.6	--
	--	600.5
Transect 5	600.2	600.2
Transect 7	600.0	600.0

QA/QC

Water chemistry samples were collected according to IDHW protocol (Bauer 1986; Bauer et al. 1986). This included the collection of duplicates, blanks, and spike samples at a rate of 1 in 20 samples. Duplicates and blanks were collected throughout the study. Spikes were collected after the first sampling trip and throughout the study year with spiking materials provided by IDHW's Boise Analytical Lab.

Duplicate samples were collected from the composite water sample in conjunction with the primary sampling effort. Blank samples were taken by filling 1-liter cubitainers in the field with distilled water provided by IDHW. Spike samples were taken by filling 1-liter cubitainers with 900 ml of water from the composite water sample, adding the spiking material, and sealing the cubitainer.

Duplicate samples were used to compare percent relative difference, a measure of precision. Blanks were analyzed to determine the percentage of blanks containing levels of the selected variables above detection limits to determine any contamination occurring in the field during sampling. Spikes were used to calculate percent recovery, a measure of accuracy. SRP did not have a spike sample determined in the QA/QC. Statistical comparisons were done on duplicate samples to determine any significant variation due to site.

Overview of All Parameters Covered in this Report (Specific protocols described later):

1. Water Column Parameters

Monthly Average Flow	Total Hardness
Velocity	Alkalinity
Total Suspended Solids	Conductivity
Turbidity	pH
Secchi Depth	Nitrate + Nitrite Nitrogen
Temperature	Total Kjeldahl Nitrogen
Dissolved Oxygen	Ammonia Nitrogen
Monochromatic Chlorophyll *a*	Total Phosphorus
Phaeophytin	Soluble Reactive Phosphorus
Trichromatic Chlorophyll *a*	

2. Aquatic Macrophyte Parameters

Total Dry Biomass /m^2	Sulfur
Phosphorus	Sodium
Magnesium	Carbon
Calcium	Hydrogen
Potassium	Nitrogen

3. Sediment Trap-Collected Parameters

Sediment Collection Rates	% Sand
Total Phosphorus	% Silt
Plant-Available Phosphorus	% Clay
Plant-Available Potassium	Organic Carbon
Carbon	Organic Matter
Hydrogen	Nitrogen

4. Suspended Sediment Parameters

Organic Carbon	Total Carbon
Organic Matter	Total Nitrogen
Hydrogen	Total Phosphorus
Depth	Velocity
pH	

Physical Variables

Maximum depth was measured in meters by sounding with a weighted line. Velocity (ft/sec) was then measured with a Marsh-McBirney current meter at the surface and mid-depth in the water column (maximum 1.5 m depth in waters deeper than 3.0 m).

Temperature and dissolved oxygen profiles were measured with a YSI Model 57 Meter at 1.0 m intervals from the surface to the bottom. The meter was air-calibrated daily according to YSI methods for the meter.

Secchi depth was determined with a Secchi disk 20-cm diameter. The recorded depth was the mean of the depths at which the disk disappeared upon lowering and reappeared on raising the disk.

Water Chemistry Variables

Samples for water chemistry analyses were collected at mid-depth with a 2-liter Kemmerer bottle. Four grab samples were collected at each point and composited in an acid-washed container for subsampling. Composite water samples were thoroughly mixed and a subsample collected for total alkalinity as $CaCO_3$ equivalent, total hardness as $CaCO_3$ equivalent, turbidity, suspended solids, and pH, then placed in a 1-liter cubitainer marked with the study identification number, site number, and date. An Orion Research Model SA 210 pH meter with manual temperature compensation was used to measure water and sediment pH. Water pH was measured in the composite water sample after the water chemistry sub-samples had been collected. Sediment pH was measured from each dredge sample before packaging. The pH meter was calibrated daily with a pH 7.0 buffer solution prior to sampling. Conductivity was measured with a YSI Model 33 S-C-T meter.

A second 1-liter subsample was taken for total ammonia nitrogen, total nitrite + nitrate nitrogen, total Kjeldahl nitrogen, and total phosphorus. Two ml of concentrated H_2SO_4 were added to the 1-liter cubitainer to fix the sample. Cubitainers were labeled with the study identification number, site number, and date for identification. A 50-ml sample was filtered through a 0.45 μm nylon filter into a 100-ml vial for soluble reactive phosphorus (SRP). SRP samples were filtered in the field as they were collected.

All water chemistry samples were stored in iced coolers (~4° C) for up to a half day while in the field. Upon return to the field laboratory at the Magic Valley Fish Hatchery, water chemistry samples were packaged on ice in coolers and shipped to the IDHW Laboratory in Boise, Idaho. SRP samples that could not be shipped the date of collection were frozen at the field laboratory.

The following protocols were followed in the analyses (Personal Communication, Jim Dodds, IDHW Bureau of Laboratories, September 25, 1995):

Parameter	Method	EPA Protocol
Total Alkalinity	Titrimetric to pH 4.5	Method 310.1
Total Hardness	Titrimetric, EDTA	Method 130.2
Turbidity	Nephelometric	Method 180.1
Non-Filterable Residue	Gravimetric, dried @ 103-105 °C	Method 160.2
Nitrite + Nitrate N	Colorimetric, automated, cadmium reduction	Method 353.2*
Ammonia N	Colorimetric, automated phenate	Method 350.1*
Total Kjeldahl N	Colorimetric, semi-automated, block digester, method does not measure $NO_2 + NO_3$ nitrogen	Method 351.2**
Ortho-Phosphorus	Colorimetric, semi-automated, ascorbic acid	Method 365.1*
Total Phosphorus	Colorimetric, semi-automated, block digester	Method 365.4**

* Lachat Instrument, System IV EPA-approved flow-injection analysis version of this method

** Perstorp Analytical, Flow Solution, EPA-approved flow-injection analysis version for this method

Phytoplankton

Chlorophyll *a*

A third subsample was collected from the composite water sample and placed in a 1-liter Nalgene bottle for chlorophyll *a* analysis. These samples were placed on ice in coolers immediately after collection for transport to the field laboratory. Chlorophyll *a* samples were filtered at the field laboratory onto GFC glass fiber filters with a millipore filter and vacuum pump. Filters were frozen at the field lab for transport and processing at the University of Idaho. Frozen filters were extracted, ground in iced acetone with Pyrex hand tissue grinders, and the supernatant analyzed with a Beckman DU-8 Spectrophotometer. Chlorophyll *a* levels were determined by monochromatic and trichromatic methods (APHA 1992) and expressed as mg/m^3. Pheophytin *a* levels were also determined on the same samples.

Sediments

Sediments Distribution and Cross-Sectional Profiles

Sediments were sampled at each water and plants measurement point with a 225-cm^2 Ponar dredge. Each sediment sample was put in a ziplock bag, pH taken, and placed in iced coolers while in the field. Sediment samples were immediately frozen upon return to the field laboratory and kept frozen until processing. Sediment samples were processed by the University of Idaho Analytical Laboratory.

In situ sediment typing was done throughout the CSR. Sediment depth was measured to determine the volume of each sediment type held in the reach. Both these measurements were collected with a probe built from a 2.0 m section of steel rod (~ 1.0 cm diameter) mounted on two 2.0 m sections of 1.0 inch PVC pipe.

A rope marked in 5m increments was secured across the river perpendicular to flow. Starting from the left bank (looking downstream), sediment depths were measured every 5m. The sediment probe was used to measure from the surface of the water to: 1) the top of the fine-grained silty, organic-rich layer; 2) the top of the sand/silt layer; and, 3) to rock (cobble or bedrock) bottom. From these measurements, water column depth, fine layer depth, sand/silt depth, and total sediment depths were calculated.

Particle Size

Soil texture was determined on the fine fraction using the Buoyoucos hydrometer method (Buoyoucos 1962, Omeuti 1980, Agronomy No. 9, Part 1, pp. 562-566). Soil samples were air-dried at 35 - 40 °C and ground [to pass through a U.S. Standard 2 mm (No. 10) sieve](AOAC, 11th Edition, 1970). A soil sample weighing 100 g for sandy soils (50 g for all others), was placed in a 150 ml nalgene cup. Distilled water was added along with 5 milliliters of 5% sodium hexametaphosphate to the solution. The soil was agitated for at least 10 minutes at high speed (five minutes for sandy soils), then allowed to set for 15 minutes and agitated again. The sample was transferred to a hydrometer cylinder and volume adjusted to 1,205 ml for sandy soils (1,130 ml for all others). The solution was stirred and timing started. Readings were taken with the hydrometer at 40 seconds and 2 hours. The 40-second reading allows calculation of percent silt and clay. The two-hour reading allows calculation of percent clay. Percent silt is the difference between the 40 second reading and the 2-hour reading. Percent sand is the difference from 100 of the silt and clay.

% Carbon - Hydrogen - Nitrogen

Percent carbon, hydrogen, and nitrogen was analyzed by combustion (University of Idaho Analytical Sciences Laboratory 1993). A tin capsule was packed with 0.2 g of soil material (dried at 35 - 40 °C and ground to pass through a 2 mm sieve), then crimped closed. The capsule was placed in a LECO Combustion Analyzer CHN-600 and combusted at 950 - 1,100 °C The method of detection for carbon and hydrogen was infrared adsorption and thermal conductivity for nitrogen. Sensitivity was 0.01% for all three elements. The analytical range for carbon and hydrogen was 0.01% to 100% and for nitrogen from 0.01% to 50%. Accuracy was ± 0.3% for carbon, ± 1.5% for hydrogen, and ± 3% for nitrogen.

Total Organic Carbon (TOC) and Total Organic Matter (TOM)

Total organic carbon and total organic matter were determined using the dichromate oxidation (Mebius 1960 and Allison 1965). This method quantifies the amount of oxidizable soil carbon as determined by reaction with Cr_2O_7(II) and sulfuric acid. The remaining untreated dichromate is titrated with ferrous sulfate using ortho-phenanthroline as an indicator and orgainc carbon calculated by difference. The method is an estimate since not all the organic carbon is oxidized. In fact, the percent organic matter can be calculated as follows: % OM = 1.72 x OC %. The method detection limit is 0.10% and reproducible to within $^+$/- 12%. If over 75% of the dichromate was reduced, the procedure was repeated with less soil.

Total Recoverable Phosphorus

Total recoverable phosphorus was analyzed by ICP atomic emission (UI Analytical Sciences Laboratory 1993 and EPA Protocol 3050). The sample was digested in HNO_3 at 175 °C. Samples were dried at 30 - 40 °C for 12 - 36 hours (until dry). Sample size for analysis was 0.25 g. The samples were placed in 10 ml digestion tubes. Three milliliters of concentrated trace metal grade HNO_3 was added to each tube. Samples were allowed to react under a hood overnight. Tubes were centrifuged if necessary to produce a clear solution and run on a Leeman 2000 ICP. Phosphorus emission was read at 213.6 nm with a detection limit of 50 µg/L.

Sediment Traps

Sedimentation rates in the reach were determined by sedimentation traps located at four points within the reach. Traps were located at RM 600.9, 600.5, 600.2 and 600.0 in waters greater than 1.5 m depth. One trap was placed at the top of the reach (RM 600.9) to measure deposition rates above the aquatic macrophyte bed (AMB) and above hatchery and irrigated agricultural inputs. The second trap was placed at RM 600.5, above the AMB's but below hatchery and irrigated agricultural returns. Two traps were placed at RM 600.2, in the middle of the AMB. Two traps were also placed at RM 600.0, the bottom of the AMB.

Sediment traps were placed in the Box Canyon Reach above, in, and downstream of the large AMB at RM 588.7, 588.5, and 588.3. In the Thousand Springs Reach, sediment traps were located at the head of Upper Salmon Falls pool at RM 585.8, 585.6, and 585.4.

Each sediment trap consisted of an array of six cylinders suspended within a steel rack. A cylindrical shape was chosen for its ability to collect sediment nearest to actual sedimentation rates in still and low-velocity waters (Gardner 1980; Håkanson et al 1989). The sediment traps were placed directly on the sediments and held in place by their gravity. The sample collection cylinders were 14" sections of 3" PVC pipe with a 0.25" PVC plate bottom. The aspect of the cylinders (height : mouth diameter) was 4.58 as recommended by the literature (Hargrave and Burns 1979; Gardner 1980; Lau 1979; Håkanson et al 1989) with a width > 45 mm to insure trapping dense inorganic particles that can be diverted from the narrower traps by turbulence created by the lip of the trap (Blomqvist and Kofoed 1981). Each sediment trap held five upright cylinders and one inverted control cylinder. The inverted cylinder was a control to correct for upward flux off the bottom and for attached growth (Fuhs 1973; Hargrave and Burns 1979).

Suspended Sediments Composition

The sediment traps were retrieved at approximately 2-week intervals and individual samples were settled, decanted into 1.0 liter cubitainers, and frozen at the field lab. Preservatives (such as $HgCl_2$, NaCl, etc.) were not used in the traps due too relatively short exposure times and possible confounding of results by accumulating salts in the samples (Hakanson et al 1989). Samples were dried at 65°C, weighed on a model H10W Mettler balance to obtain dry weight, and hand-sieved through a 2 mm sieve to separate fine fractions. Sediment analyses for available phosphorus (AP), available potassium (AK), total organic carbon (TOC), percent carbon, percent hydrogen, and percent nitrogen were conducted by the University of Idaho Analytical Laboratory according to the methods described above under "Sediments."

In addition to the above parameters, sediment trap samples were analyzed for plant-available phosphorus and potassium using the sodium bicarbonate method for soils (Olsen et al. 1954, Olsen and Watanche 1965, Olsen and Sommers 1982). This method is used with calcareous, alkaline, or neutral soils containing calcium phosphates. Sodium bicarbonate (0.5 N $NaHCO_3$, pH = 8.5 $^+$/- 0.05) was used to extract available phosphorus and potassium. Potassium on exchange sites was replaced by the sodium ion until equilibrium was achieved. Phosphorus was determined using a single reagent containing sulfuric acid, ammonium molybdate, ascorbic acid, and antimony potassium tartrate. An ammonium molybdophosphate complex was formed and reduced by ascorbic acid and color-stabilized by antimony. The blue color was stable for 1 hr. and read at 30 minutes optimum absorbance at 660 nm. Potassium was read directly by AA or ICP-AES at 404.7 nm. A soil sample (dried at 30 - 40 °C and ground to pass through a 2 mm sieve) weighing 5.00 ± 0.05 g was placed in a 500 ml Wheaton bottle. Darco decolorizing carbon and 100 ml of 0.5 N $NaHCO_3$ were added to the bottle. The sample was shaken for 30 minutes and gravity filtered through S & S #605, 18-cm filters. The extract was analyzed for plant-available phosphorus and potassium.

Suspended Sediments Deposition Rates

Rates of accrual (g/m^2/day) for total sediment, organic carbon, organic matter, Total P, Plant-available P, Plant-available K, and C, H, and N were calculated for each multi-day (usually 14 day) collection period. We multiplied mean concentration of each parameter by mean weight of total sedimented material to obtain accrual rates (g/m^2/day) for each parameter. Therefore, when the value is µg/g...µg/g Nutrient / 10^{-6} x g/m^2/day Sample = g/m^2/ day accrual OR when the value is %...(% Nutrient x 10,000) / 10^{-6} x g/m^2/ day Sample = g/m^2/day accrual.

Aquatic Macrophytes

Composition and Biomass

Aquatic macrophytes were collected with a 225-cm^2 Ponar dredge and washed in the field over a #32 mesh screen. Samples were then placed in zip-lock bags and placed on ice while in the field. They were then immediately frozen at the field lab for transport back to the University of Idaho. Samples were processed by thawing individual samples and immediately sorting to species. Epiphytic algae were separated from rooted macrophytes.

Plant material was placed in metal tins and wet weights (in milligrams) taken on a Mettler H10-W electronic balance. Individual tins were then placed in a drying oven and dried at 105 °C for 24 hr. Samples were cooled in desiccators to room temperature before dry weights were measured on the Mettler balance. Biomass was expressed as oven dry weight per square meter of river bottom. Percent composition by species was also expressed from those biomass data.

Plant Tissue Nutrients

Samples of whole plants were collected monthly (except for September, as noted earlier), then frozen for transport back to the University of Idaho. Plant tissue samples were processed by the University of Idaho Analytical Sciences Laboratory. Whole plant tissue samples were dried at 30 - 40 °C for 12 - 36 hrs., ground to pass through a 40-mesh screen (<40 µM or <0.420 mm), and analyzed for percent carbon, hydrogen, nitrogen, and total phosphorus. Percent carbon, percent hydrogen, and percent nitrogen were analyzed by combustion techniques described under

"Sediments." Absorption was used for the detection of carbon and hydrogen, and thermal conductivity was used for the detection of nitrogen. The sensitivity is 0.01% for all three elements. Total phosphorus was analyzed by ICP (inductively coupled plasma) atomic emission, where the sample was digested in HNO_3 at 175 °C.

Statistical Analyses

Between Transects

Statistical Analyses were done with the PC software package JMP 2.0.5 produced by the SAS Institute, Inc. An *a priori* significance level of a = 0.05 was selected for all statistical tests. In addition, variable significance levels were used *post hoc* throughout the results and discussion of this report to demonstrate the actual degree of certainty the data provide concerning the hypotheses being tested. Maxima, minima, means, standard errors, and 95% Confidence interval values of parameters were identified by transect at all sampling times. Curve-fitting was done with Excel 5.0 (MacIntosh system).

All data was tested for a normal distribution using a Shapiro-Wilk W Test (a = 0.05). Data that did not fit a normal distribution was log-transformed to fit a normal distribution. ANOVA was used to determine significant effects for all normal data sets. Means were compared by Tukey-Kramer, LSD, and a t-test (p as high as 0.20 where field data showed high variability. Means for data that did not show a normal distribution were compared by the non-parametric Wilcoxon/Kruskal-Wallace Test.

Plant Sites vs. No-Plant Sites

We compared physical and chemical variables between sites containing aquatic macrophytes and sites with little or no macrophyte growth. Plant locations were defined as sites containing > 100 g/m^2 total dry biomass. Sites containing < 100 g/m^2 of macrophyte dry biomass were considered 'no plant sites'. We tested the hypothesis that mean observations of physical and chemical variables were equal between the two treatments (Plant vs. No plant). A multivariate t-test, Hotellings T, was used to test overall treatment effects for all variables measured (PROC GLM, SAS 1987). Individual ANOVAs (t-tests) were also computed by the PROC GLM procedure, comparing each variable between the two treatment effects. For individual variables, ANOVAs reduce to simple t-tests since there were only two treatments.

Clustering Analyses for Similarity Between Variables

Canonical coefficients were generated from the MANOVA model and plotted to illustrate similarities and differences among transects for all variables measured. Canonical coefficients reduce dimensionality of the data and represent transect similarities in multivariate space.

Canonical analysis is particularly useful at identifying any clustering tendency of data, such as determining whether parameters from one transect tends to show consistent, significant differences from those same parameters in another transect. It does not indicate causality, simply differences.

RESULTS

QA/QC

The results of QA/QC analyses are summarized in Table 2 for all water chemistry variables and chlorophyll *a*. Duplicate, blank, and spike samples were analyzed according to procedures outlined in Bauer (1986) and Bauer et al. (1986).

Percent relative difference data presented in Table 2 indicated highest *precision* in the measurement of total alkalinity and total hardness with next highest precision for total phosphorus and soluble reactive phosphorus. Coefficients of Variation were 13% and 12% for total hardness and alkalinity, and 33% and 36% for TP and SRP, respectively. For other chemical parameters, Coefficients of Variation ranged from 38% (ammonia) to 64% (TSS).

Analysis of blank samples indicated some very low level contamination for ammonia nitrogen (<0.005 mg/l), nitrite + nitrate nitrogen (<0.005 mg/l), SRP (<0.005 mg/l), and alkalinity (<1.0 mg/l). All contamination levels were very low as all variables showed a low frequency of contamination at very low levels (averaging less than the MDL).

Analysis of spiked samples showed a high percent recovery for all variables ranging from 92.4% to 114.4%. The lowest percent recovery was SRP at 92.0% (un-replicated value). Coefficients of Variation for percent recovery were 9.8% (NH_3), 6.2% ($NO_2 + NO_3 \cdot N$), 24.2% (TKN), 9.6% (TP), and 1.8% (TSS). respectively (Table 2).

Physical

Data Organization

Processesed or summarized data are included in the Figures F1 through F60 and Tables T1 through T40 with most text references from those Figures and Tables. Raw data is presented in its entirety as Appendices A - E and is referenced in the text.

Water Discharge

Water year 1994 (October 1, 1993 - September 30, 1994) was the 7th consecutive extreme low flow year since Water Year 87 (Figures 2 and 3; Tables 3 and 4). WY 94 total flow past the Buhl gage was 2,340,000 Aft compared to the 1947-1994 average water delivery of 3,678,000 Aft/year. The mid-1980's saw average flows double the long-term mean flow while flows of the late 1980's and early 1990's dropped to one quarter of those long-term mean flows.

The study period in this report covers WY 94 with additional data through December, 1994. In WY 94, December, 1993 was the high average flow month, averaging 4,155 cfs. June, 1994, the normal high flow month, carried only 3,164 cfs. For the rest of the study year, through December, 1994 flows averaged 2,549 cfs at the Buhl gauge, a *pattern* consistent with the preceding drought years (Figures 2 and 3), but total water volume was lower in 1994. Summer-fall flows in 1994 averaged 71% of summer-fall flows in 1993. December, 1994 was the low average flow month (2,202 cfs). Maximum flow in WY 94 was 4,870 cfs on October 22, 1993 and was nearly matched at 4,820 cfs again on April 11, 1994. Minimum flow during study months was 1,950 cfs on November 29-30, 1994.

In contrast to uncontrolled snowmelt hydrographs common to the northern Rockies, flows remained comparatively low March through early May as high runoff was stored in upstream reservoirs. Flows increased briefly in the early summer. Recharge of the Snake River from irrigation return flows maintained moderate summer flows through September (Table 3).

Water Depth

Water column depth through the 4 CSR transects decreased downstream from transect 2 to 7, and was least in the random sites between transects 2 and 7. Shallowest depths occurred at transect R (~1.2 m). Greatest depths were at transect 2 (~2.3 m)(Figure 4 and Table 5).

Water Velocity

Depending on chance placement of samples points in heavy plant cover or in open, scoured channel areas between plant clumps, water velocities on a given transect could vary widely. In a given sampling period, water velocity at sample locations was greatest at the shallowest sites, i.e. transect 7, especially on the left bank, facing downstream (Figure 5 and Table 6). But low velocities were also seen on those downstream transects. At a given time, water velocities sometimes ranged from the study maximum of 2.45 fps to 0 fps on the same transect. Sites of 0 velocity were most common in August (Transects 2, 7, and R) and next most common in July (Transect 2). Because of the very high velocity range on a transect, significant differences between mean transect velocities were rarely seen (Table 6).

Suspended Solids

Suspended solids were greatest in August (transect 7 mean = 25.6 mg/l) and least in June and October. In November, suspended solids averaged 21.0 mg/l at transect R, significantly greater than means of other transects (7.0 - 9.4 mg/l).

Turbidity and Water Transparency

Turbidity showed similar patterns as total suspended solids, peaking upstream August (Figure 7 and Table 8). Mean early summer turbidity was about 10 NTU at the head of CSR and increased through the summer to 13 NTU in August, approximately 50% of 1993 values. Individual values up to 18 NTU were seen in August (Figure 7 and Table 8). Peaks were only 35% of 1993 values. Turbidity declined in the fall to mean values of 3-4 NTU. Trends of upstream - downstream turbidity values were generally not significant in 1994 (Table 8).

Water transparency showed similar trends of low transparency in August (means of 0.6 - 0.9 m, minimal values ~ 0.3 m), increasing to 1.2 m through fall months. Mean transparency did not show the 1993 tendency of more clear water with water passage through aquatic macrophyte beds (AMB), but high variability between measurements (because of random siting in or out of AMB) reduced significance of upstream - downstream trends (Figure 8 and Table 9). The clearing influence of spring and hatchery inflows was also apparent in summer months on the right bank (Figure 8).

Water Temperature

Mean water temperatures in the CSR increased from 8.5 - 9.5 °C in April to 19.8 - 23.9 °C in July before declining to 12.4 °C in October and 7.3 - 8.2 °C in November (Figure 9 and Table 10). We did not observe the small (~0.5 °C), but significant increases in temperature from upper to lower transects seen in 1993 on a given date. Temperature decreases through the reach (either caused by spring inflows or shading in macrophte beds) were evident in July in August. Decreases from Transects 2 to 7 averaged 4.1 °C and 0.9 °C in July and August, respectively (Table 10). Maximum mean temperature of any transect was 23.9 °C at transect 2 in August, 3.3 °C greater, and one month earlier than in 1993.

Water Chemistry

Dissolved Oxygen

Although dissolved oxygen means increased downstream through the CSR reach during most months in 1993, this trend was not seen in 1994 (Figure 10 and Table 11). In April, mean dissolved oxygen was slightly supersaturated (~115% saturation) throughout the reach during the spring phytoplankton bloom. In July, mean oxygen only declined to 8.4 mg/l (107% saturation) with a minimum single value of 7.5 mg/l (95% saturation) at transect R. This was the annual low oxygen recorded for the year. In August, oxygen increased to as high as ~140% saturation. Mean November oxygen in CSR was 10.2 mg/l (104% saturation). Oxygen stress in CSR was not evident, even below aquaculture outfalls. The overriding observation through the reach was typical oxygen superstaturation from phytoplankton and AMB photosynthetic activity. Diel oxygen was not measured.

Total Hardness and Total Alkalinity

Total hardness is summarized in Table 12. Hardness generally increased slightly down through the reach at all sampling times with transect 2 generally about 4% lower than downstream transects. Hardness over all transects in April, 1994 averaged 207 mg $CaCO_3$/l, increasing to 239 mg $CaCO_3$/l during late summer, and to 263 mg $CaCO_3$/l in October - November with the cessation of both irrigation water releases and irrigation return flows (Figure 27 and Table 12). The result was a steady increase in total hardness over the year.

Total alkalinity (Table 13) showed no obvious upstream - downstream trends through CSR at any time. Total alkalinity gradually increased through the seasons (Figure 27). Average April alkalinity of 179 mg $CaCO_3$/l increased to annual highs of 224 mg/l by October and November. Slight month-to-month differences for both hardness and alkalinity were usually significant.

Electrical Conductivity

Electrical conductivity ranged from 370 - 600 μmho through the year with most values in the 400 - 500 μmho range (Figure 11 and Table 14). Mean low values were in April (390 - 426 μmho) with annual highs in August (590 -600 μmho). Mean values were only slightly lower than in 1993 although peak values were 25% lower than in 1993. Between-site differences were not obvious and were not significant.

pH

Water column pH varied little over the study, with median pH values always falling in the 7.3 - 8.5 range (Table 15). Neither between-site nor date trends were obvious. Median pH values were lowest in October (7.3 - 7.8) and highest in July (7.9 - 8.3). Sediment pH values are discussed under sediments.

Nitrite + Nitrate Nitrogen

Mean nitrite + nitrate nitrogen concentrations in the Middle Snake River were very high, ranging from 1.0 mg/l in July to 3.0 mg/l in November (Figures 13 and 28; Table 16). Month-to-month increase was greatest from July to August and concentrations remained high through November. Nitrite + nitrate nitrogen individual values ranged from 1.0 - 3.2 mg/l. Transect 2 (upstream) mean nitrite + nitrate nitrogen levels were usually significantly lower than transect 7 (downstream) but no differences were seen in October and November. Nitrite + nitrate nitrogen concentrations increased downstream through CSR in June, July, and August, months of greatest

AMB growth. Although of small magnitude, the upstream - downstream increases were significant at $p = 0.05$. Transect 7 was below all springs and aquaculture sources to CSR.

Total Kjeldahl Nitrogen (TKN)

Considering the large magnitude of nitrite + nitrate nitrogen concentrations, Kjeldahl nitrogen levels (organic nitrogen + ammonia nitrogen and exclusive of $NO_2 + NO_3 \bullet N$) were comparatively modest, with means over all transects ranging from 0.17 in July to 0.37 mg/l in June (Figure 14 and Table 17). Individual Kjeldahl nitrogen values ranged from 0.1 to 0.6 mg/l.

Sites downstream through CSR showed no clear between-site differences. Standard errors were generally 3 - 30% of the mean, so transects were seldom significantly different at $p = 0.05$.

Ammonia Nitrogen

Ammonia nitrogen individual values were relatively low, with study lows of 0.02 mg/l and highs of 0.22 mg/l, both in April at Transect 2 (Figure 15 and Table 18). Only in June and October did ammonia means significantly increase from transects 2 to 7.

Total Phosphorus (TP)

Mean total phosphorus over all transects in CSR peaked in April and November (0.15 and 0.20 mg/l, respectively) (Figure 16 and Table 19). Low mean transect phosphorus was in July (0.05 mg/l at transect 7). Individual data points ranged from 0.05 mg/l in July to 0.23 mg/l in November. These levels of total phosphorus are considered eutrophic and supportive of high plant production levels (Horne and Goldman 1994). In July, August, and October, TP declined from transect 2 to 7, but the decrease was significant only in July.

Soluble Reactive Phosphorus (SRP)

Soluble reactive phosphorus increased from summer levels ~0.07 mg/l to 0.16 mg/l in November (Figures 17 and 28; Table 20). Largest increases were from October to November. Individual SRP values ranged from 0.05 mg/l in August to 0.19 mg/l in November. In each month (except for two months of missing data), SRP declined from transect 2 downstream to 7. This upstream - downstream reduction in SRP with passage through CSR was significant in November with a drop from 0.16 to 0.13 mg/l. In 1993, we also observed reduction in SRP downstream through CSR during high plant biomass months.

Interrelationships Between Water Quality Variables

We evaluated relationships between water quality variables using several functions. Several groupings of linear relationships are apparent:

Strong Correlation: r > 0.950	
Alkalinity vs. Total Hardness	r = 0.994***
Alkalinity vs. Nitrite + Nitrate Nitrogen	r = 0.969***
Poor Correlation: 0.950 > r > 0.500	
TSS vs. Total Phosphorus @ Transect R	r = 0.561
No Correlation: r < 0.500	
Alkalinity vs Conductivity:	r = 0.453
Alkalinity vs. Total Phosphorus	r = 0.195
TSS vs. Nitrite + Nitrate Nitrogen	r = -0.418
TSS vs. Turbidity:	r = 0.389
TSS vs. TKN:	r = 0.336
TSS vs. Total Phosphorus @ Transect 2:	r = -0.368
TSS vs. Total Phosphorus @ Transect 7:	r = -0.274
TSS vs. Total Phosphorus @ all Transects	r = 0.106
Additional Correlations:	
Flow vs. Depth:	r = 0.615
Flow vs. Velocity:	r = 0.545
Transparency vs. Turbidity:	r = -0.605
Temperature vs. Dissolved Oxygen:	r = -0618 + Seasonal Correlation
Total Hardness vs. Sediment pH	r = 0.657
Alkalinity vs. Sediment pH:	r = 0.615
Conductivity vs. TSS:	Seasonal Correlation
Conductivity vs. Total Hardness:	Seasonal Correlation
Conductivity vs. Alkalinity:	Seasonal Correlation
Total Phosphorus vs. Soluble Reactive Phosphorus	r = 0.913

Selected relationships between variables are also shown in Figures 30-34.

Total alkalinity, as in 1993, again correlated well with other water quality parameters, via the above linear relationships and second order polynomial fit (Figures 30 and 31). Alkalinity related well to other parameters because of the very low standard error as a percentage of the alkalinity mean. As alkalinity showed little response to transect, the observed significant relationships of alkalinity with hardness, conductivity, and nitrite + nitrate nitrogen express similar seasonal changes in these parameters rather than between-transect differences.

Total alkalinity correlated well with total hardness, expected because of the common divalent metal ions involved with these parameters. The correlation of total alkalinity with conductivity was not nearly as high (Figure 30). Total alkalinity correlated very well with nitrite + nitrate nitrogen since the two parameters have similar solublities while there was little correlation between total alkalinity and total phosphorus; most ions contributing to alkalinity are in soluble form while most total phosphorus components are in particulate form (Figure 31).

For similar reasons, there were no significant correlations between total suspended solids and nitrite + nitrate nitrogen (Figure 32) or between total suspended solids and Kjeldahl nitrogen (Figure 33).

Total suspended solids and total phosphorus were poorly correlated linearly at transect R (above data and Figure 34), indicating a large component of the TP pool was in soluble form in CSR in 1994. This was in contrast to a highly significant correlation of TSS with TP in 1993 via a second order polynomial fit.

Aquatic Plants

Species Composition

Species composition of the aquatic macrophyte community of CSR is shown in Table 21. As in 1993, in 1994 we found ten taxa of flowering aquatic macrophytes from seven families and one moss (*Drapanocladius*) present in CSR. The three macrophytic (epiphytic) algae taxa of 1993 were again present and dominant in CSR in 1994, but we also found a fourth epiphyte, *Enteromorpha* sp. These filamentous epiphytic algae (*Chara* and the three filamentous green algae *Hydrodictyon*, *Cladophora*, and *Enteromorpha*) were all co-dominant. Appendix Table D presents dry biomass and percent species composition data for individual CSR samples taken in 1994.

Plant Biomass Between Sites and Months

Potamogeton crispus and *C. demersum* dominated community composition through all transects in April and May, 1994. Species distribution and biomass (Table 22) was very clumped with adjacent sites on a transect sometimes totally reversing species composition between two sites, depending primarily on bottom composition as well as influence of spring, hatchery, and irrigation return flows. Results and Discussion of conditions at plant vs. no-plant sites follows in the Section "Environmental Variables as a Function of Plant Cover."

P. crispus biomass diminished slightly through early- and mid-summer as *P. pectinatus* and epiphytes (especially *Cladophora*), dominated in June and July. Algal epiphytes in the two lower transects R and 7 developed rapidly June through July, reaching 1,194 g/m^2 dry weight in July on transect R (62% of total plant biomass), and eventually peaking at 2,090 g/m^2 (81% of total plant biomass) in October at transect R (Appendix Table D and text table on following page). Mean epiphyte density in October at transect R was 365 g/m^2 (following table). Downstream transects attained greatest biomass levels in July and August, when *C. demersum* and algal epiphytes combined dominated the very high biomass levels, contributing up to 1,800

g/m^2 dry weight to total sample biomass (Appendix Table D). All of these latter taxa obtain their nutrients from the water column as they do not have root systems.

In October, peak algal epiphyte and *C. demersum* densities sporadically declined by up to 40 - 50% but *P. pectinatus* developed biomass levels exceeding 2,000 g/m^2 dry weight at lower transect sites. In November, *P. pectinatus* was again replaced by algal epiphytes and *C. demersum* which attained peak plant biomass densities up to 1,800 g/m^2 dry weight (following text table and Table 22).

Transect 2 (the upstream transect) never had mean macrophyte biomass levels greater than 176 g/m^2, while downstream transects attained mean biomass up to 1,272 g/m^2. Timing of macrophyte development was markedly different between transects (Figures 18, 35, and 36; Table 22). Transects 2 and 7 mean biomass appeared to be different through summer months, but differences were not signficant at the 0.05 level (Table 22). In October and November, however, plant biomass levels were significantly greater at transect 7 compared to transect 2.

The downstream transects also had very high biomass through October, whereas mean biomass in the upstream transect declined after August (Figure 18 and Table 22), a pattern also observed in 1993. Downstream nutrient- and sediment-enriched transects attained high biomass earlier and sustained them later and at higher levels than the upstream transect (well into November) as graphically depicted in Figures 18 and 35. In October and November, downstream transects averaged 689 and 226 g/m^2 biomass, 977% and 653% greater, respectively, than the upstream transect.

Mean plant biomass of plant beds in 1994 in CSR was comparable to levels found in 1992 and 1993 (Table 23). In CSR, plant dry biomass transect means ranged from 23 to 1,272 g/m^2 in 1994 (Table 22) compared to 5 to 1,012 g/m^2 in 1993. Between-sample variation was high, so significance was not often seen, but transect 2 was significantly lower than R and 7 in both October and November, 1994.

The following table insert summarizes 1994 aquatic macrophyte mean dry biomass over all transects and months. The dry weights in g/m^2 in this table are *overall river means*, separated into three functional groupings, epiphytic algae, non-rooted vascular macrophytes, and rooted vascular macrophytes. The two categories of epiphytic algae and non-rooted vascular macrophytes are functionally grouped together in that they absorb their nutrients from the water column rather than from sediments. The following overall river means are true average concentrations over the entire river, plant- and plant-free areas alike, and are more appropriate for insertion into a river ecological model which considers the entire river bottom. For example, *within selected plantbeds* mean biomass at transects 7 and R in August and October, the heaviest plant months, was 692 g/m^2 while *overall river mean* for transects 7 and R in August and October was 679 g/m^2. The agreement between those means indicated comparable validity of the two approaches.

g/sq m	Epiphytes			Epiphyte	NonRooted			NonRooted
	Tr 2	Tr 7	Tr R	Mean	Tr 2	Tr 7	Tr R	Mean
April	0	0.2	--	**0.1**	0	68	--	**34.0**
May	--	--	1.3	**1.3**	--	--	3.6	**3.6**
June	17.9	631.2	45.5	**231.5**	141.5	91.6	2.3	**78.5**
July	38.4	206.8	245	**163.4**	42.8	2.4	31.5	**25.6**
August	63.7	284.7	172.9	**173.8**	36.5	563.2	146.9	**248.9**
October	29.5	249.0	364.6	**214.4**	28.5	143.9	242.5	**138.3**
Nov.	15.8	98.4	75.8	**63.3**	11.5	61.1	67.2	**46.6**

	Rooted			Rooted	Epiphyte	NonRooted	Rooted	All Types
	Tr 2	Tr 7	Tr R	Mean	%ofTotal	%ofTotal	%ofTotal	Total
April	22.8	38.3	--	**30.6**	**0.2%**	**52.6%**	**47.3%**	**64.7**
May	--	--	230.8	**230.8**	**0.6%**	**1.5%**	**97.9%**	**235.7**
June	19.5	315.4	382.6	**239.2**	**42.2%**	**14.3%**	**43.6%**	**549.2**
July	11.4	113.9	286.0	**137.1**	**50.1%**	**7.8%**	**42.0%**	**326.1**
August	12.2	59.8	173.3	**81.8**	**34.5%**	**49.3%**	**16.2%**	**504.4**
October	0	14.6	297.6	**104.1**	**46.9%**	**30.3%**	**22.8%**	**456.7**
Nov.	2.7	52.6	103.4	**52.9**	**38.9%**	**28.6%**	**32.5%**	**162.8**

All plant types combined (i.e. average total aquatic macrophytes in CSR) increased from 65 g/m^2 in April to an average of 459 g/m^2 in the summer - fall months of June, July, August, and October. Biomass fell off to 163 g/m^2 in November. High biomass months were June and August with 549 and 504 g/m^2 mean biomass, respectively. The epiphyte category followed a similar trend, from <1 g/m^2 in April to a summer-fall mean of 196 g/m^2 (June to October). High months were June and October with 232 and 214 g/m^2 mean biomass, respectively. Non-rooted vascular macrophytes developed later in the season, averaging only 35 g/m^2 April through July to an annual peak mean of 249 g/m^2 in August. True rooted macrophytes developed first, attaining an average of 231 g/m^2 by May before steadily declining to 53 g/m^2 in November.

Epiphytes comprised <1% of the plant community early in the season, but shifted to ~50% dominance through the remaining sampling period. Rooted macrophytes dominated the plant community early in the year, even up to 98% of total composition in May, before gradually declining as a percent of total composition later in the year. In August, rooted macrophytes comprised only 16% of total macrophyte biomass.

True rooted macrophytes developed earlier in the year (May). It is possible that the nutrient and energy reserves of the perennial root masses permit earlier, faster plant development than epiphytes and rootless Epiphytic algae cannot reach high biomass levels until June when epiphytes can obtain three required conditions: 1) high enough temperatures (Millner et al 1982), 2) sufficient nutrients from the water column, and 3) adequate physical support provided by rooted plants high enough in the water column to obtain their required high light nearer the water surface. By mid-summer, the combined community of epiphytes and non-rooted macrophytes apparently out-competes rooted forms. The faster rates of nutrient uptake by the entire plant and the light-favored position higher in the water column which permits epiphytes to avoid light limitation ensures their success. Considering their absence of nutrient-absorbing roots, the epiphytes and non-rooted forms dominant in late summer and fall can only attain high biomass levels with high water column nutrients. Howard-Williams (1981) found that fertilization with N and P sharply increased the development of epiphytes (*Cladophora*) on *P. pectinatus* communities, but did not increase the rooted plant biomass. As to the eventual outcome of continued enrichment, Moss (1976) concurred with the general observations of sewage and fish pond managers that continued nutrient enrichment to hypereutrophic ranges of limiting nutrients will push the community through epiphyte dominance to *phytoplankton* dominance with eventual complete suppression of the *rooted macrophyte* community.

Nutrient Content

Aquatic macrophyte nutrient concentrations were measured in CSR for the months of July, August, October, and November (Table 23 and following text table).

Mean nutrient content of three species of aquatic macrophytes from the CSR, 1994.

		P ug/g	Mg ug/g	Ca ug/g	K ug/g	S ug/g	Na ug/g	C %	H %	N %
C. demersum	Leaves	2,873	5,618	23,000	26,364	3,455	3,936	34.4	5.0	3.4
	Shoots	3,340	7,700	16,600	27,200	2,700	4,820	32.0	5.1	2.2
	Plant mean	3,107	6,659	19,800	26,782	3,078	4,378	33.2	5.1	2.8
P. crispus	Leaves	5,590	2,970	18,000	15,700	4,360	5,460	38.0	5.4	4.4
	Shoots	3,886	2,329	13,571	36,571	3,543	6,571	35.3	5.4	2.6
	Roots	4,880	3,640	34,200	20,000	4,860	2,700	21.7	3.5	1.7
	Plant mean	4,785	2,980	21,924	24,090	4,254	4,910	31.7	4.8	2.9
P. pectinatus	Leaves	4,533	4,922	16,000	19,167	6,056	8,633	37.1	5.7	3.8
	Shoots	3,618	3,600	13,782	31,182	3,745	8,373	35.3	5.5	2.4
	Roots	2,700	3,100	19,220	22,500	9,250	7,080	33.0	5.2	1.4
	Plant mean	3,617	3,874	16,334	24,283	6,350	8,029	35.1	5.5	2.5

We collected *P. crispus*, *P. pectinatus*, and the non-rooted macrophyte, *C. demersum*. Epiphytic algae samples not available for nutrient analysis as they were lost in transportation and storage. As in 1993, *Potamogeton crispus* had the highest mean phosphorus level over all months (4,785 µg/g). Mean concentrations of P for leaves, shoots, and roots were 5,590, 3,886, and 4,880 µg/g, respectively. Mean concentrations of N for leaves, shoots, and roots were 4.4%, 2.6%, and 1.7%, respectively. Next highest nutrient content was in the rooted form *P. pectinatus* with a mean whole plant total phosphorus concentration of 3,617 µg/g. Mean concentrations of P for leaves, shoots, and roots of *P. pectinatus* were 4,533, 3,618, and 2,700 µg/g, respectively. Mean concentrations of N for leaves, shoots, and roots were 3.8%, 2.4%, and 1.4%, respectively.

The non-rooted species *Ceratophyllum demersum* had lower whole plant mean phosphorus concentrations of 3,107 µg/g. Mean concentrations of P for leaves and shoots were 2,873 and 3,340 µg/g, respectively. Mean concentrations of N for leaves and shoots were 3.4% and 2.2%, respectively. As in 1993, leaves and shoots of rooted aquatic macrophytes had higher mean concentrations of P, N, and Ca than non-rooted aquatic macrophytes. On the other hand, *C. demersum* had much higher concentrations of Mg and K than rooted macrophytes. Rooted aquatic macrophytes also had higher percent carbon concentrations in leaves and shoots than *C. demersum* with 37.5% and 37.1% C content, respectively, compared to 34.4% C in leaves of *C. demersum*..

Nutrient level monthly means of composite groupings of mixed aquatic macrophytes were also compared over the growing season (Table 23b). As in 1993, phosphorus levels decreased from 3,972 µg/g in July to 3,656 µg/g in August but not significantly at $P = 0.05$. P concentration remained level through October and increased to 4,863 µg/g in November. Percent carbon concentrations were 34% in July and peaked at 37% in November. Total nitrogen ranged from from 2.7% in June and October to 4.0% in November.

Phytoplankton

Individual monochromatic chlorophyll *a* concentrations in CSR (RM 599.5-601.3) ranged from 1.4 to 107.9 mg/m^3 (Table 24). Transect mean monochromatic chlorophyll *a* concentrations ranged from 5.1 to 33.8 mg/m^3 (Table 24). Chlorophyll lows were in July at transects R and 7 while maxima were in July at transect 2.

Individual trichromatic chlorophyll *a* concentrations in CSR (RM 599.5-601.3) ranged from 2.2 to 113.8 mg/m^3 (Table 25). Transect mean trichromatic chlorophyll *a* concentrations ranged from 6.2 to 36.6 mg/m^3 (Table 25). Mean trichromatic chlorophyll lows were again in July at transects R and 7 while maxima were in July at transect 2. Trichromatic chlorophyll *a* usually exceeds monochromatic chlorophyll *a* by an amount equal to the level of pheophytin (degraded chlorophyll) present. The monochromatic measure is therefore accepted as the value more representative of community photosynthesis.

When comparing means of all transects by month, monochromatic chlorophyll *a* concentrations declined from April through May to June (from 28.3 to 16.8 and 10.8 mg/m^3) before mean transect concentrations increased to 15.3 and 12.9 mg/m3 in July and August, then again declined to 9.2 and 8.3 mg/m^3 in October and November, respectively. The fall phytoplankton pulse noted in 1993 was not seen in 1994. Phytoplankton composition was not assessed in 1994.

These mean transect plankton chlorophyll concentrations indicated that CSR was mesotrophic to eutrophic (2-10 mg/m^3 for mesotrophy and >10 mg/m^3 for eutrophy as defined by EPA 1990) but dropped to mesotrophic levels only in July at transects R and 7. Within AMB, the combination of macrophyte nutrient uptake and filtering of plankton from water masses creates a microenvironment which effectively controls phytoplankton.

Sediments

Sediment Traps and Sediment Deposition Rates

Samples were used to calculate a total sediment dry weight deposition rate ($g/m^2/day$) with sufficient replicates at each location to determine mean total sediment deposition rate, minimum and maximum deposition rates, standard error, 95% confidence intervals, and sedimentation rate changes through CSR and the aquatic macrophyte beds (Table 26).

Sediment deposition rates were compared through the CSR, Box Canyon (BCR) and Thousand Springs Reaches from May 24, 1994 to September 27, 1994. For an individual collection period, the RM 600.0 site in CSR, at transect 7 and below the AMB again had the highest mean rate (482.2 ± 61.7 $g/m^2/day$) for the entire study period. The lowest rate in CSR for an individual sampling period (69.5 ± 9.1 $g/m^2/day$) was again measured at RM 600.2, at transect 5 in the middle of the AMB. Mean rates at RM 600.9 (~ transect 1), 600.5, 600.2, and 600.0 were 283.7, 275.7, 199.4, and 247.9 $g/m^2/day$, respectively. Sediment collection rates were least in the AMB. As in 1993, the data again show that either the AMB are dense enough to limit import of suspended sediment to the AMB, or the macrophytes filter sediments from the water column before they can be collected in traps located in AMB.

Maximum mean deposition rates were ~30% of mean rates in 1993. Highest deposition rates (~500 $g/m^2/day$) occurred from May through August. Lowest rates were comparable to 1993. The lowest 14-day deposition rate was measured at RM 600.2 with a mean of 69.5 $g/m^2/day$, compared to 89.2 $g/m^2/day$ in 1993 for the late September period.

Sediment collection rates in BCR and Thousand Springs were much lower than in CSR, averaging only 115.5, 149.9, and 136.5 g/m^2/day at RM 588.7, 588.5, and 588.3, respectively. Sediment collection rates in Thousand Springs were comparable at 119.4 g/m^2/day. It is apparent that the 15 mile reach between CSR and Thousand Springs is an effective sediment trap, at least through the May - November period. It is likely that the CSR, Niagara Springs reach, and BCR are the major collection points.

Sediment collected in the sediment traps in CSR had mean plant-available phosphorus (PAP) concentrations of 147, 135, 153, and 149 μg/g at RM 600.9, 600.5, 600.2, and RM 600.0 respectively (Table 27). Total P of collected sediments averaged 1,178, 1,429, 1,380, and 1,166 μg/g g at RM 600.9, 600.5, 600.2, and RM 600.0 respectively. Plant-available potassium (PAK) averaged 346 μg/g with no obvious downstream trends.

Sediment collected in the sediment traps in BCR had an overall reach mean plant-available phosphorus (PAP) concentration of 150 μg/g, not different from CSR (Table 27). Total P of collected sediments in BCR averaged 1,362 μg/g, also not different from CSR. Plant-available potassium (PAK) averaged 419 μg/g. Nutrient concentrations of all parameters Thousand Springs were comparable to BCR and CSR (Table 27).

Percent organic carbon ranged from 2.1 to 5.9% with a mean of 3.1% (compared to 2.6% in 1993) and percent organic matter ranged from 3.6 to 10.2% with a mean of 5.5% (compared to 5.5% in 1993). It would appear that ~ 95% of the sediment collected in the trap is inorganic, a finding also supported by 1993 data. Percent carbon was similar to percent organic carbon. Percent hydrogen averaged 0.9% and ranged from 0.7% to 1.4%. Percent nitrogen of trapped suspended solids ranged from 0.3 to 0.9% in CSR with a mean of 0.5 %, generally about 50% greater than N content of reach bottom sediments.

Deposition Rates and Nutrient Movement *via* Suspended Solids

The product of suspended solids depositon rate and nutrient or organic matter content of those solids is an estimate of mass movement of nutrients and organic matter *via* suspended matter moving through a reach (Table 28). Estimated mass transport for CSR is summarized in the following table. Mean collection rates over all three sites were: Total P = 0.256 g/m^2/day; Plant-Available P = 0.028 g/m^2/day; Plant-Available K = 0.070 g/m^2/day ; Organic Matter = 10.50 g/m^2/day, and Total N = 0.96 g/m^2/day (following text table).

Summary Deposition Rates in Sediment Traps

Transect at RM....	Total P $g/m^2/day$	Plant-Available P $g/m^2/day$	Plant-Available K $g/m^2/day$	Organic Matter $g/m^2/day$	Total N $g/m^2/day$
600.9	0.31	0.04	0.10	13.08	1.39
600.5	0.38	0.03	0.08	15.44	1.16
600.2	0.26	0.04	0.06	10.85	0.86
600.0	0.33	0.04	0.09	11.34	0.90
Reach Mean	0.320	0.038	0.083	12.68	1.08
588.7	0.15	0.01	0.05	7.42	0.60
588.5	0.20	0.02	0.06	10.84	0.95
588.3	0.20	0.02	0.07	8.27	0.60
Reach Mean	0.183	0.017	0.060	8.84	0.72
588.4 - .6	0.22	0.02	0.05	6.77	1.21

Collection rates were higher at the upstream site (RM 600.9) and the downstream site (RM 600.0), compared to sites within the AMB (RM 600.5 and 600.2). No consistent differences in collection rates between AMB vs. open water sites were seen. Collection rates of organic matter and Total N decreased from above AMB to below AMB. The *export* of these parameters from CSR during the May - November collection period might be expressed by collections at the downstream CSR site, RM 600.0. Thes export rates from CSR were: Total P = 0.33 $g/m^2/day$; Plant-Available P = 0.04 $g/m^2/day$; Plant-Available K = 0.09 $g/m^2/day$; Organic Matter = 11.34 $g/m^2/day$, and Total N = 0.90 $g/m^2/day$. Import rates to BCR decreased by 55, 75, 44, 35, and 57 % for TP, PAP, PAK, OM, and Total N, respectively, compared to CSR. Export rates from the BCR increased slightly or showed no change for TP, PAP, PAK, OM, and Total N, respectively, compared to import to BCR. Export rates from the TSR were 29, 50, 50, 48, and 13% less for TP, PAP, PAK, OM, and Total N, respectively, than import to CSR (Table 27 and preceeding text table).

Sediment Distribution in Crystal Springs

Sediment distribution in CSR was obtained from 5-meter interval depth profiling across three transects (Tables 29 - 31). The following table depicts mean sediment layers on each of the three sediment transects taken in CSR in July 1994:

Sediment Characteristics of Transect Means in CSR

Transect at RM....	Water Depth	Off-Bottom Water Velocity	Organic Depth	Sand-Silt Depth	Total Sediment
	m	m/sec	m	m	m
600.9	3.15	0.09	0.68	0.36	1.04
600.5	2.08	0.10	0.65	0.31	0.97
600.0	1.69	-	0.23	0.08	0.31

Mean total sediment deposits were greatest at RM 600.9 and 600.5 with a mean total sediment depth of 1.02 m (mean depth of 1.05 m in 1993) although several individual sample points exceeded 2 m in total sediment depth (Tables 29 and 30). In the above table, "organic depth" refers to the layer of ooze higher in clay and organics. These fine sediments were also thickest at RM 600.9 and 600.5, averaging 0.66 m in depth. As shown in Tables 29 - 31, a fine sediment layer was often on the surface, grading to sand-silt just above the historic cobble bottom but additional layers of fine sediments below the sand-silt layer were not uncommon.

Sediment Composition in Crystal Springs

Mean Surficial Sediment Composition - All Transects Averaged

Month	Sand %	Clay %	Organic Matter %	Nitrogen	Hydrogen %	Phosphorus µg/g
April	59.1	36.8	2.6	0.2	0.5	1,209
June	50.1	42.6	2.8	0.3	0.7	1,030
July	46.0	45.9	3.0	0.3	0.7	1,073
August	53.0	40.8	2.9	0.2	0.6	1,024
October	56.3	36.8	4.0	0.3	0.7	1,577
November	57.1	34.9	2.6	0.3	0.5	1,295

Sands dominated sediments in the CSR, averaging 46 - 59% of dredged sediments. Seasonal shift in surficial sediment composition was shown by change in mean percent sand from 59% in April, decreasing to 46% in August after summer high irrigation flows, and increasing back to 57% in November. A similar trend was seen in 1993.

Concurrently, clay and organic matter *increased* in the high-plant months of July through October. Mean sediment nitrogen change with season was not significant (values of 0.2 - 0.3%), but sediment hydrogen (indicative of high energy, reduced compounds in sediments) increased through October with plant development.

Mean sediment phosphorus over all transects increased by 53% from June to high plant development in October (1,030 μg/g to 1,577 μg/g). As in 1993, Transect 2 had highest average June - November sediment total phosphorus concentrations (1,341 μg/g in 1994 compared to 1,301 μg/g in 1993) while other transects averaged 1,189 μg/g in 1994 compared to 1,090 μg/g in June - November, 1993. In 1993, the transect above CSR, transect 1, had average June - November sediment total phosphorus concentrations of 758 μg/g.

SAS general linear models procedure on log-transformed data showed no significant differences between sediment pH, nitrogen, total phosphorus, pH, or organic matter and transects in 1994.

Interrelationships Between Plants and Other Factors

Figures 37 - 45 graphically show relationships between total plant dry biomass and environmental factors in water and sediments. The relationships plotted were those which showed best linear correlations in multivariate analysis of all parameters over all samples. General trends often were graphically obvious but the wide variability shown by parameters at randomly selected sample sites combined with the large number of variables entered into correlation models can cause low r^2 (but high P) values.

Plant Biomass vs. Water Column Parameters

Depth again falls out as a major controller of macrophyte occurrence (Figure 37). Plant biomass was always less than 650 g/m^2 at depths greater than 2 m. The higher plant densities observed (>1,000g/m^2) were again clustered in the 0.5 - 1.5 m depth band.

As in 1993, there was also an association of high biomass with water velocity less than 0.7 fps (Figure 38). Transects R and 7 showed a trend of declining biomass with water velocities over 0.7 fps.

Plant biomass correlated poorly with water column nitrite + nitrate nitrogen and Kjeldahl nitrogen (Figures39 - 40). Unlike in 1993, water column total phosphorus showed a positive relationship with plant biomass (Figure 41). At transect R, biomass peaked at TP levels ~ 0.10 mg/l and declined at TP levels >0.10 mg/l. Soluble reactive phosphorus also showed an optimal level (~0.08 mg/l) with plant biomass dropping off at higher SRP levels. The trend was seen in 1993, but the threshold value was higher at 0.15 mg/l SRP.

Plant Biomass vs. Sediment Parameters

Figures 43 - 45 illustrate the relationships between total dry plant biomass and the sediment parameters of organic matter, total nitrogen, and total phosphorus.

The all-transects-combined plots, as in 1993, show an optimal relationship of plant biomass with sediment organic matter where biomass increases up to a threshold of ~4% organic matter and declines above that threshold (Figure 43). Transect 2 did not show this pattern, but the pattern of increasing plant biomass up to ~4% sediment organic matter was seen in the other transects. These relationships of total plant biomass (all species combined) are apparent even without treating non-rooted macrophytes separately from rooted macrophytes.

Sediment total nitrogen was also related to plant biomass, on transects 2 and 7 (Figure 44). Biomass increased with percent sediment nitrogen up to an upper limit (0.40% total sediment nitrogen) with biomass declining above that point. Transect 2 did not show this pattern. Transects 5 and 7 did show this pattern of maximal plant biomass in the 0.40% sediment nitrogen range with plant biomass declining above the 0.40% sediment nitrogen level.

As in 1993, sediment total phosphorus was strongly related to plant biomass (Figure 45). Maximal plant biomass again, as in 1993, occurred at a total phosphorus level of ~1,100 μg/g. This trend was seen at all transects except transect 2. With the higher sediment phosphorus levels in downstream transects (up to and beyond 1,000 μg/g), plant biomass increased to peak levels seen in CSR. Transects 5 and 7 had the highest sediment nutrients. Biomass tended to decline at sediment phosphorus >1,100 μg/g. As with biomass declines above 0.40% total sediment nitrogen, high concentrations of nutrients are likely not the direct cause of biomass decline. The direct limiting factors are likely other parameters associated with extremely high sediment nutrients and organic matter...low sediment oxygen, redox potential, and higher ammonia levels.

Canonical Analysis of All Parameters

Canonical analysis for separation of transects over all months pooled and over all physical-chemical parameters showed clear separation of transect 2 from transects 5 and 7, as evaluated by separate clumping and by distance apart on the *x* or *y* axes (Figure 59). Transect 2 also separated from most of the transect R sites, the random series (represented at transect 9 on Figure 59). In aggregate, transect 2 clearly shows different types of habitats than 5, R, and 7, even though analysis of individual parameters by individual months often did not show significant differences (though visual trends were often there, such as with sediments, plants, and some physical - chemical parameters). Transect 5 also clearly separated out from transect 7. Characteristics of the random sites overlapped with each of the other transects. Limnological and habitat characteristics of the transects sampled fell out as different habitats, even though covering a short river length in CSR. Spring inflows, sediment, and nutrient loadings account for the rapid changes.

On the vertical canonical axis, water alkalinity, along with sediment organic carbon, organic matter, total phosphorus, pH, sand content, and sediment total nitrogen were variables responsible for most of the separation of transects. On the horizontal axis, water depth, hardness, and turbidity, along with sediment organic carbon and organic matter were variables responsible for most of the separation of transects (Figure 59).

Canonical analysis for separation of the individual months of April, May, June, July, August, October, and November over all transects showed that most months differed significantly from one another when all parameters were evaluated in aggregate (Figure 60). Again, limnological and habitat characteristics of the months sampled fell out as different habitats. On the vertical canonical axis, water temperature, total phosphorus, and conductivity, along with sediment organic carbon, organic matter, and silt were variables responsible for most of the separation of months. On the horizontal canonical axis, water turbidity, alkalinity, and nitrite + nitrate nitrogen, along with sediment organic carbon, organic matter were variables responsible for most of the separation of months.

Relationships Between Site Descriptors (Canonical Analysis)

The following table summarizes significant correlations developed through canonical analysis. These relative directions of parameter change between transects were summarized using canonical coefficients, indicating a positive relationship between these variables and loadings along the first canonical axis. Strongest upstream - downstream trends were seen with sediment organic carbon, organic matter, and sediment nitrogen, along with water depth, alkalinity, hardness, and turbidity. The trends between transects are indicated below where arrows indicate relative direction of a parameter on a transect compared to another transect. The strong upstream - downstream trends of sediment total phosphorus and plankton chlorophyll *a* were not apparent in 1994 as in 1993.

Trends of Descriptors in One Transect Relative to Another

Parameter	7	vs. 5	7	vs. 2	5	vs. 2
Water...						
Depth	--	--	⇓	⇑	⇓	⇑
Turbidity	--	--	⇓	⇑	⇓	⇑
Alkalinity	⇑	⇓	--	--	--	--
Hardness	--	--	⇑	⇓	⇑	⇓
TP	⇓	⇑	--	--	--	--
Sediment...						
Organic C	⇑	⇓	⇑	⇓	⇑	⇓
Org. Matter	⇑	⇓	⇑	⇓	⇑	⇓
Sediment pH	⇓	⇑	--	--	--	--
Sand	⇓	⇑	--	--	--	--
Sediment N	⇑	⇓	--	--	--	--

Environmental Variables as a Function of Plant Cover

Water Column Variables vs. Plant Cover

Environmental conditions were compared between open water (open channels or no-plant sites) and adjacent aquatic macrophyte beds (AMB)(Figures 46 - 58). Open water sites were defined as sites with <100 g/m^2 dry biomass.

With respect to mean water column depth, it was observed that mean depths of AMB were $\leq$1.5 m. Open water sites all averaged >3.0 m in depth. There were significant differences between depths of open water vs. AMB sites. Largest differences were observed in June through November when mean depth for open water sites was 3.2 m while AMB averaged 1.5 m depth (Figure 46).

Hotelling's T^2-test also showed a significant difference between velocity of open water vs. AMB May through October (Figure 46). Mean velocity was somewhat slower in AMB than in the open water sites. The greatest difference was observed in June, July, and August when mean velocity in the open water sites peaked at 1.4 ft/s. At that time, velocity in the AMB averaged 0.2 ft/s. These summer peak velocities reflected the heavy influence of irrigation return flows to the CSR (Figure 46).

Mean temperatures of open water and AMB sites were similar; some differences, however, were observed between temperatures of open water sites and AMB. Mean temperatures were not significantly different in AMB than they were in the open water sites (Figure 47). Greatest differences in temperatures were observed during November when open water sites had mean temperatures of 8.0 °C and AMB had mean temperatures of 7.5 °C.

Mean water column dissolved oxygen levels were similar between open water and the AMB (Figure 47). There were no *significant* differences between AMB and open water sites, even though some individual sample sites had August supersaturation up to 140% (App. Table A). Patterns were not consistent enough to produce significance. Greatest AMB vs. open water differences were observed in November when AMB showed lower level of oxygen with a mean of 10.0 mg/l compared to the open water sites which showed mean levels of 10.5 mg/l (Figure 47).

Mean water column hardness and alkalinity were essentially identical between open water and AMB sites (Figure 48). The slight differences indicate that these parameters are neither limiting to macrophte production nor changed by flow through AMB.

Suspended solid concentrations were one standard error lower in AMB vs. open water sites in July and November. Suspended solids were always lower in AMB vs. open water sites (Figure 38).

Mean Secchi depths were variable between AMB and open water sites with no clear pattern apparent. Visibility dropped during the summer months and increased during the rest of the year. There were, however, no significant differences between AMB and open water Secchi transparency. The fact that so many of the Secchi measurements were missing because of shallow depth was undoubtedly a factor in the lack of patterns (Figure 38).

Mean turbidity showed comparable trends to the total suspended solids where levels increased during the summer months with peaks in August and minima in the fall of the year. Turbidity levels in the open water sites were consistently higher than in AMB (Figure 38). Although this trend was common, no significant differences were observed. During the months of August and

October, mean turbidity was ~ 3 NTU's higher in the open water than it was in the AMB (Figure 38).

Mean water column nitrite + nitrate nitrogen concentrations were similar between open water sites and AMB. Nitrite + nitrate nitrogen peaked in November at both habitats with means of 1.0 mg/l in July, rising steadily in both habitats to 3.0 mg/l in November (Figure 51).

Mean water column total Kjeldahl nitrogen concentrations were again, as in 1993, higher in AMB than in open water sites in May and August. However, Hotelling's T^2-test showed no significant difference between AMB and open water (Figure 52). Total Kjeldahl nitrogen levels again fell dramatically during August and October, rising sharply to near annual peaks in November.

Mean water column total ammonia nitrogen increased during summer months then remained high in fall months. Mean ammonia peaked in open water sties in November with a mean of 0.10 mg/l (Figure 52). Ammonia differences between open water sites and AMB were not significant.

Mean water column total phosphorus decreased sharply from 0.14 to 0.06 mg/l in July and increased to annual peaks (0.17 mg/l) in fall (Figure 53). No consistent patterns between open water and AMB sites were seen.

Mean water column soluble reactive phosphorus levels again, as in 1993, peaked in November with mean levels reaching 0.16 mg/l in the open water and 0.14 mg/l in the AMB (Figure 53). Through the summer of 1994, SRP levels in open channels vs. in the AMB were similar in concentration and did not show any significant differences between open water and AMB sites. In 1993, differences had been apparent. Only in November did open water and AMB sites differ by more than one standard error. At that time, open water sites had higher SRP than did AMB.

Sediment Variables vs. Plant Cover

Mean sediment pH levels in both open water and AMB showed greater variation in 1994 compared to 1993, from 6.5 to 8.1 for the May - November period of 1994 (Table 15). In every month except October, AMB sites had lower sediment pH, reflecting the higher sediment organic matter which, under the quiescent conditions beneath the plant cover, would develop accumulations of decomposition end products, including carbon dioxide and organic acids. July and August median pH was 6.86 in plant beds compared to 7.25 in open water sites (Figure 54).

Mean percent sand concentrations were always greater in open water sites than in AMB (Figure 55). Sand content of sediments would logically be greater at higher velocity, open-channel sites than under AMB. Since the open water channels have greater velocity, it would be expected that less silt and clay would settle in these channeled areas. Hotelling's T^2-test showed significant differences in sediment sand content between AMB and open water sites. Sand concentrations peaked in May, October, and November in the open water sites with a mean of 80% while AMB had 50% mean sand in those months. In AMB, sand concentrations peaked during June and November with a mean of 50% sand.

Conversely, mean percent silt levels were always higher in the AMB than in the open water areas (Figure 55). This again is more a function of velocity than of any other variable. The AMB act as traps for the fine particulate matter, allowing it to settle to the bottom. Silt peaked in April and May in the AMB with a mean of 52% while silt content in the open water was 16%. Through the summer and fall, silt content steadily increased to 36%.

Mean percent clay was significantly lower in the open water than in the AMB in most months (Figure 56). Clay content steadily increased from April through July in the AMB (4.7% to 8.4%). This again is more a function of velocity than of any other variable where clay particles are settled out with passage through the AMB. Differences were significant most months. Clay content peaked in AMB during July with a mean of 8.4% when open water sites averaged 2.4%. These patterns of sand, silt, and clay content mirrored those found in 1993.

Mean sediment hydrogen concentrations were always higher in AMB compared to open water sites (Figure 56). Hydrogen levels increased in AMB through October (0.59% to 0.80%),.suggesting reduced organic matter was increasing through this time period coincident with the accumulation of energy-rich (reduced) plant biomass. Mean sediment hydrogen in open water sites peaked in April at 0.41%.

Open water sites always had lower levels of sediment carbon and organic carbon than did AMB. Sediment carbon peaked during April and August in open water sites with mean values of 2.2%. In AMB, sediment peaked in October at 4.4 % (Figure 57). Sediment organic carbon peak means in open water sites were 1.2% compared AMB peaks of 2.8%.

Mean sediment nitrogen levels were always higher in AMB than in the open water ranging from 0.25% to 0.39% (Figure 58). Nitrogen levels in AMB decreased slightly through the peak of the growing season then increased into October. The sediment nitrogen in open water sites, however, decreased from April highs of 0.16% to annual lows of 0.08% in July. The open water decline was likely a result of water scouring. The slight AMB decline of sediment nitrogen could have been a result of plant utilization at high biomass levels rather than scouring. Mean sediment nitrogen peaked in open water sites in April, August, and September at 0.16% while AMB sediment nitrogen peaked at 0.39% in October.

As in 1993, mean sediment total phosphorus concentrations were fairly constant at ~1,000 μg/g in both sediments of AMB and in open water sites (Figure 58). In open water sites, concentrations of phosphorus were sharply higher in October and November with a mean concentrations of ~3,100 and 1,800 μg/l. AMB, however, showed a much more constant level of sediment phosphorus concentrations at 1,000 μg/g throughout the year. The AMB October and November peaks were not *significantly* different from open water sites. and there is no apparent explanation for those October and November peaks at open water sites other than lack of plant uptake in those bare areas.

CONCLUSIONS

Water Column Physical Variables

- The 1994 study year had higher mean flows than 1993, but lower peak flows. Monthly mean peak water discharge in the study was 3,056 cfs compared to 2,870 cfs in the comparable 15-month period of the 1993 study. Peak mean daily discharge in WY 94 occurred on October 22, 1993 at only 4,870 cfs and on April 11, 1994 at 4,820 cfs. On the other hand, flows exceeded 11,000 cfs for nine days in June, 1993.
- Both total annual water delivery and mean summer water flows through CSR (Crystal Springs Reach) were very low for the seventh year in a row, totaling 2,340,000 Aft in Water Year 94 compared to 1,750,000 Aft in WY 1993 and averaging 2,637 cfs in the 1994 summer - fall months. Total water yield in WY 94was less than 50% of the 46-year average.
- Water depth at study sites in CSR ranged from 0.7m to 3.9 m.
- Maximum water velocity obtained in CSR was 2.4 fps, in open channel areas between AMB (aquatic macrophyte beds). Minimum water velocity was 0 at some locations in the AMB.
- Total suspended solids peaked in August (all-transect mean = 19 mg/l). Suspended solids were ~50% of 1993 levels.

  Turbidity peaked in August (all-transect mean = 15.2 NTU) with minimal water clarity at that time (all-transect July-August mean = 0.8 m visibility). Only slight trends of TSS reduction with flow through AMB were seen in 1994.
- Mean reach temperatures in July and August were 21.5 °C and 17.8 °C, respectively. Maximal water temperatures were in July (= 30°C; all-transect July mean = 21.5 °C), maintaining this reach as a transitional "cool to warm water" system in July, but cooling in August.

  In July and August, mean temperature declined 3.1 °C and 0.2 °C, respectively, through the CSR from spring inflows.

Water Column Chemical Variables

- QA/QC for water column chemistry was generally good except for NH_3 nitrogen and TSS which showed high variability. Except for NH_3 nitrogen and TSS, precision was high.
- Laboratory recovery of spiked samples was high with recovery of 92.0% to 114.4%.
- Blanks indicated that field and transport contamination of water samples was not excessive, with contamination averaging less than the MDL for all parameters.
- Overall mean water column chemical values in Crystal Springs Reach in the April - November, 1994 study period *.

-	Total Hardness	- 240 mg/l
-	Alkalinity	- 199 mg/l
-	Conductivity	- 494 μmhos
-	pH	- 7.3 - 8.5
-	Nitrite + Nitrate Nitrogen	- 1.8 mg/l
-	Total Kjeldahl Nitrogen	- 0.25 mg/l
-	Ammonia Nitrogen	- 0.06 mg/l
-	Total Phosphorus	- 0.12 mg/l
-	Soluble Reactive Phosphorus	- 0.10 mg/l
	Total Suspended Solids	- 10 - 25 mg/l
	Turbidity	- 10 - 20 NTU
	Secchi Depth	- 0.8 - 1.0 m

* These numbers are typical values presented to generally describe the Mid-Snake River in the CSR. Specific means and measures of variability are presented in Figures 46 - 53 and Tables 7 - 20.

- Key water quality conditions observed in the summer - fall period:
  - Lowest dissolved oxygen observed at a single site was 7.4 mg/l in July in heavy plant beds. Lowest mean transect oxygen was 8.0 mg/l at transect R in May.
  - Highest mean transect oxygen was 11.2 mg/l at transect 2 in April. Mid-summer oxygen upersaturation reached 140%.
  - Median pH fell in the moderately basic range of 7.3 - 8.5.

- $NO_2 + NO_3 \bullet N$ was high and peaked in November (transect mean = 3.0 mg/l).
- TKN was only moderate, peaking in June, July, and November (~ 0.4 mg/l).
- NH_3 - N June through November was ~ 0.09 mg/l.
- Total alkalinity was strongly correlated to water column total hardness, conductivity, and NO_2-$NO_3 \bullet N$.
- TP transect means averaged 0.08 mg/l through July and August and peaked at 0.23 mg/l in November. TP decreased slightly through CSR macrophyte beds in July at maximum biomass.
- SRP was the predominant form of water column phosphorus. SRP transect means ranged from 0.07 - 0.16 mg/l through CSR, averaged 0.09 mg/l, and peaked at 0.16 mg/l in November.
- As in 1993, SRP again declined with flow downstream through macrophytes beds in 1994.

• These levels of $NO_3 + NO_2$, TP, and SRP are associated with highly eutrophic waters.

Phytoplankton and Aquatic Macrophytes

• As in 1992 and 1993, epiphytic filamentous green algae (*Hydrodictyon* and *Cladophora,* and the new taxon *Enteromorpha*) in 1993 were abundant components of aquatic macrophyte beds, but appeared about 40 days earlier in the summer than in 1993. In 1994, the absence of June flushing flows permitted earlier macrophyte development. Epiphytic algal dominance of the macrophyte biomass (up to 50-60% of total community biomass) was common through summer and fall.

• Species composition of rooted aquatic macrophytes in the CSR was dominated by *Potamogeton crispus*, *P. pectinatus*, *Ceratophyllum demersum*, and the epiphytic algae, *Cladophora* and *Hydrodictyon*..

• *P. crispus* and *C. demersum* were the dominant macrophytes in more turbid sites. *P. pectinatus* was equally abundant in clear or turbid water sites.

• Peak transect mean plant biomass levels in CSR were higher in 1994 were higher than in 1992 and 1993, averaging 1,272 g/m^2 dry weight at peak densities in downstream transects in August, decreasing to 833 g/m^2 peaks in October. There were no significant differences in 1994 biomass densities in April between sites.

- Individual sample peak macrophyte biomass level was 3,364 g/m^2 in June, similar to the 3,500 g/m^2 peak in 1993.

- In June, the month of highest mean macrophyte density, transect means were 176 g/m^2 at transect 2 at the upper end of CSR while transect 7 (downstream end of CSR) biomass averaged 1,272 g/m^2. Transect R, a mid-reach transect, averaged 478 g/m^2 at that time.

  Macrophyte biomass at transect 2 was less than macrophyte biomass at transects R and 7 in all months. Downstream transects averaged up to 8-10x upstream transects in August and October although not significant because of the high range of biomass values between sites. Highest biomass levels occurred at transects 5, R, and 7, which were below aquaculture and agricultural loading to the reach.

- Rooted macrophytes, epiphytes, and non-rooted macrophytes were co-dominant through August; and epiphytes were dominant through October.

- Rooted macrophytes had 35% and 18% greater concentrations of phosphorus and nitrogen, respectively, than non-rooted macrophytes.

- Average nutrient content of macrophytes increased through the summer to annual maxima in November.

- Phytoplankton chlorophyll *a* (monochromatic) in 1993 ranged from 1.4 to 107.9 µg/l through the summer with annual maximum values at the downstream transect in November. Transect means ranged from 5.1 µg/ (transect 7 in July) to 33.8 µg/l (transect 2 in July).

- Chlorophyll *a* minima were in AMB at peak macrophyte biomass months.

- Macrophyte biomass correlated inversely with water depth and velocity and directly with water column total phosphorus and SRP, and with sediment organic matter, nitrogen, and phosphorus. The latter three parameters had optimal concentrations above which plant biomass declined.

- Comparison of aquatic macrophyte bed conditions compared to adjacent open channels:
  - Depth was significantly greater in open channels than in AMB.
  - Water velocities in macrophyte beds were significantly less (sometimes 0) than in open channel sites.
  - Temperatures, dissolved oxygen, total hardness, conductivity, and alkalinity levels were not different between AMB and open channel sites.

- Total suspended solids and turbidity were both significantly lower in AMB compared to open water sites.
- Water column nitrite + nitrate nitrogen and ammonia nitrogen were not significantly different between open water sites and AMB.
- Kjeldahl nitrogen was significantly higher in AMB.
- Neither TP nor SRP were significantly different between open water sites and AMB.
- Percent sediment sand was significantly lower in AMB; Percent sediment silt and clay were both significantly higher in AMB.
- Scouring at slightly elevated August flows decreased sediment clay and nitrogen content in open water sites, but not in AMB.
- Mean sediment N, H, total carbon, and total organic carbon were always higher in AMB.
- Mean sediment total P was not different between AMB and adjacent open channels except for higher sediment TP in October in open water sites.

Sediments

- Fine, organic-rich, surficial sediments averaged 0.68 m thickness at the upper end of CSR, and decreased to 0.23 m thickness at the downstream end.
- The sediment phosphorus difference between open water sites and AMB observed in 1993 was not seen in 1994 except in October when open water sediment phosphorus was greater than sediment phosphorus in AMB (but not significantly so).
- As in 1992 and 1993, data again indicate lower limits of sediment N (0.1%), sediment P (0.08%), and sediment organic matter (2.0%) for high (>500 g/m^2) macrophyte densities.
- There was a well-defined upper limit of sediment organic matter (4.0%) and sediment N (0.35%) above which macrophyte densities declined. An upper limit of sediment P was again evident at 1,100 μg/g (compared to 1,200 μg/l in 1993) , but less sharply defined. We do not believe that the sediment organic matter, N, or P are causing the biomass decline at higher nutrient concentrations, but that correlative factors associated with high sediment organic matter, N, and P cause the macrophyte decline, i.e. low sediment oxygen, redox potential, or high sediment levels of ammonia and organic acids from organic matter decomposition in enriched sites.

- Nutrients in suspended solids deposited at the downstream end of CSR during July - November, 1994, i.e. an estimate of export from the CSR, were: Total P = 0.33 g/m^2/day, Plant-available P = 0.04 g/m^2/day, Plant-Available K = 0.09 g/m^2/day , Organic Matter = 11.34 g/m^2/day, and Total N = 0.90 g/m^2/day. Except for plant-available P, these rates were approximately half of 1993 deposition (export) rates.

Bibliography

Allison, L.E. 1965. Organic carbon. In C.A. Black (Ed.), Methods of soil analysis, part 2. Agronomy. 9:1346-1365.

American Public Health Association. 1992. Standard Methods for the Examination of Water and Wastewater, 17th edition. Washington D.C.

Anderson, M.R., and J. Kalff. 1988. Submerged aquatic macrophyte biomass in relation to sediment characteristics in ten temperate lakes. Freshwater Biology 19:115-121.

Andrews, D.S., D.H. Webb, A.L. Bates. 1984. The use of aerial remote sensing in quantifying submersed aquatic macrophytes. Ecological Assessment of Macrophyton: Collection, use and meaning of data. ASTM STP 843. W.M. Dennis and B.G. Isom, eds., American Society of Testing and Materials pp. 92-99.

Barko, J.W., D. Gunnison, and S.R. Carpenter. 1991. Sediment interactions with submersed macrophyte growth and community dynamics. Aquatic Botany 41:41-65.

Bauer, S.B. 1986. Pilot study of quality assurance sample procedures. Water Quality Bureau Report, Idaho Department of Health and Welfare Division of Environment, Boise, Idaho. January, 1986.

Bauer, S.B., W.H. Clark, and J.A. Dodds. 1986. Quality assurance sample procedures for water quality surveys. Journal of the Idaho Academy of Sciences, Volume 2, Number 2.

Best, E.P.H., J.H.A. Dassen, J.J. Boon, and G. Wiegers. 1990. Studies on decomposition of *Ceratophyllum demersum* litter under laboratory and field conditions: losses of dry mass and nutrients, qualitative changes in organic compounds, and consequences for ambient water and sediments. Hydrobiologia 194:91-114.

Best, M.D., and K.E. Mantai. 1978. Growth of *Myriophyllum*: Sediment or lake waters as the source of nitrogen and phosphorus. Ecology 59:1075-1080.

Blomqvist, S., and C. Kofoed. 1981. Sediment trapping - a subaquatic *in-situ* experiment. Limnology and Oceanography 26(3):585-590.

Bouyoucos, G. 1962. Hydrometer method improved for making particle size analysis of soils. Agronomy. 54:464-465.

Brockway, C.E., and C.W. Robison. 1992. Middle Snake River water quality study, phase 1, final report. University of Idaho, Idaho Water Resources Institute, Kimberly Research and Extension Center. Submitted to: Idaho Department of Health and Welfare, Division of Environmental Quality.

Carignan, R., and J. Kalff. 1980a. Phosphorus sources for aquatic plants: water or sediments. Science 207:987-989.

Carignan, R., and J. Kalff. 1980b. Phosphorus release by submerged macrophytes: Significance to epiphyton and phytoplankton. Limnology and Oceanography 27(3):419-427.

Chambers, P.A., E.E. Prepas, H.R. Hamilton, and M.L. Bothwell. 1991a. Current velocity and its effect on aquatic macrophytes in flowing waters. Ecological Applications 1(3):249-257.

Chambers, P.A., E.E. Prepas, H.R. Hamilton, and M.L. Bothwell. 1991b. Towards prairie river restoration: Manipulation nutrients and current flow to control aquatic plant growth in flowing waters. Final report for the Donner Canadian Foundation, NHRI contribution #90075. June 1991. Unpublished Report.

Coots, R., and R. Williams. 1991. Pend Oreille River primary productivity and water quality of selected tributaries. Washington Department of Ecology, Water Body No. WA-62-1020.

Covington, H., and J. Weaver. 1990. Geologic maps and profiles of the north wall of the Snake River Canyon, Jerome, Filer, Twin Falls, and Kimberly quadrangles, Idaho. USGS Misc. Inves. Ser. Map I-1947-D.

Dey, P.D., and G.W. Minshall. 1992. Middle Snake River Biotic Resources: A summary of literature in the Middle Snake River water quality assessment bibliographic database. Final report, Volume 1. Department of Biological Sciences, Idaho State University, Pocatello, Idaho. 94 pp.

Edmondson, W. T., H. B. Ward, and G. C. Whipple. 1959. Fresh-Water Biology, Second edition. John Wiley and Sons Inc., New York, New York. 1248 pp.

Falter, C.M., C. Burris, J.W. Carlson, and R. Freitag. 1995. Middle Snake River productivity and nutrient assessment - 1993. University of Idaho, Idaho Water Resources Institute, University of Idaho. Submitted to: Idaho Department of Health and Welfare, Division of Environmental Quality, Twin Falls, Idaho.

Falter, C.M., and J.W. Carlson. 1994. Middle Snake River productivity and nutrient assessment - 1992. University of Idaho, Idaho Water Resources Institute, University of Idaho. Submitted to: Idaho Department of Health and Welfare, Division of Environmental Quality, Twin Falls, Idaho.

Falter, C.M., C. Baines, and J.W. Carlson. 1991. Water quality, fish, and wildlife characteristics of Box Canyon Reservoir, Washington, Section 2: Water Quality. Department of Fish and Wildlife Resources, University of Idaho. 223 pp.

Filbin, G.J., and J.W. Barko. 1985. Growth and nutrition of submersed macrophytes in a eutrophic Wisconsin impoundment. Journal of Freshwater Ecology 3:275-285.

Fuhs, G. W. 1973. Improved device for the collection of sedimenting matter. Limnology and Oceanography 18:989-993.

Gore, J.A., S. Niemala, V.H. Resh, and B. Statzner. 1994. Near-substrate hydraulic conditions under artificial floods from peaking hydropower operation: A preliminary analysis of disturbance intensity and duration. Regulated rivers: Research and Management 9:15-34.

Gardner, W. D. 1980. Sediment trap dynamics and calibration: A laboratory evaluation. Journal of Marine Research 38:17-39

Graneli, W., and D. Solander. 1988. Influence of aquatic macrophytes on phosphorus cycling in lakes. Hydrobiologia 170:245-266.

Håkanson, L., S. Floderus, and M. Wallin. 1989. Sediment trap assemblages - a methodological description. Hydrobiologia 176/177:481-490.

Hargrave, B. T., and N. M. Burns. 1979. Assessment of sediment trap collection efficiency. Limnology and Oceanography 24:1124-1136.

Howard-Williams, C. 1981. Studies on the ability of a *Potamogeton pectinatus* community to remove dissolved nitrogen and phosphorus compounds from lake water. Journal of Applied Ecology 18:619-637.

Howard-Williams, C., and B.R. Allanson. 1981. Phosphorus cycling in a dense *Potamogeton pectinatus* L. bed. Oecologia 49:56-66.

Kemp, W.M., W.R. Boynton, J.C. Stevenson, J.C. Means, R.R. Twilley, and T.W. Jones. 1984. Submerged aquatic vegetation in Upper Chesapeake Bay: Studies related to possible causes of the recent decline in abundance. USEPA 600/S3-84-015.

Kennedy, R.H., and R.C. Gunkel, Jr., eds. 1987. Limnological studies at Eau Galle Lake, Wisconsin; Report 2, Special studies and summary, Technical Report E-85-2, US Army Engineer Waterways Experiment Station, Vicksburg, Mississippi. 167 pp.

Kozerski, H-P. 1994. Possibilities and limitations of sediment traps to measure sedimentation and resuspension. Hydrobiologia 284: 93-100.

Lau, Y. L. 1979. Laboratory study of cylindrical sedimentation traps. Journal of the Fisheries Research Board of Canada 36:1288-1291.

Lund, J.W.G., C. Kipling, and E.D. LeCren. 1958. The inverted mecroscope method of estimating algal numbers and the statistical basis of estimations by counting. Hydrobiologia 11:143-170.

MacMillan, R. 1992. Water quality of the Middle Snake River and review of aquatic plant growth control literature. Clear Springs Foods, Inc., Buhl, Idaho, USA. 55 pp.

Madsen, J.D., and M.S. Adams. 1988. The nutrient dynamics of a submersed aquatic plant community in a stream ecosystem dominated by *Potamogeton pectinatus* L. Journal of Freshwater Ecology 4(4):541-550.

Merritt, R. W. and K. W. Cummins. 1984. An introduction to the insects of North America. Kendall/Hunt Publishing, Dubuque, Iowa. 722 pp.

Millner, G.C., R.A. Sweeney, and V.R. Frederick. 1982. Biomass and distribution of *Cladophora glomerata* in relation to some physical-chemical variables at two sites in Lake Erie. Journal of Great Lakes Research 8(1):35-41.

Minshall, G.W., C.T. Robinson, and T.V. Royer. 1993. Monitoring of the Middle Reach of the Snake River: Nonpoint Assessment. Final Report. Submitted to the Idaho Division of Environmental Quality, Twin Falls, Idaho. 15 October, 1993. 76 pp.

Moss, B. 1976. The effects of fertilization and fish on community structure and biomass of aquatic macrophytes and epiphytic algal populations: an ecosystem experiment. Journal of Ecology 64: 313-342.

Nichols, D.S., and D.R. Keeney. 1976. Nitrogen nutrition of *Myriophyllum spicatum* : uptake and translocation of ^{15}N by shoots and roots. Freshwater Biology 6:145-154.

Nichols, S.A., and B.H. Shaw. 1986. Ecological life histories of the three nuisance plants, *Myriophyllum spicatum*, *Potamogeton crispus*, and *Elodea canadensis*. Hydrobiologia 131:3-21.

Olsen, S.R. and F.S. Watanche. 1965. Test of an ascorbic acid method for determining phosphorus in water and $NaHCO_3$ extracts from soil. Soil Science Society of America Proceedings 29:677.

Olsen, S.R. et al. 1954. Estimation of available phosphorus in soils by extraction with sodium bicarbonate. USDA Circular 939.

Omueti, I.A.I. 1980. Sodium hypochlorite treatment for organic matter destruction in tropical soils of Nigeria. Soil Science Society of America Journal 44:878-880.

Orth, R.J., K.A. Moore, and J. van Montfrans. 1983. Submerged aquatic vegetation: Distribution and abundance in the Lower Chesapeake Bay and the interactive effects of light, epiphytes, and grazers. USEPA-600/S3-83-019, June 1983.

Pennak, R.W. 1989. Fresh-water Invertebrates of the United States, 3rd Edition. John Wiley and Sons, New York, NY. 628 pp.

Rattray, M.R., C. Howard-Williams, and J.M.A. Brown. 1991. Sediment and water as sources of nitrogen and phosphorus for submerged rooted aquatic macrophytes. Aquatic Botany 40:225-237.

Royer, T.V., C.T. Robinson, and G.W. Minshall. 1995. Ecological structure and function of the Middle Reach of the Snake River: Volume I: Water quality and benthic monitoring. Final report to the Idaho Department of Health & Welfare, Division of Environmental Quality. June, 1995. 84 pp. + App.

SAS Institute. 1987. SAS user's guide: Statistics Version. SAS Institute, Cary, NC, USA.

U.S. Environmental Protection Agency. 1990. The lake and reservoir restoration guidance manual. 2nd edition. Criteria and Standards Division Nonpoint Sources Branch, Washington, D.C. EPA 440/7-90-006.

University of Idaho Analytical Sciences Laboratory. 1993. Laboratory Standard Methods. Holm Research Center, University of Idaho, Moscow, Idaho.

Utermohl, H. 1958. Zur Vervollkomnung der quatitativen phytoplankton methodik. Mitt. Int. Verein. Limnol. 9:1-38.

Willen, E. 1976. A simplified method of phytoplankton counting. British Phycological Journal 11:265-278.

FIGURES

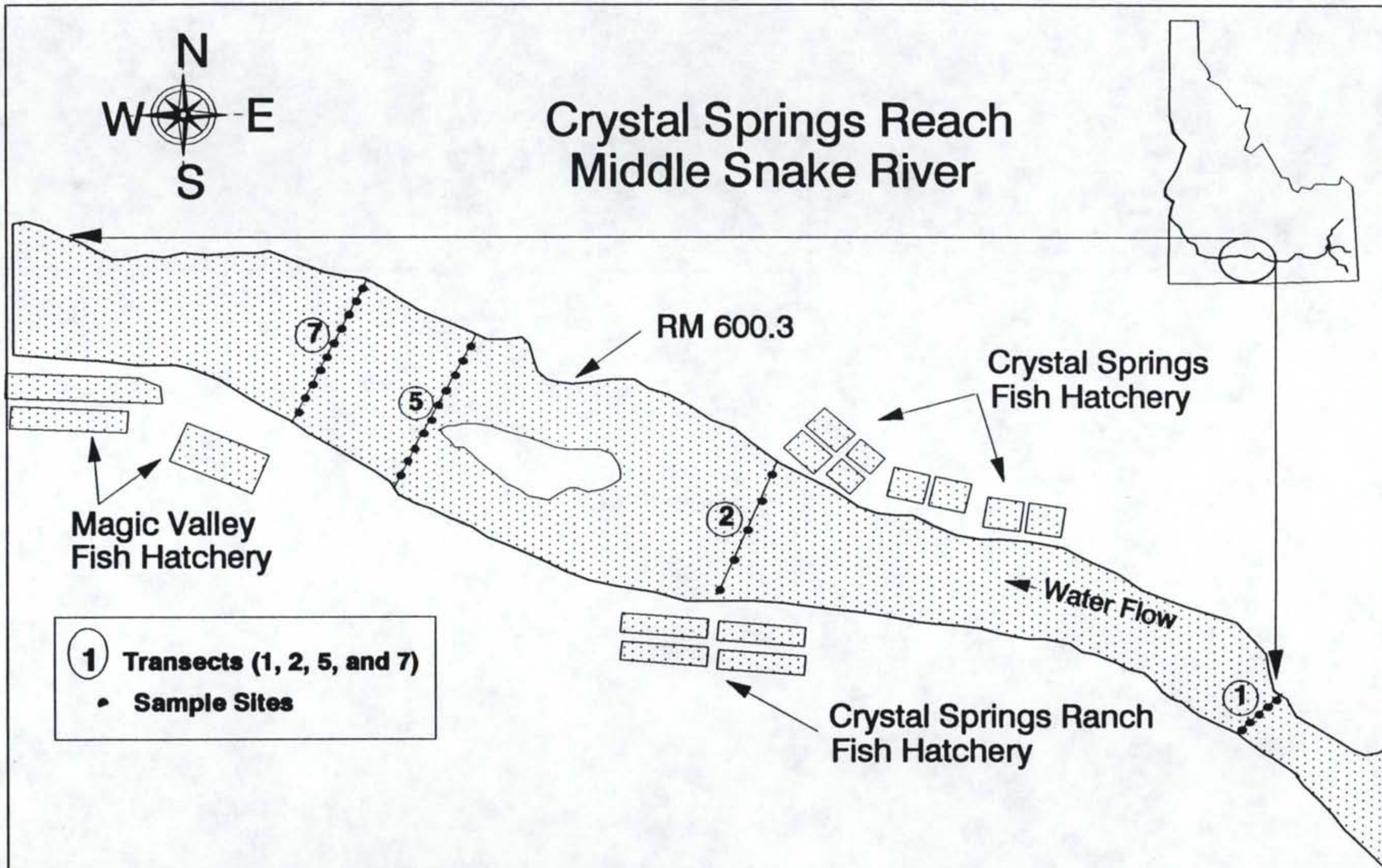
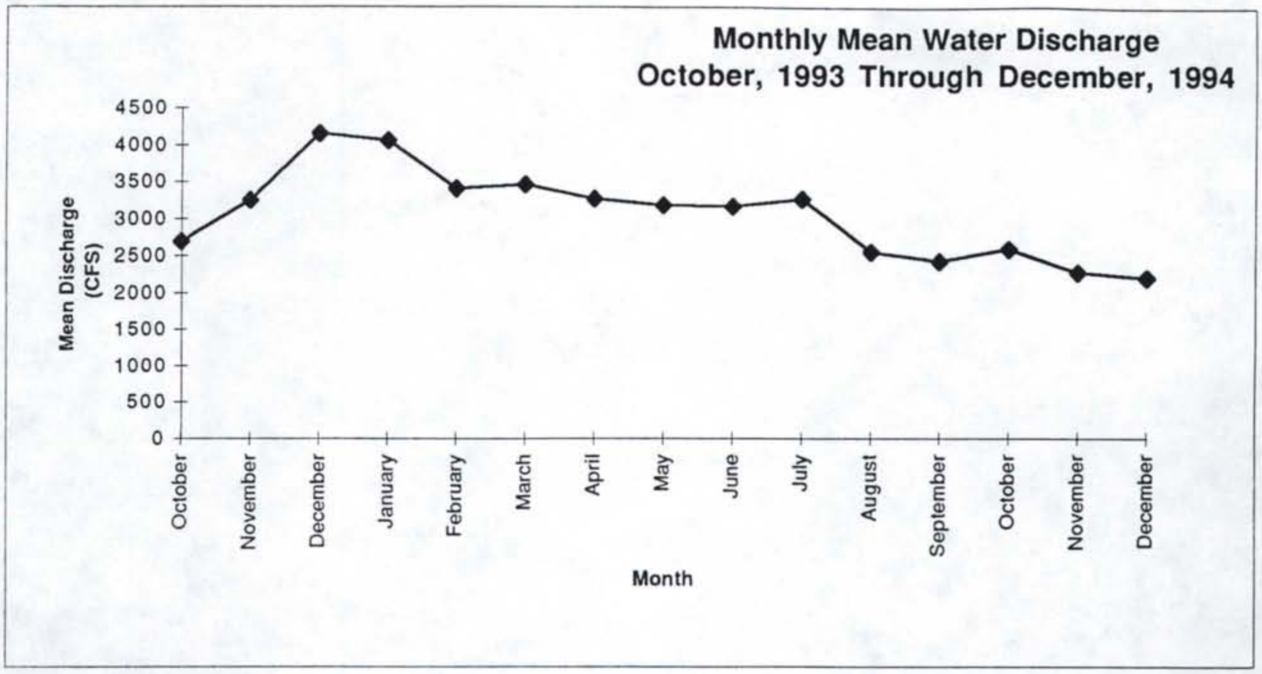


Figure 1. Crystal Springs Reach of the Middle Snake River, Idaho, showing locations of transects and sample sites, 1994.



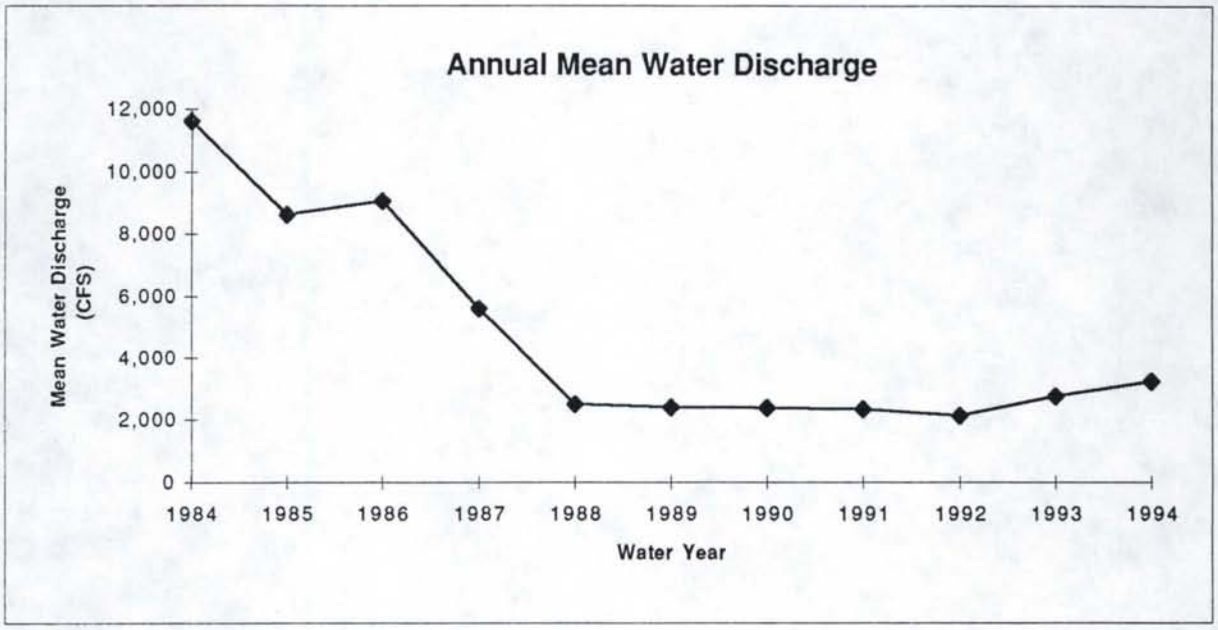
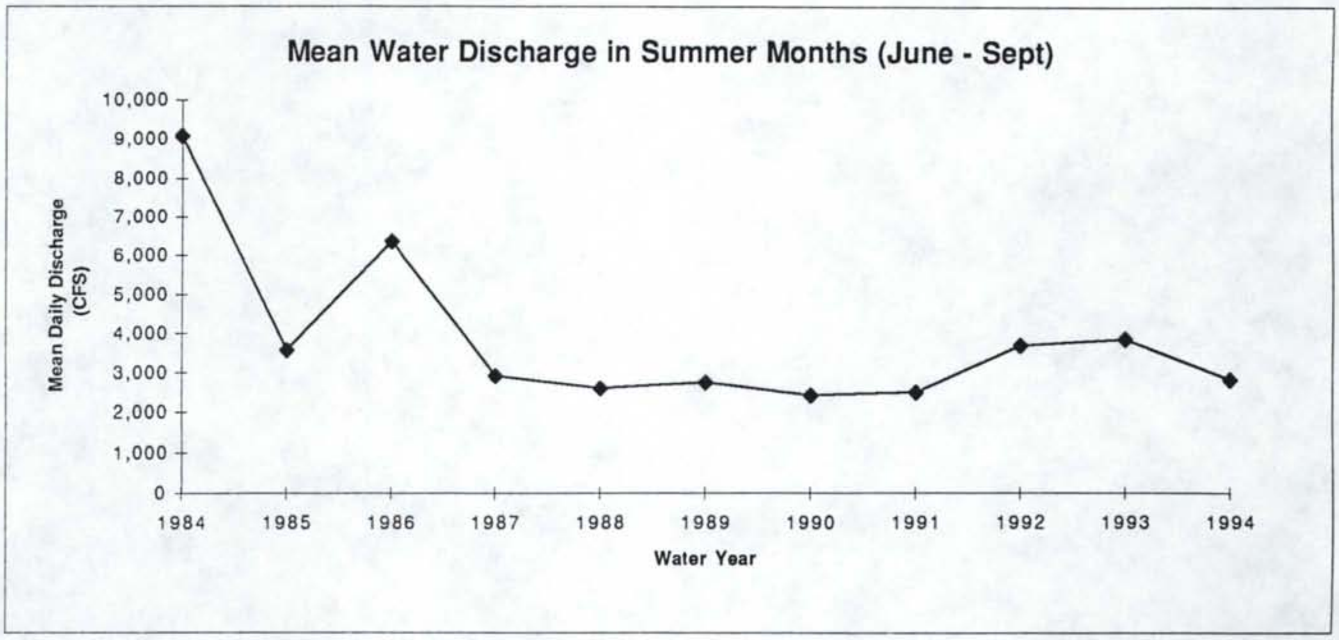


Figure 2. Monthly mean water discharge (cfs) of mainstem Snake River plotted by month (October, 1993 through December, 1994) and annual mean water discharge for Water Years 1984 - 1994. Water discharge recorded at river mile 596.8, six miles northeast of Buhl, Idaho. Data extracted from USGS Water Data Reports ID-94-1 and USGS unpublished data (USGS 1994 and 1995).



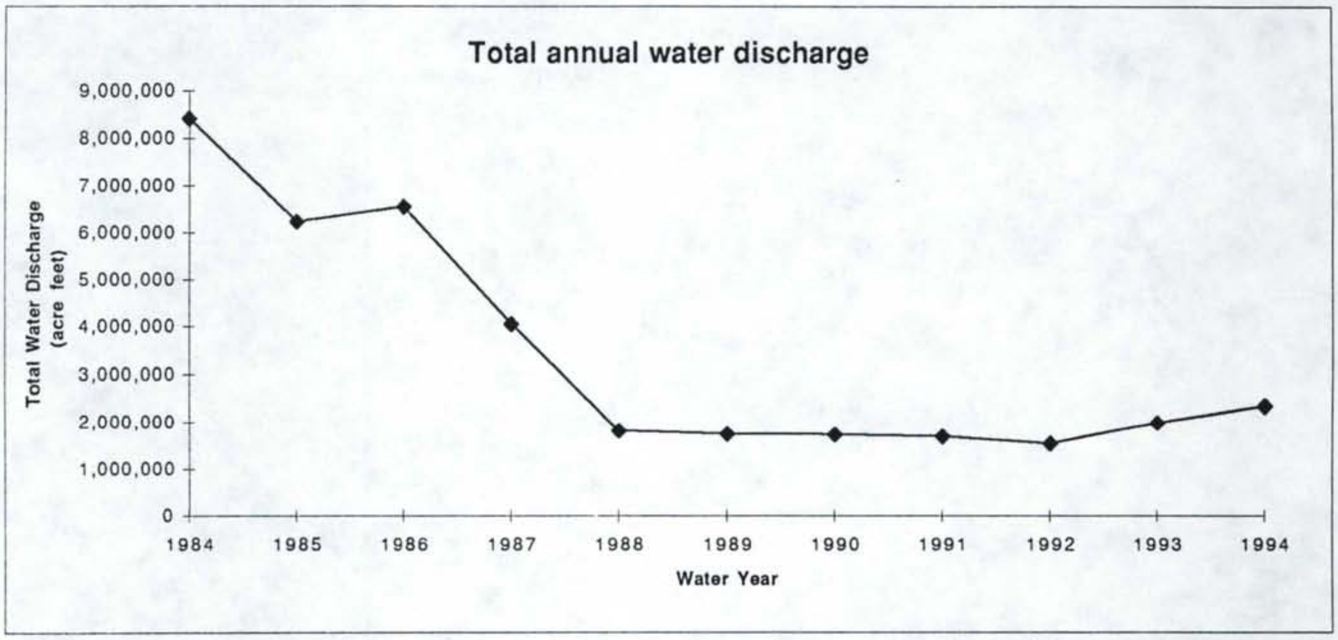


Figure 3. Mean water discharge (cfs) in summer months (June - Sept.) and total annual flow (ac-ft) of mainstem Snake River recorded at river mile 596.8, six miles northeast of Buhl, Id. for Water Years 1984 through1994. Data extracted from USGS Water Data Report ID-94-1 (USGS 1994).

Water Depth

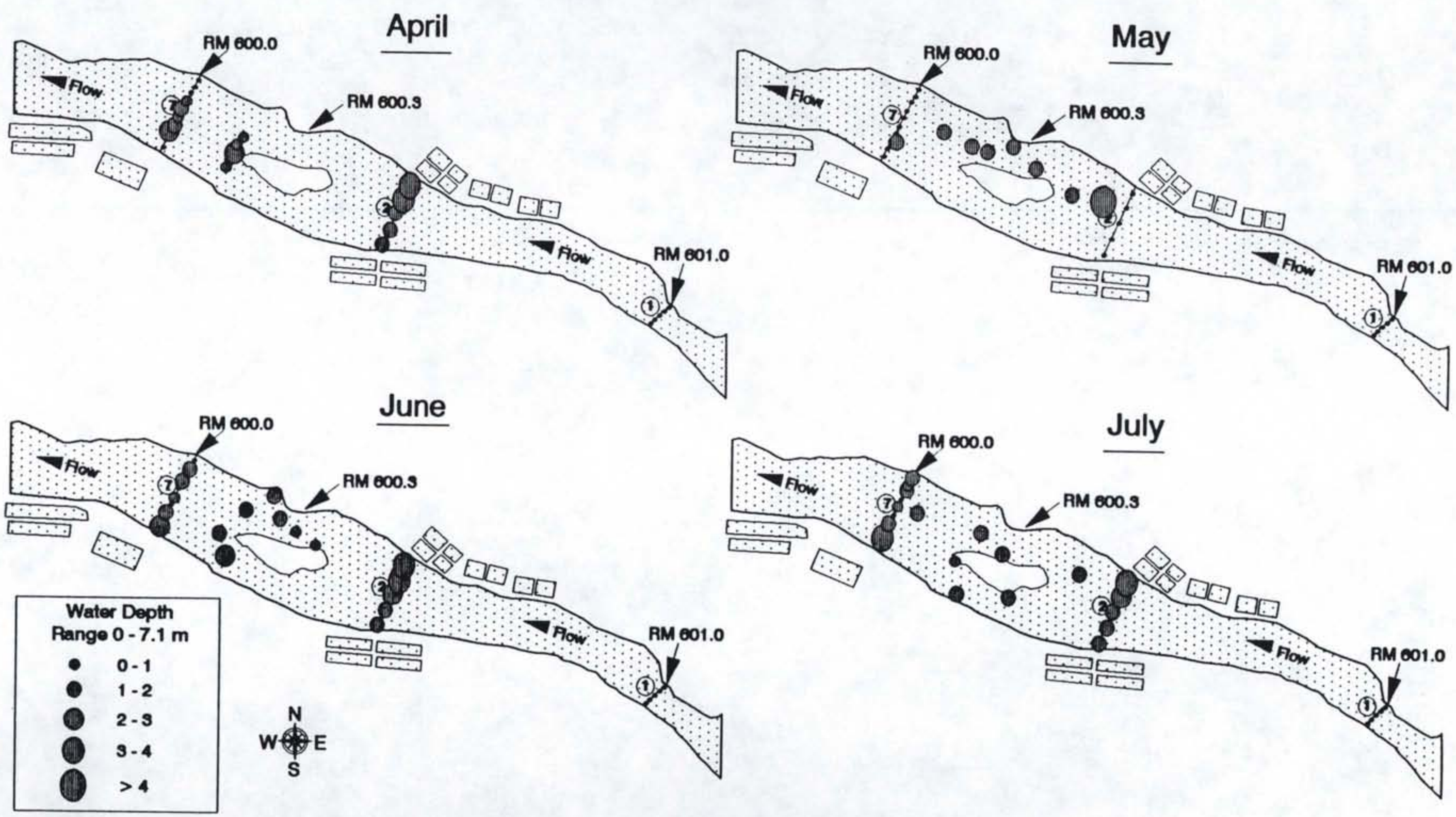


Figure 4. Water depth in April, May, June, and July in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Water Depth

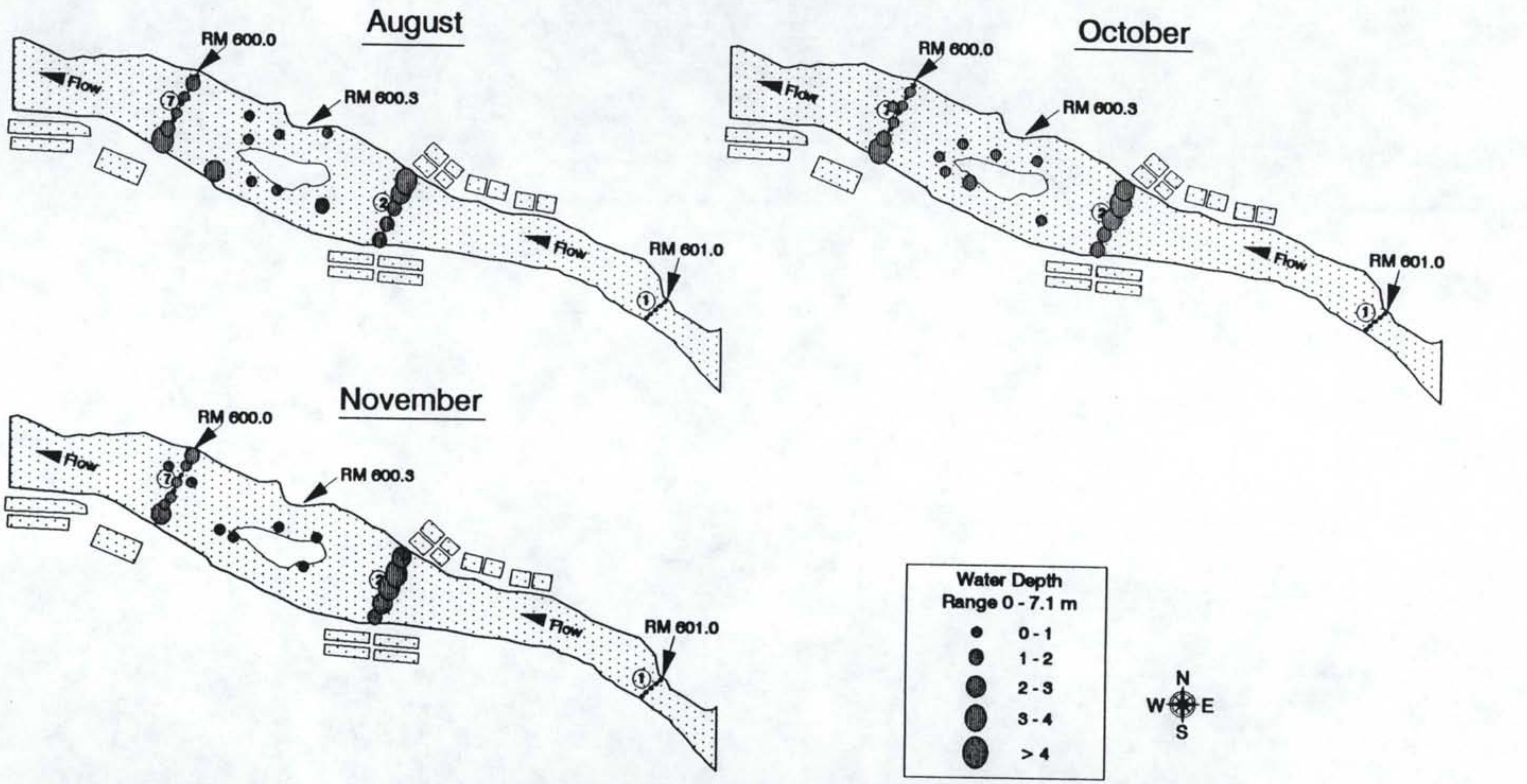


Figure 4 (cont.). Water depth in August, October, and November in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

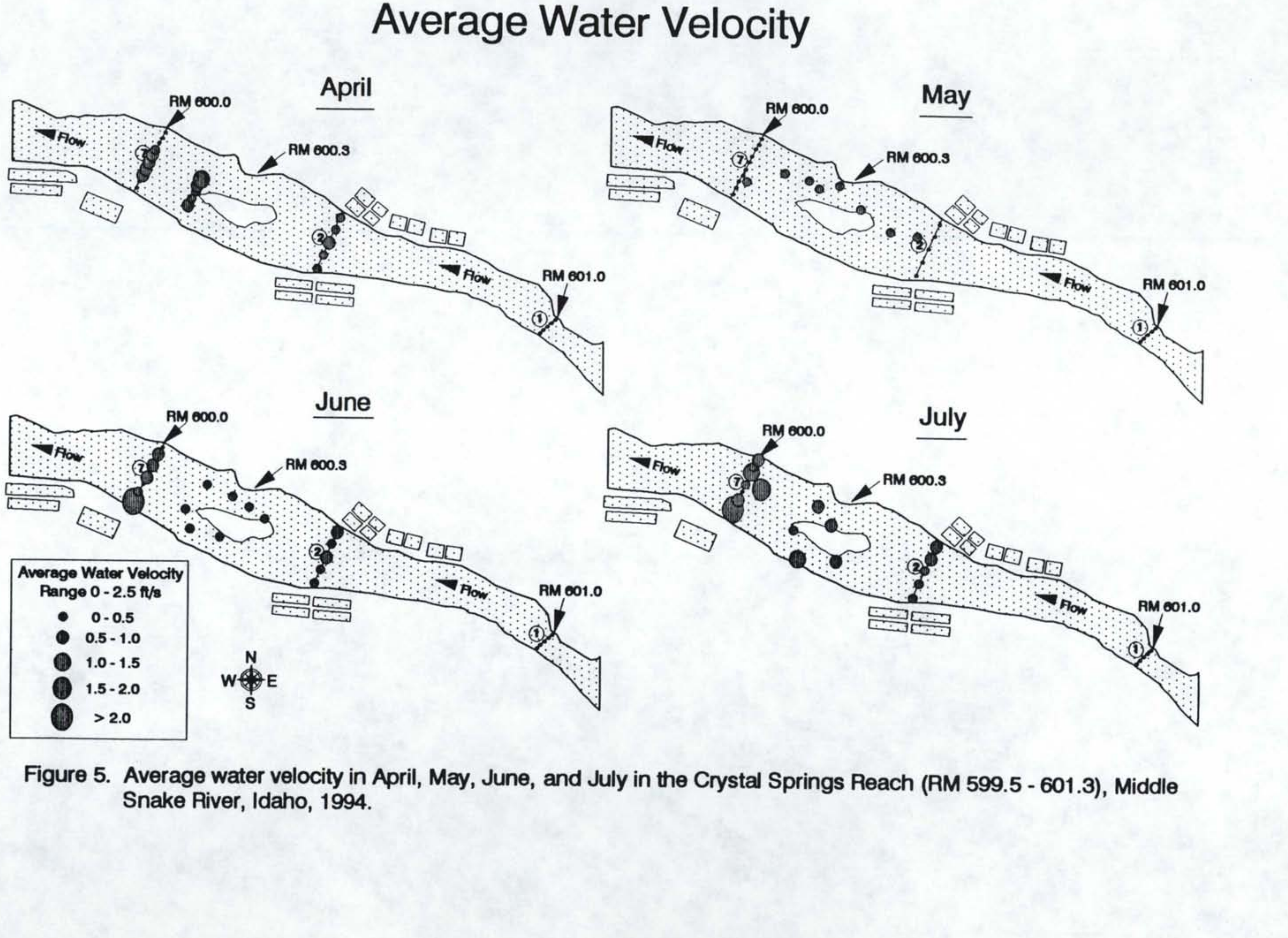


Figure 5. Average water velocity in April, May, June, and July in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

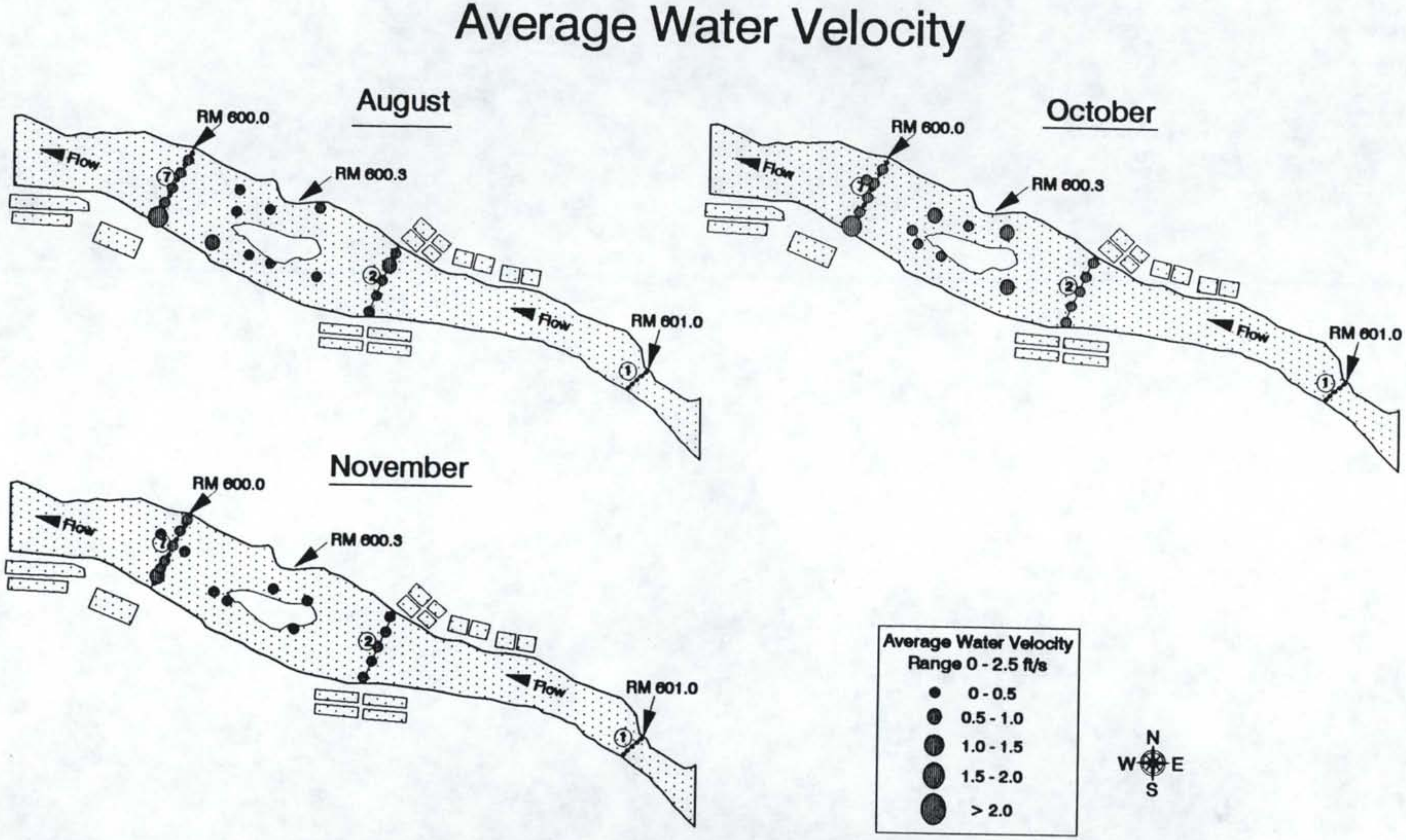


Figure 5 (Cont.). Average water velocity in August, October, and November in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Total Suspended Solids

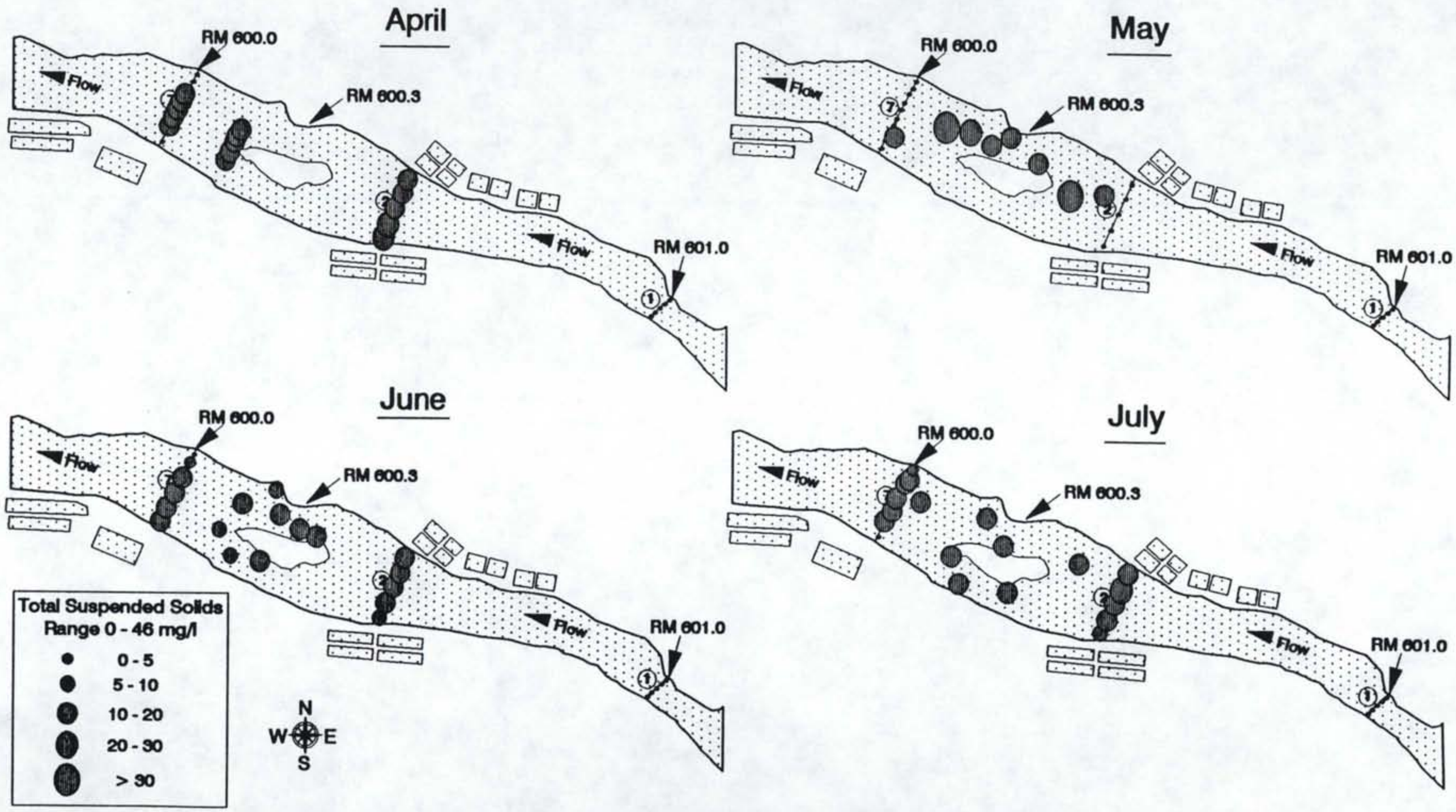


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Figure 6. Total suspended solids in April, May, June, and July in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Total Suspended Solids

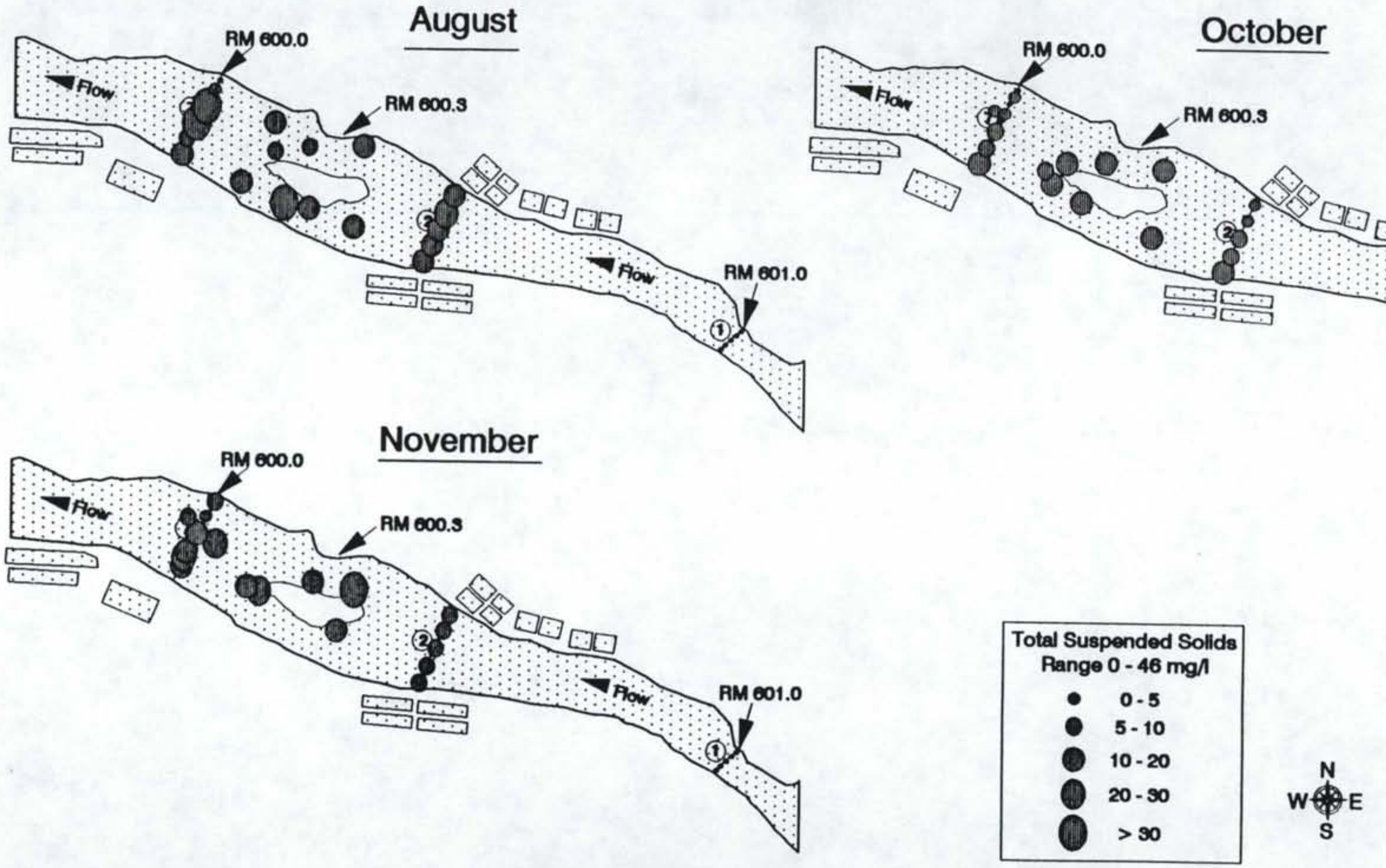

Figure 6 (Cont.). Total suspended solids in August, October, and November in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Turbidity

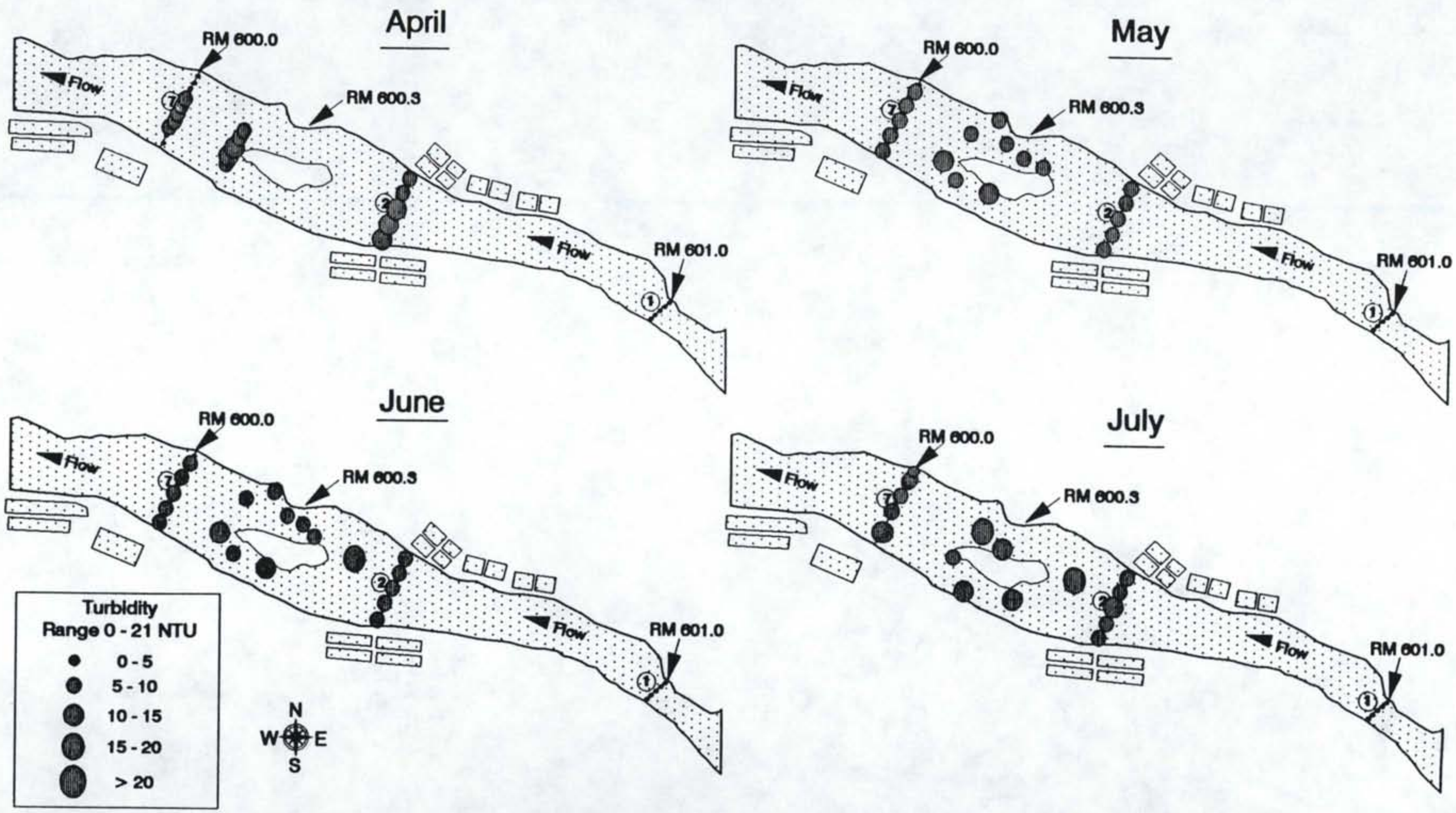

Figure 7. Turbidity in April, May, June, and July in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

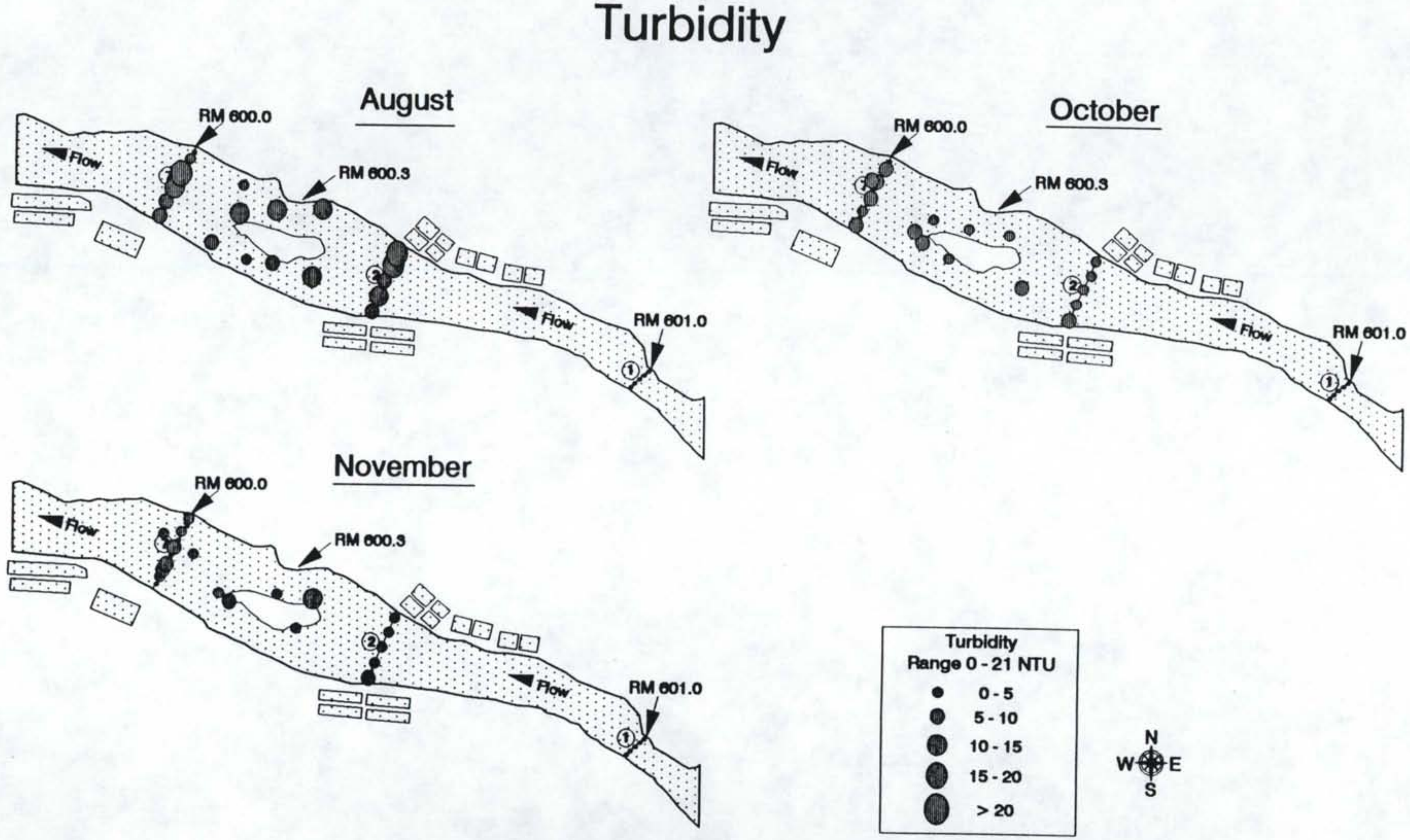

Figure 7 (Cont.). Turbidity in August, October, and November in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Secchi Depth

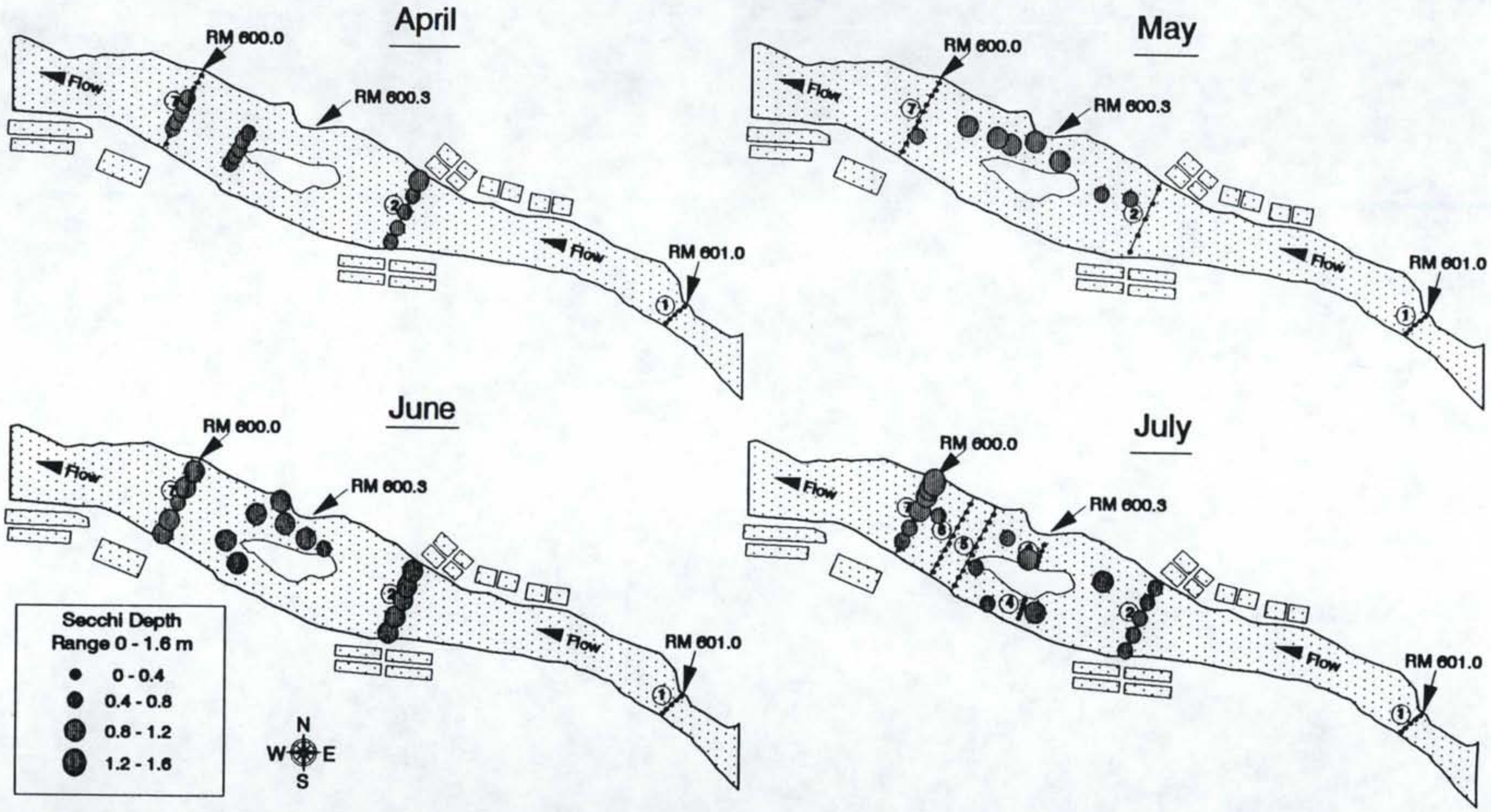

Figure 8. Secchi depth in April, May, June, and July in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Secchi Depth

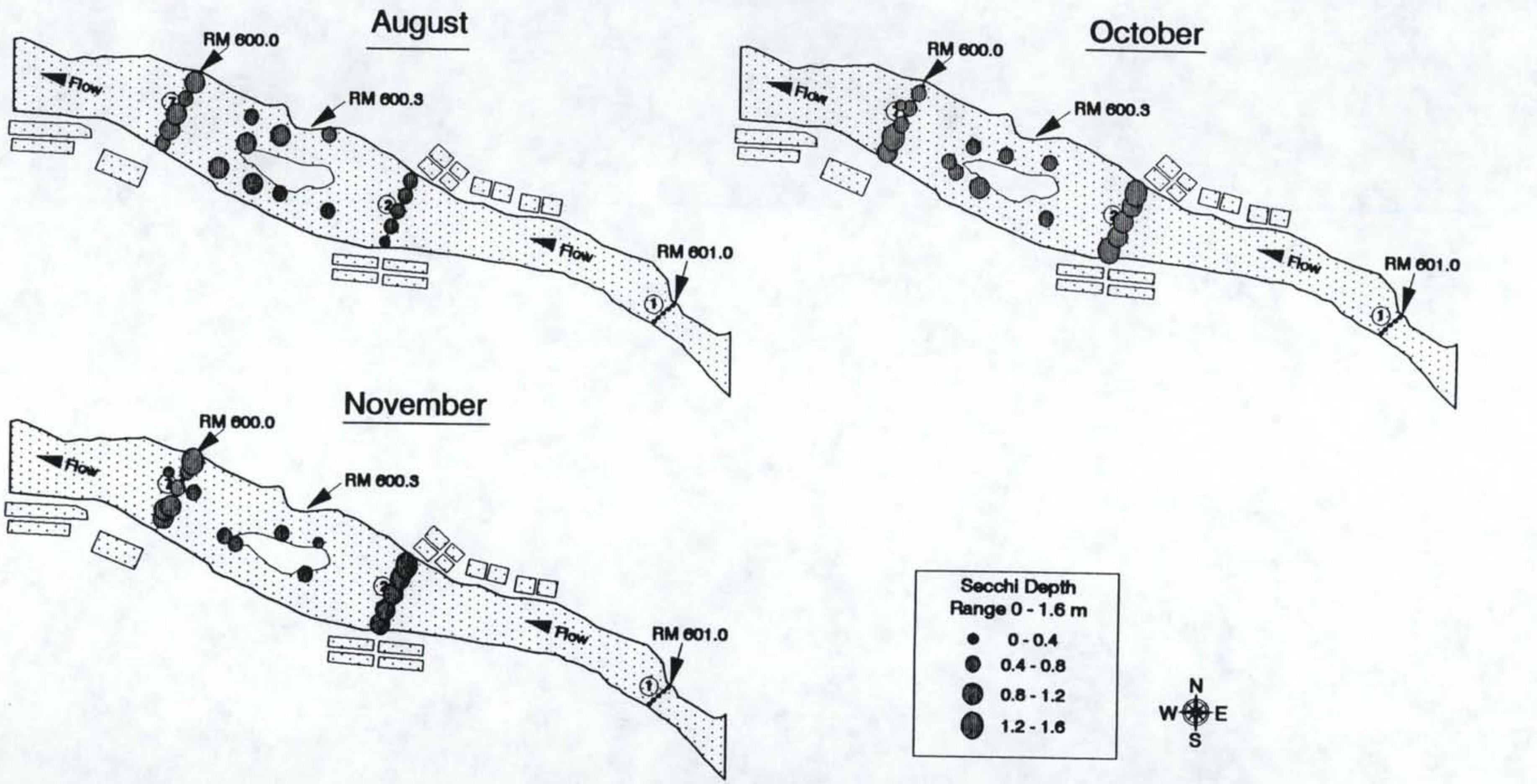

Figure 8 (Cont.). Secchi depth in August, October, and November in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Average Water Temperature

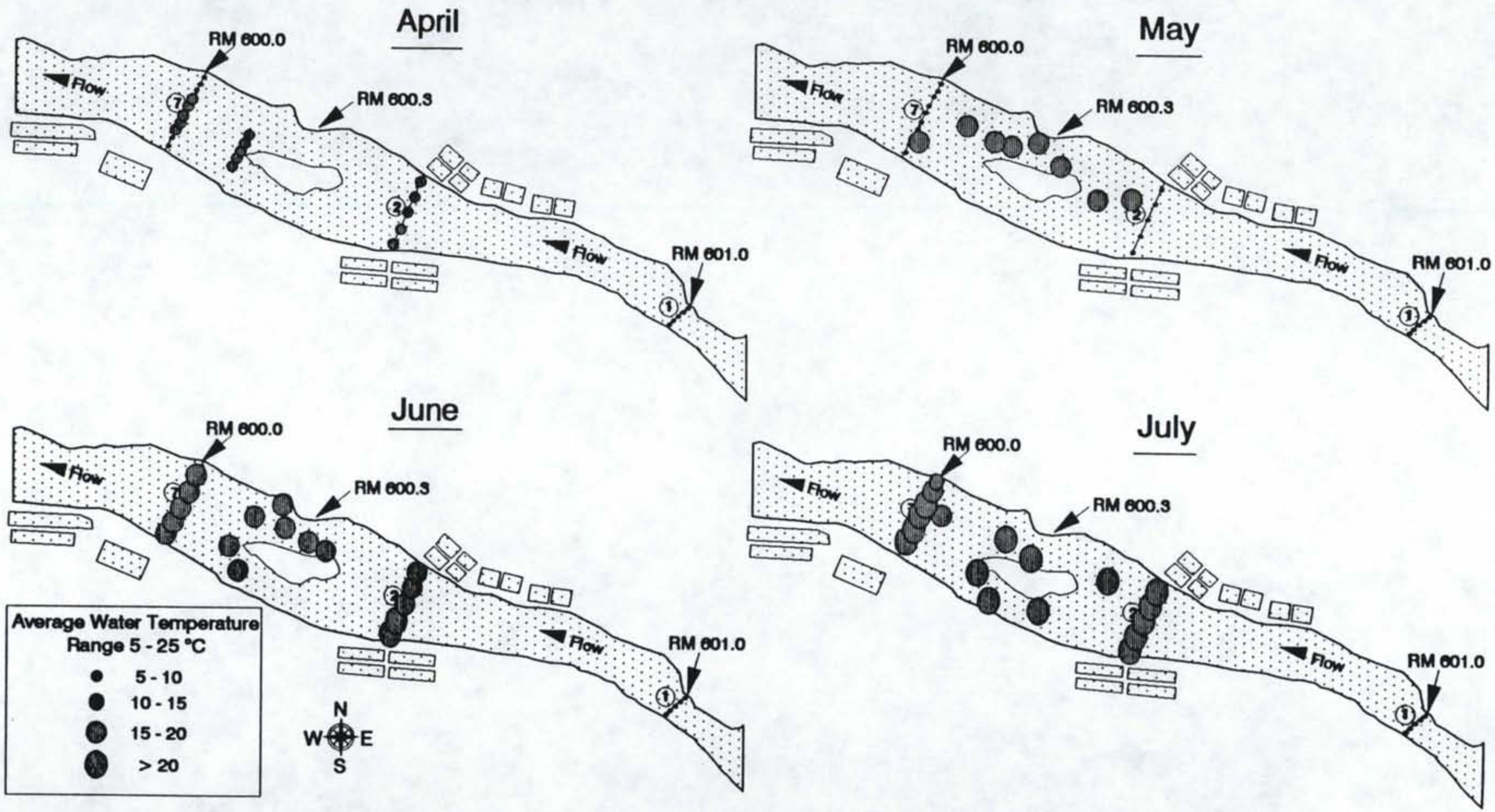

Figure 9. Average water temperature in April, May, June, and July in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Average Water Temperature

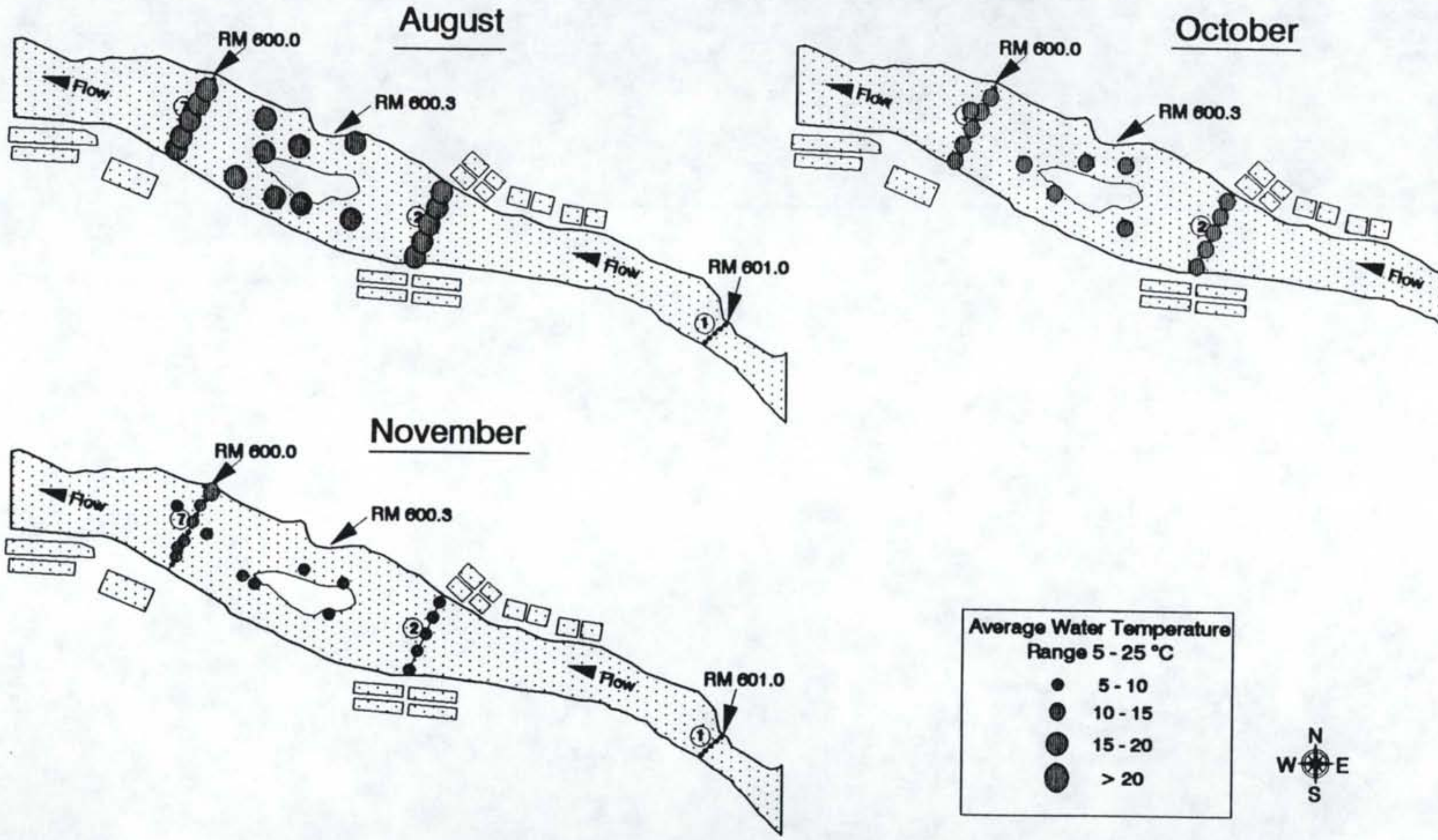

Figure 9 (Cont.). Average water temperature in August, October, and November in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Total Dissolved Oxygen

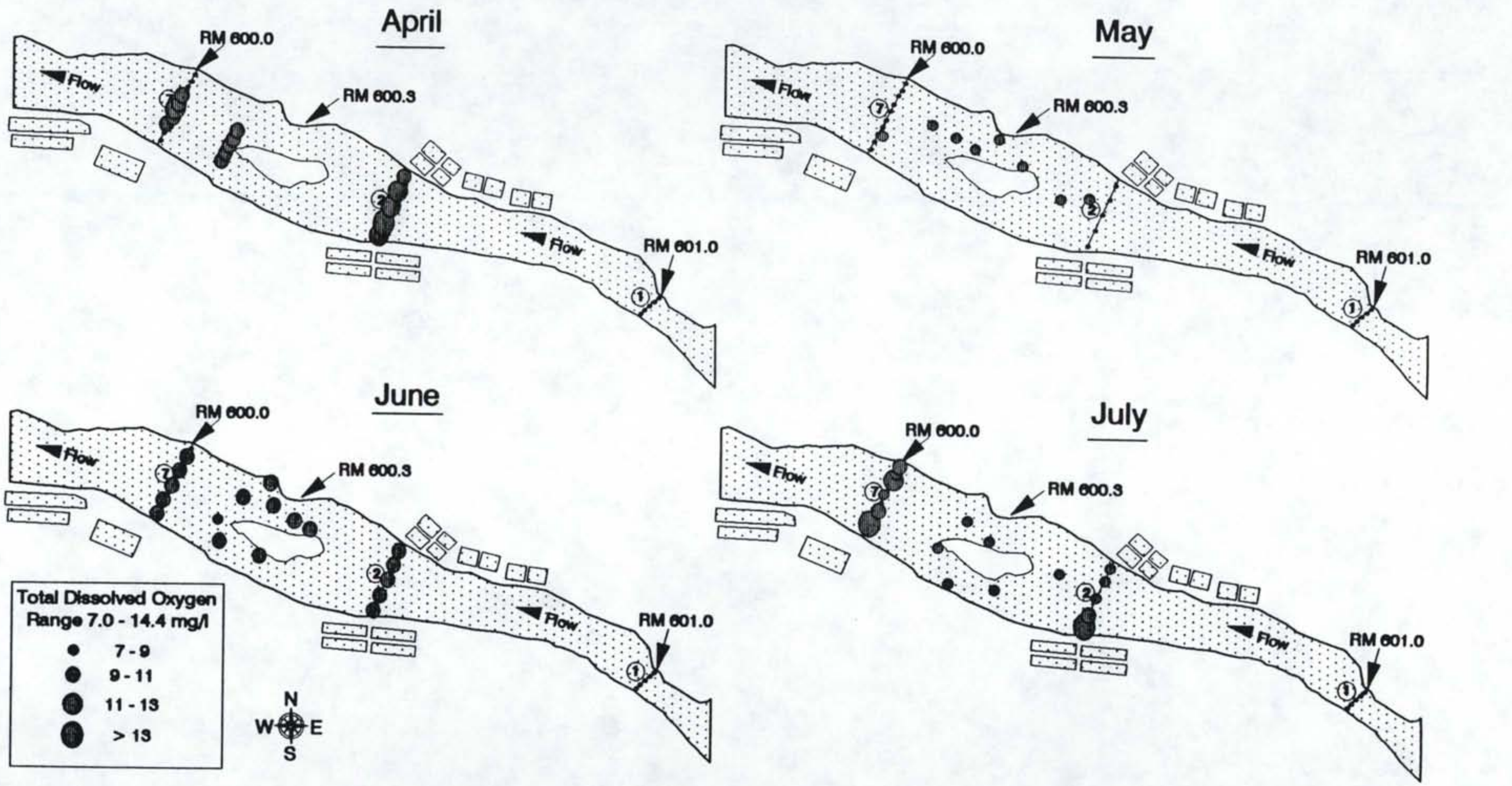

Figure 10. Total dissolved oxygen in April, May, June, and July in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Total Dissolved Oxygen

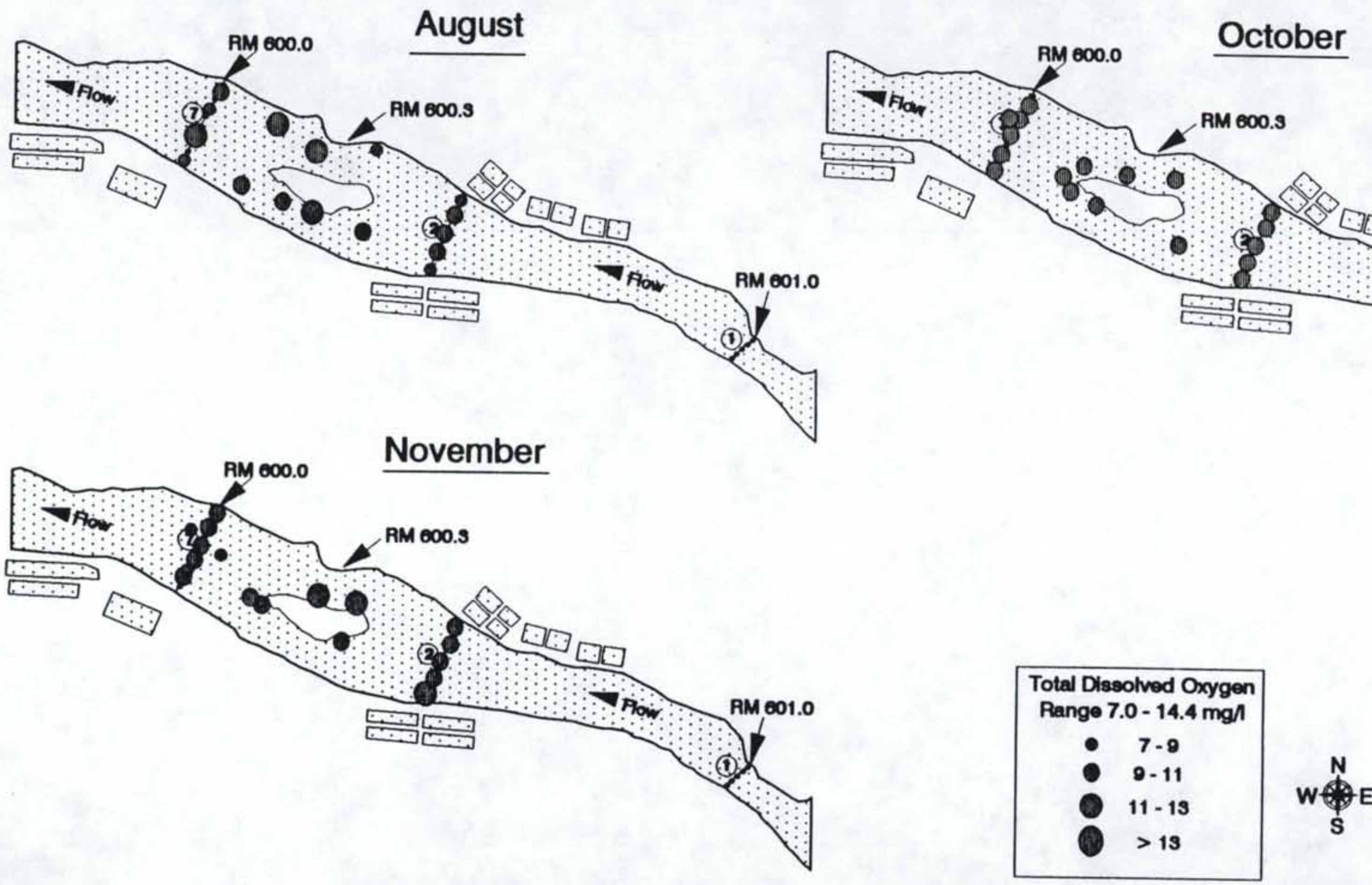

Figure 10 (Cont.). Total dissolved oxygen in August, October, and November in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Electrical Conductivity

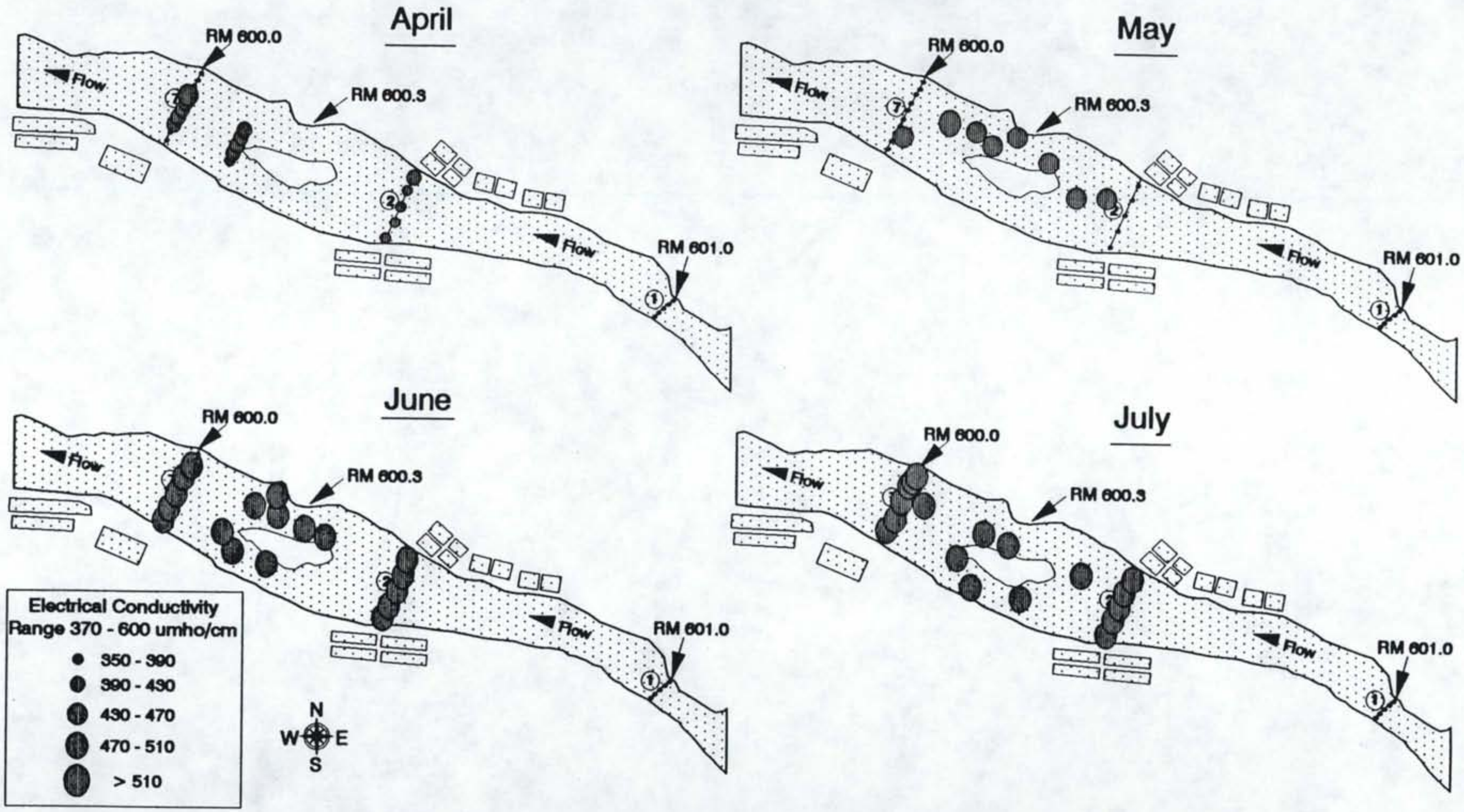

Figure 11. Electrical conductivity in during April, May, June, and July in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

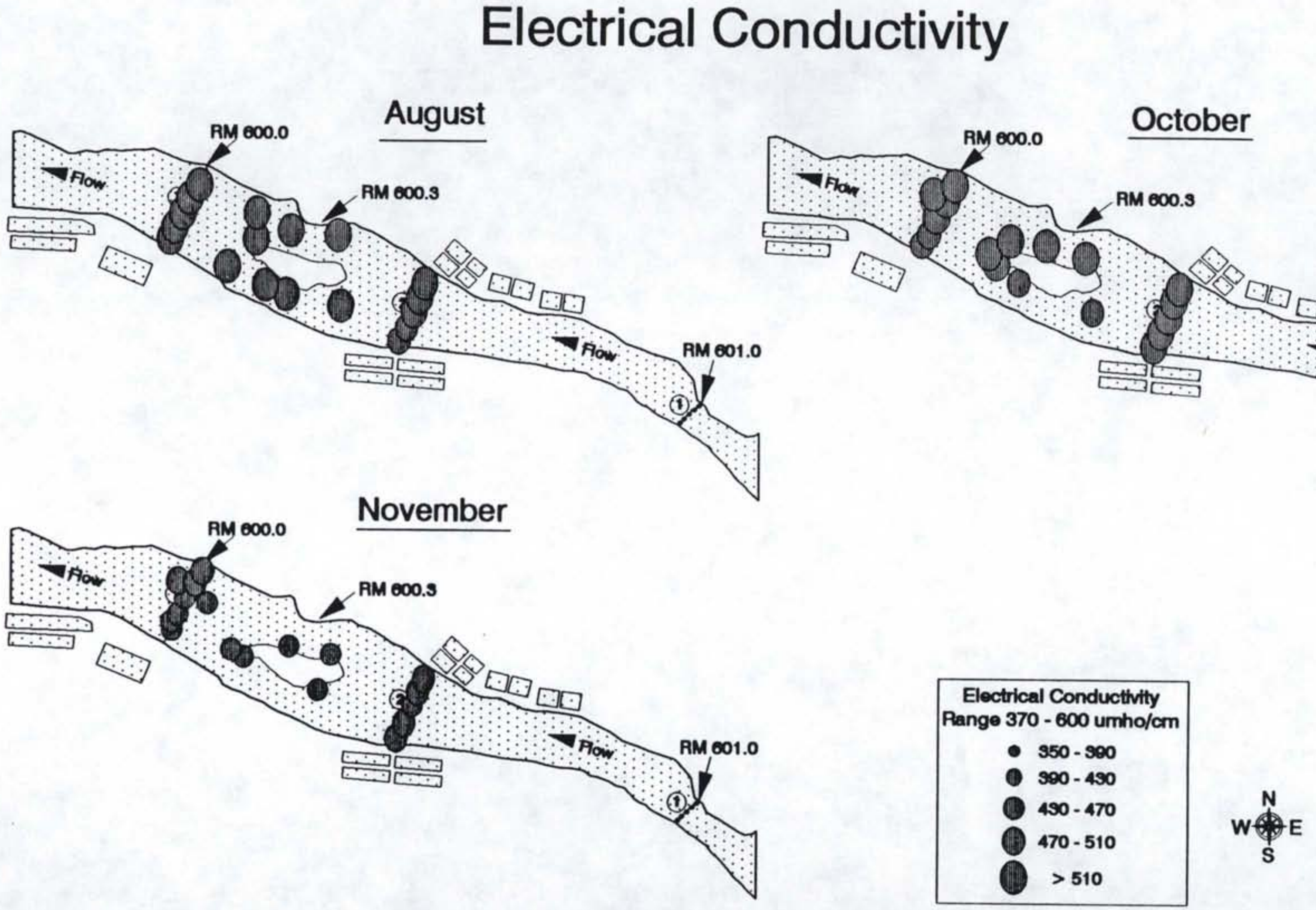

Figure 11 (Cont.). Electrical conductivity in August, October, and November in the Crystal Springs Reach (RM 599 - 601.3), Middle Snake River, Idaho, 1994.

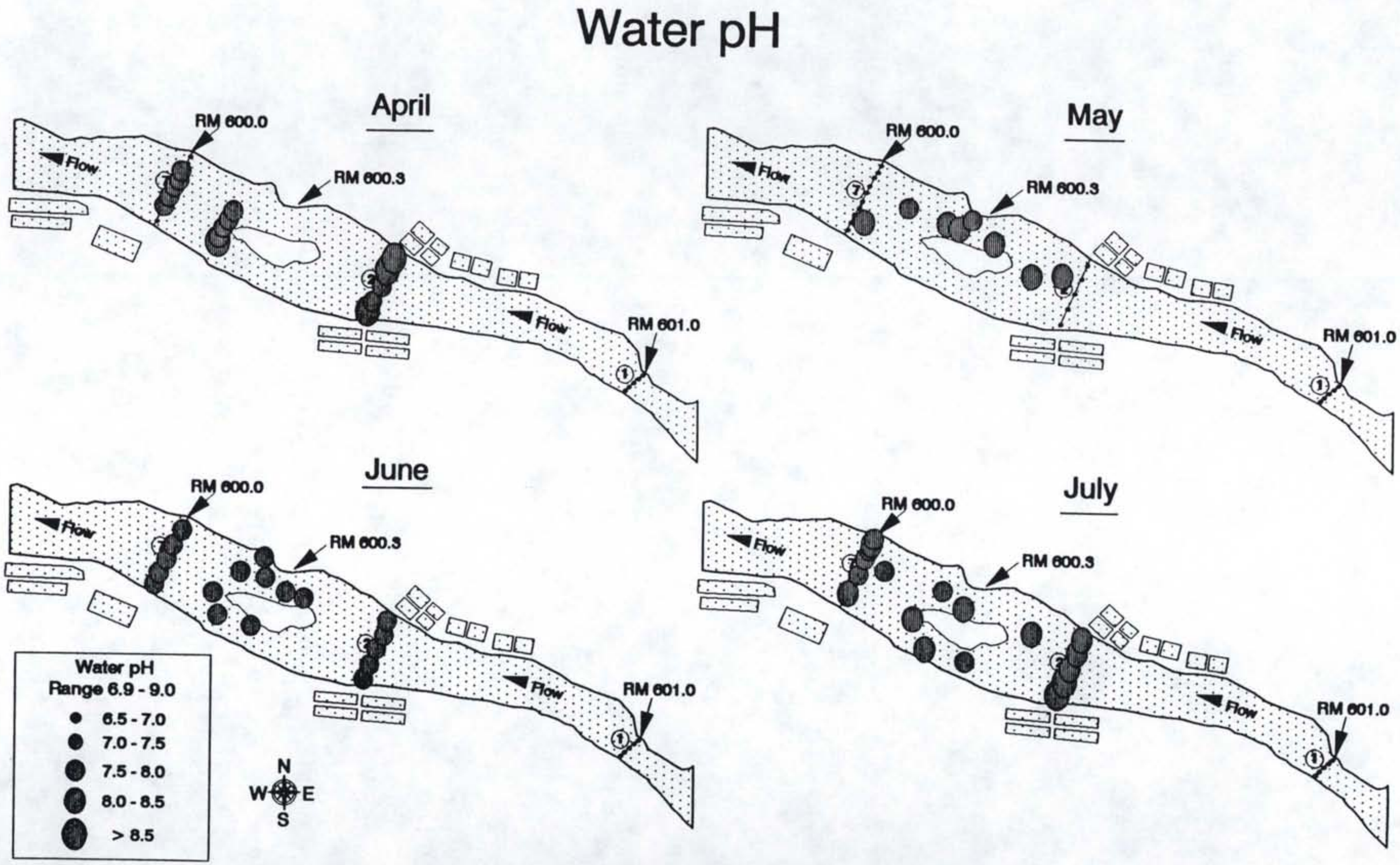

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Figure 12. Water pH in April, May, June, and July in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Water pH

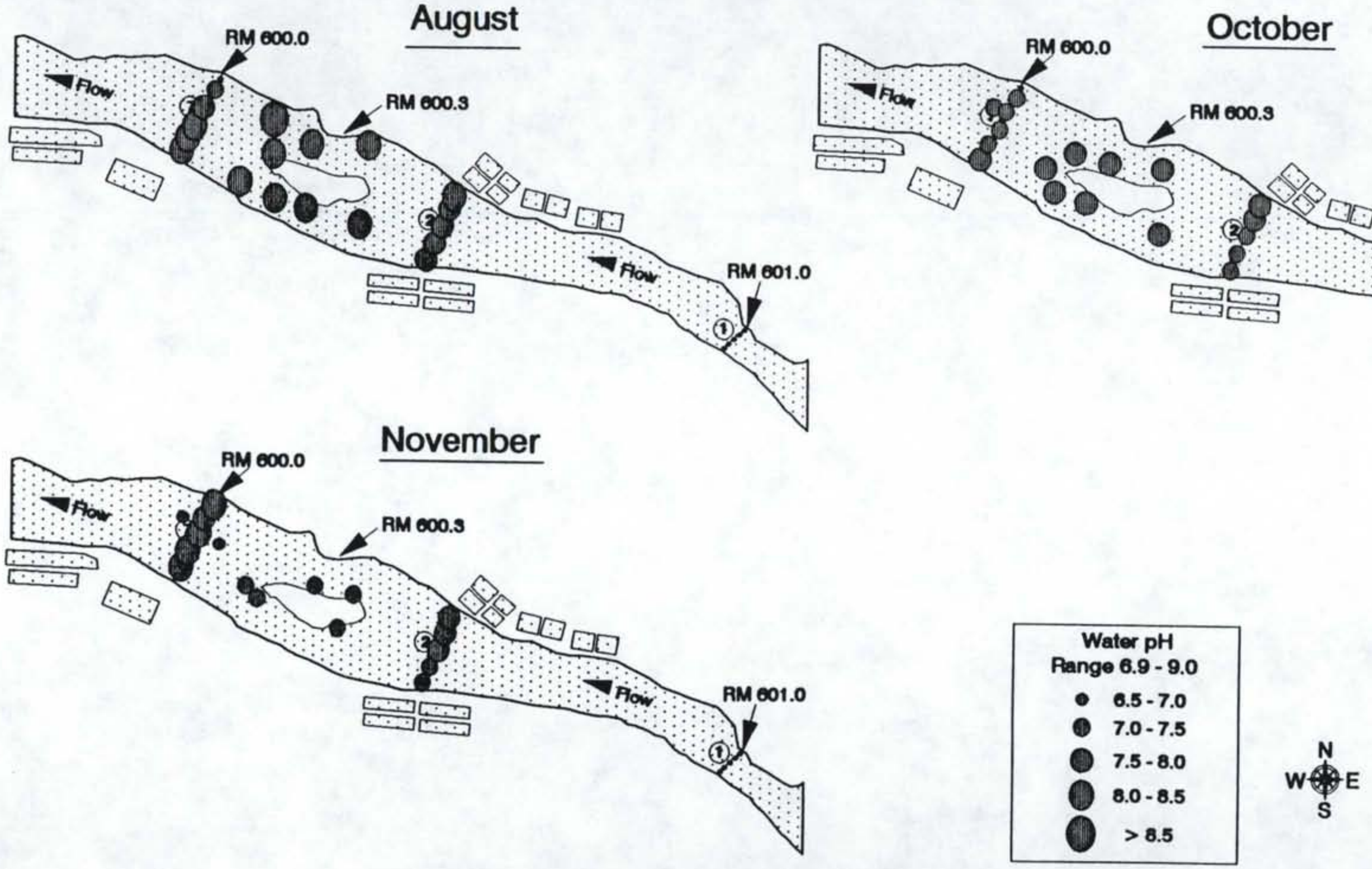


Figure 12 (Cont.). Water pH in August, October, and November in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

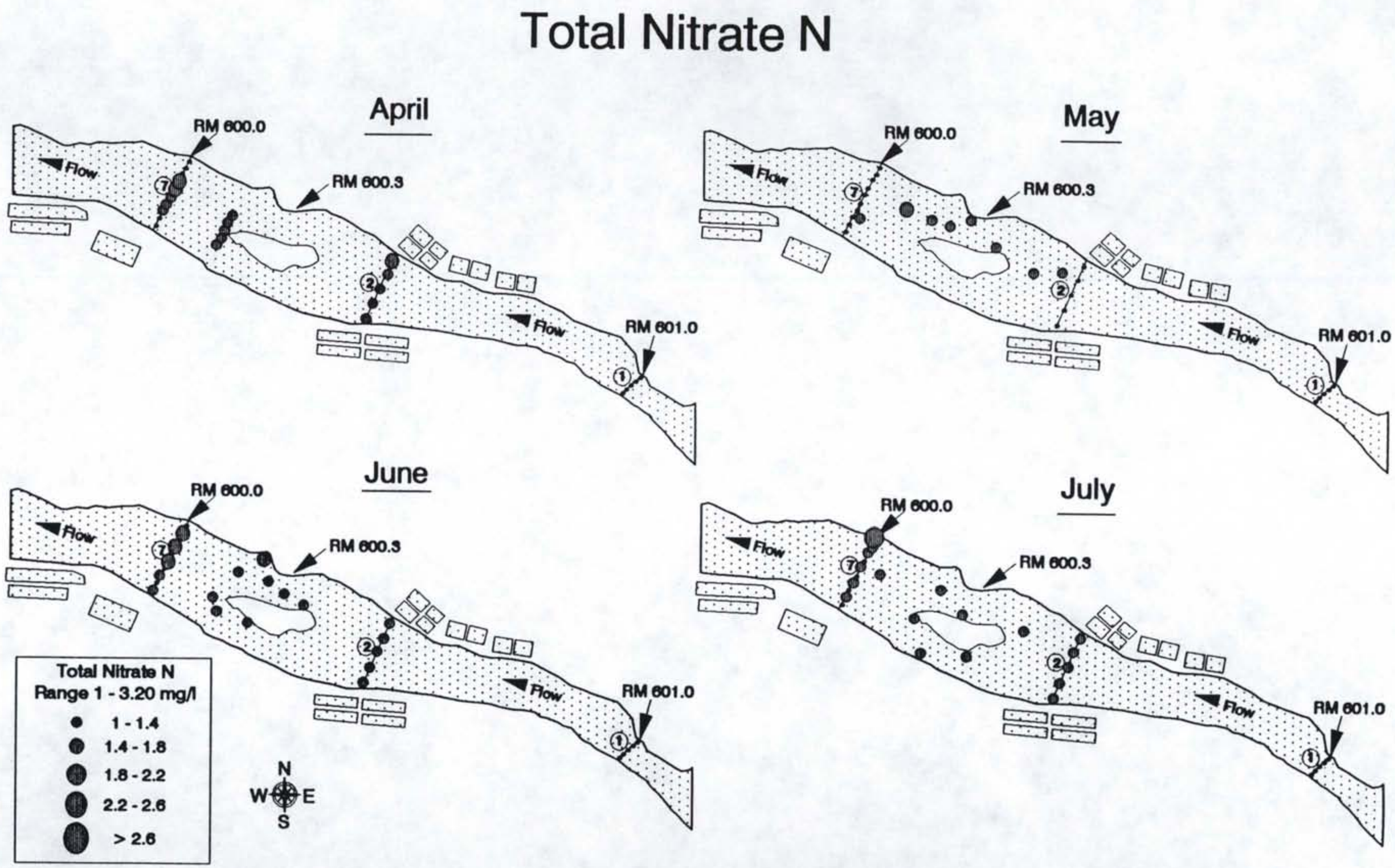


Figure 13. Total nitrate nitrogen in April, May, June, and July in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Total Nitrate N

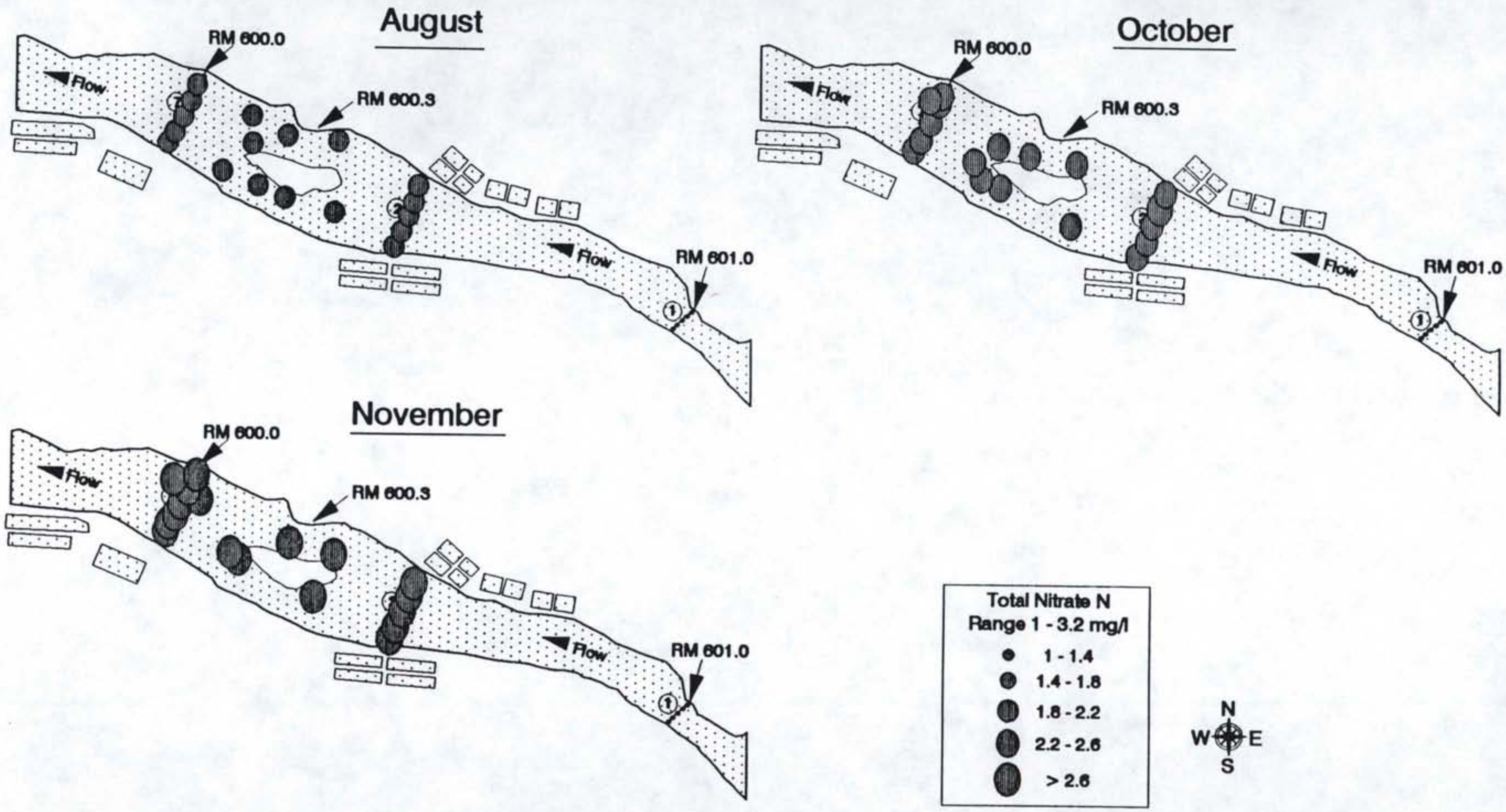


Figure 13 (Cont.). Total nitrate nitrogen in August, October, and November in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

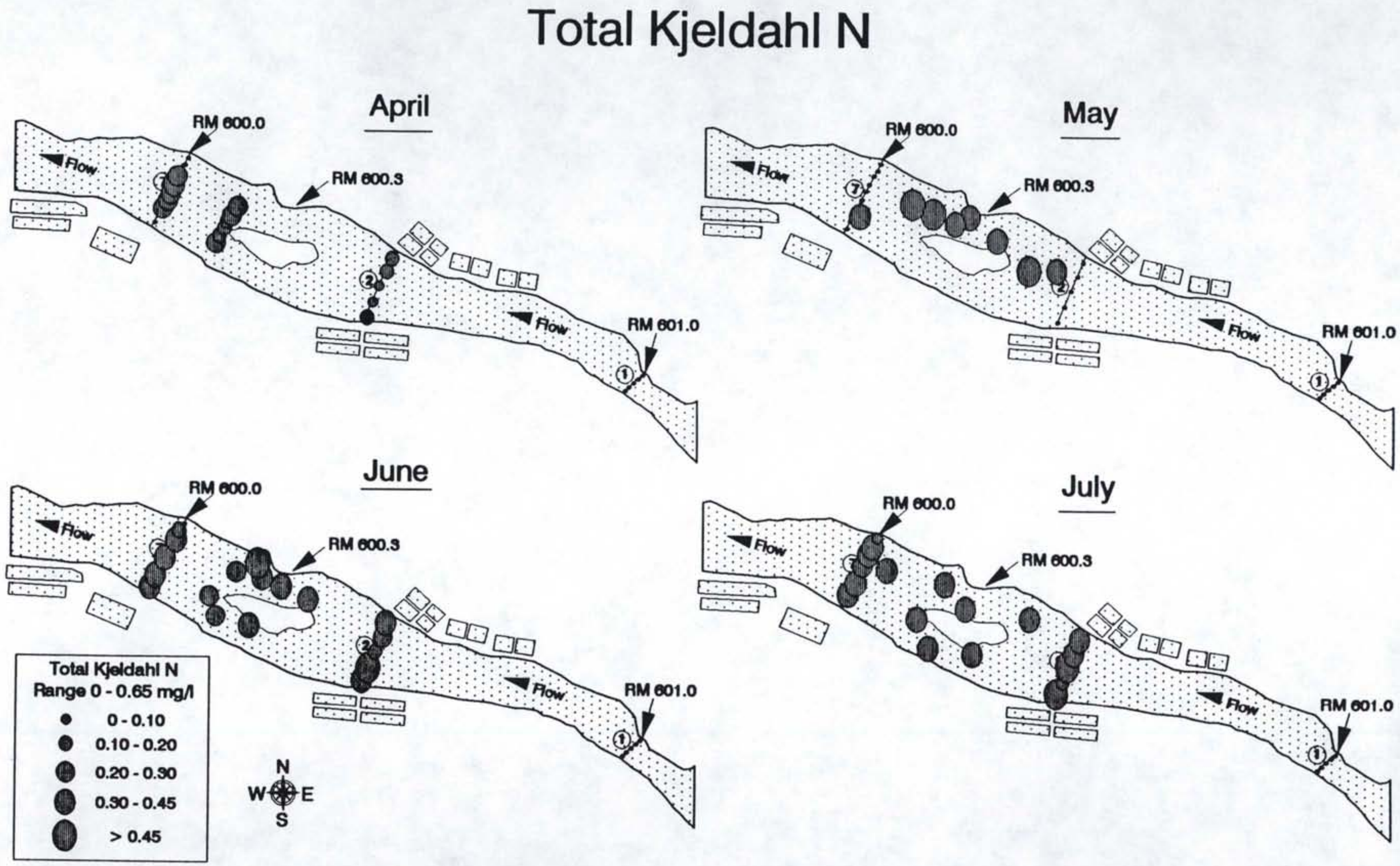


Figure 14. Total Kjeldahl nitrogen in April, May, June, and July in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Total Kjeldahl N

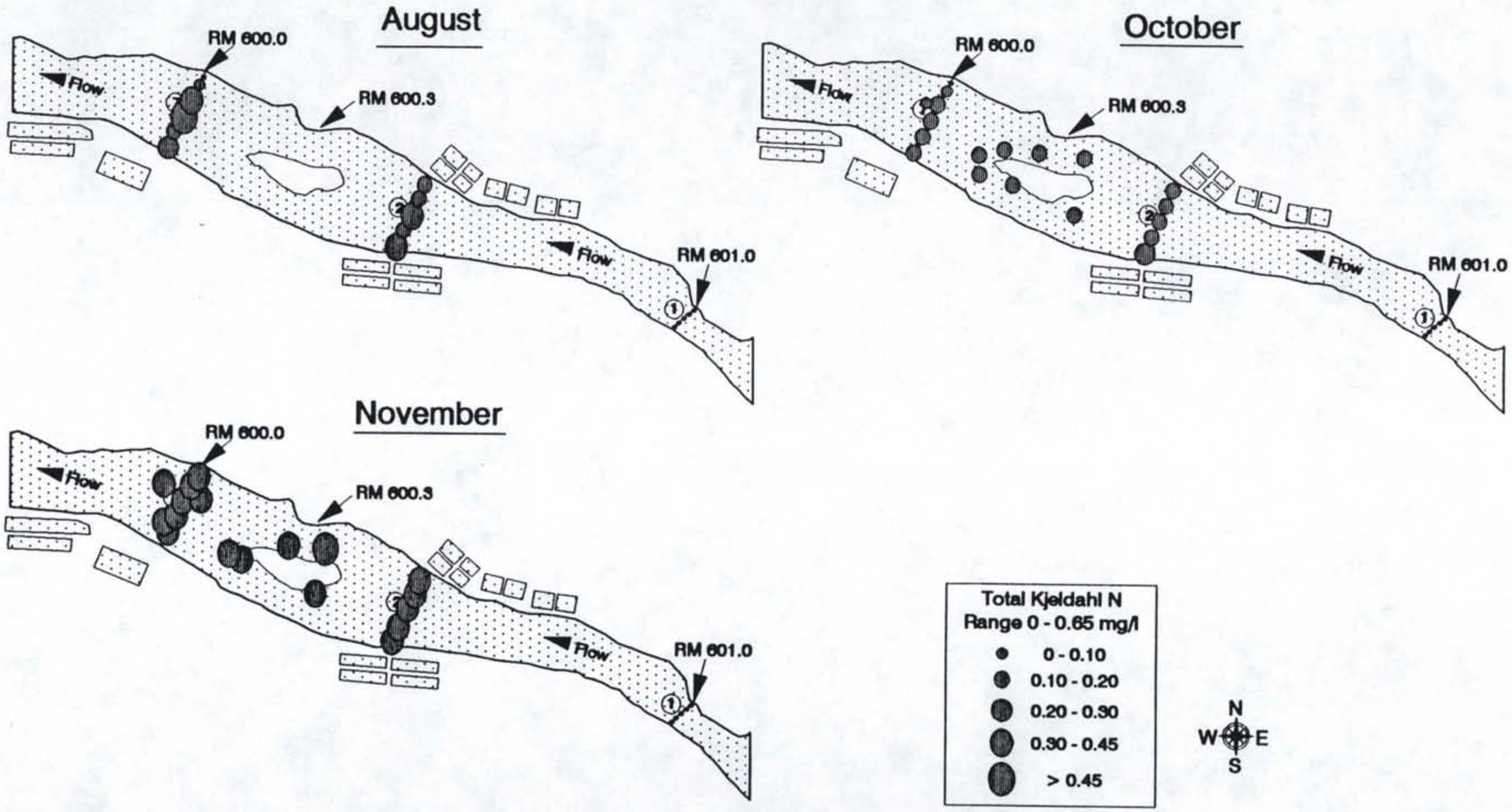


Figure 14 (Cont.). Total Kjeldahl nitrogen in August, October, and November in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

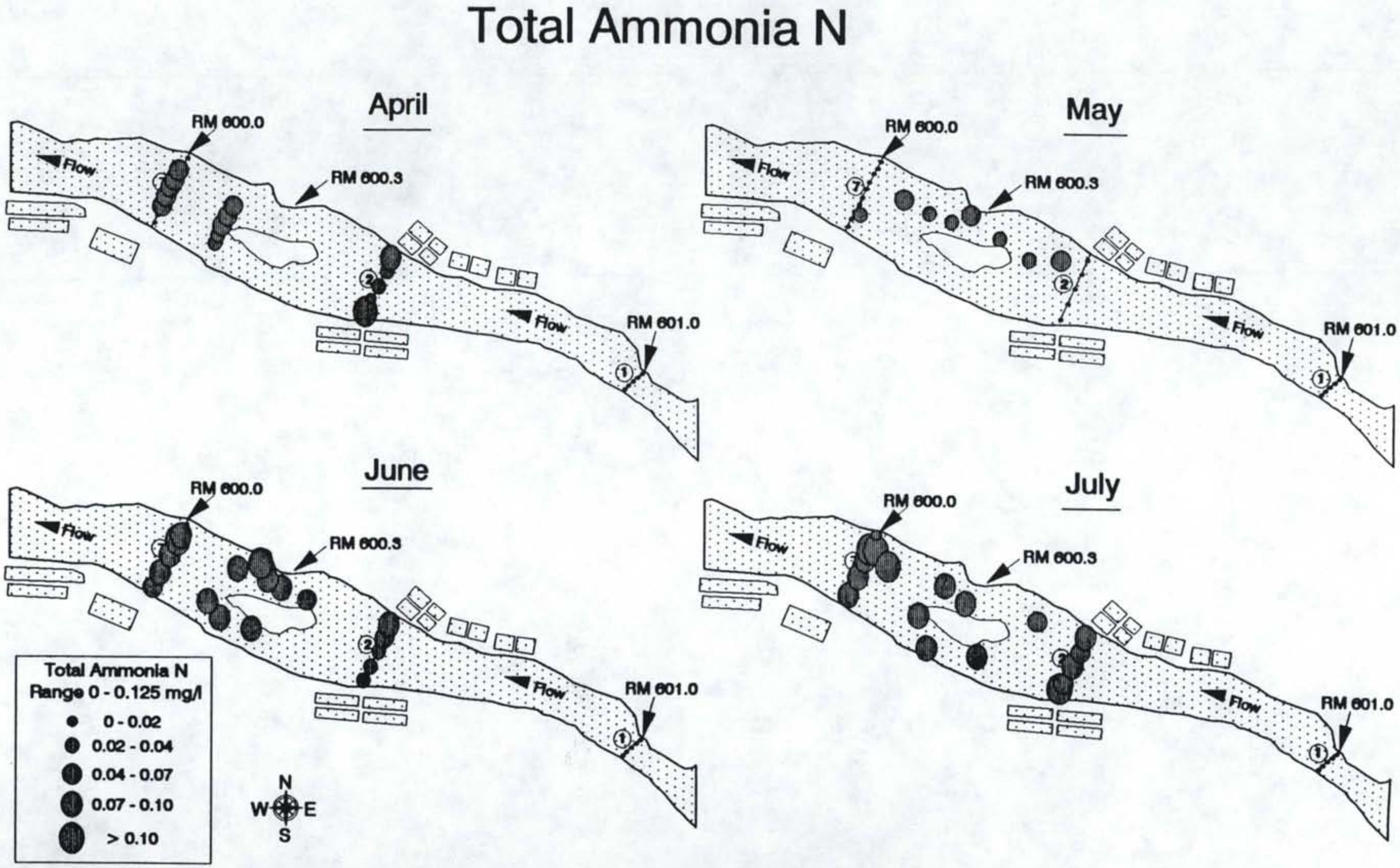


Figure 15. Total ammonia nitrogen in April, May, June, and July in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

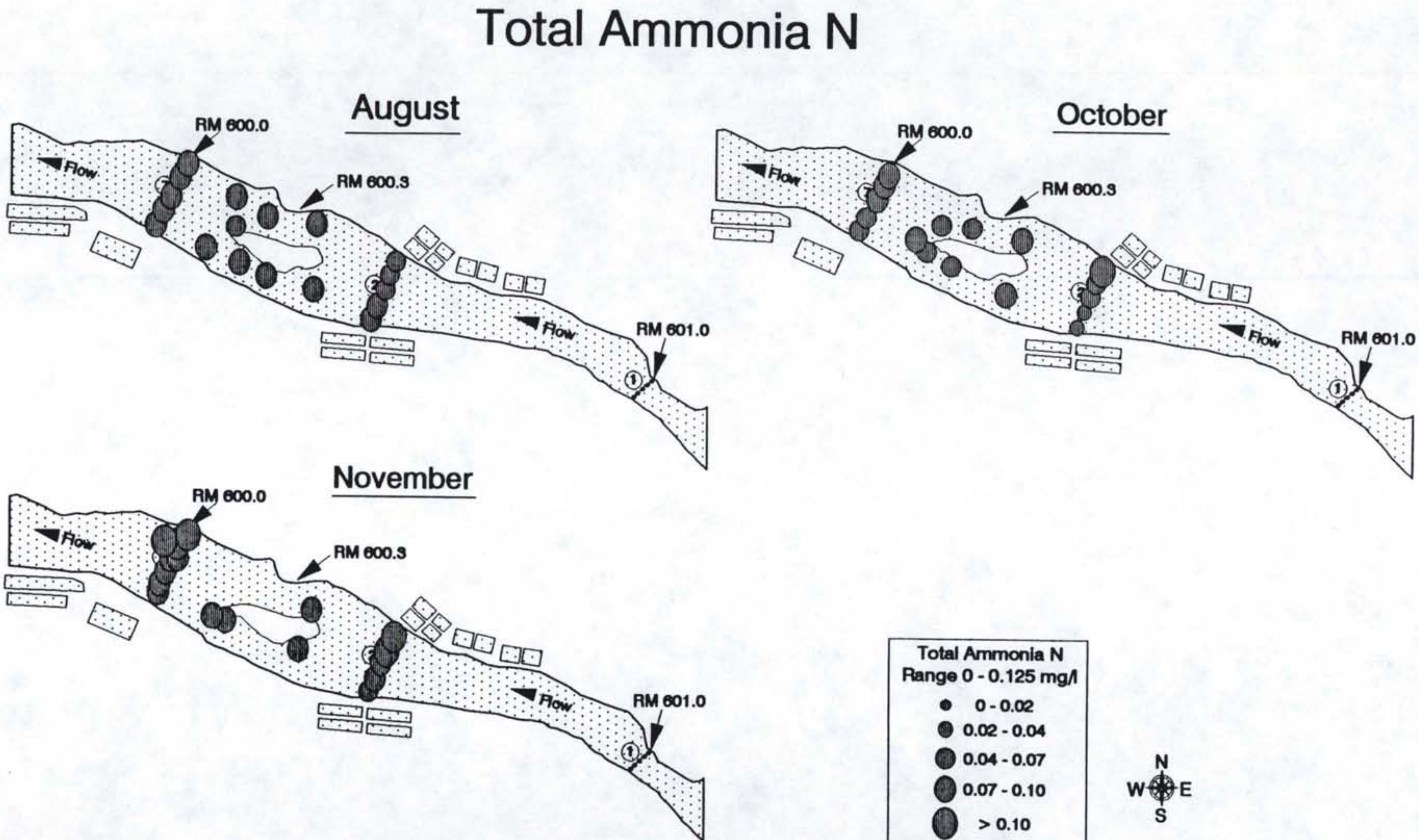


Figure 15 (Cont.). Total ammonia nitrogen in August, October, and November in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

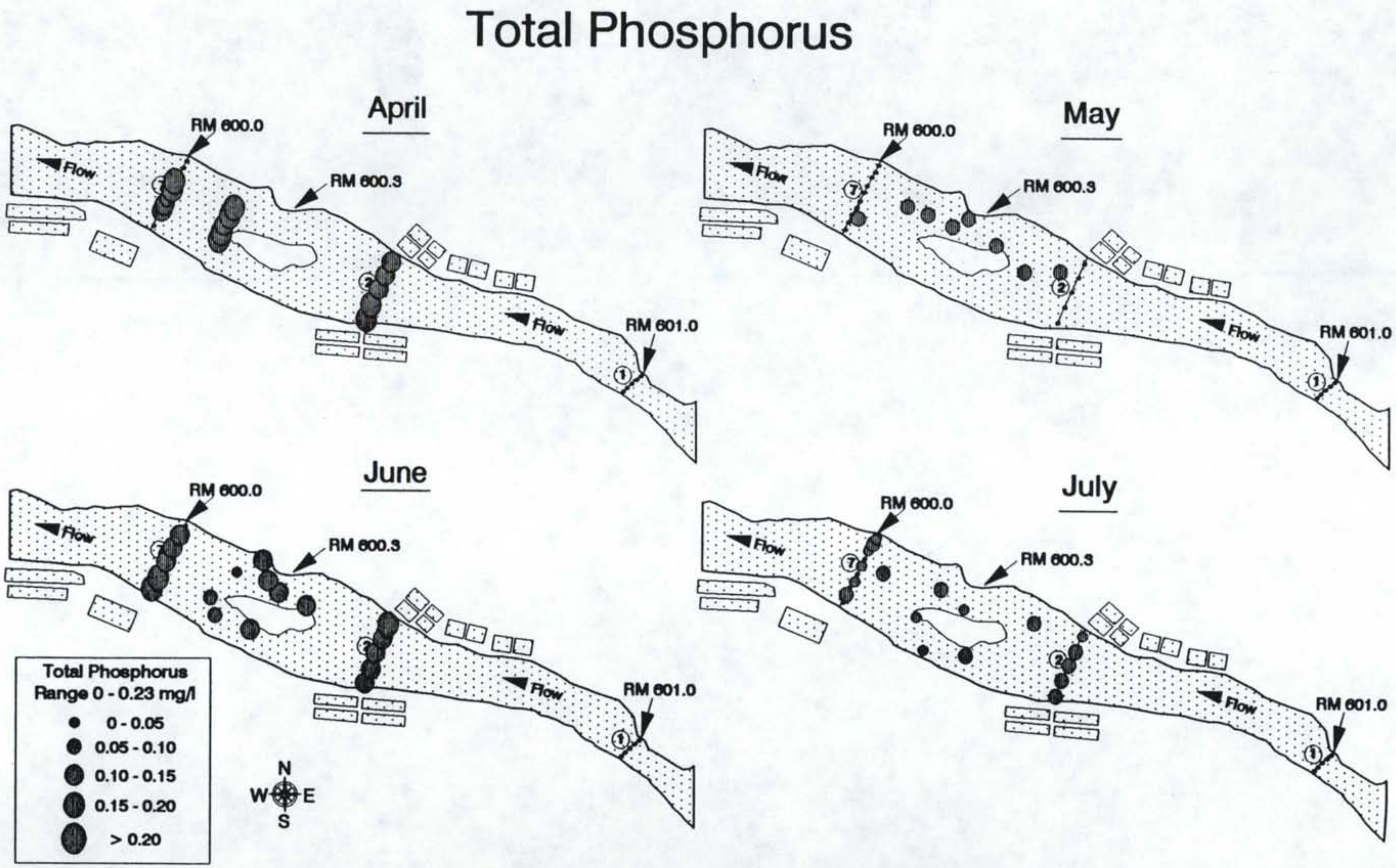


Figure 16. Total phosphorus in April, May, June, and July in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Total Phosphorus

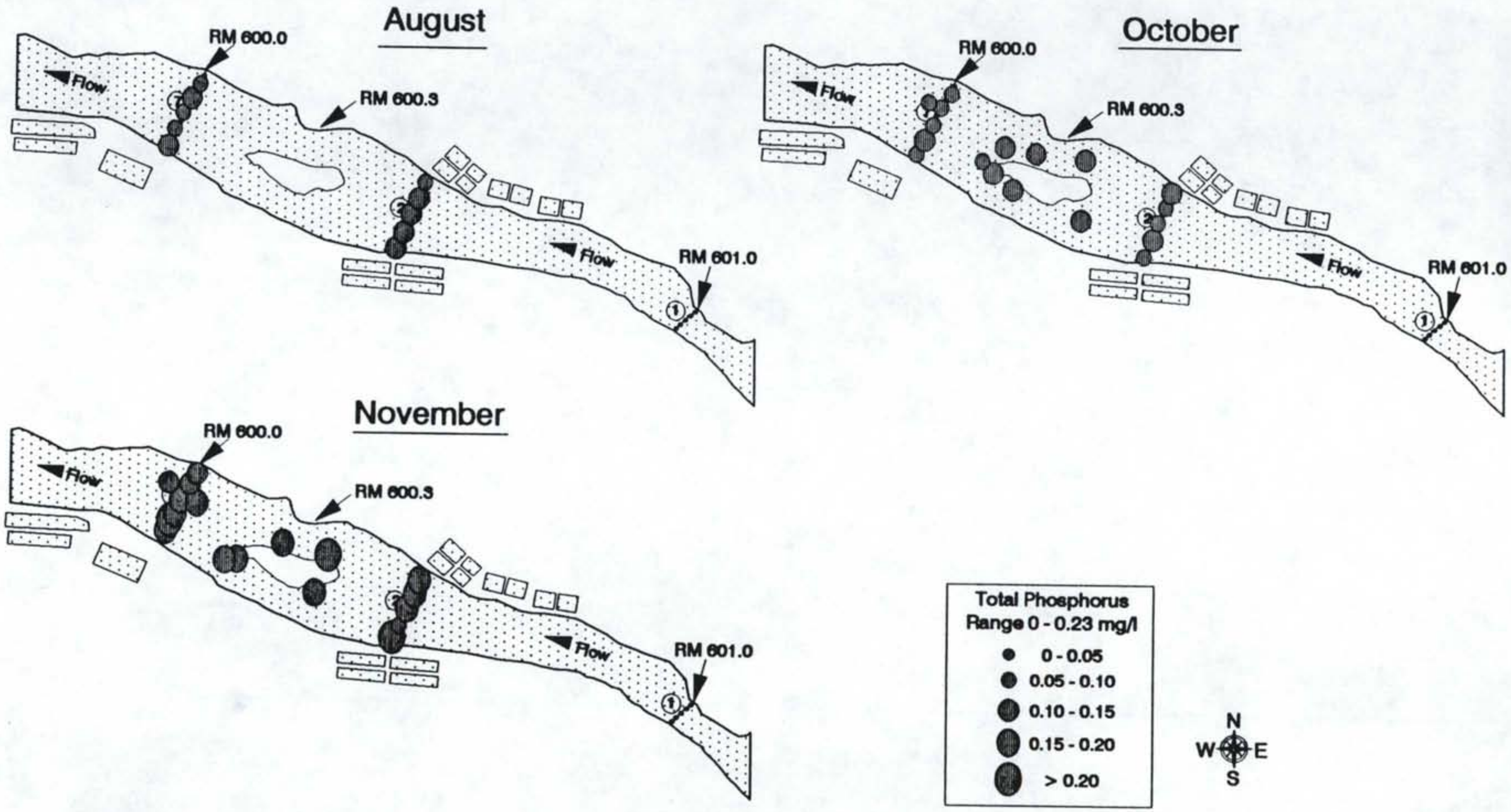


Figure 16 (Cont.). Total phosphorus in August, October, and November in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

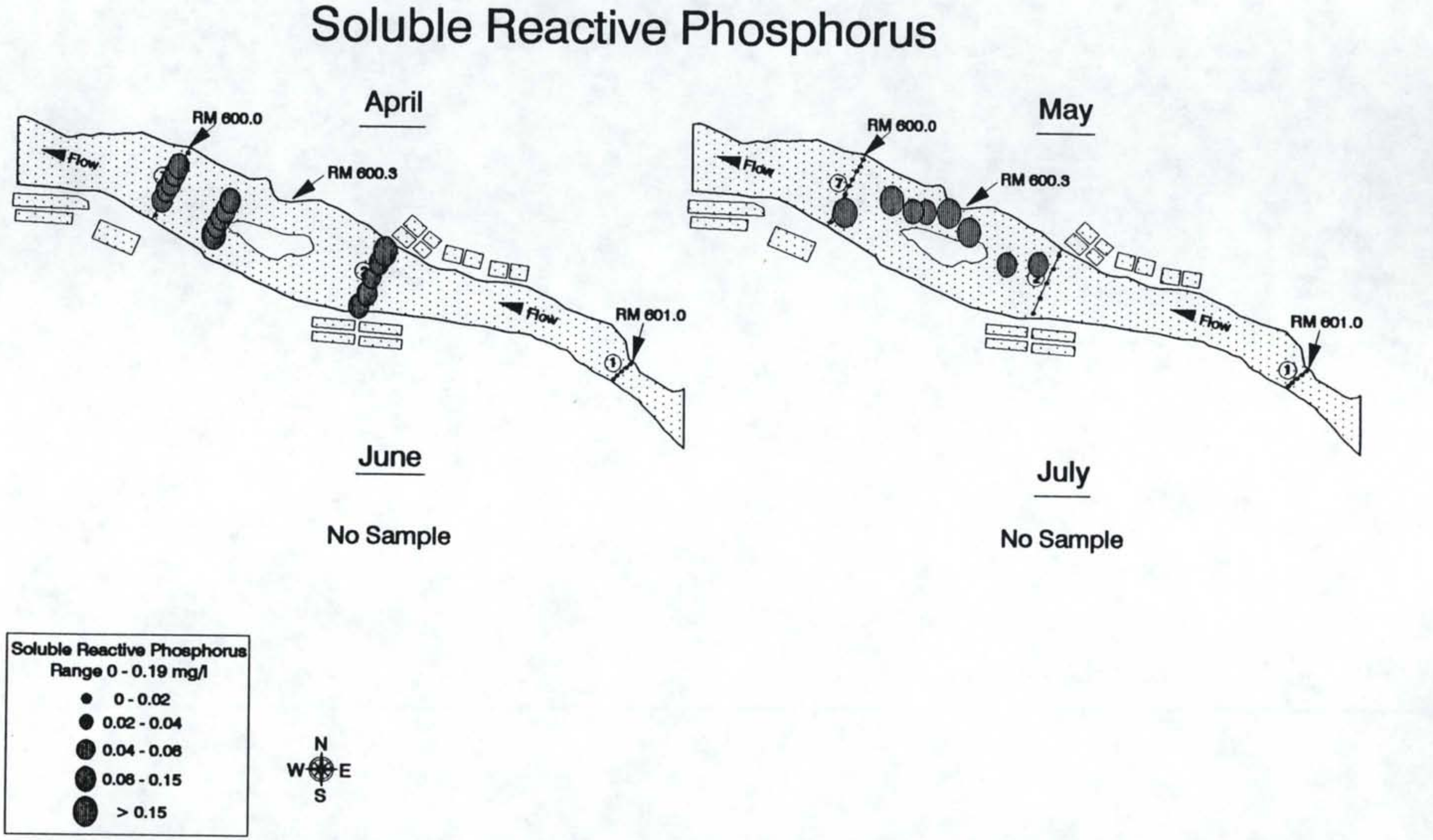


Figure 17. Total soluble reactive phosphorus in April, May, June, and July in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Soluble Reactive Phosphorus

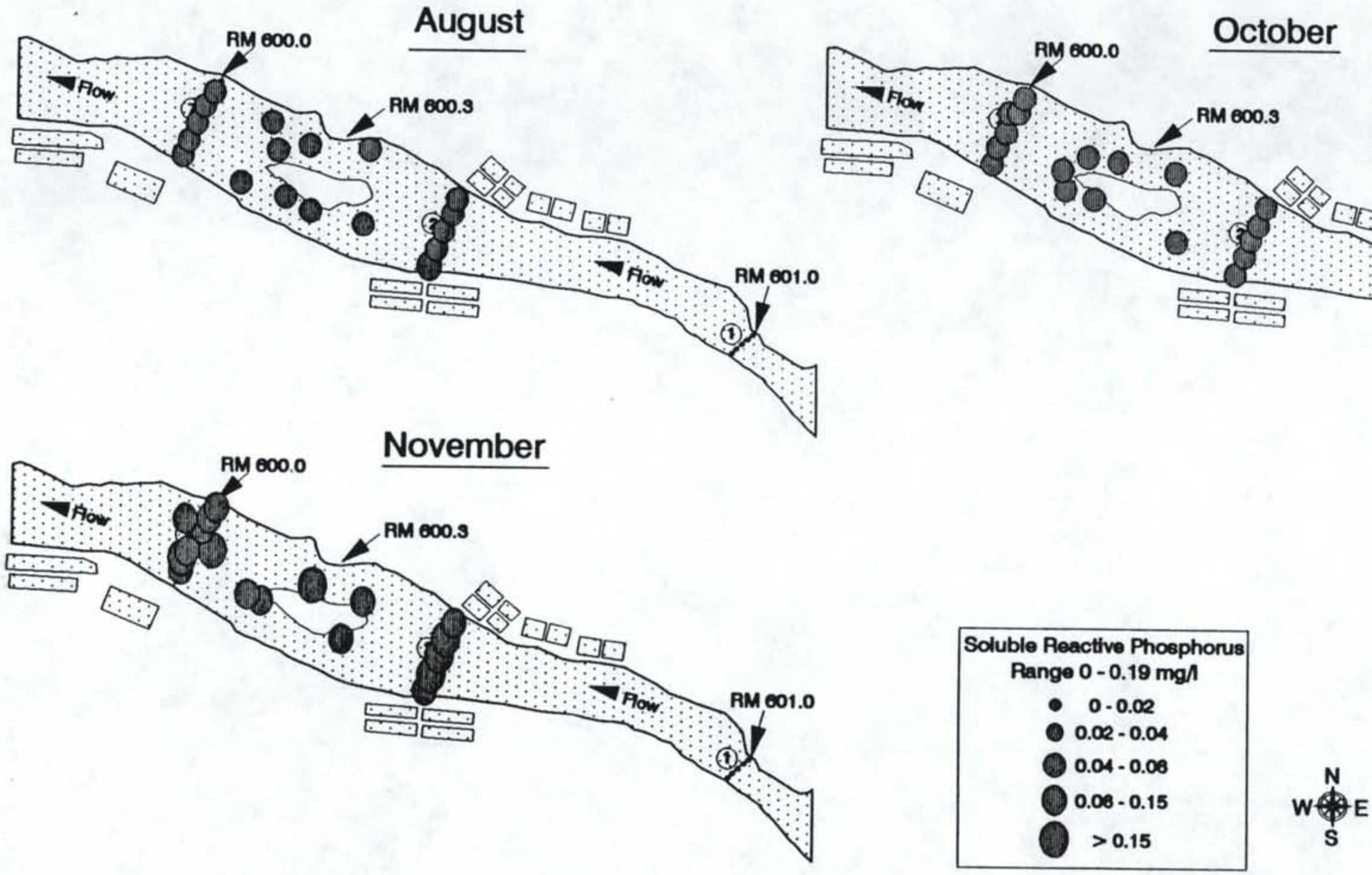


Figure 17 (Cont.). Total soluble reactive phosphorus in August, October, and November in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Total Dry Biomass

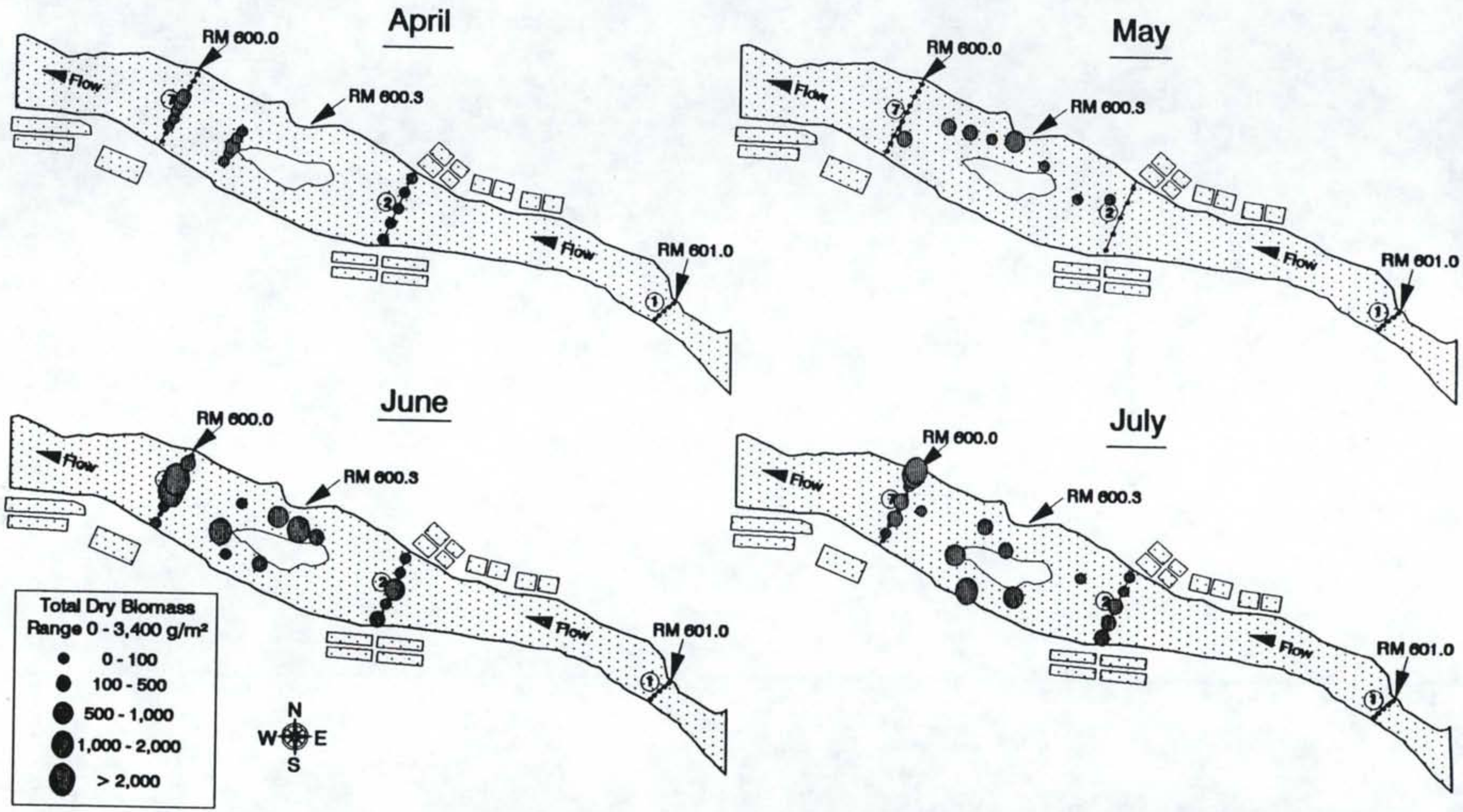


Figure 18. Total aquatic macrophyte dry biomass in April, May, June, and July in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Total Dry Biomass

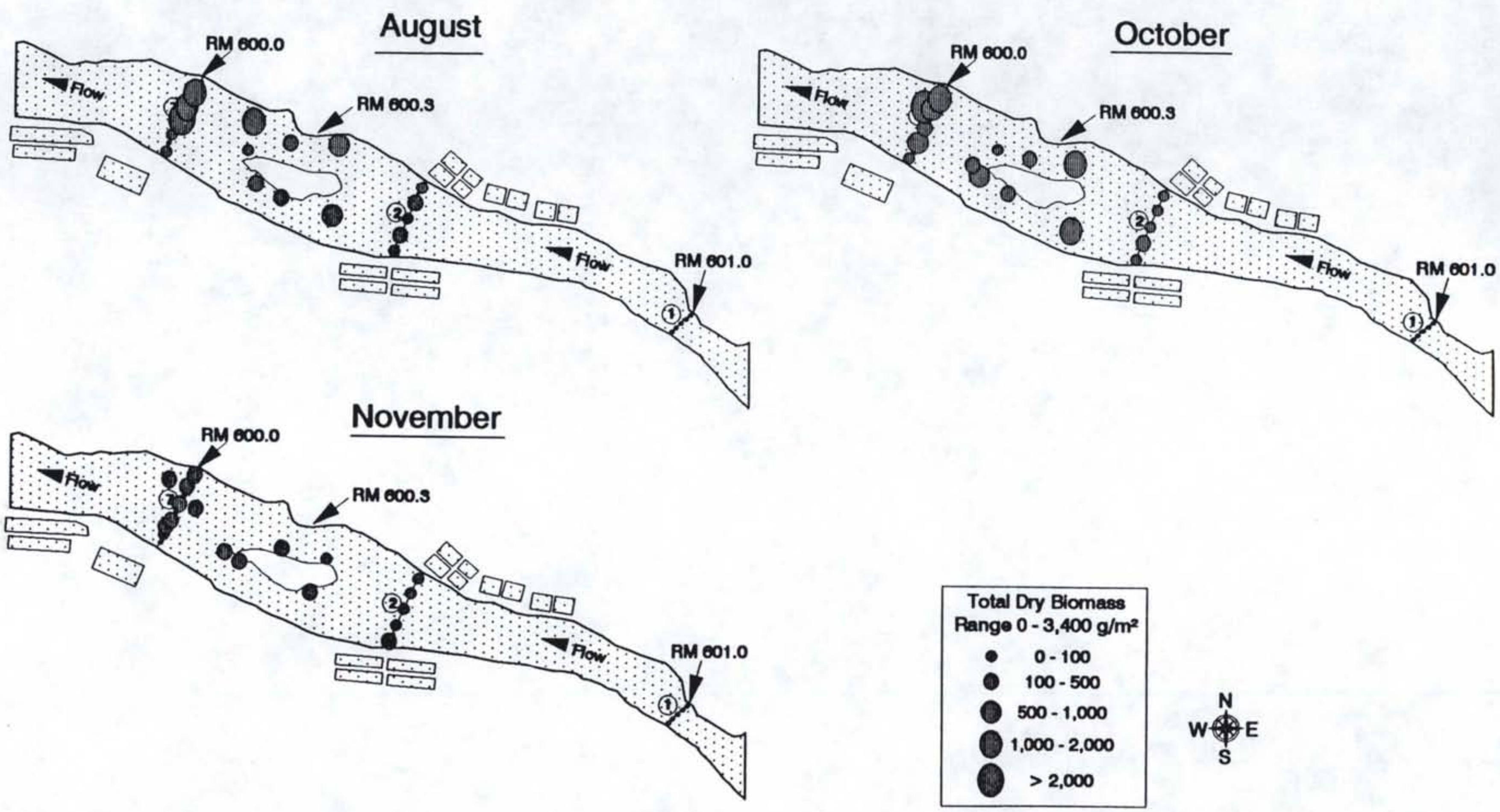


Figure 18 (Cont.). Total aquatic macrophyte dry biomass in August, October, and November in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Chlorophyll *a* (Monochromatic)

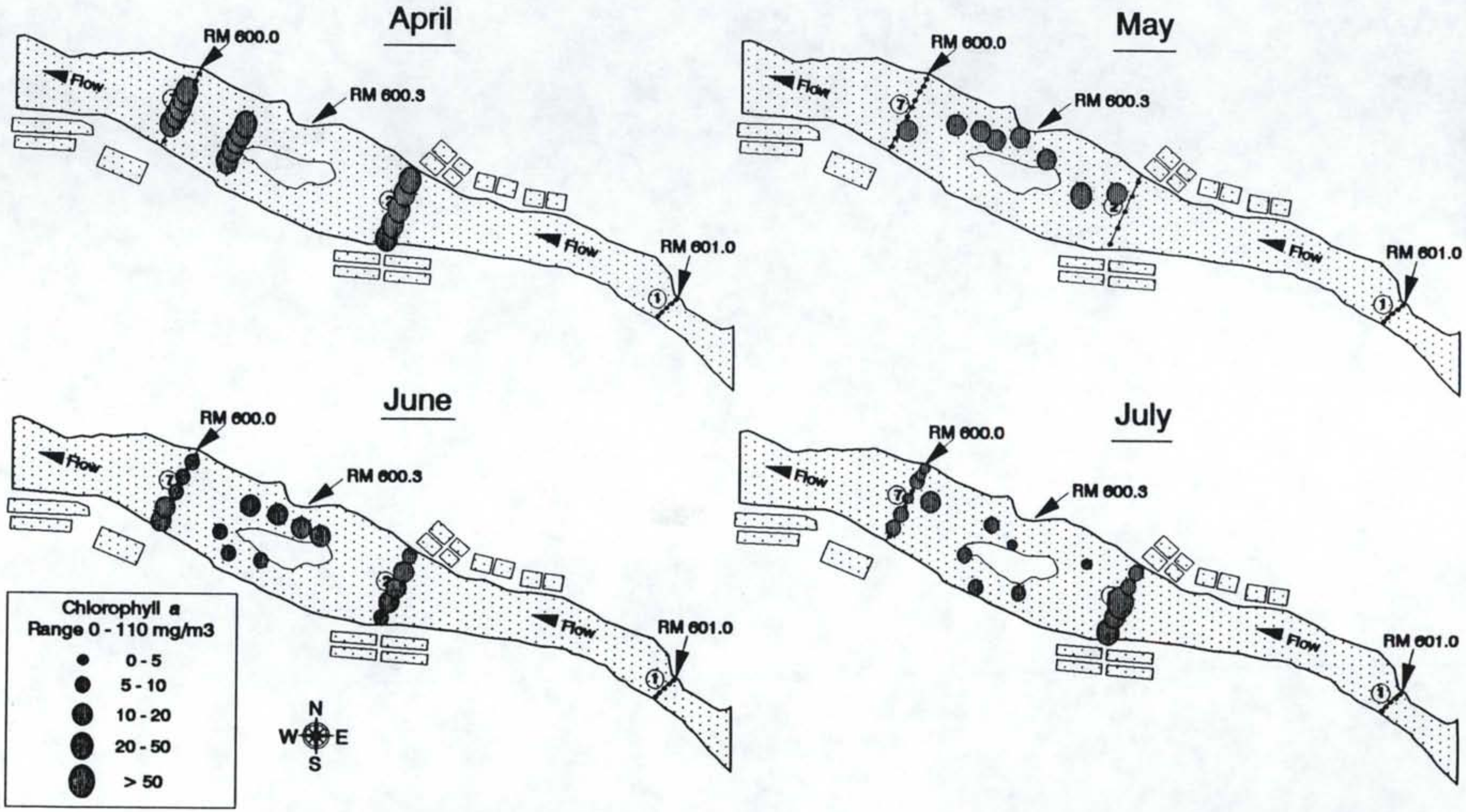


Figure 19. Total chlorophyll *a* (monochromatic) in April, May, June, and July in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

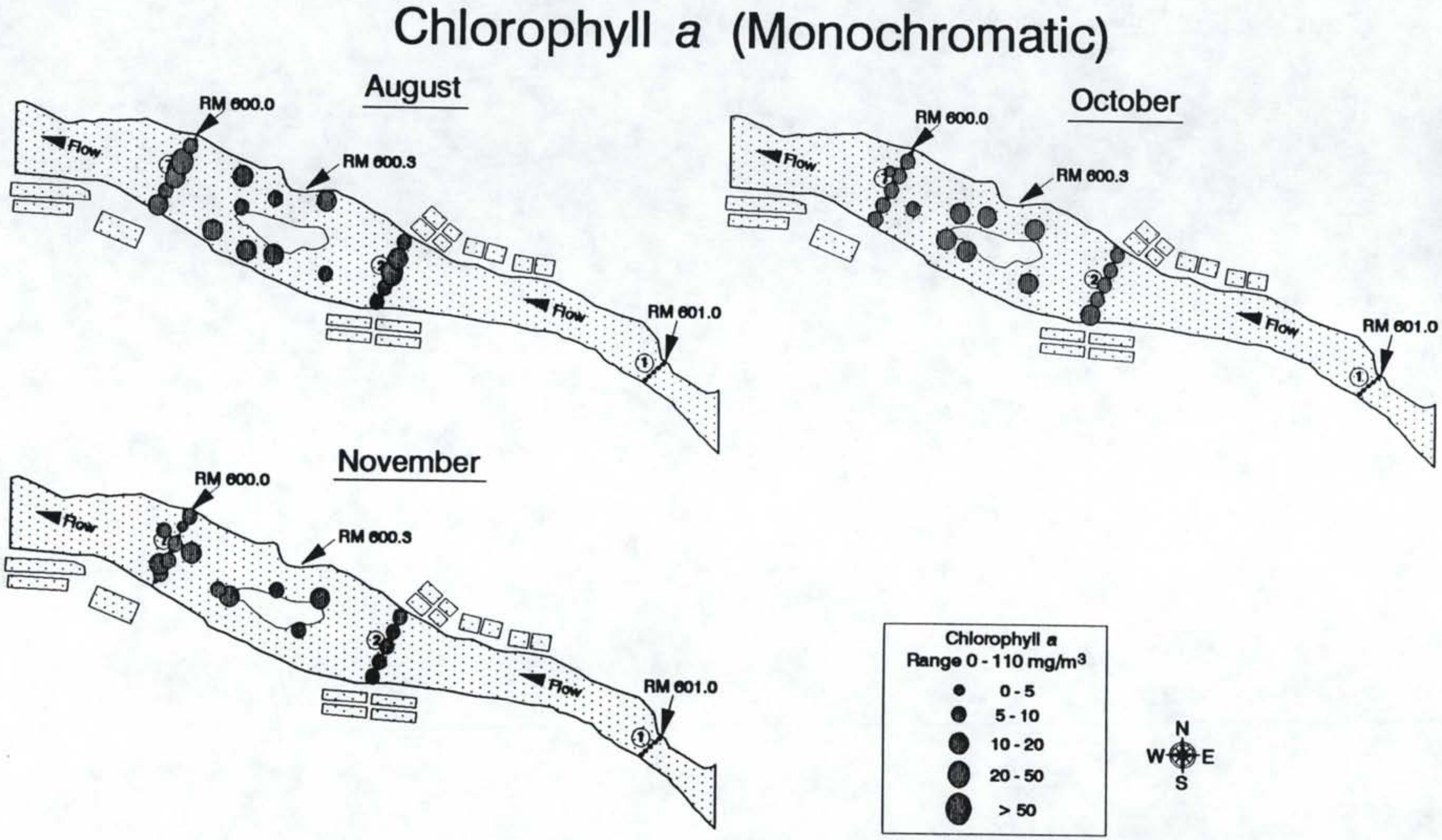


Figure 19 (Cont.). Total chlorophyll *a* (monochromatic) in August, October, and November in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

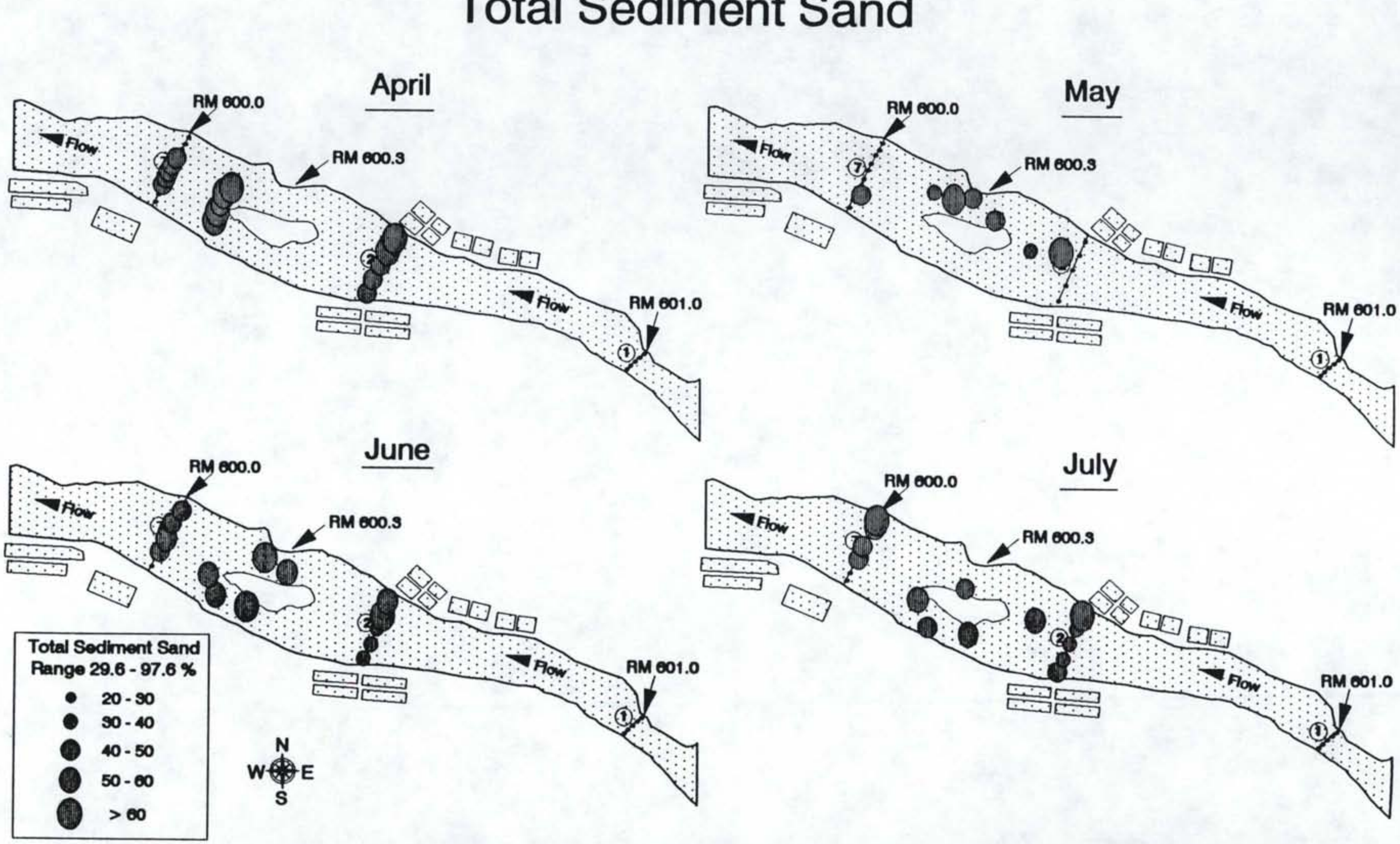


Figure 20. Total sediment sand in April, May, June, and July in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Total Sediment Sand

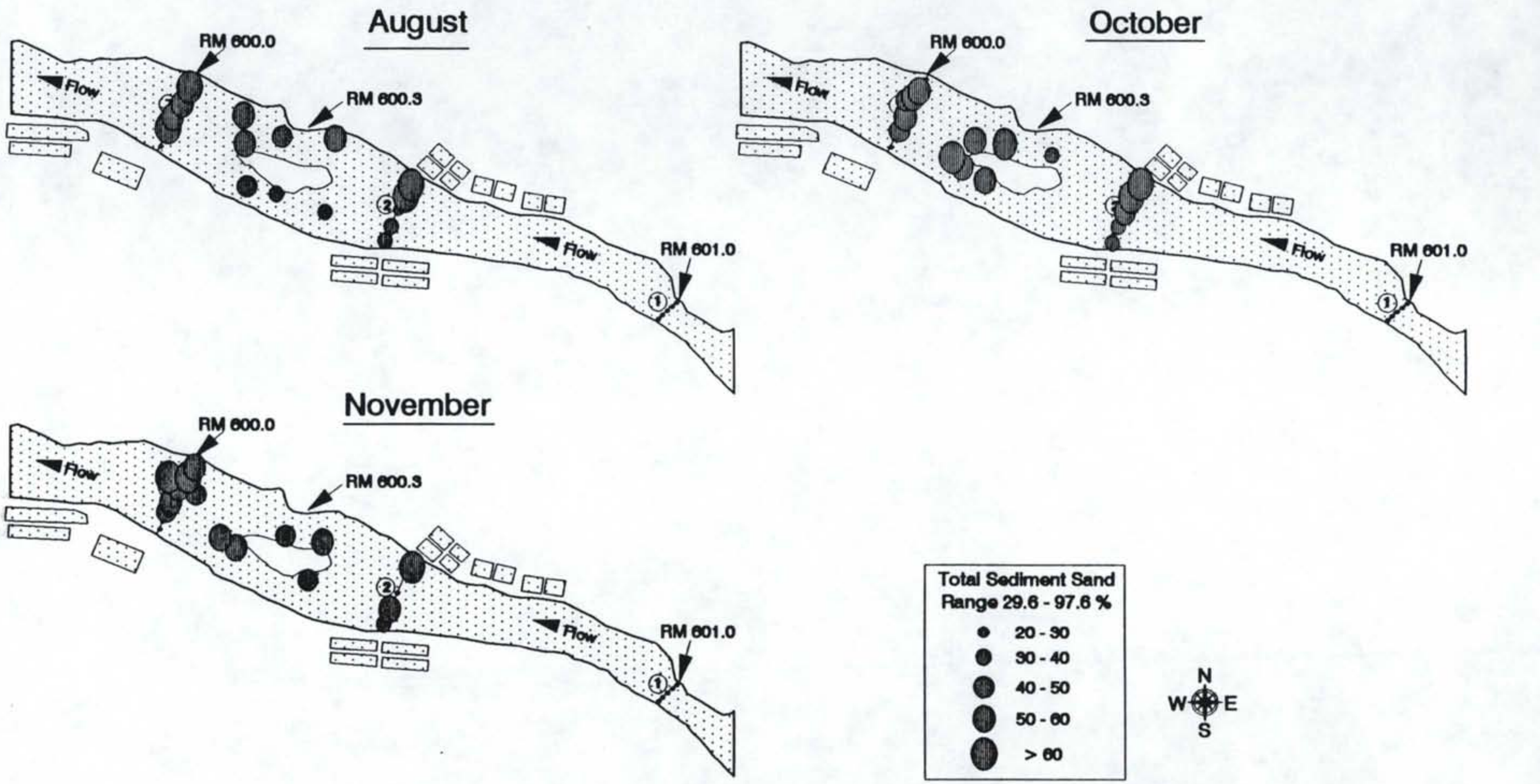


Figure 20 (Cont.). Total sediment sand in August, October, and November in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Total Sediment Clay

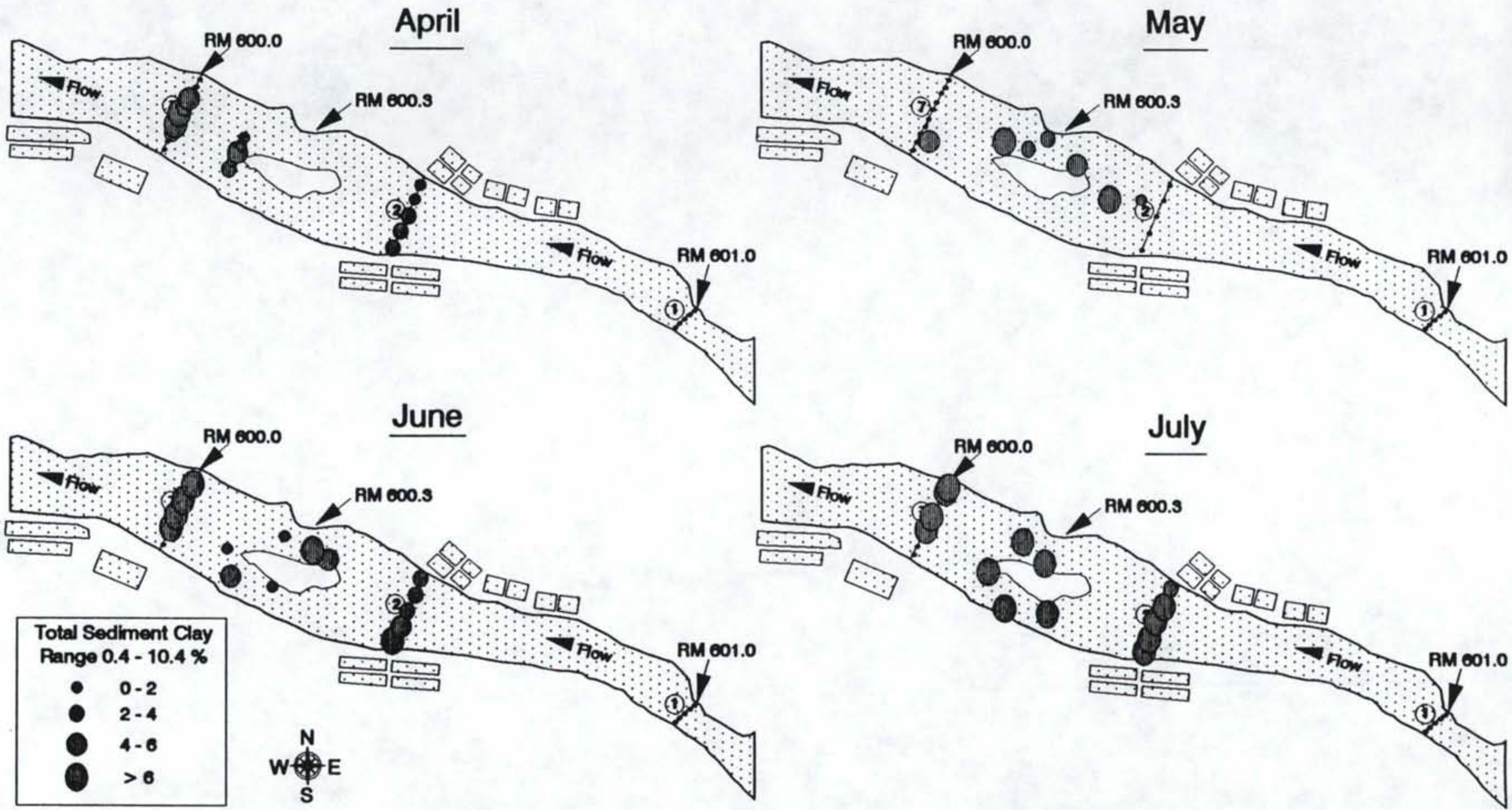


Figure 21. Total sediment clay in April, May, June, and July in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Total Sediment Clay

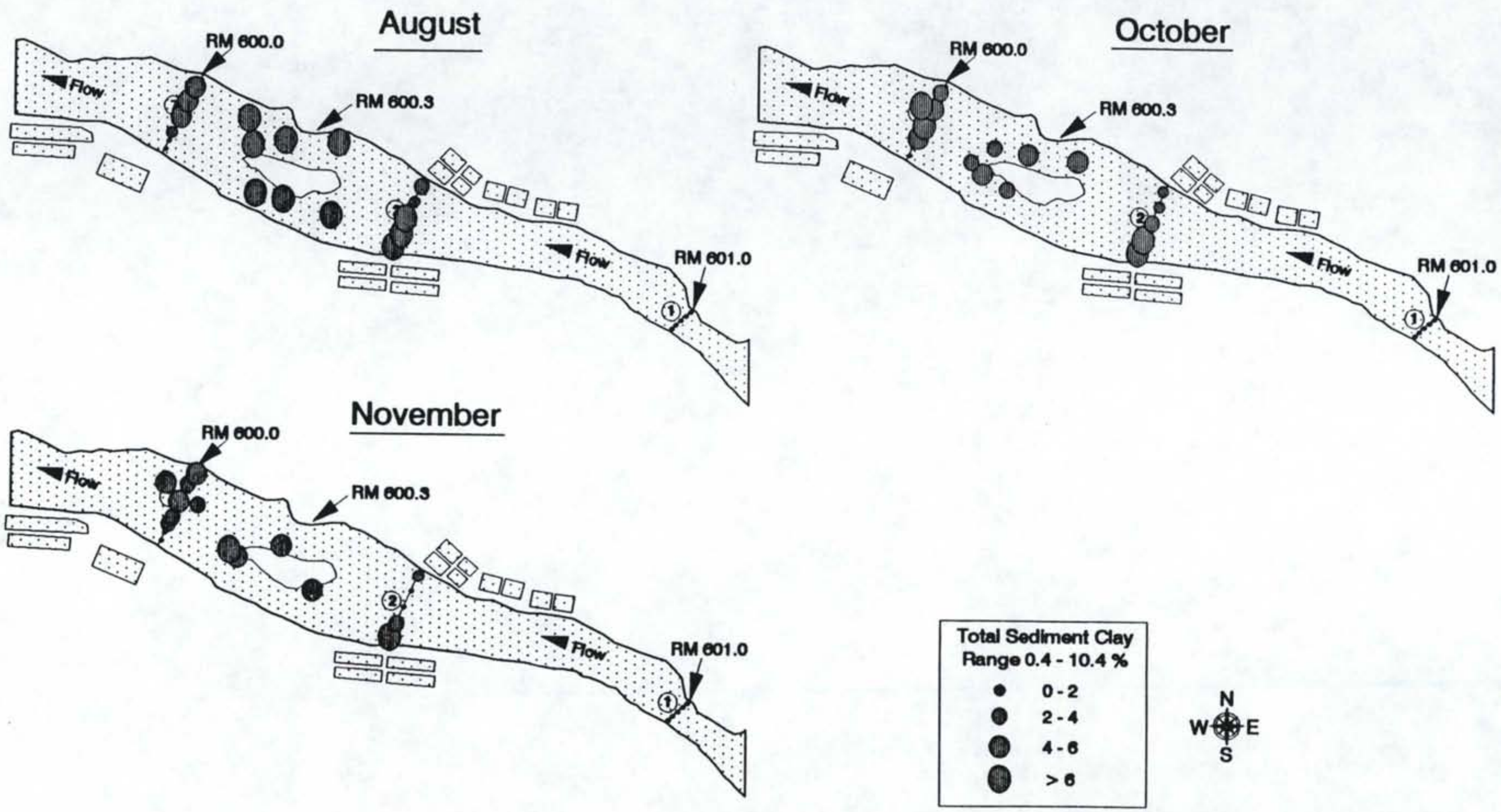


Figure 21 (Cont.). Total sediment clay in August, October, and November in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

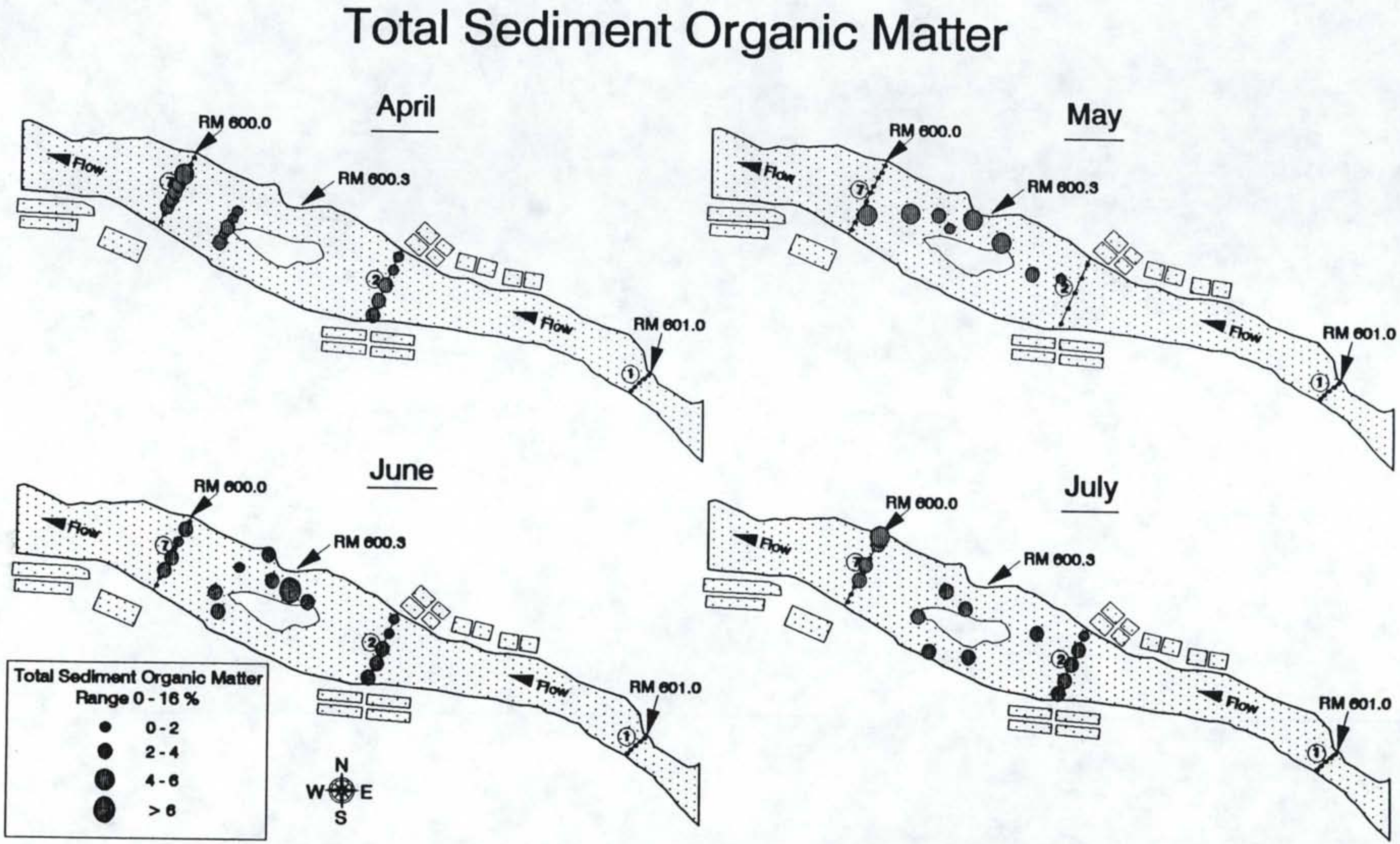


Figure 22. Total sediment organic matter in April, May, June, and July in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

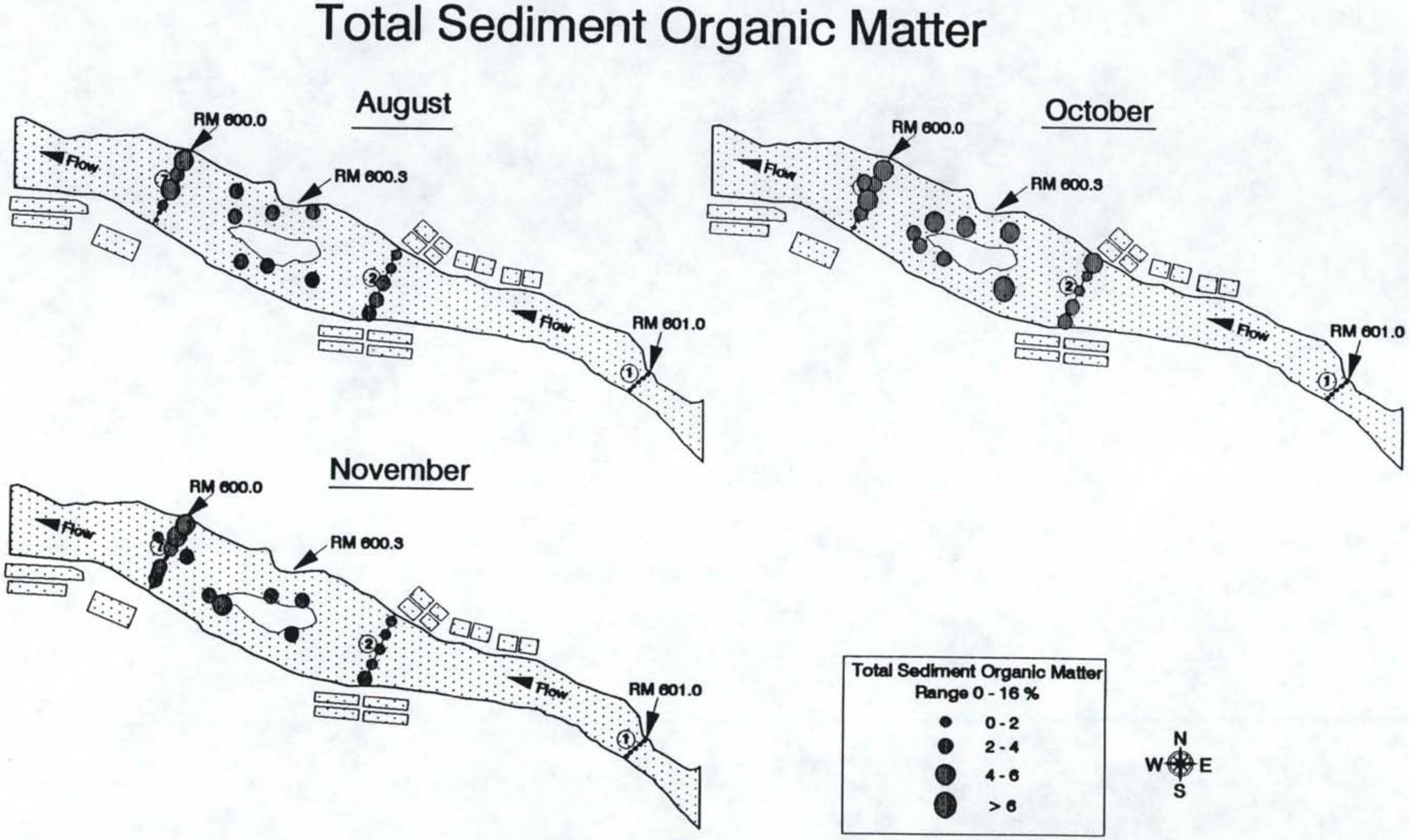


Figure 22 (Cont.). Total sediment organic matter in August, October, and November in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Total Sediment Hydrogen

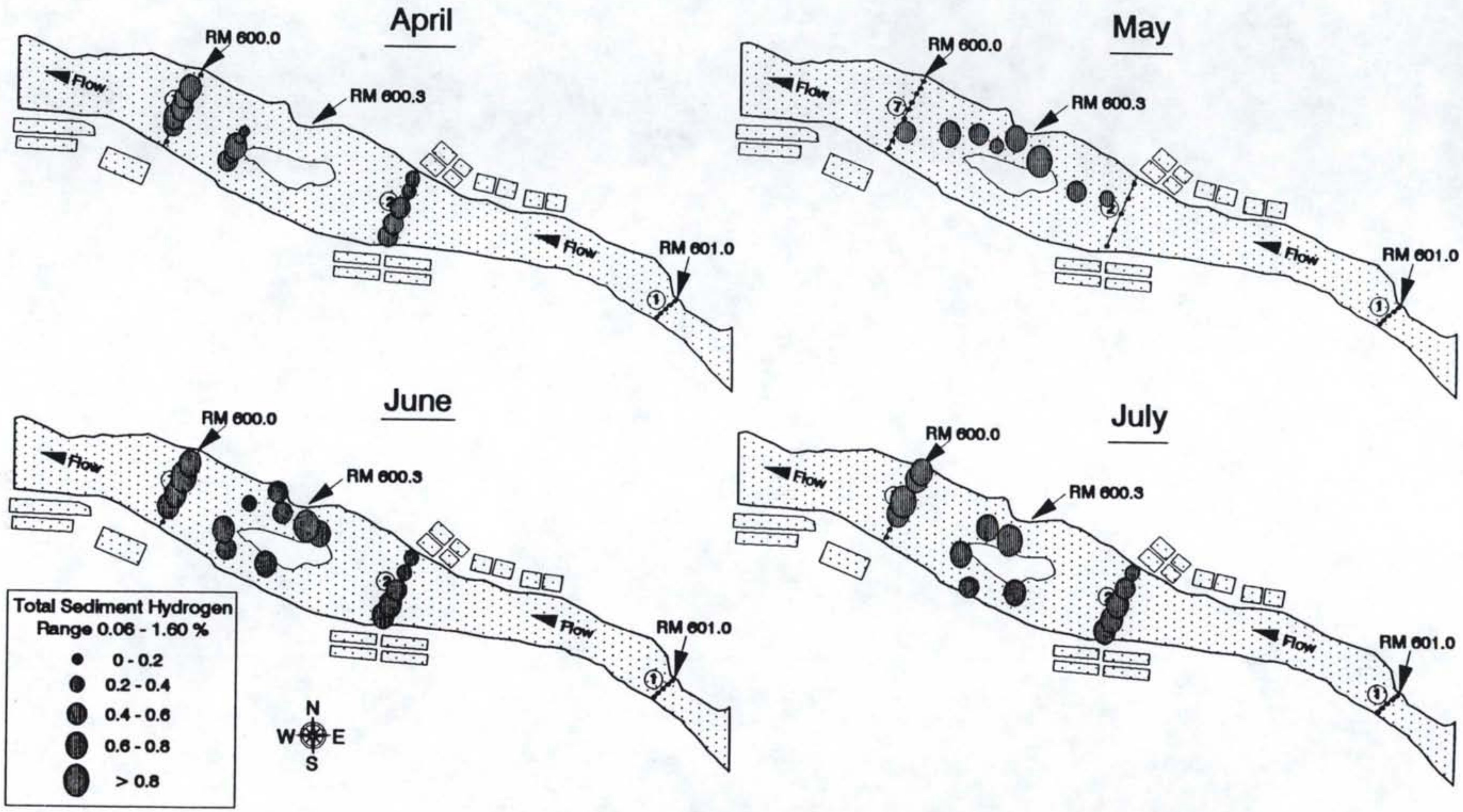


Figure 23. Total sediment hydrogen in April, May, June, and July in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Total Sediment Hydrogen

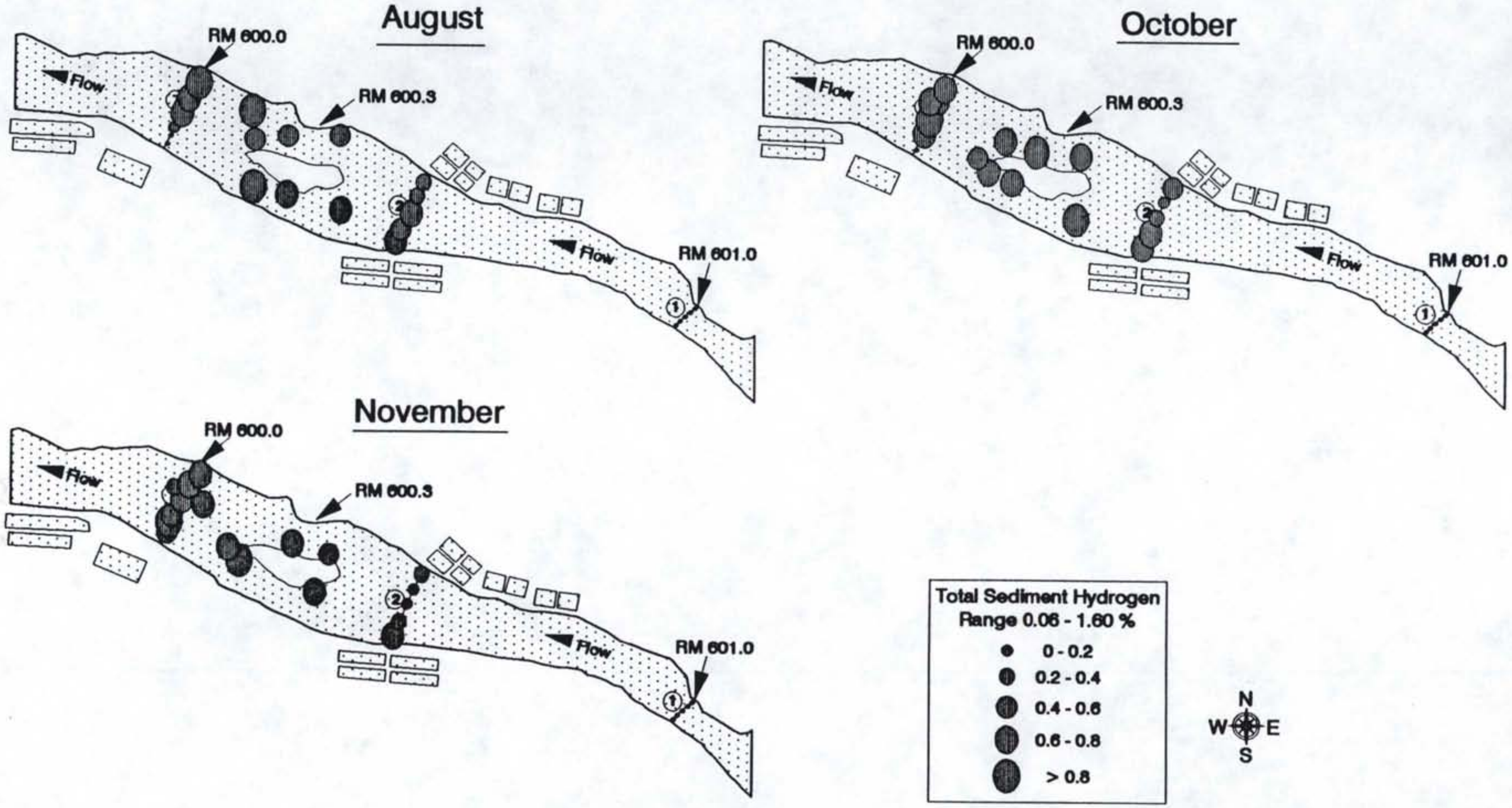


Figure 23 (Cont.). Total sediment hydrogen in August, October, and November in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Sediment pH

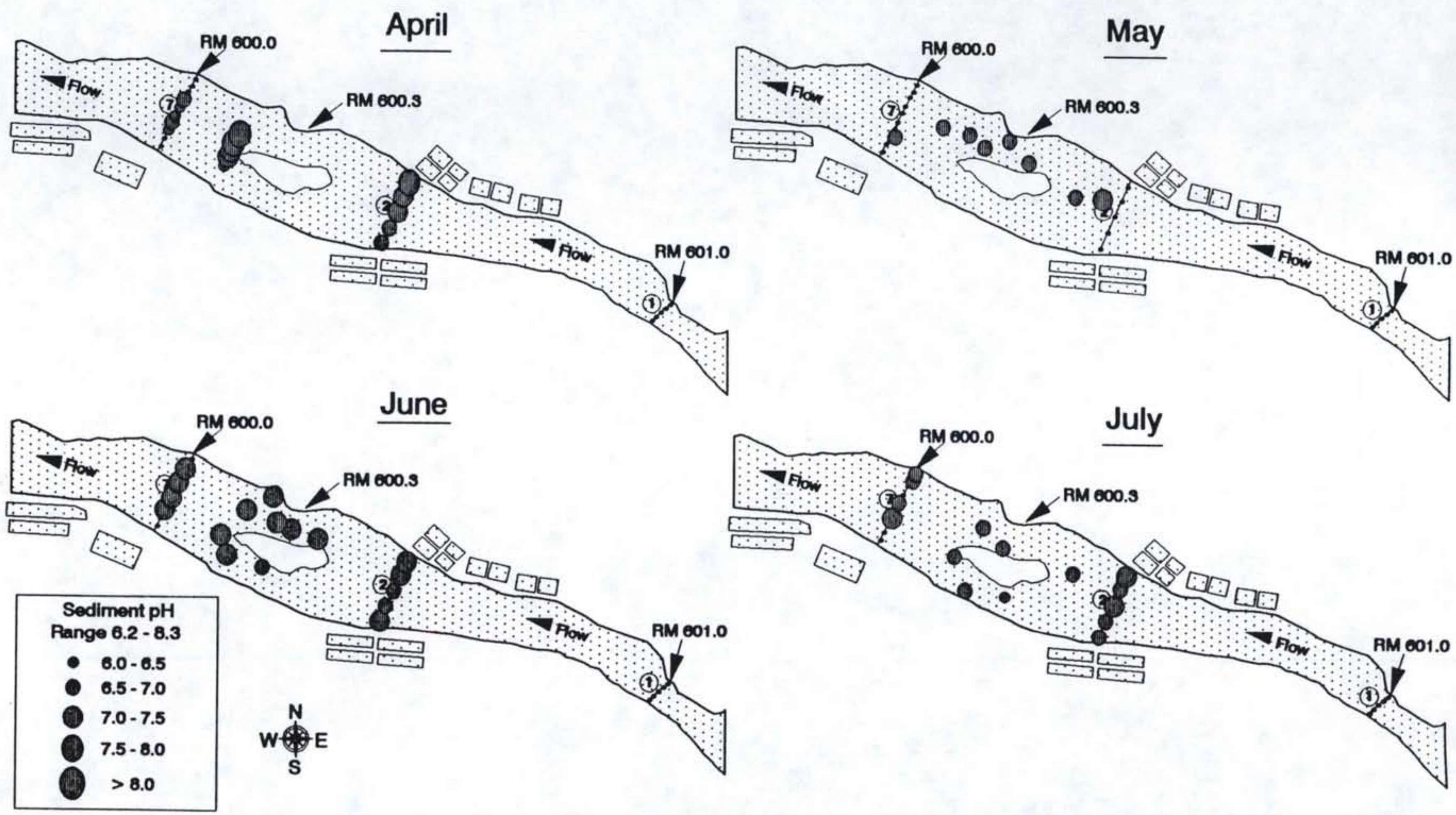


Figure 24. Sediment pH in April, May, June, and July in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Sediment pH

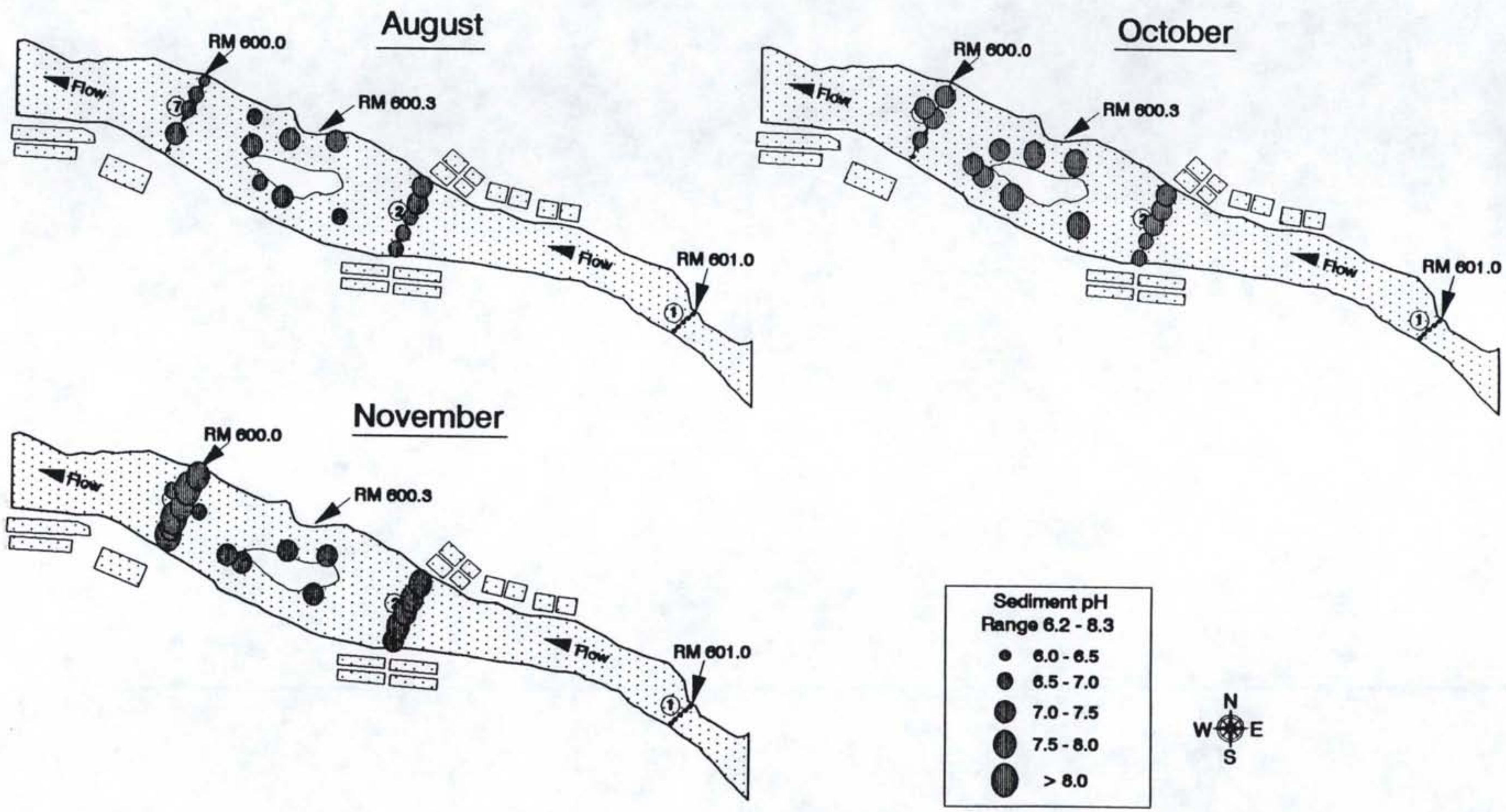


Figure 24 (Cont.). Sediment pH in August, October, and November in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

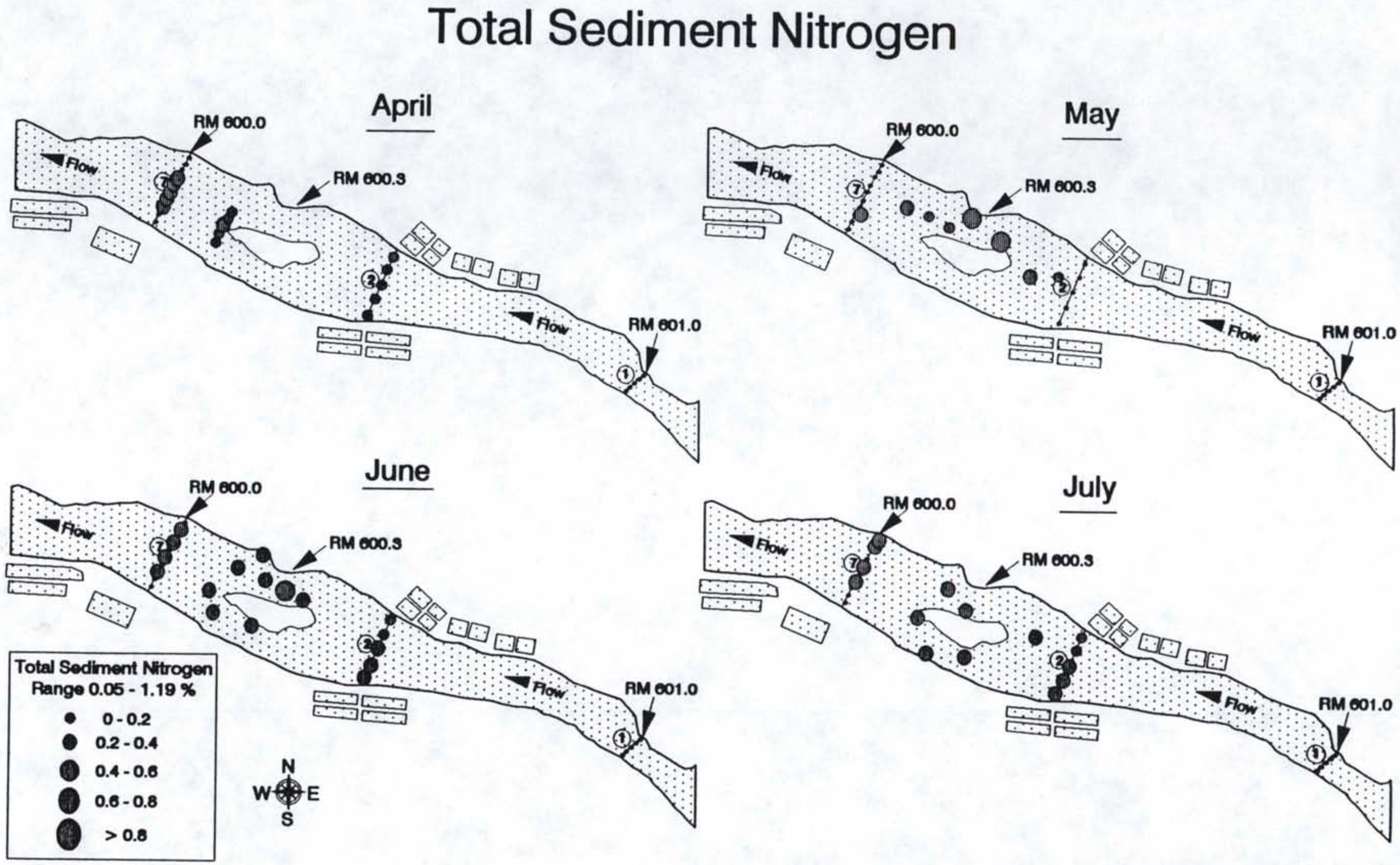


Figure 25. Total sediment nitrogen in April, May, June, and July in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Total Sediment Nitrogen

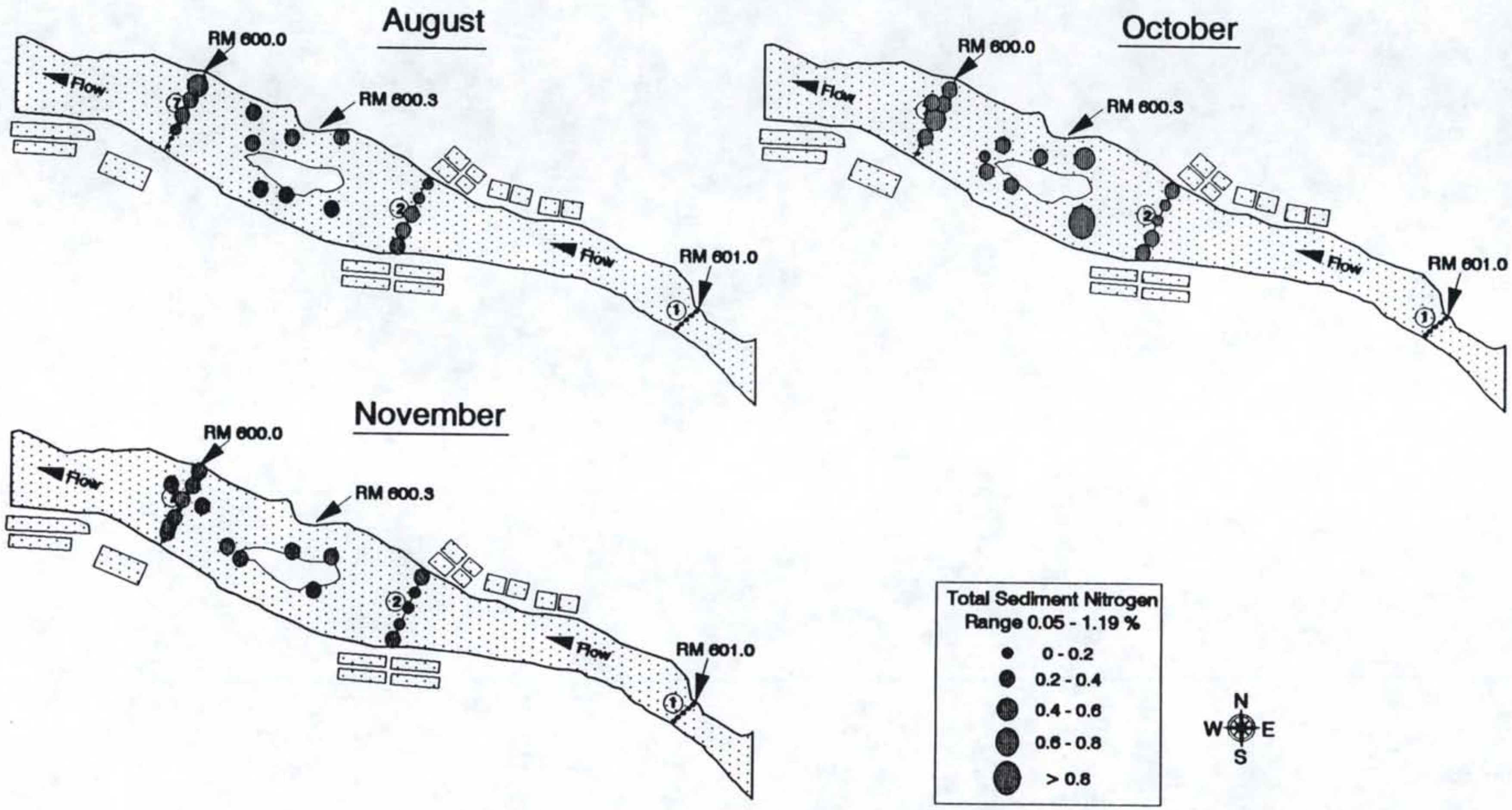


Figure 25 (Cont.). Total sediment nitrogen in August, October, and November in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Total Sediment Phosphorus

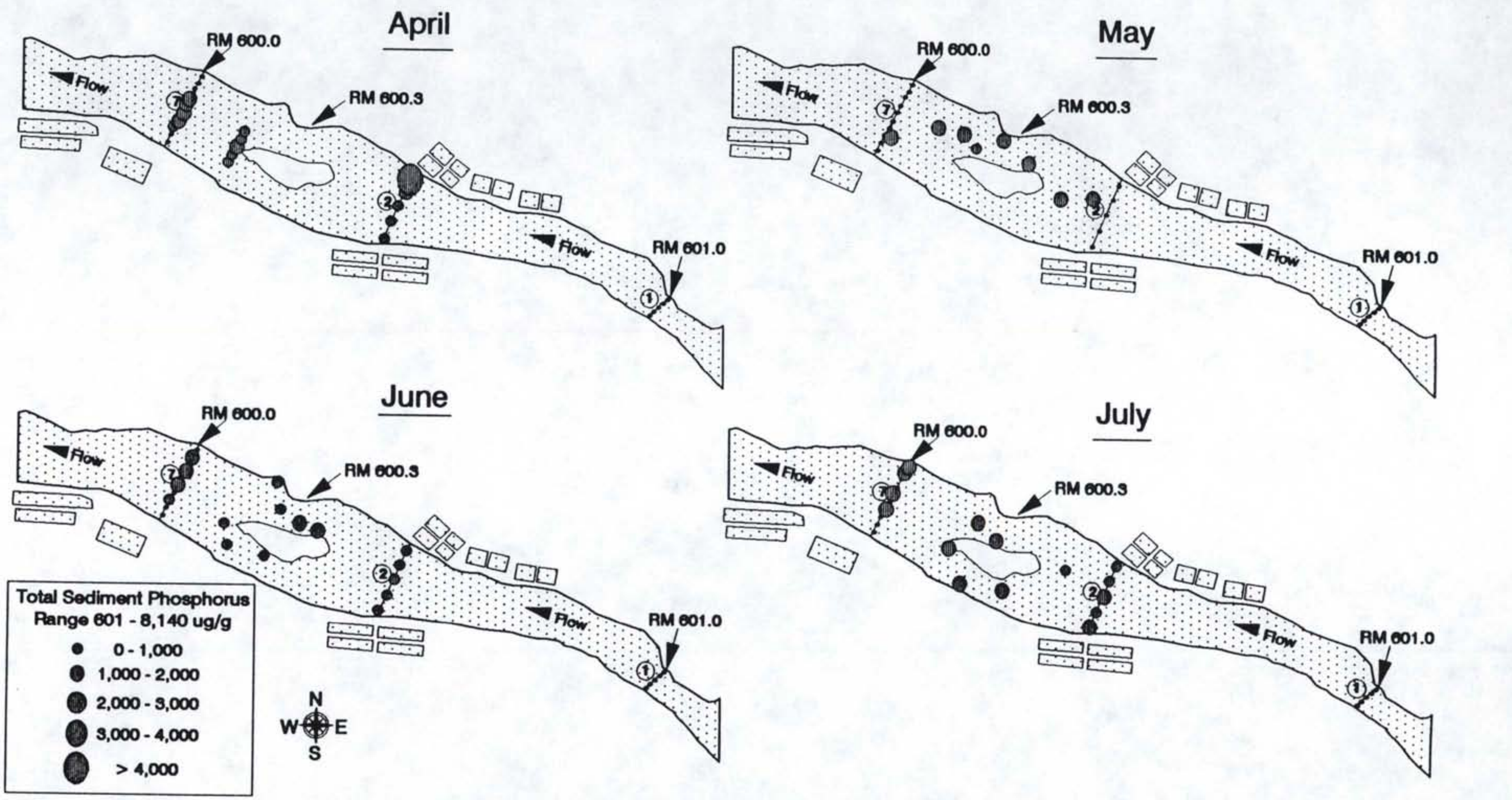


Figure 26. Total sediment phosphorus in April, May, June, and July in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Total Sediment Phosphorus

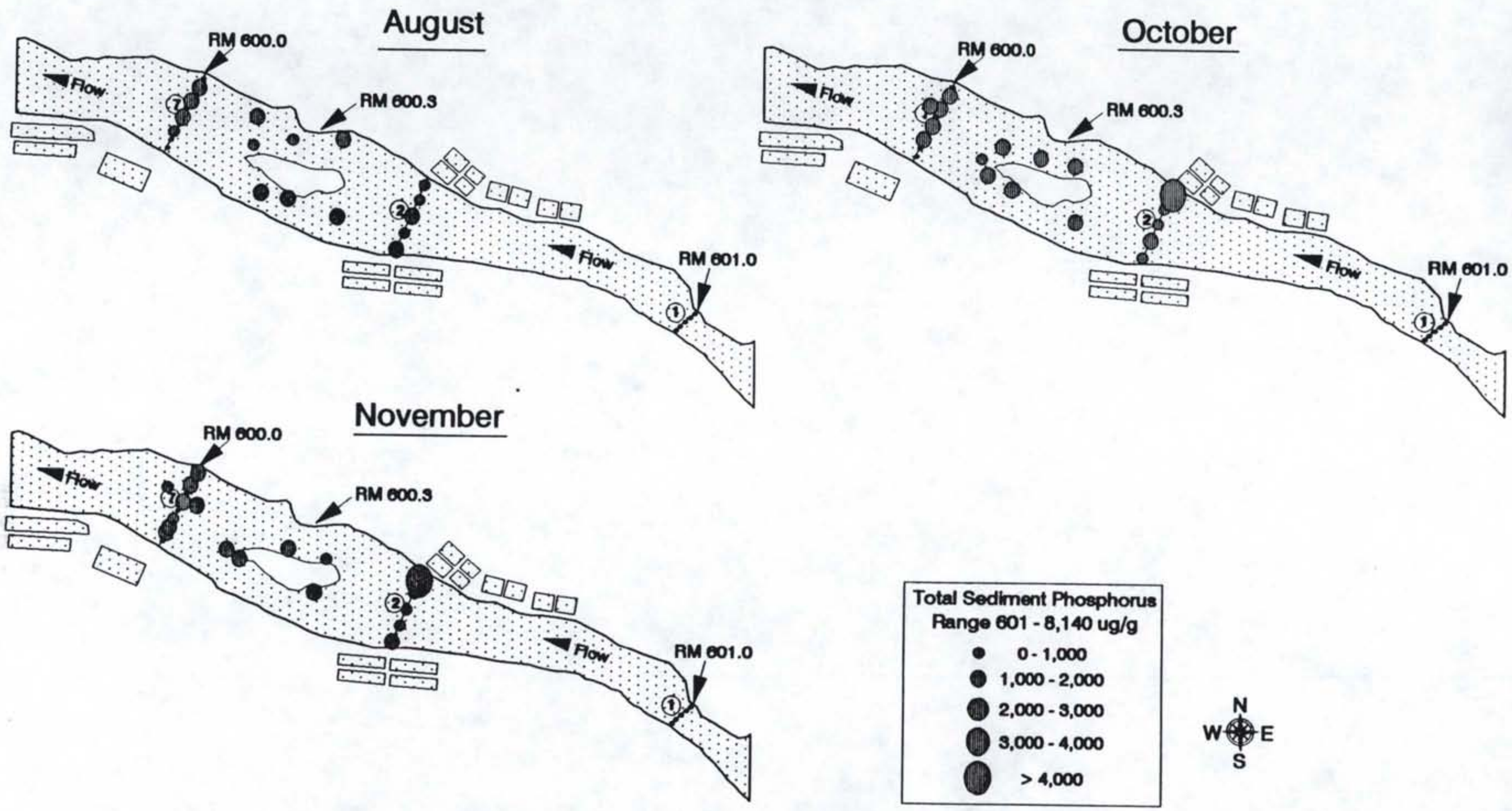
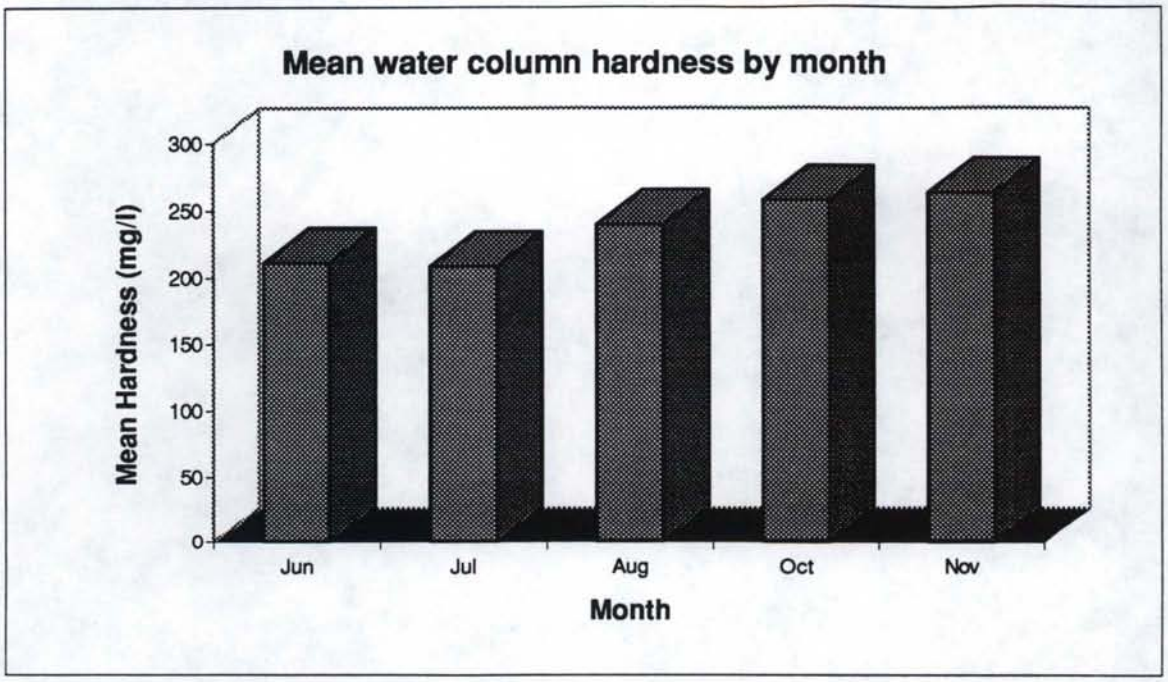


Figure 26 (Cont.). Total sediment phosphorus in August, October, and November in the Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.



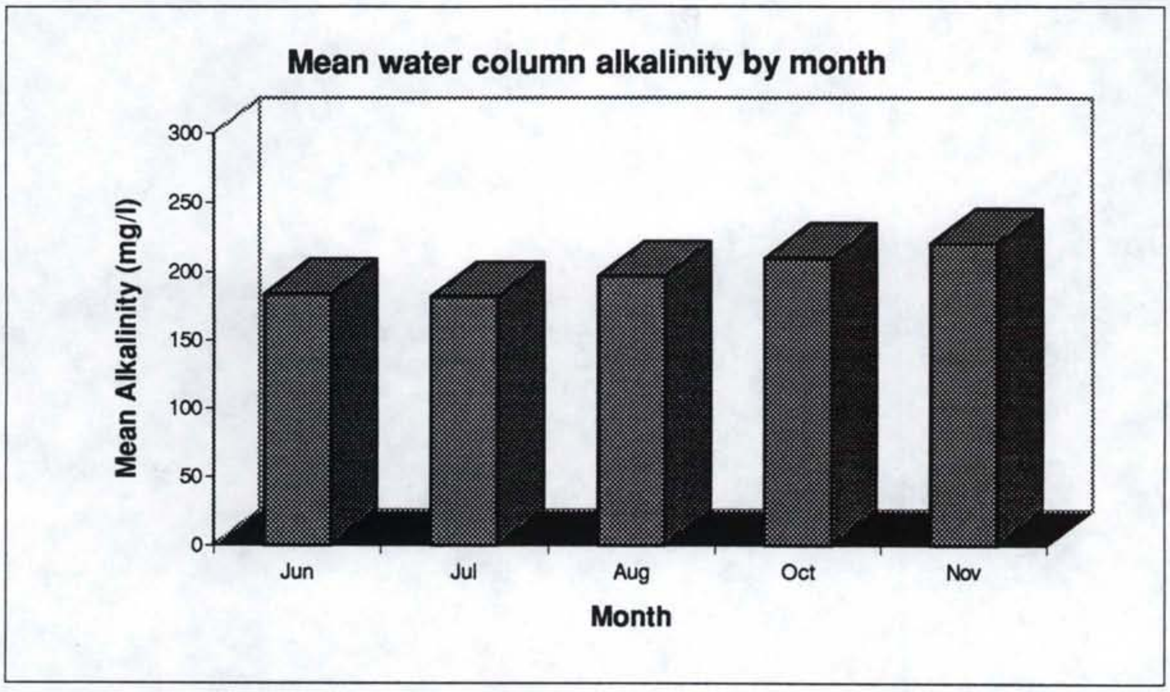
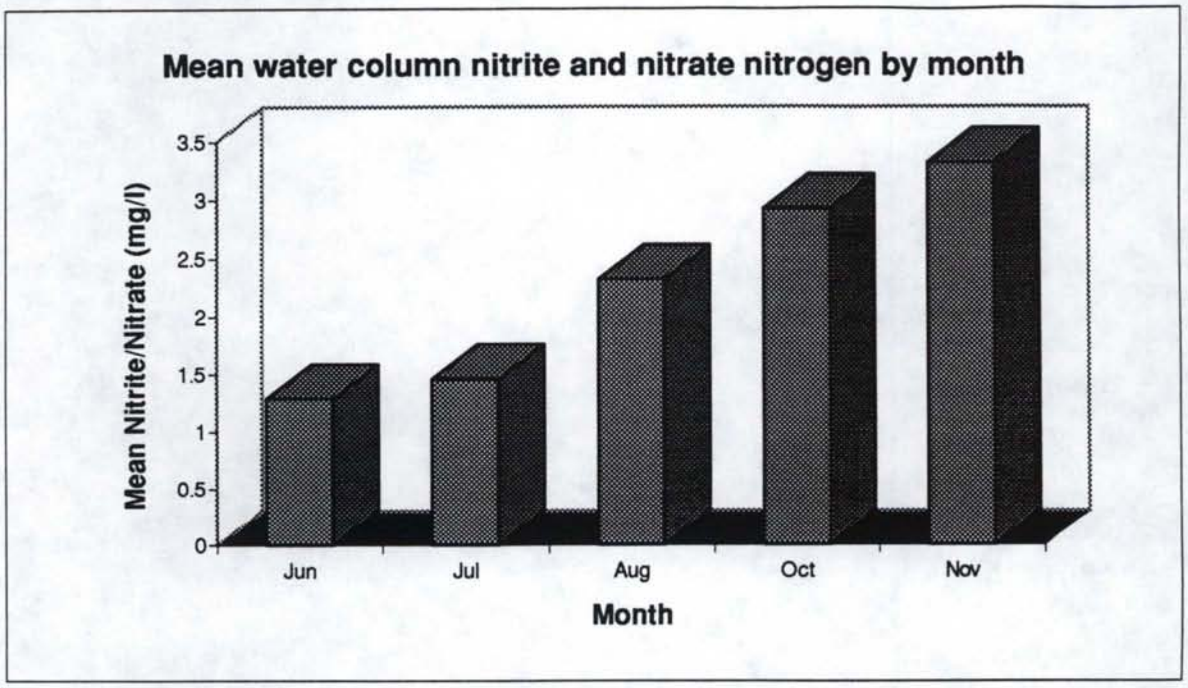


Figure 27. Mean water column hardness and alkalinity by month for all transects (2 through R), Crystal Springs Reach (RM 599.5-601.3), Middle Snake River, Idaho, 1994.



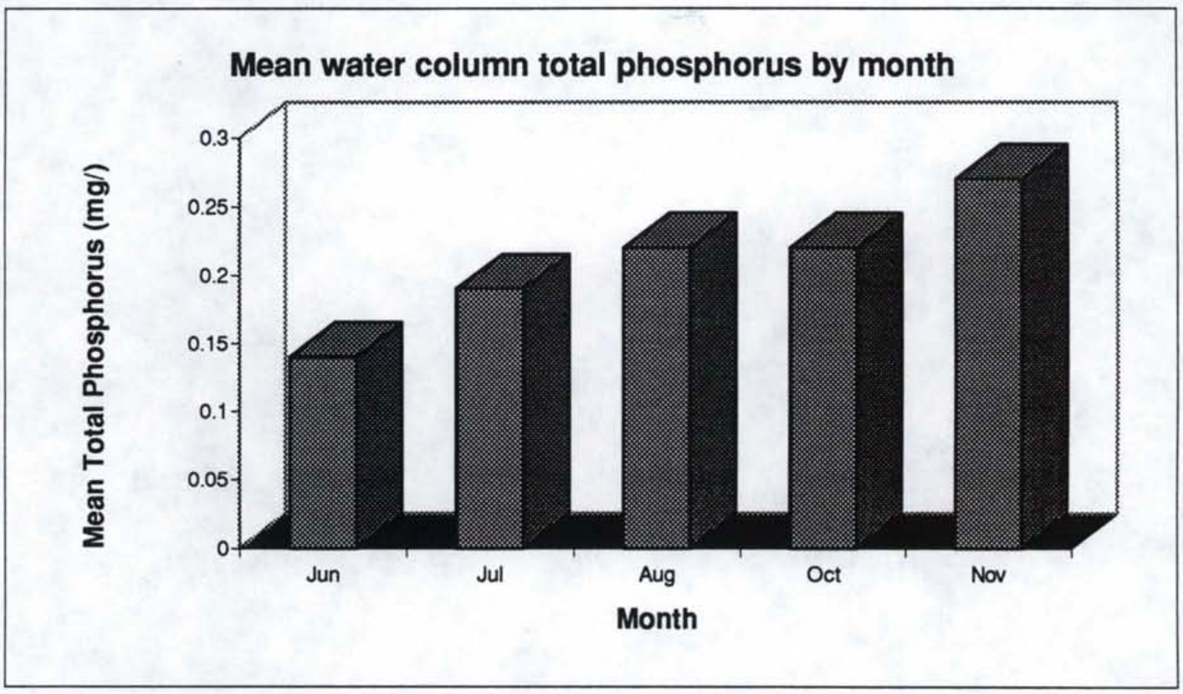
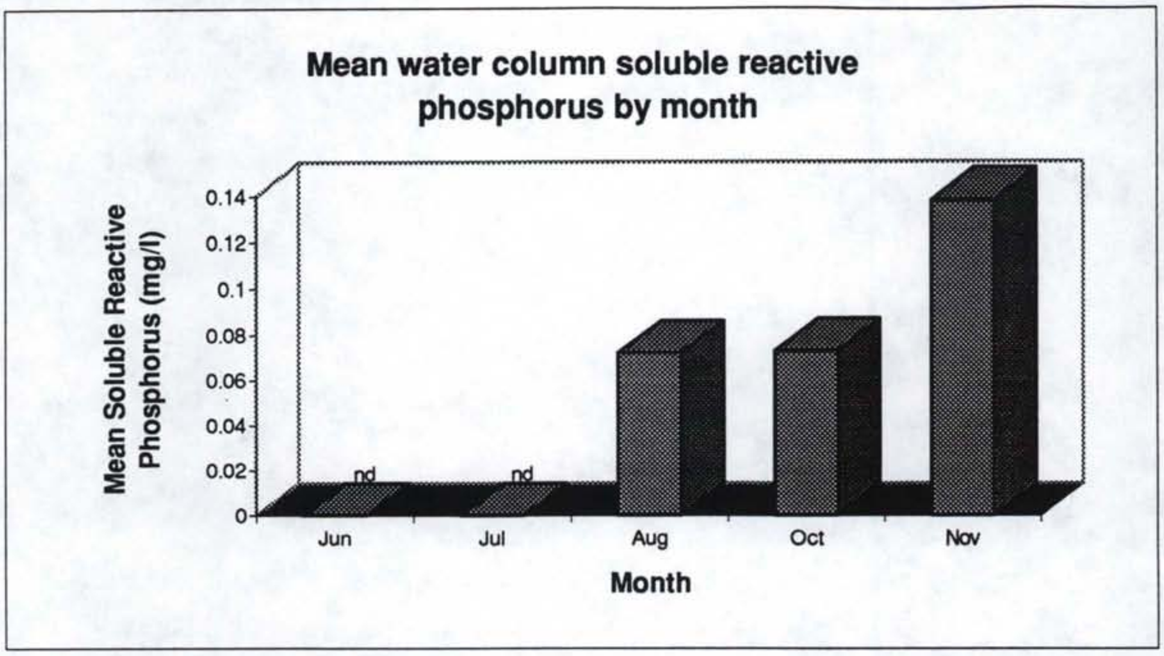


Figure 28. Mean water column nitrite and nitrate nitrogen and total phosphorus by month for all transects (2 through R), Crystal Springs Reach (RM 599.5-601.3), Middle Snake River, Idaho, 1994.



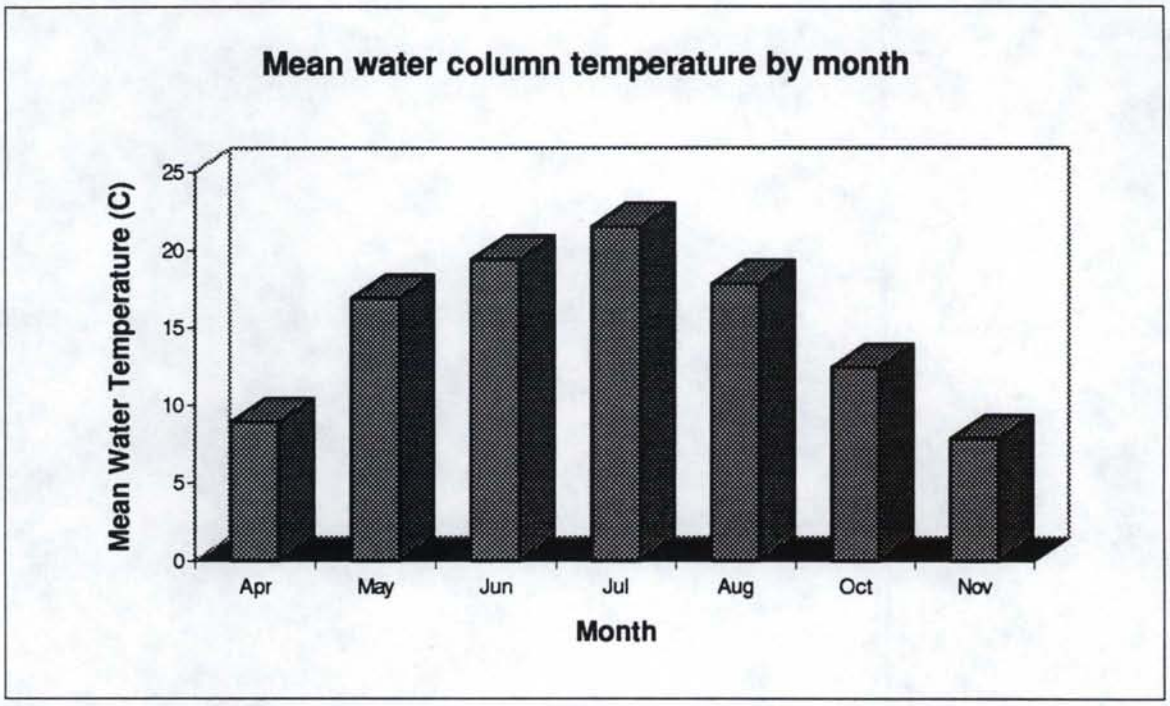
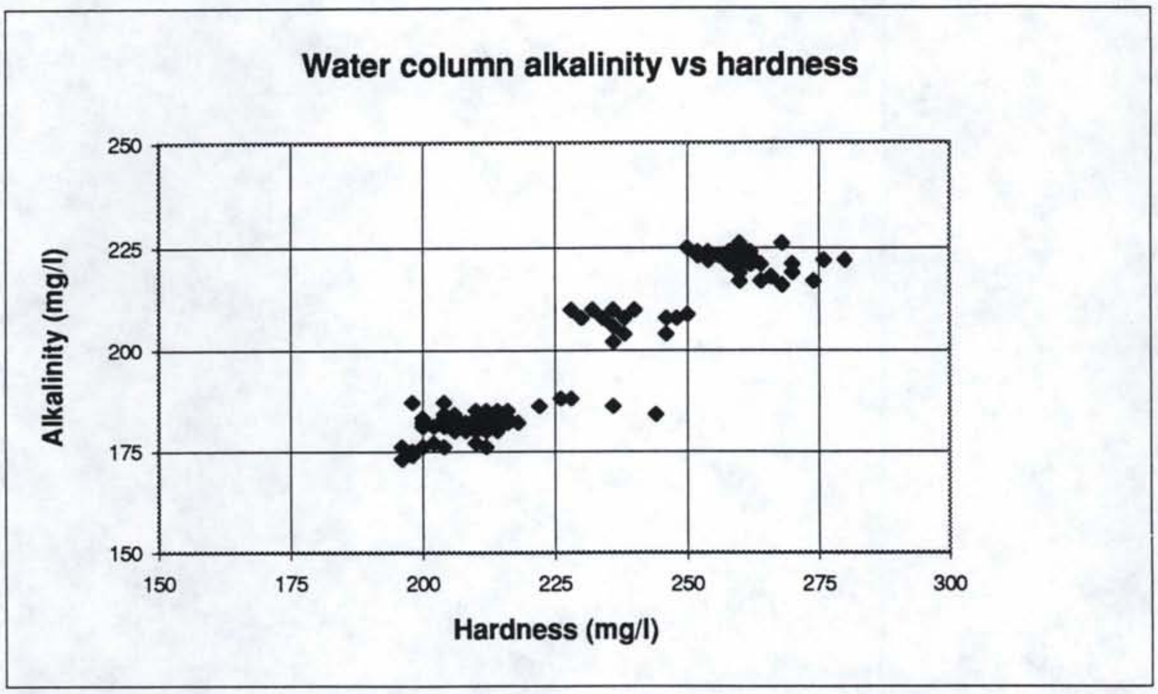


Figure 29. Mean water column soluble reactive phosphorus and water temperature for all transects (2 through R), Crystal Springs Reach (RM 599.601.3), Middle Snake River, Idaho, 1994.



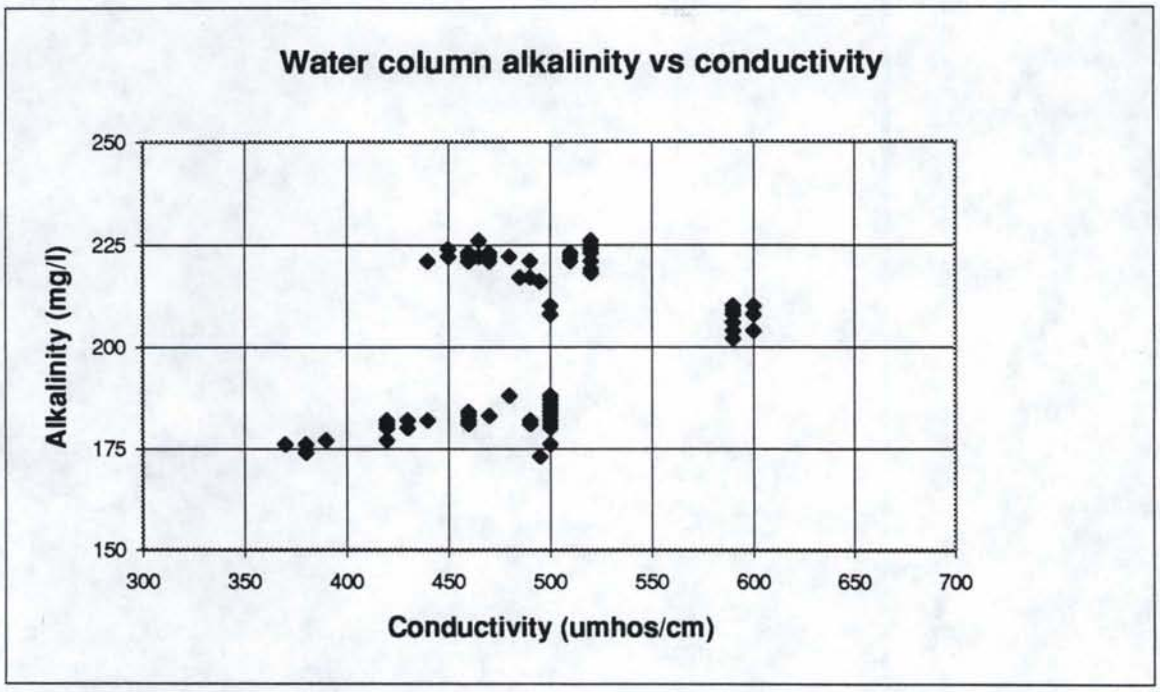
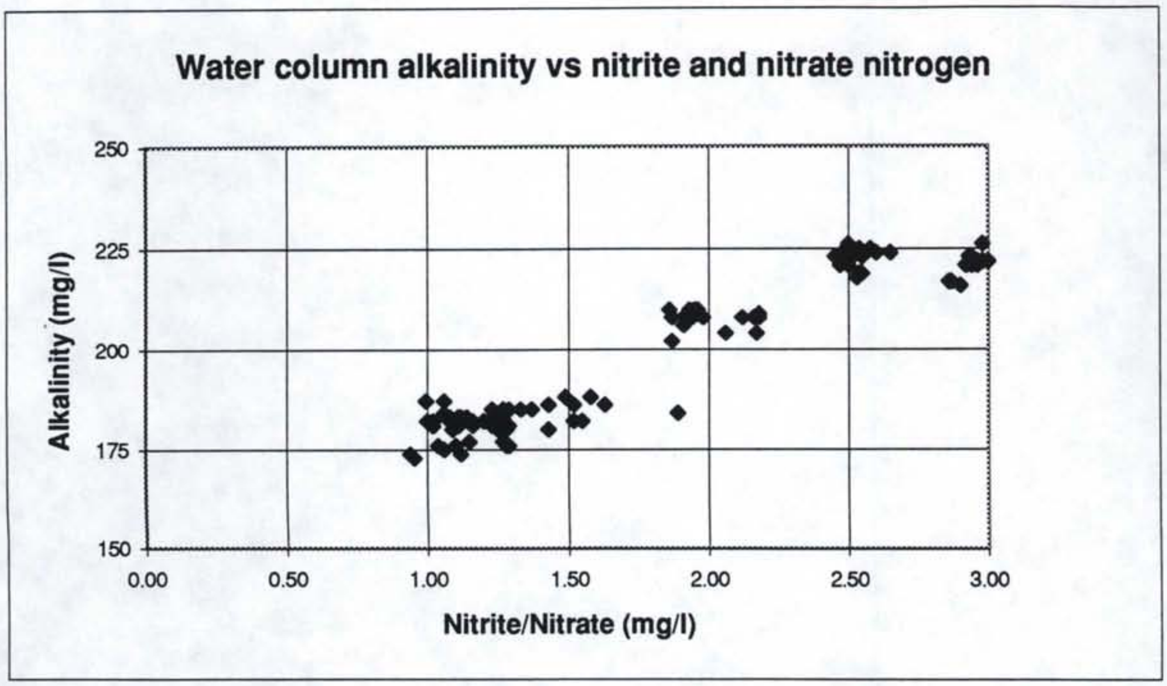


Figure 30. The relationships between water column alkalinity and hardness and between alkalinity and conductivity, Crystal Springs Reach (RM 599.5-601.3), Middle Snake River, Idaho, 1994.



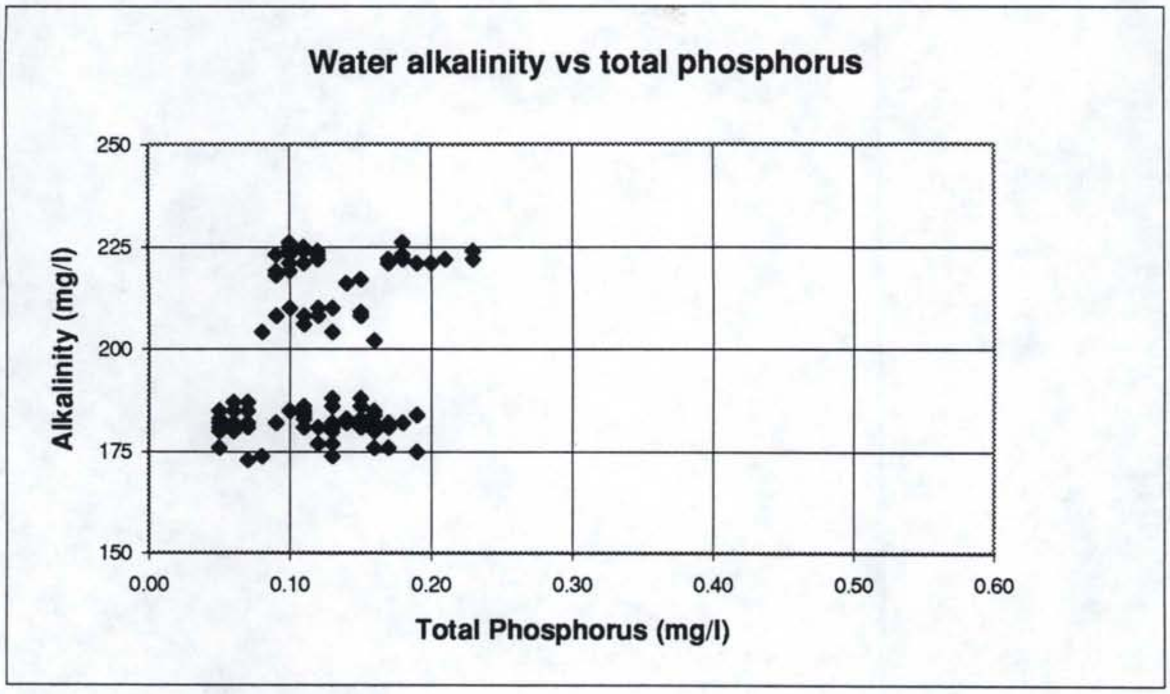
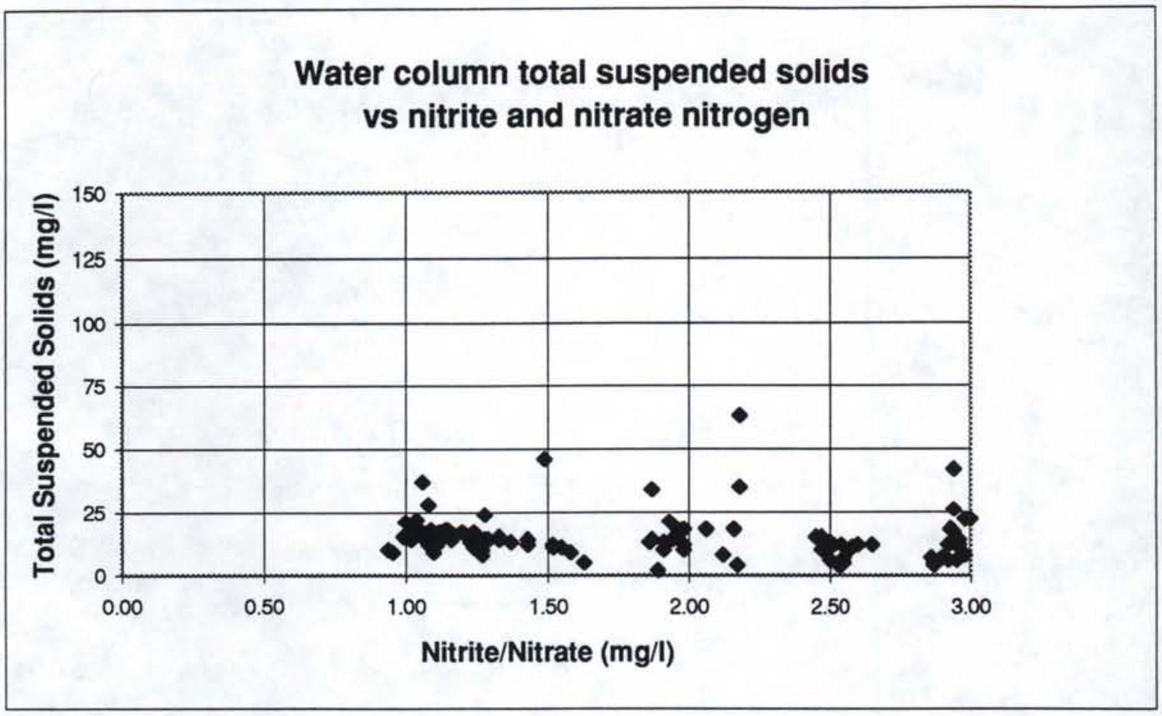


Figure 31. The relationships between water column alkalinity and nitrite and nitrate nitrogen and and alkalinity and total phosphorus, Crystal Springs Reach (RM 599.5-601.3), Middle Snake River, Idaho, 1994.



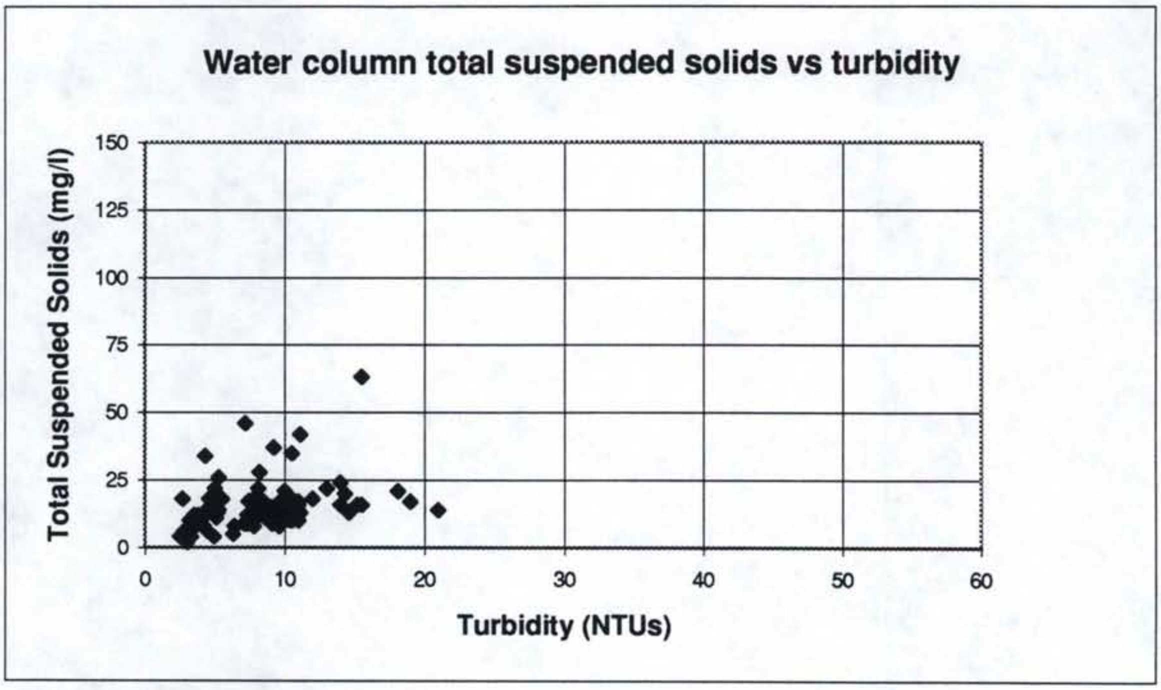


Figure 32. The relationships between water column total suspended solids and nitrite and nitrate nitrogen and between total suspended solids and turbidity, Crystal Springs Reach (RM 599.5-601.3), Middle Snake River, Idaho, 1994.

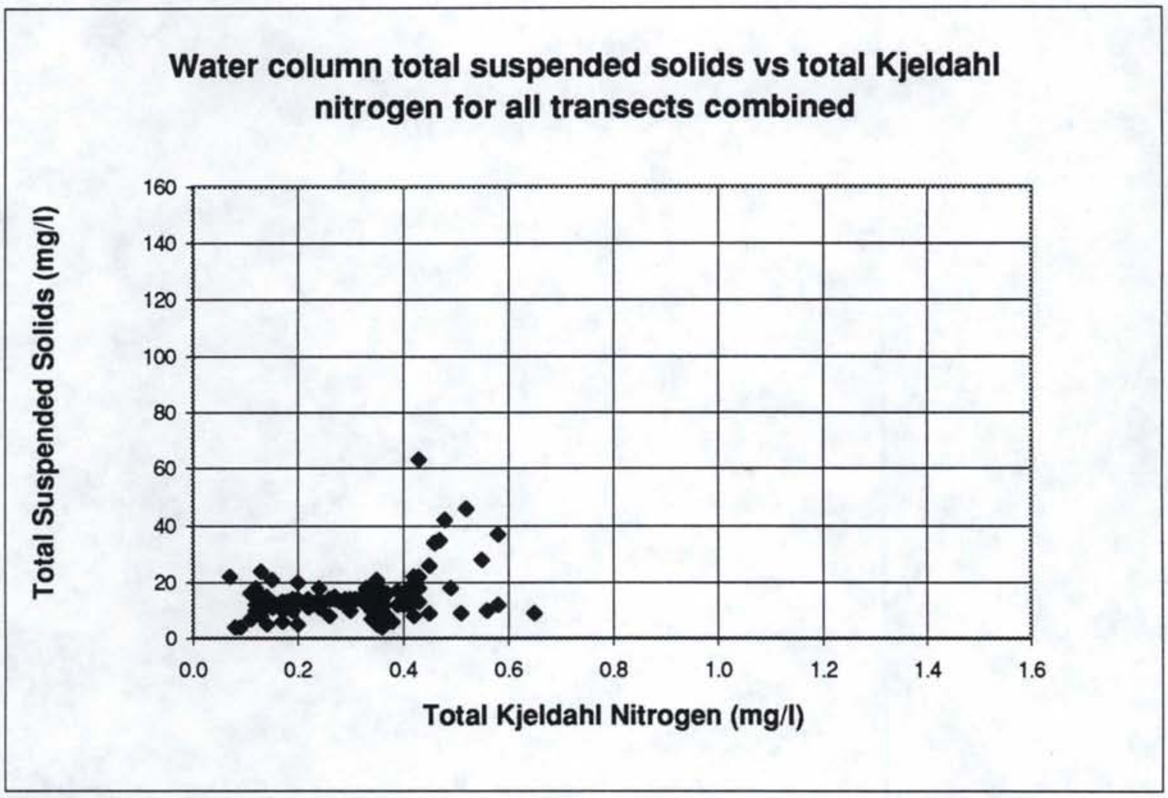
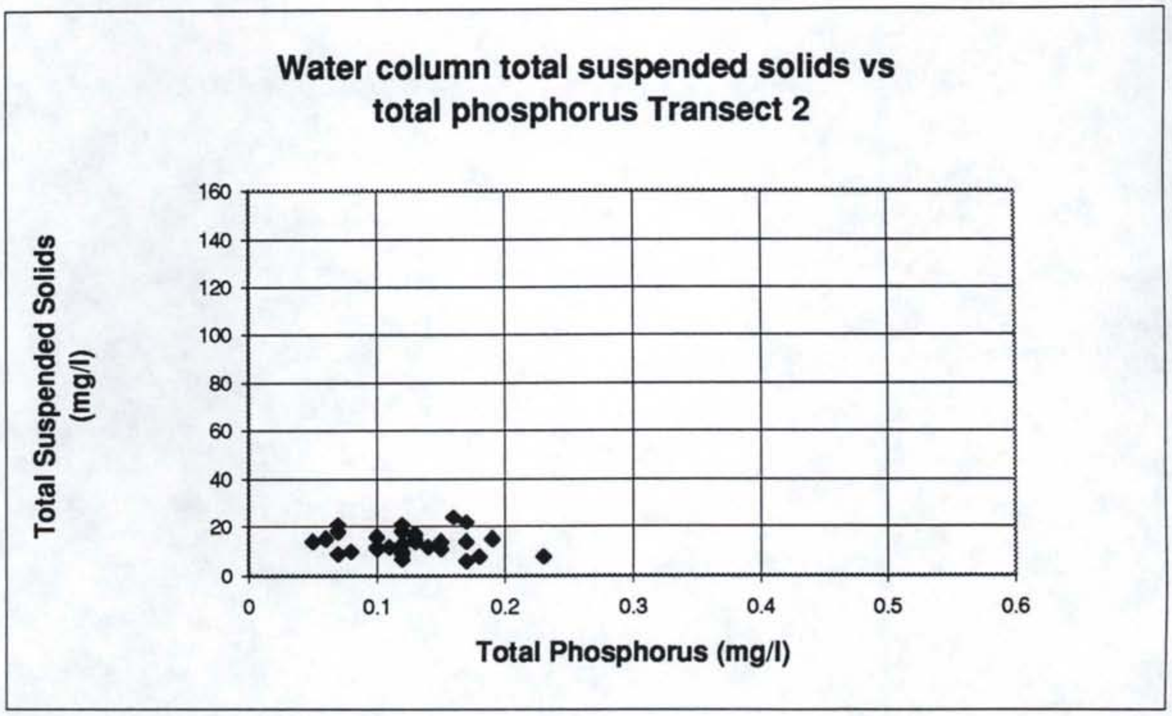


Figure 33. The relationship between water column total suspended solids and Kjeldahl nitrogen for all transects combined (2 through R), Crystal Springs Reach (RM 599.5-601.3), Middle Snake River, Idaho, 1994.



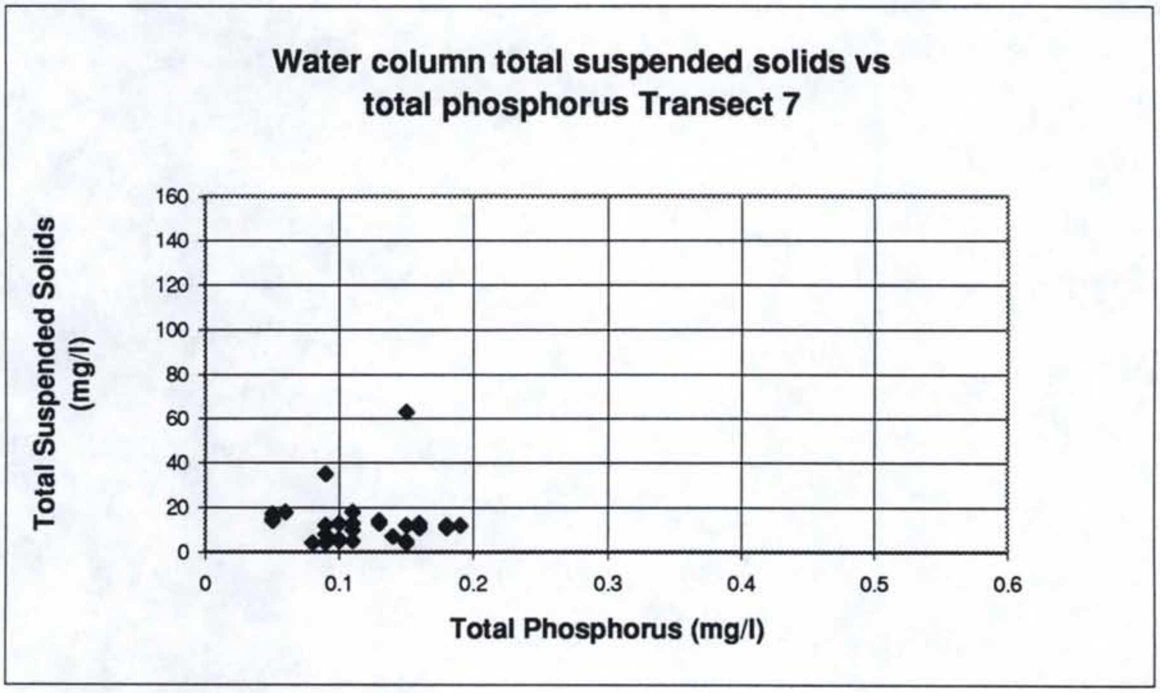
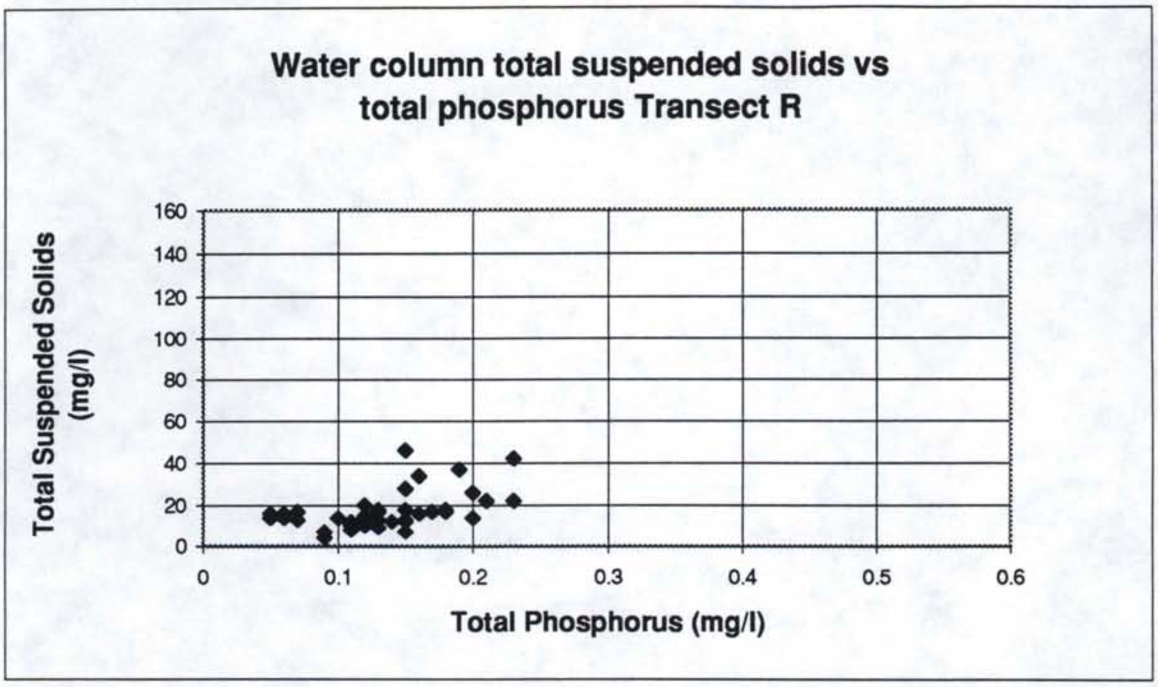


Figure 34. The relationship between water column total suspended solids and total phosphorus for each transect (2 through R) plotted separately and for all transects combined, Crystal Springs Reach (RM 599.5-601.3), Middle Snake River, Idaho, 1994.



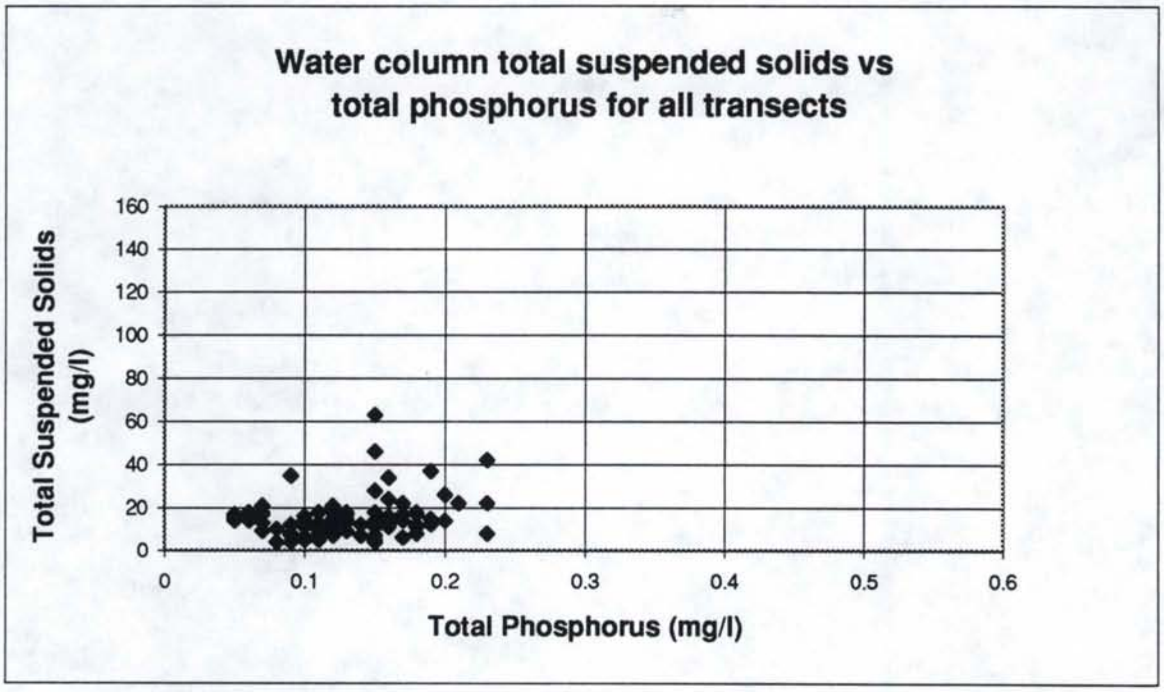
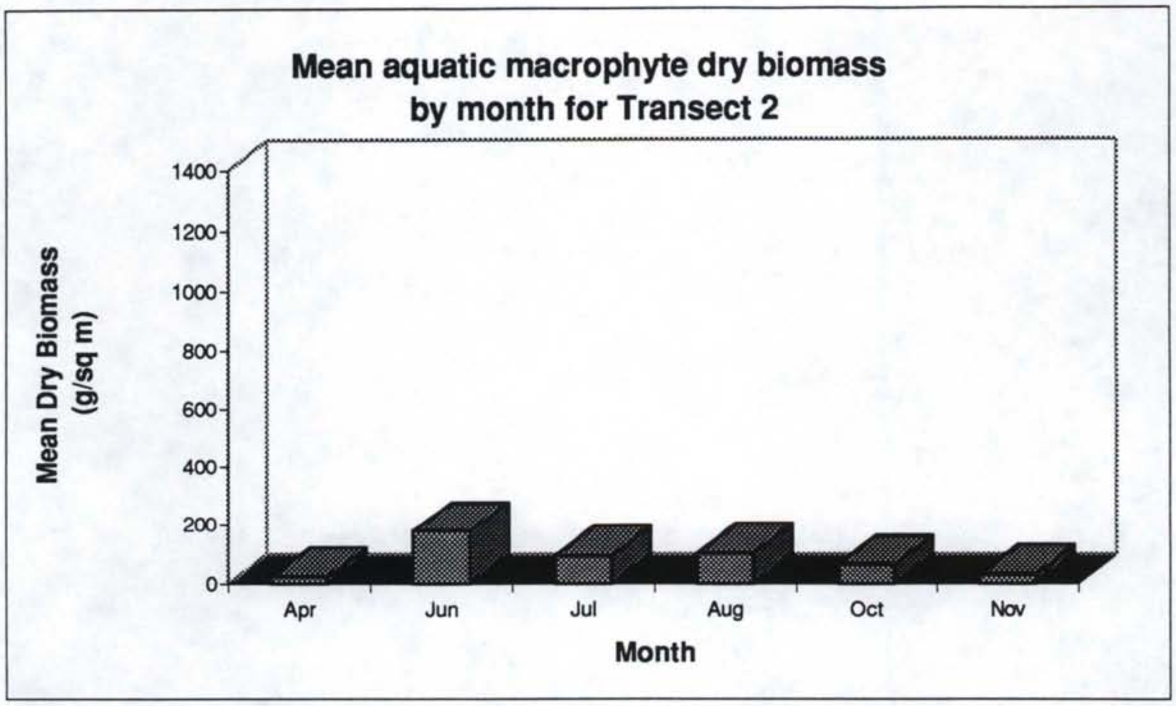


Figure 34 (continued). The relationship between water column total suspended solids and total phosphorus for each transect plotted (2 through R) and for all transects combined, Crystal Springs Reach (RM 599.5-601.3), Middle Snake River, Idaho, 1994.



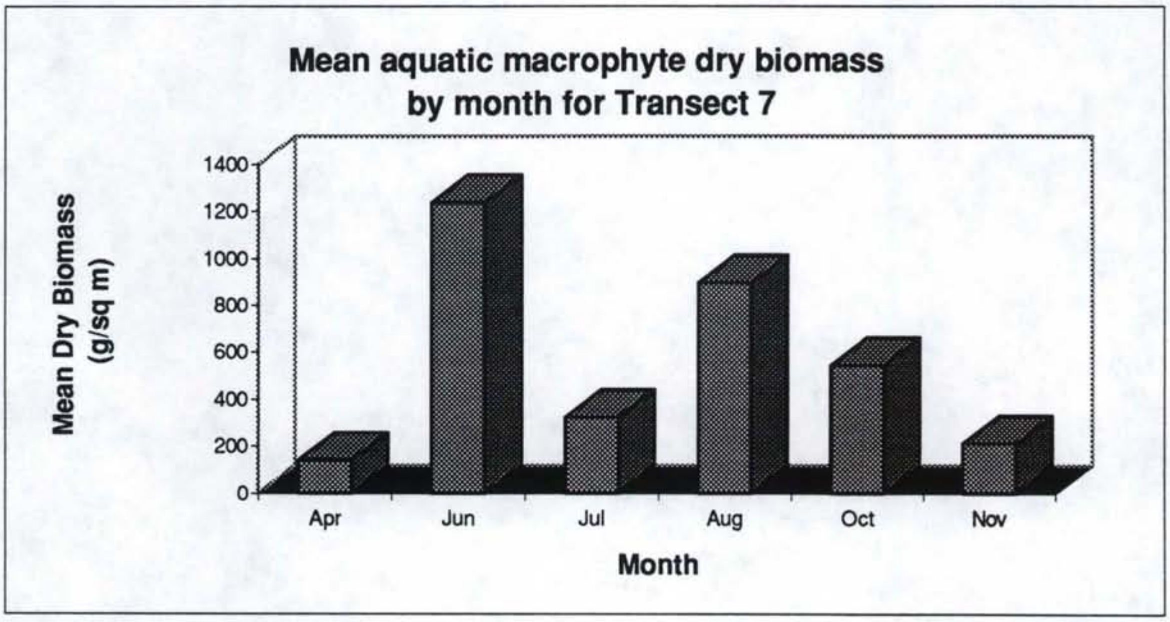
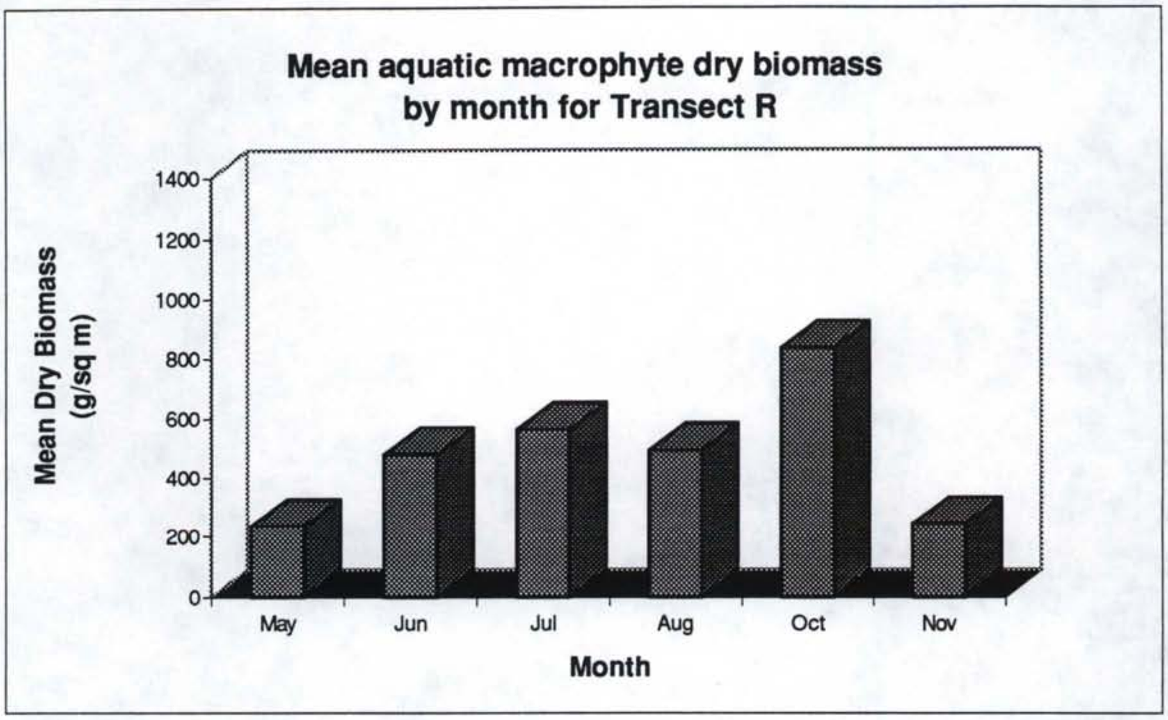


Figure 35. Mean aquatic macrophyte dry biomass by month for each transect (2 through R), and for all transects combined, Crystal Springs Reach (RM 599.5-601.3), Middle Snake River, Idaho, 1994.



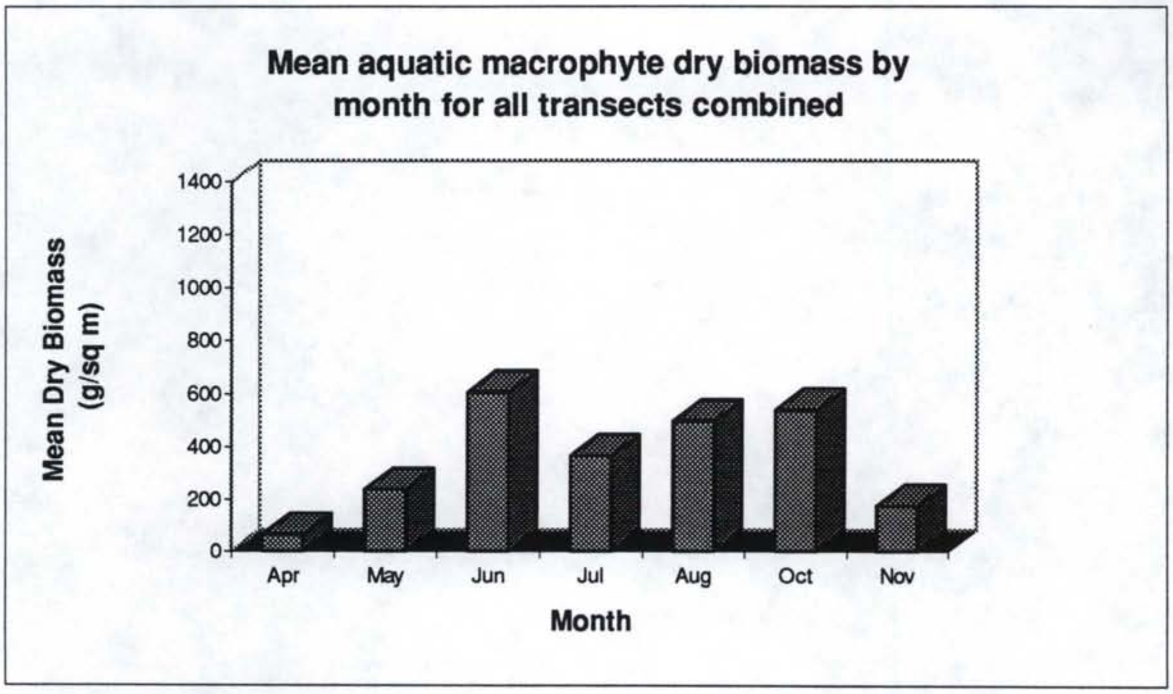
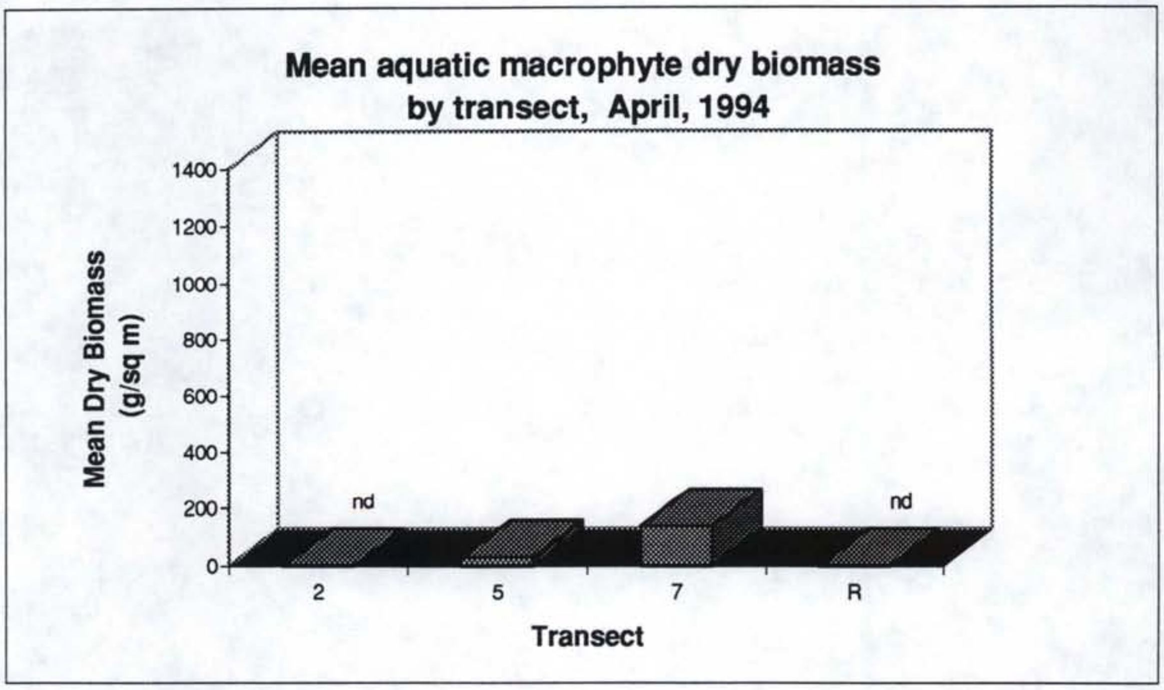


Figure 35 (continued). Mean aquatic macrophyte dry biomass by month for all transects (2 through R) and for all transects combined, Crystal Springs Reach (RM 599.5-601.3), Middle Snake River, Idaho, 1994.



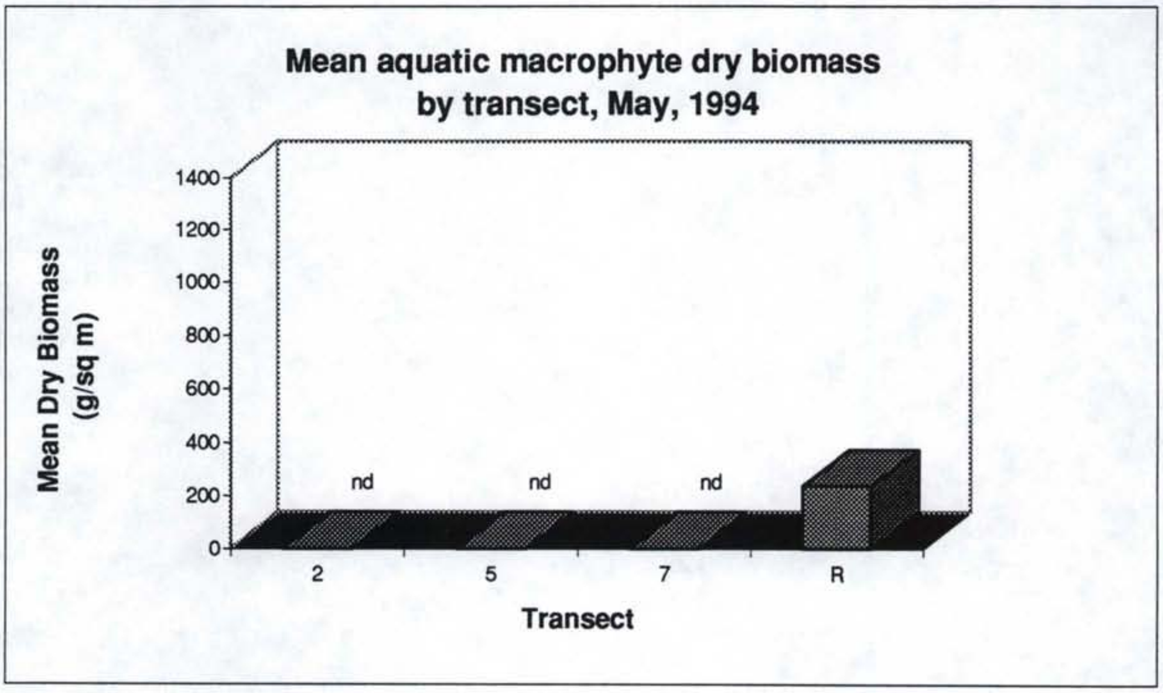
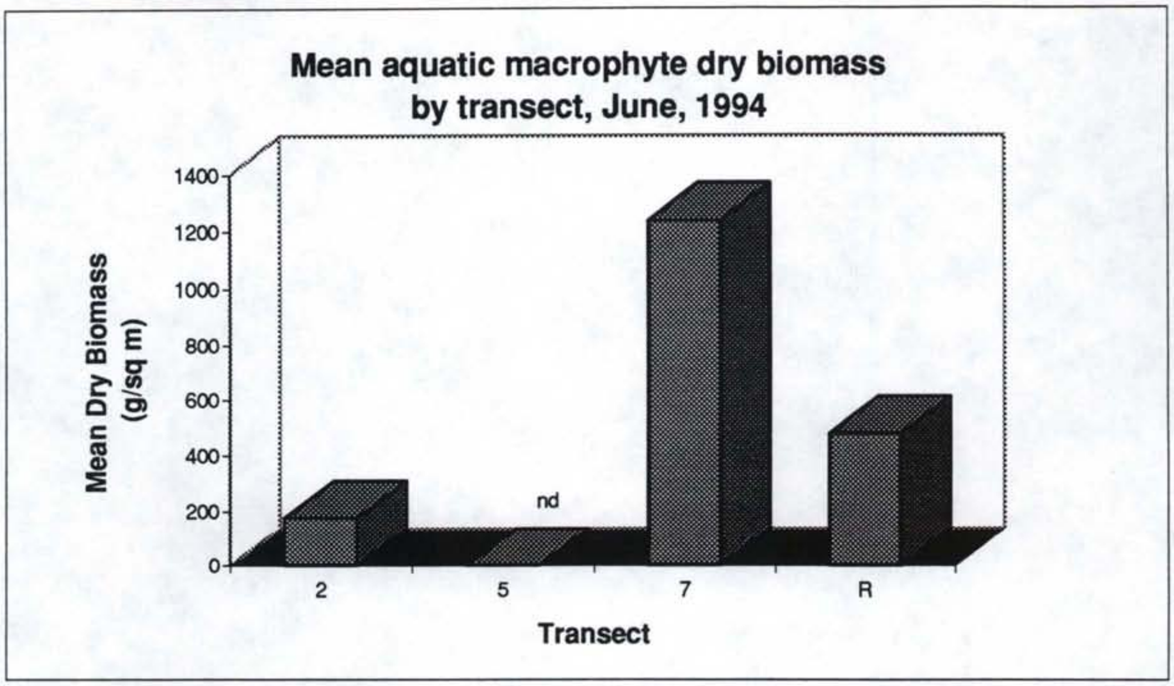


Figure 36. Mean aquatic macrophtye dry biomass for all transects (2 through R) plotted separatelyr for April, May, June, July, August, October, and November, and for all months combined Crystal Springs Reach (RM 599.5-601.3), Middle Snake River, Idaho, 1994.



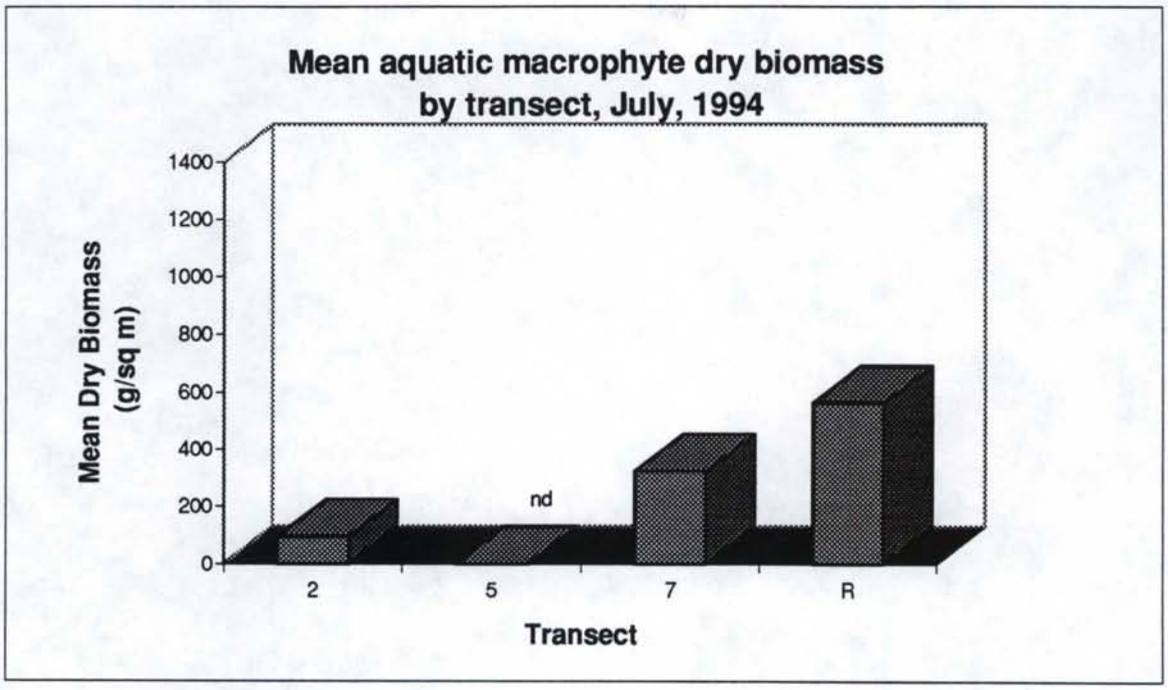
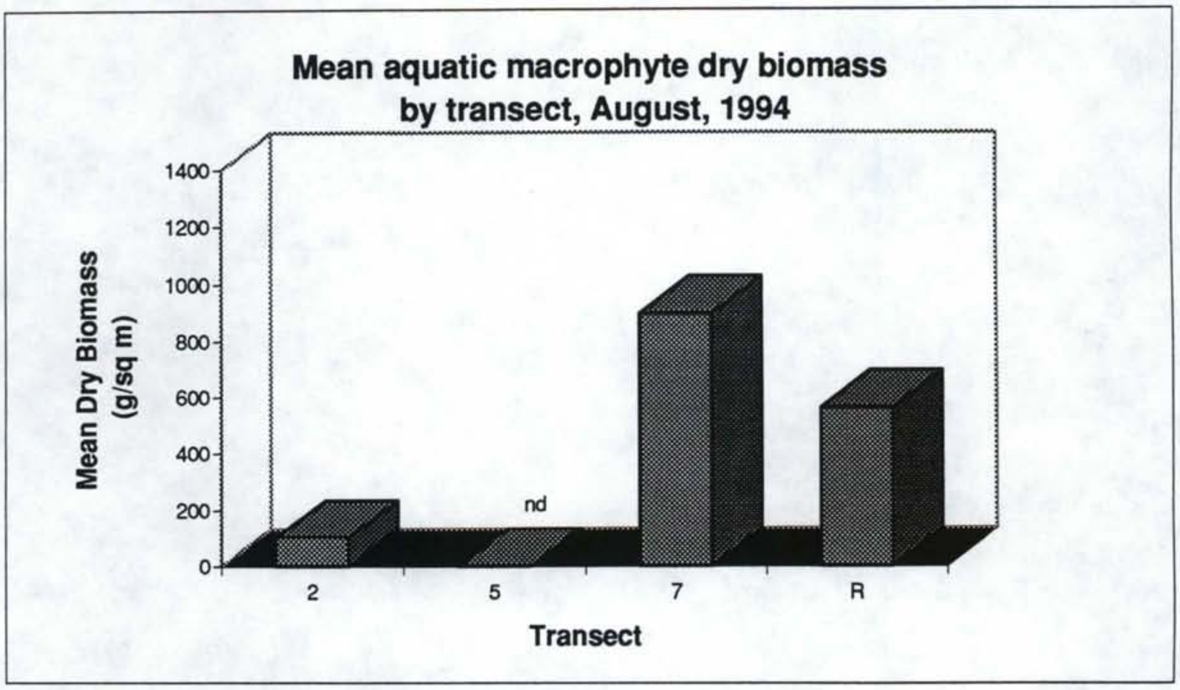


Figure 36 (continued). Mean aquatic macrophyte dry biomass for all transects (2 through R) plotted separately for April, May, June, July, August, October, and November, and for all months combined, Crystal Springs Reach (RM 599.5-601.3), Middle Snake River, Idaho, 1994.



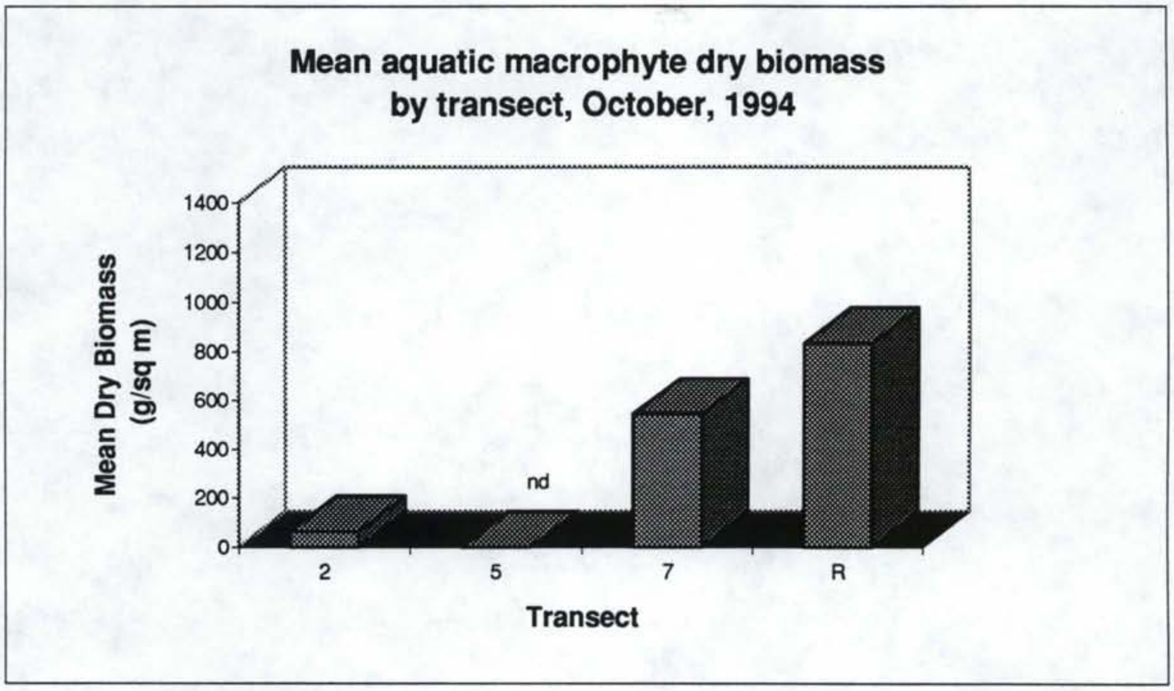
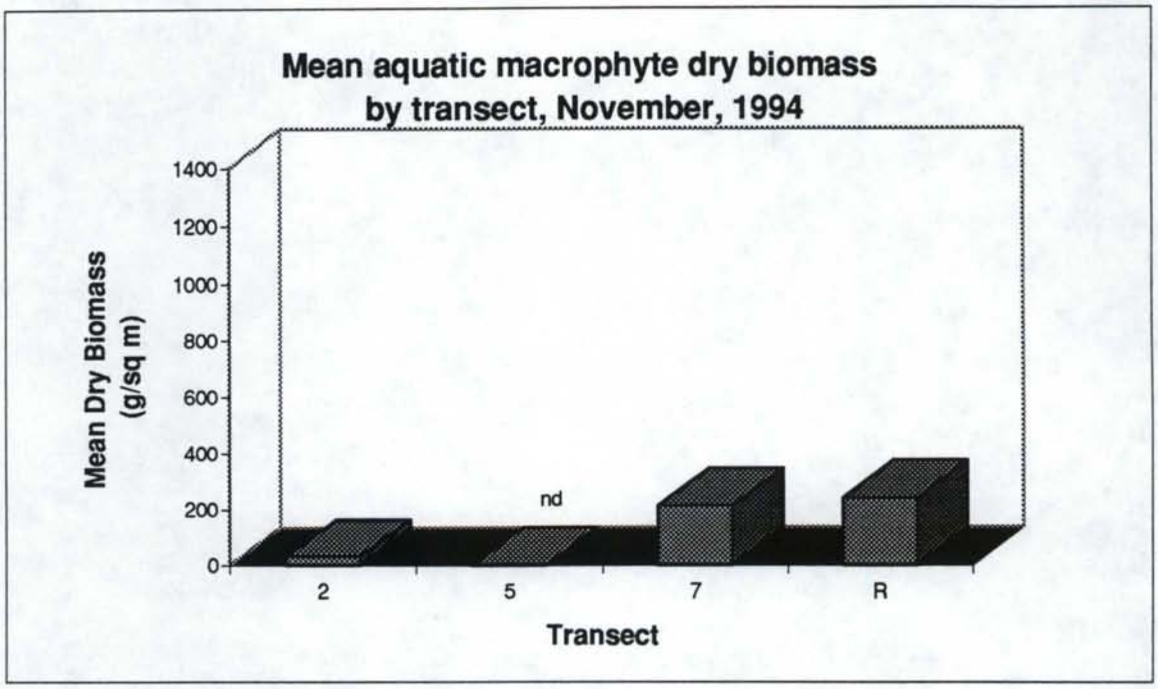


Figure 36 (continued). Mean aquatic macrophyte dry biomass for all transect (2 through R) plotted seperately for April, May, June, July, August, October, and November, and for all months combined, Crystal Springs Reach (RM 599.5-601.3), Middle Snake River, Idaho, 1994.



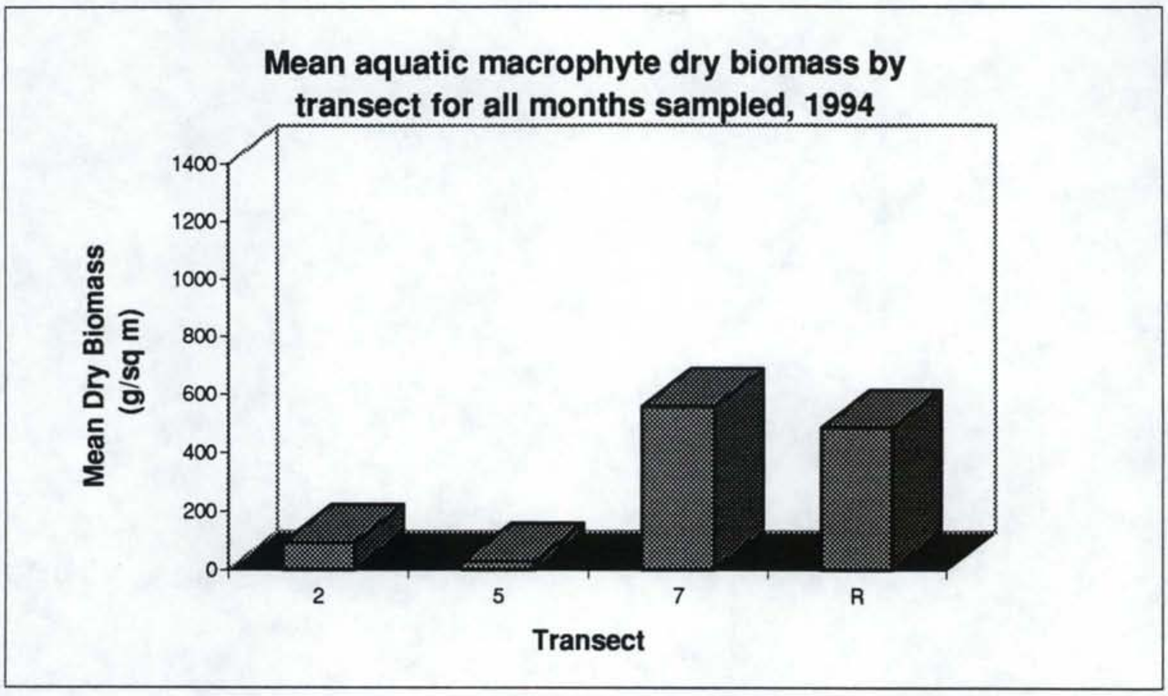
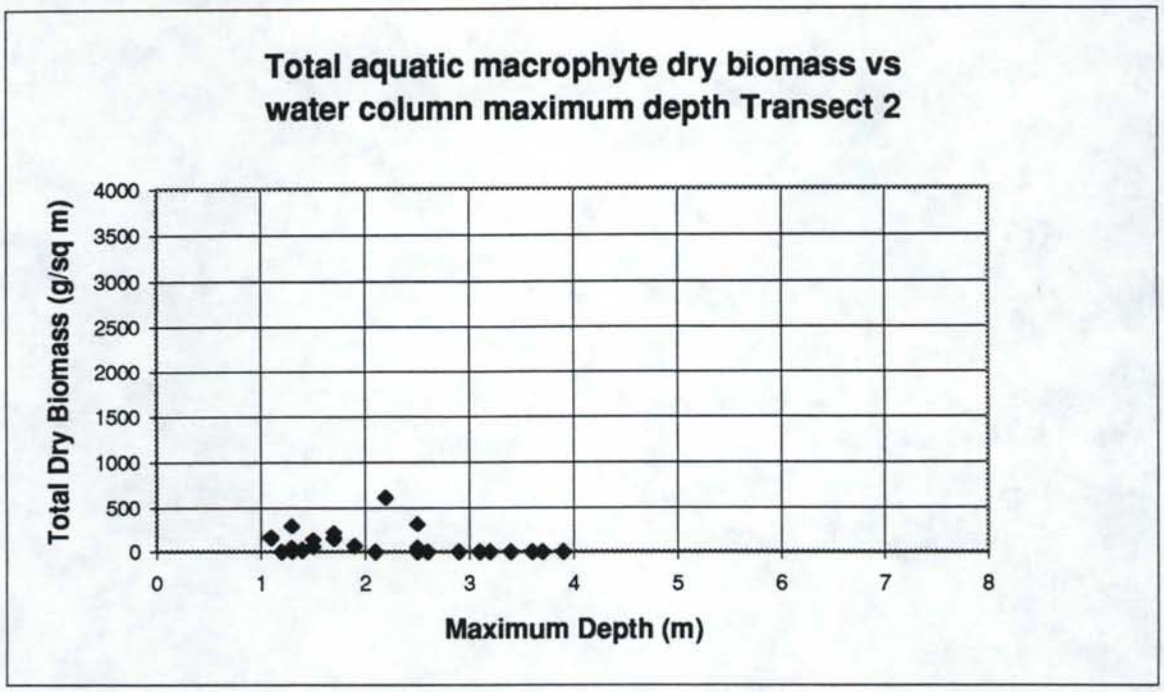


Figure 36 (continued). Mean aquatic macrophyte dry biomass for all transects (2 through R) plotted separately for April, May, June, July, August, October, and November, and for all months combined, Crystal Springs Reach (Rm 599.5-601.3), Middle Snake River, Idaho, 1994.



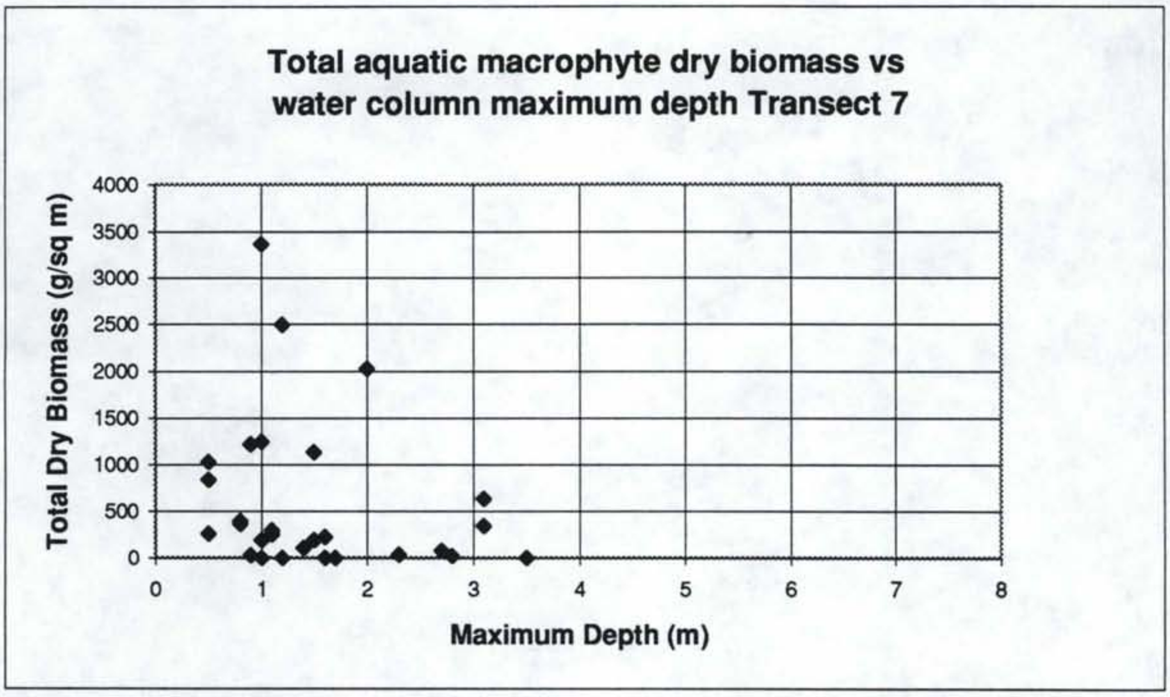
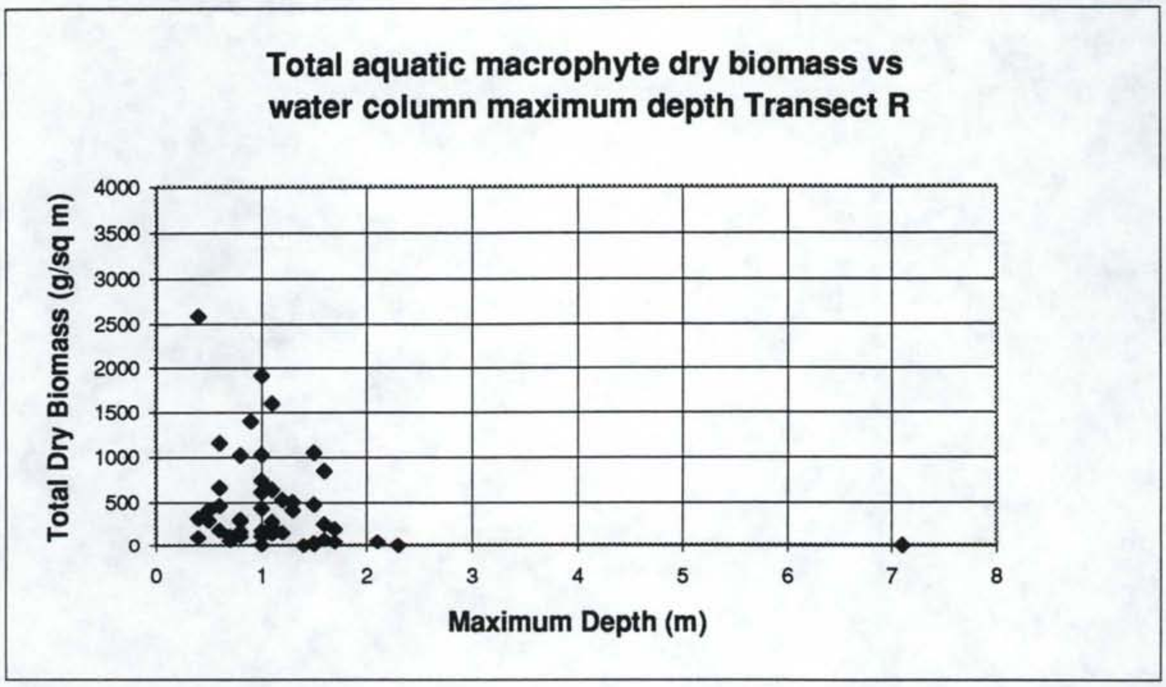


Figure 37. The relationships between total aquatic macrophyte dry biomass and water column maximum depth plotted separately for all transects (2 through R) and for all transects combined Crystal Springs Reach (RM 599.5-601.3), Middle Snake River, Idaho, 1994.



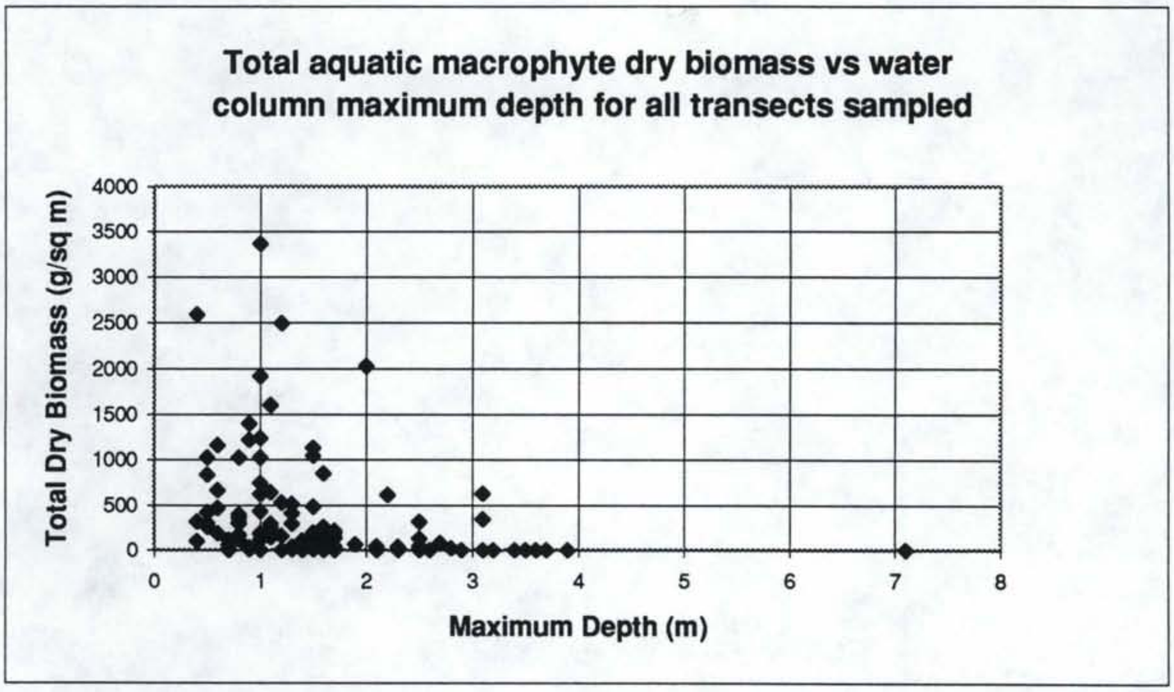
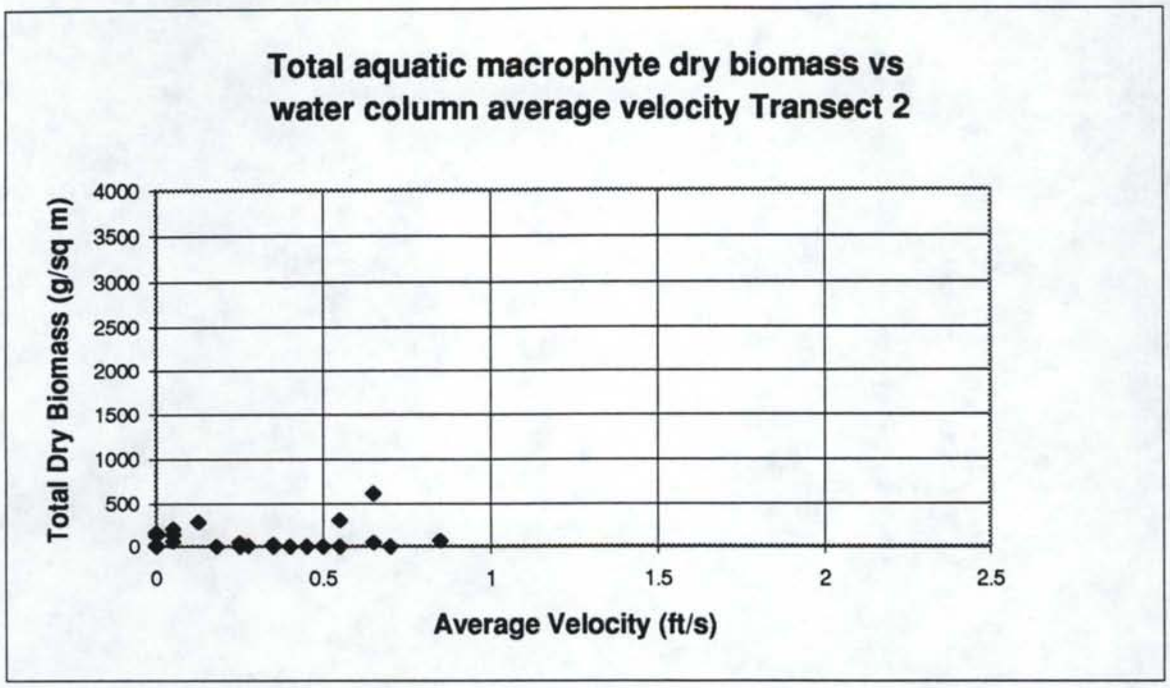


Figure 37 (continued). The relationships between total aquatic macrophyte dry biomass and water column maximum depth plotted separately for all transects (2 through R) and for all transects combined, Crystal Springs Reach (RM 599.5-601.3), Middle Snake River, Idaho, 1994.



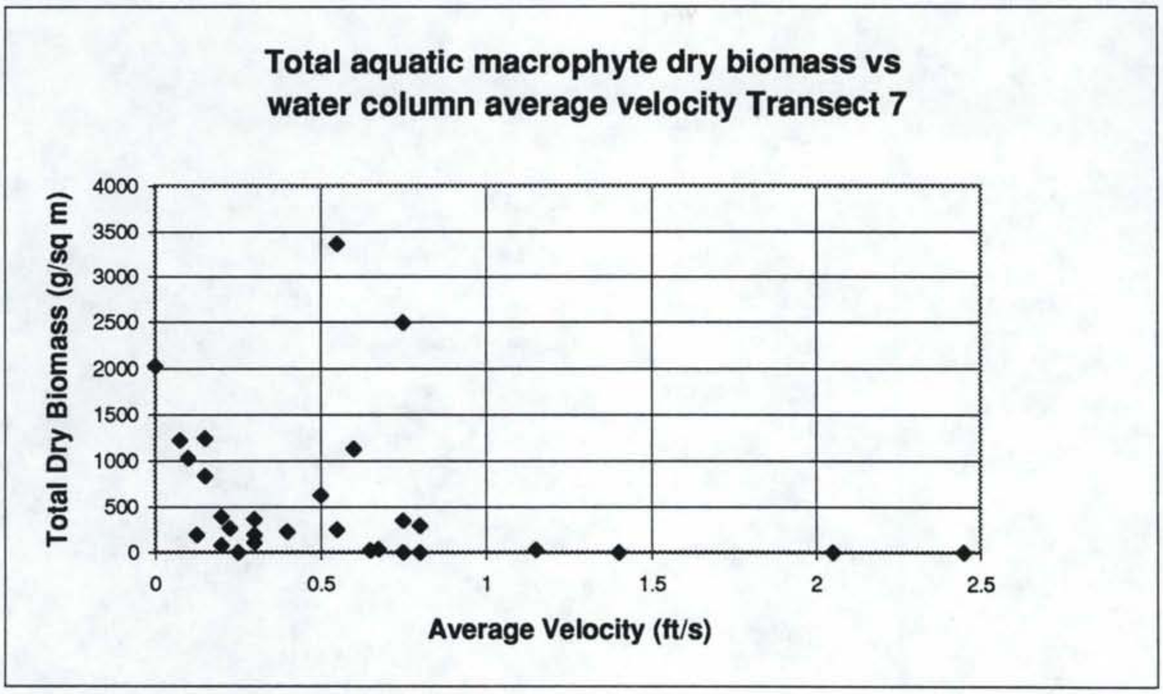
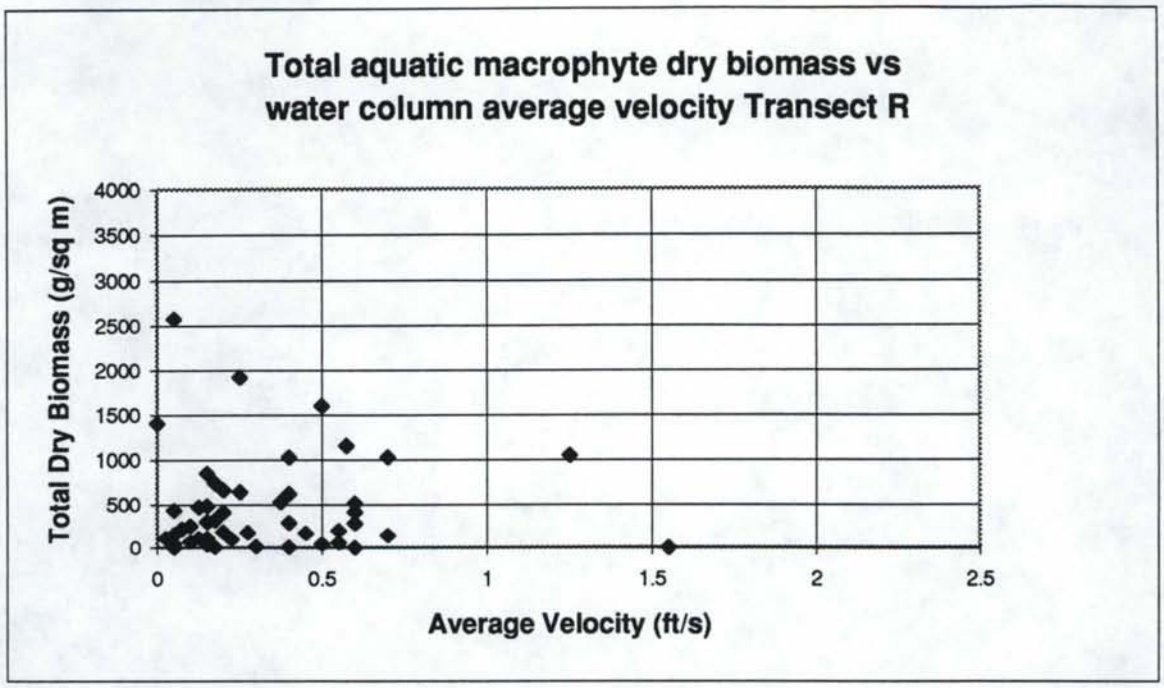


Figure 38. The relationships between total aquatic macrophyte dry biomass and water column average velocity plotted separately for transects (2 through R), and for all transects combined Crystal Springs Reach (RM 599.5-601.3), Middle Snake River, Idaho, 1994.



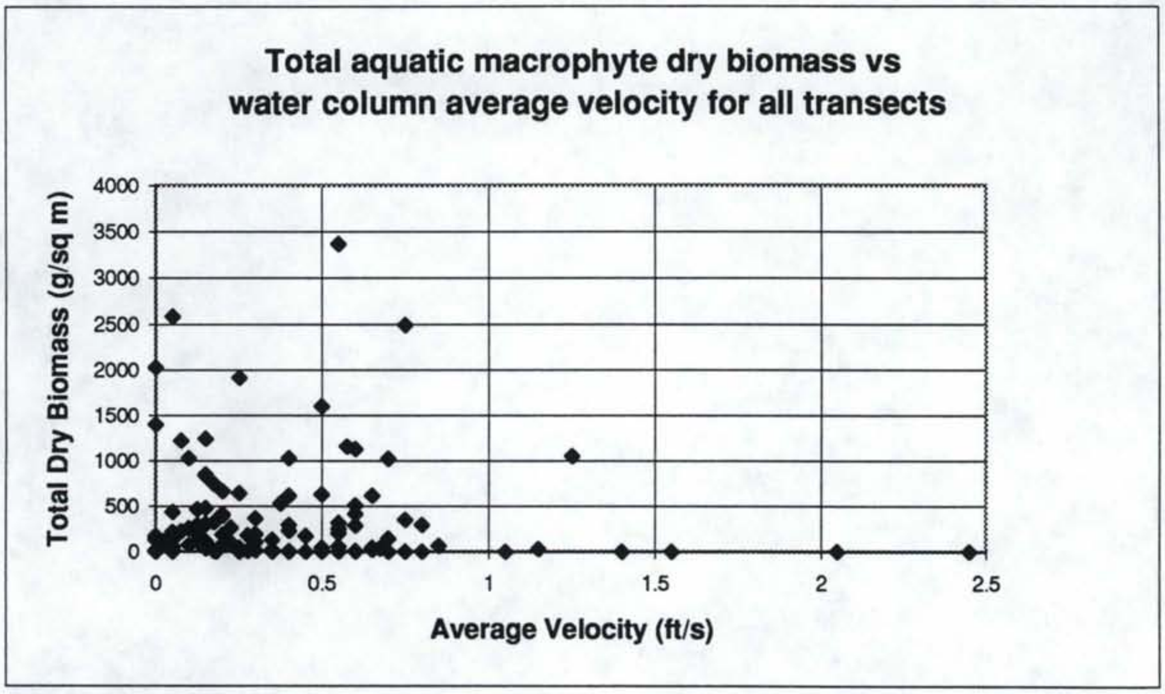
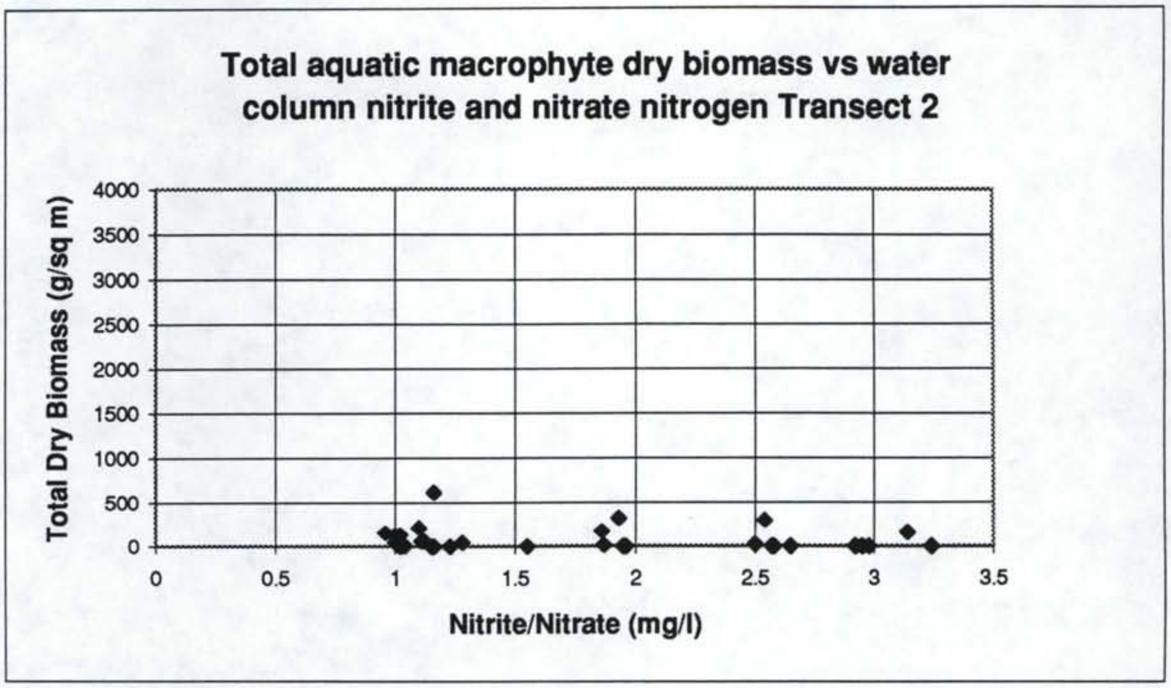


Figure 38 (continued). The relationships between total aquatic macrophyte dry biomass and water column average velocity plotted separately for transects (2 through R) and for all transects combined, Crystal Springs Reach (RM 599.5-601.3), Middle Snake River, Idaho, 1994.



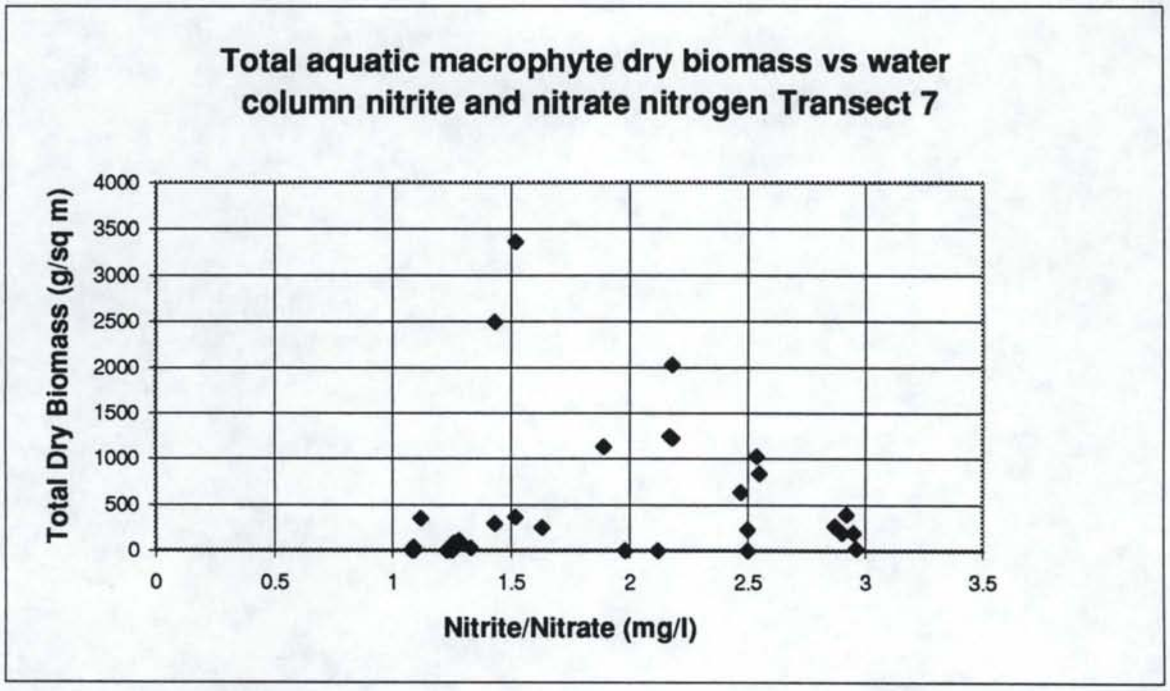
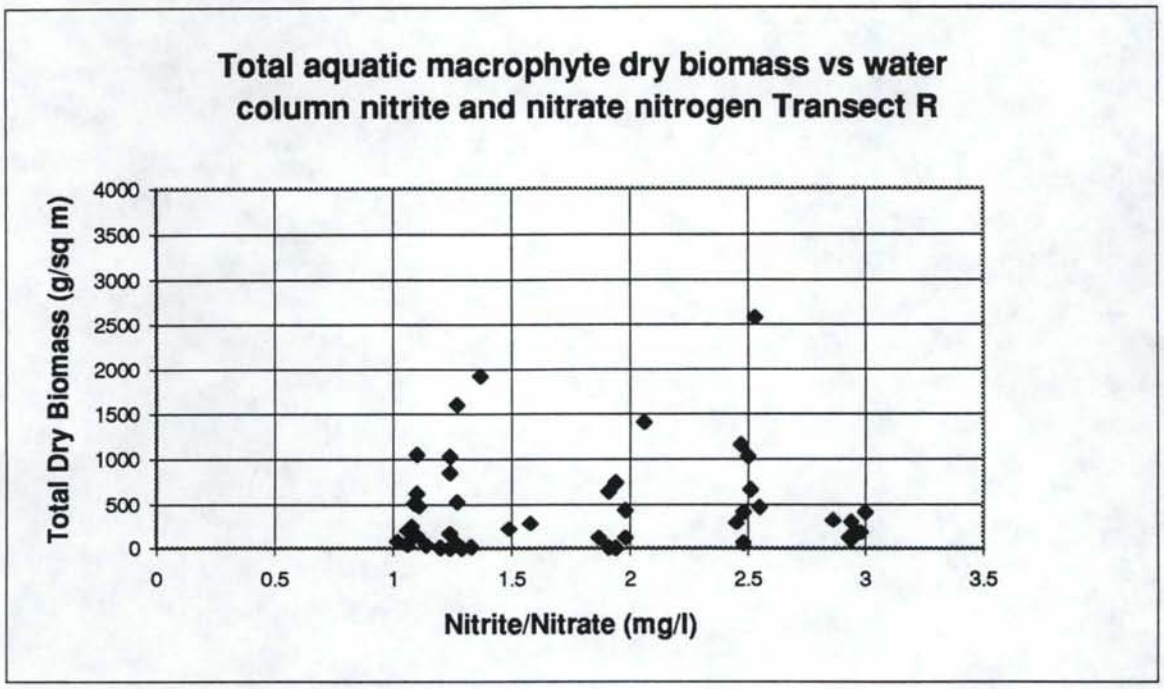


Figure 39. The relationships between total aquatic macrophyte dry biomass and water column nitrite and nitrate nitrogen plotted separately for all transects (2 through R) and for all transects combined, Crystal Springs Reach (RM 599.5-601.3), Middle Snake River, Idaho, 1994.



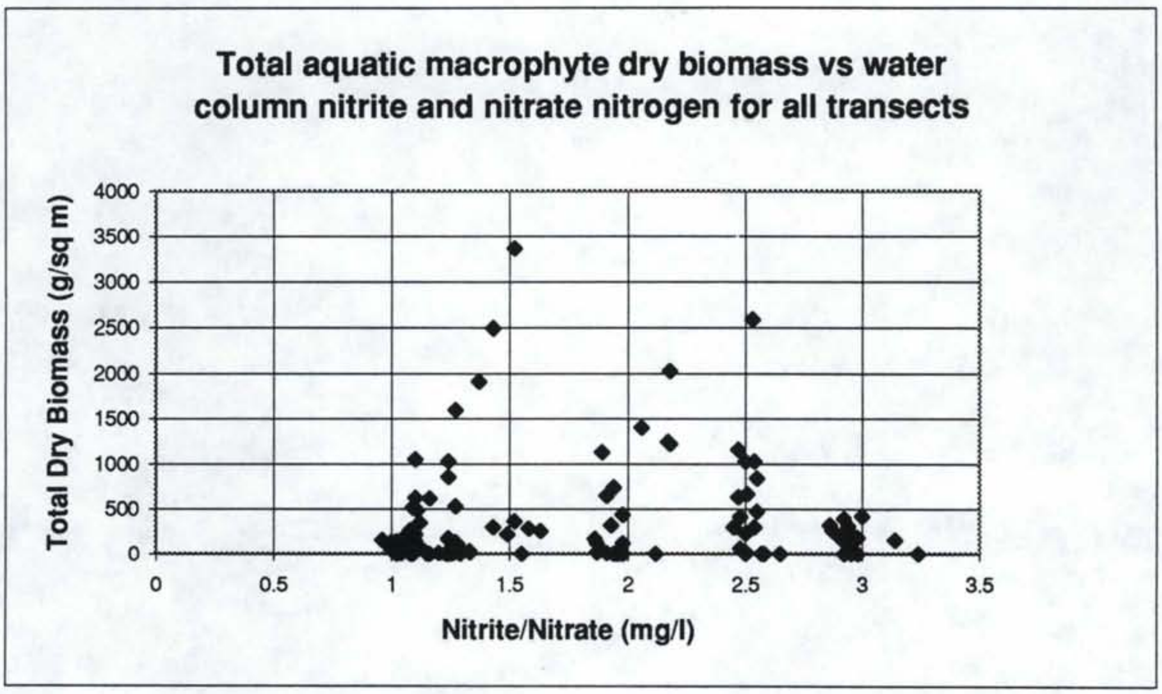
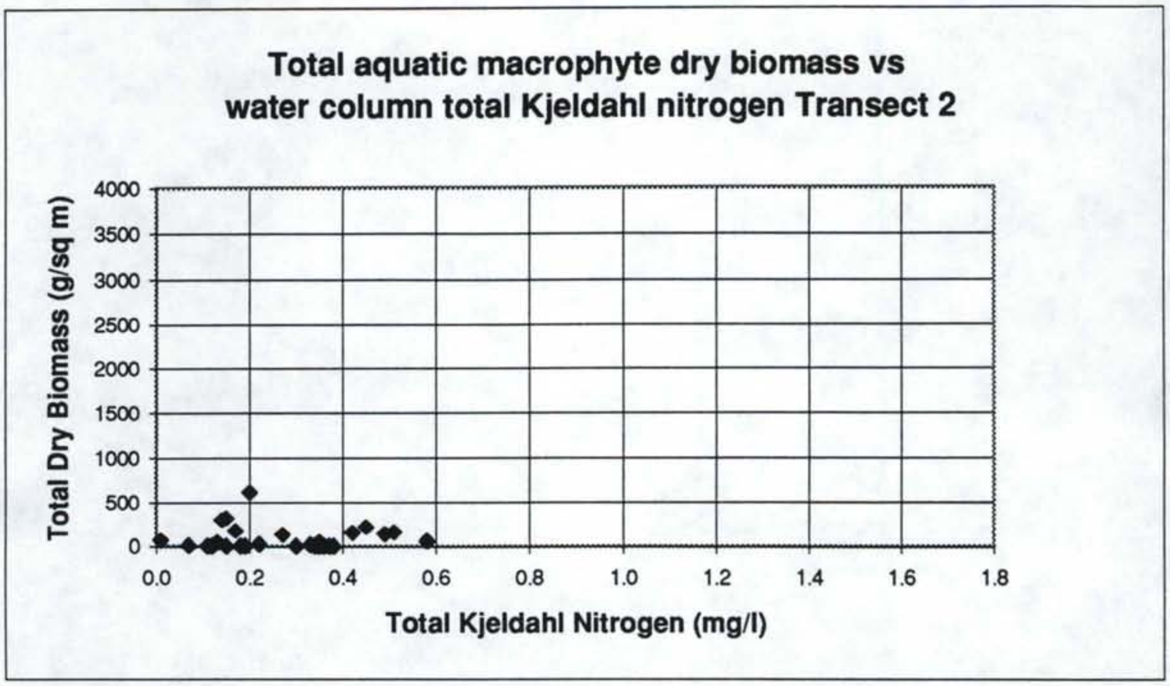


Figure 39 (continued). The relationships between total aquatic macrophyte dry biomass and water column nitrite and nitrate nitrogen plotted separately for all transects (2 through R) and for all transects combined, Crystal Springs Reach (RM 599.5-601.3) Middle Snake River, Idaho, 1994.



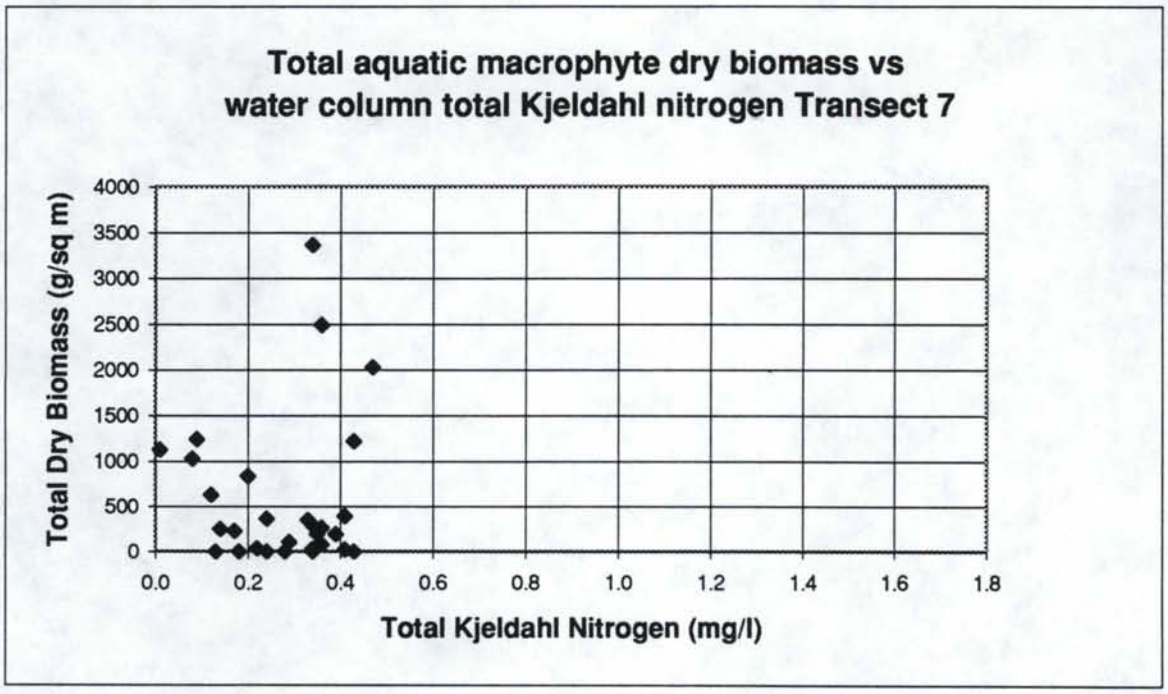
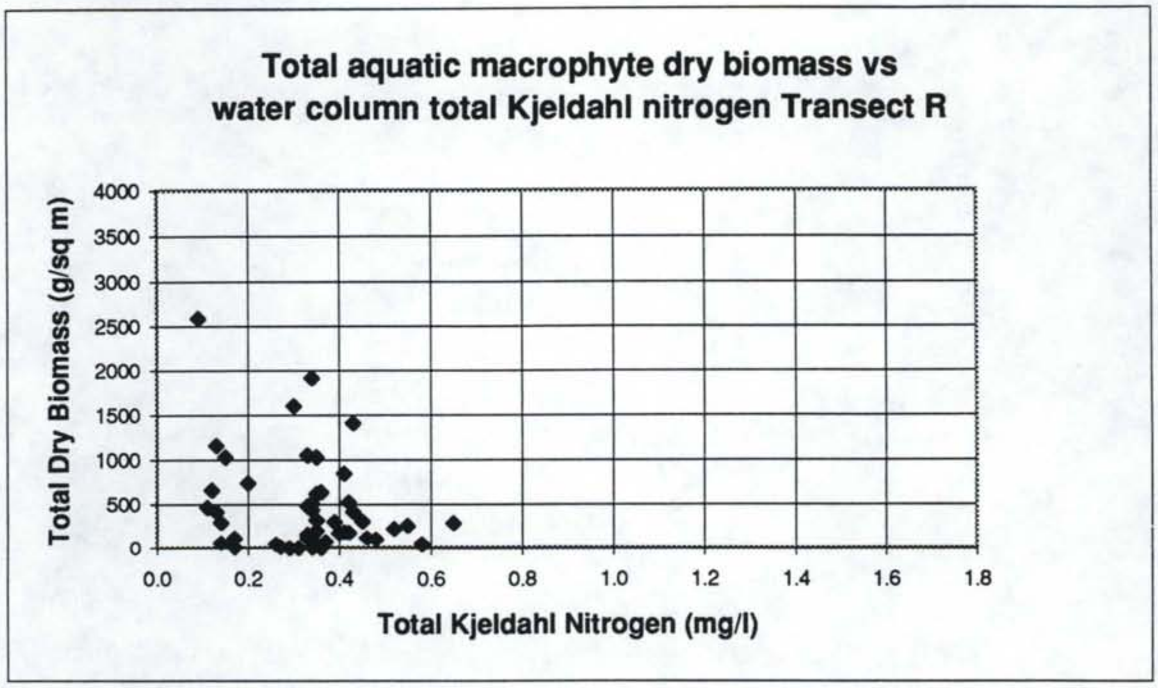


Figure 40. The relationships between total dry biomass and water column total Kjeldahl nitrogen plotted separately for all transects (2 through R) and for all transects combined, Crystal Springs Reach, (RM 599.5-601.3), Middle Snake River, Idaho, 1994.



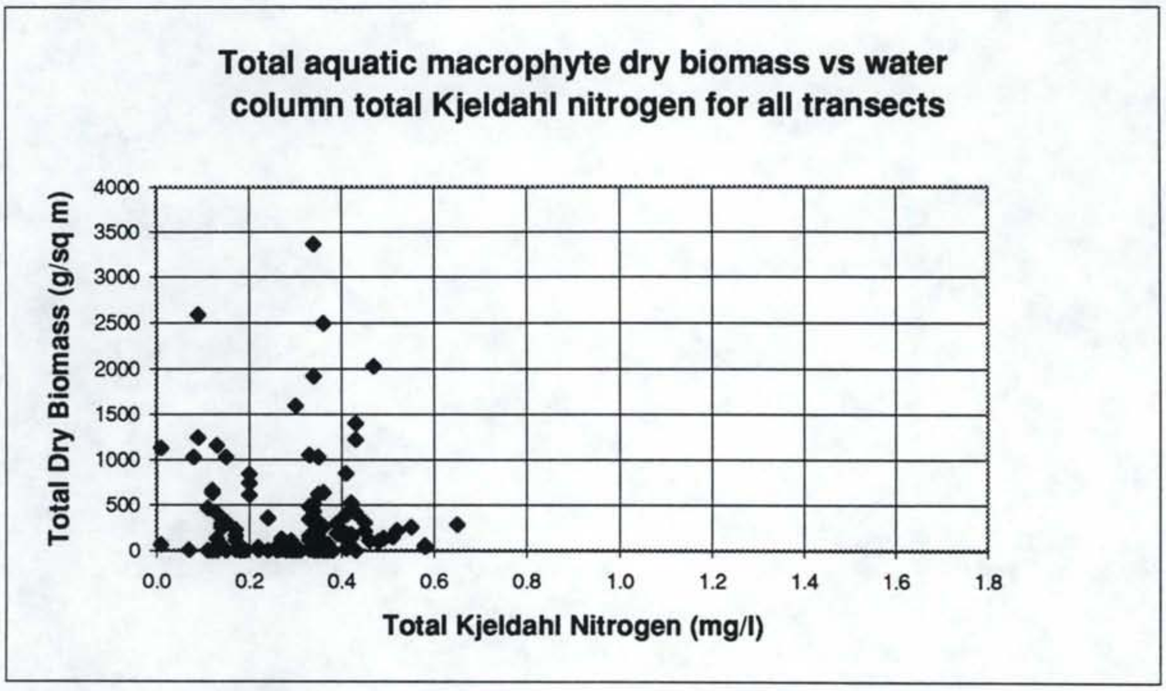
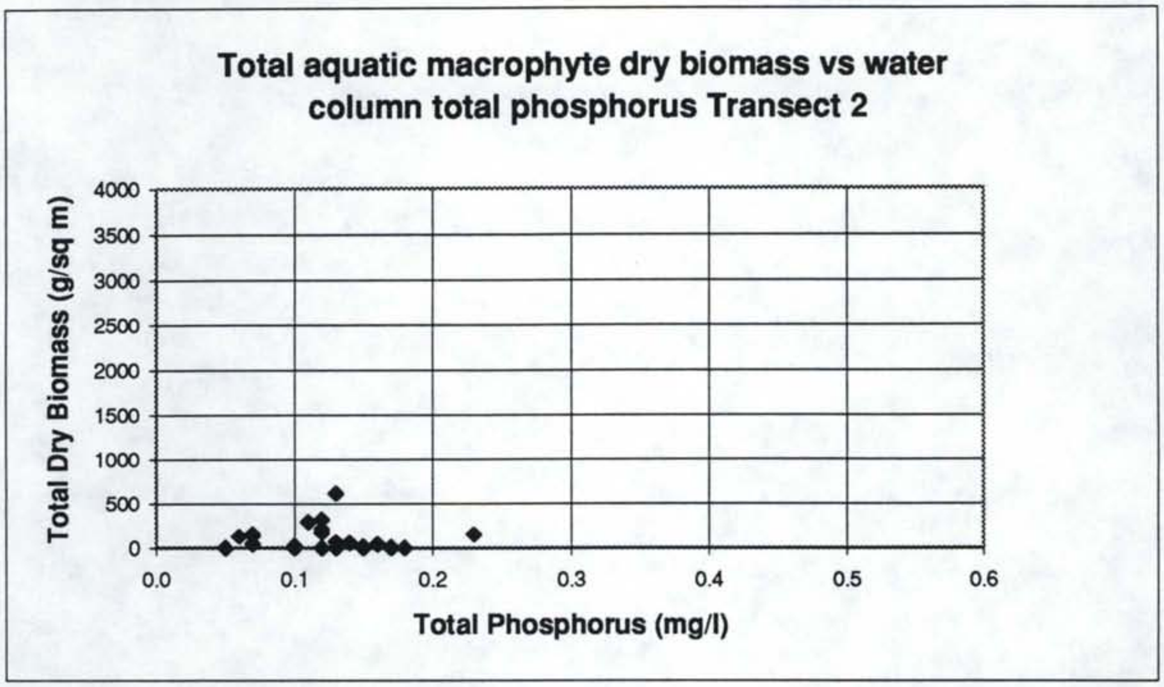


Figure 40 (continued). The relationships between total dry biomass and water column total Kjeldahl nitrogen plotted separately for all transects (2 through R) and for all transects combined, Crystal Springs Reach, (RM 599.5-601.3), Middle Snake River, Idaho, 1994.



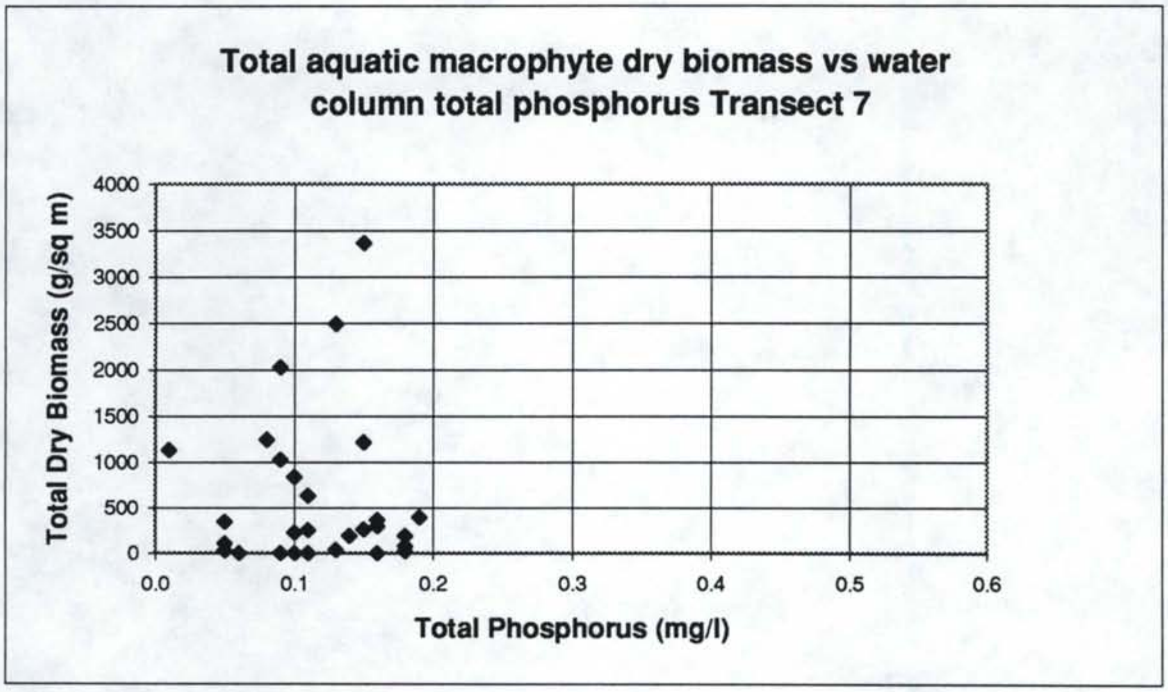
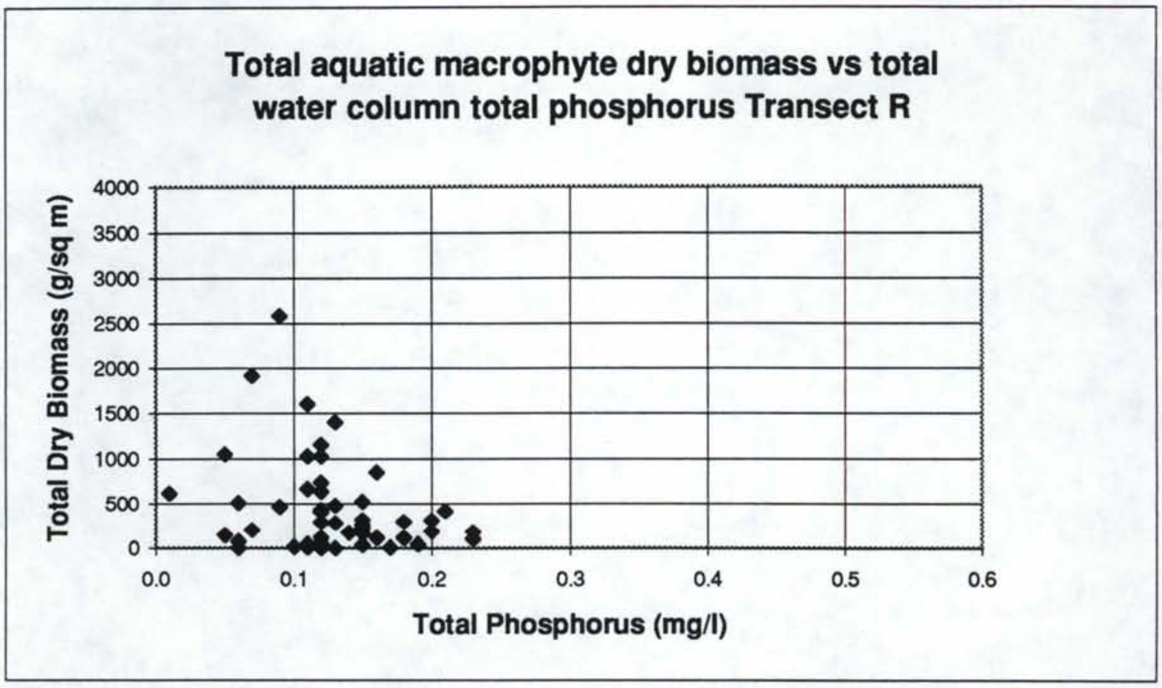


Figure 41. The relationships between total dry biomass and water column total phosphorus plotted separately for all transects (2 through R) and for all transects combined, Crystal Springs Reach (RM 599.5-601.3), Middle Snake River, Idaho, 1994.



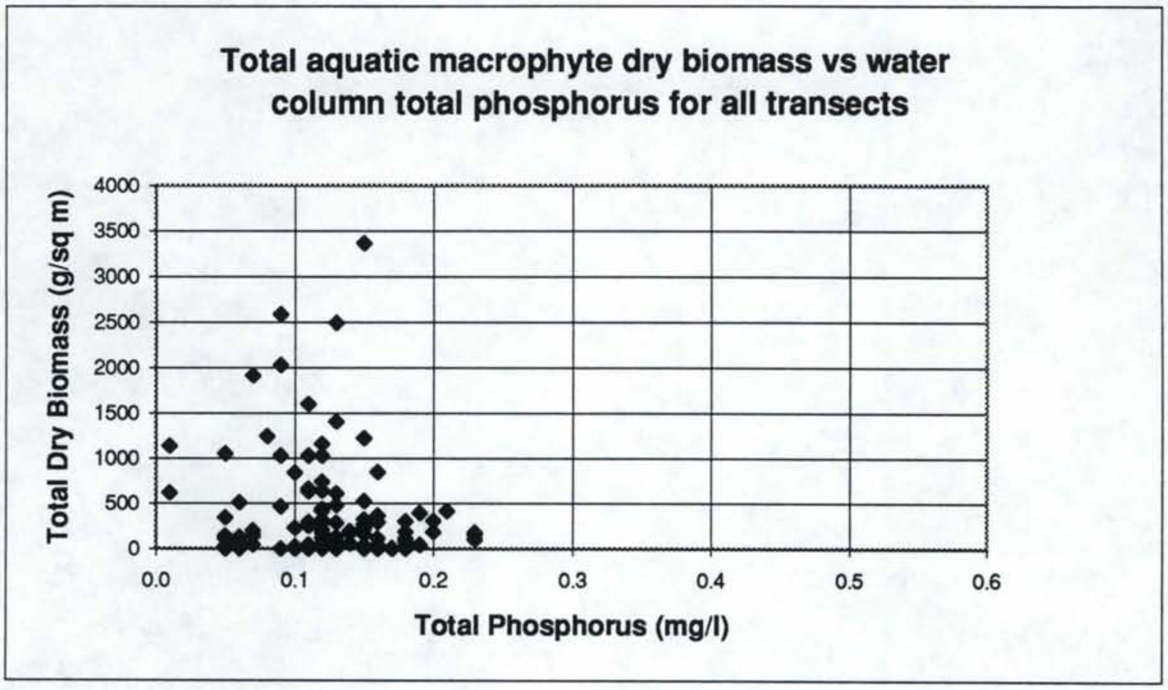
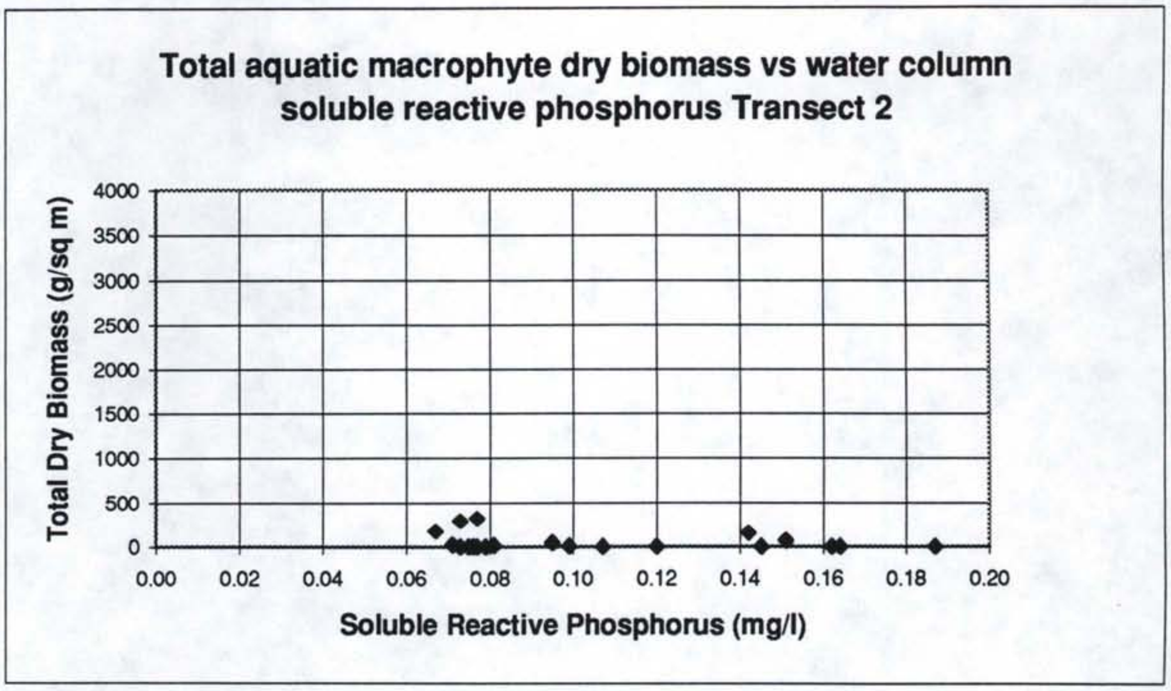


Figure 41 (continued). The relationships between total dry biomass and water column total phosphorus plotted separately for all transects (2 through R) and for all transects combined Crystal Springs Reach (RM 599.5-601.3), Middle Snake River, Idaho, 1994.



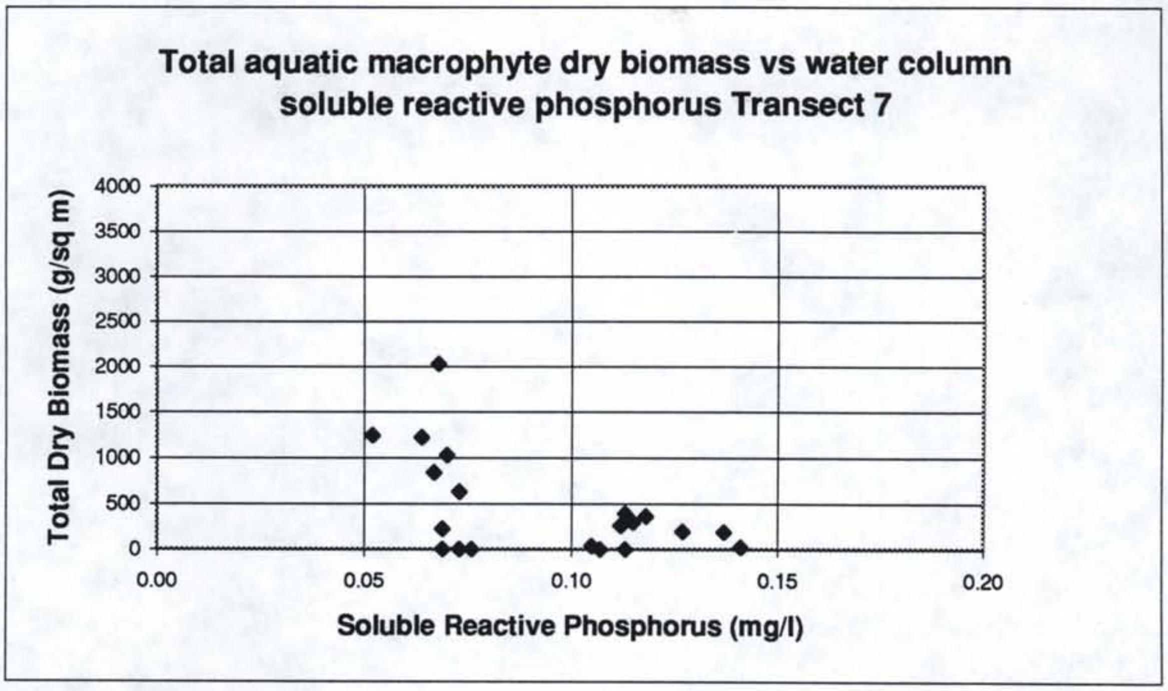
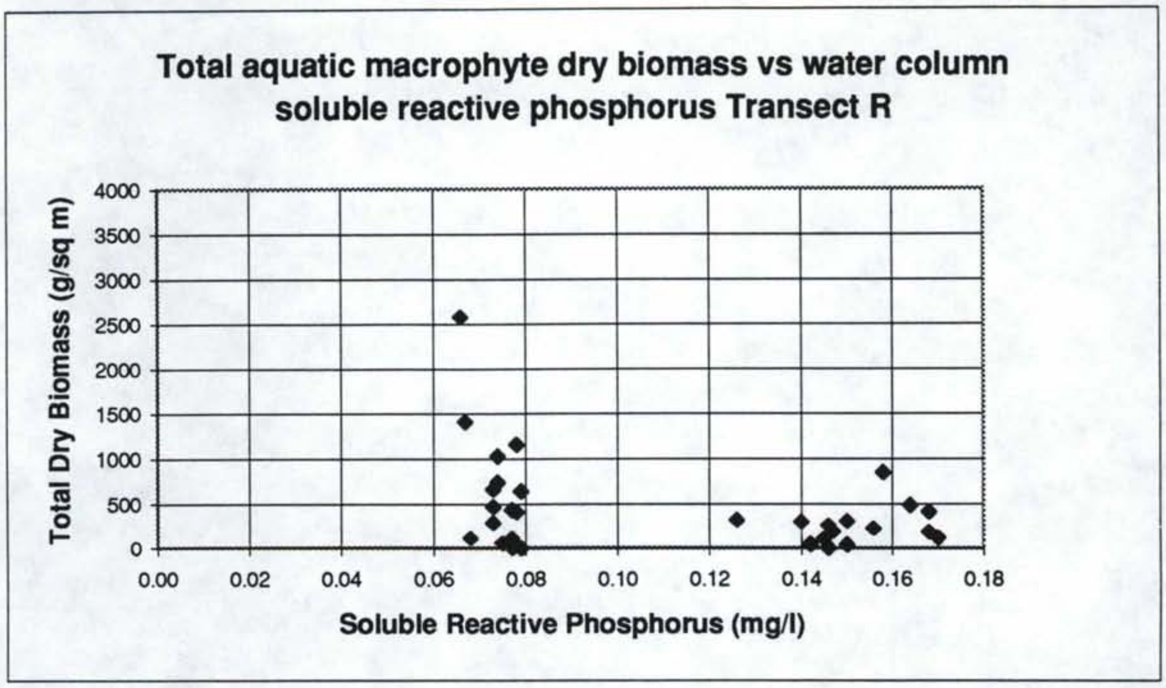


Figure 42. The relationships between total dry biomass and water colum soluble reactive phosphorus plotted separately for all transects (2 through R) and for all transects combined, Crystal Springs Reach (RM 599.5-601.3), Middle Snake River, Idaho, 1994.



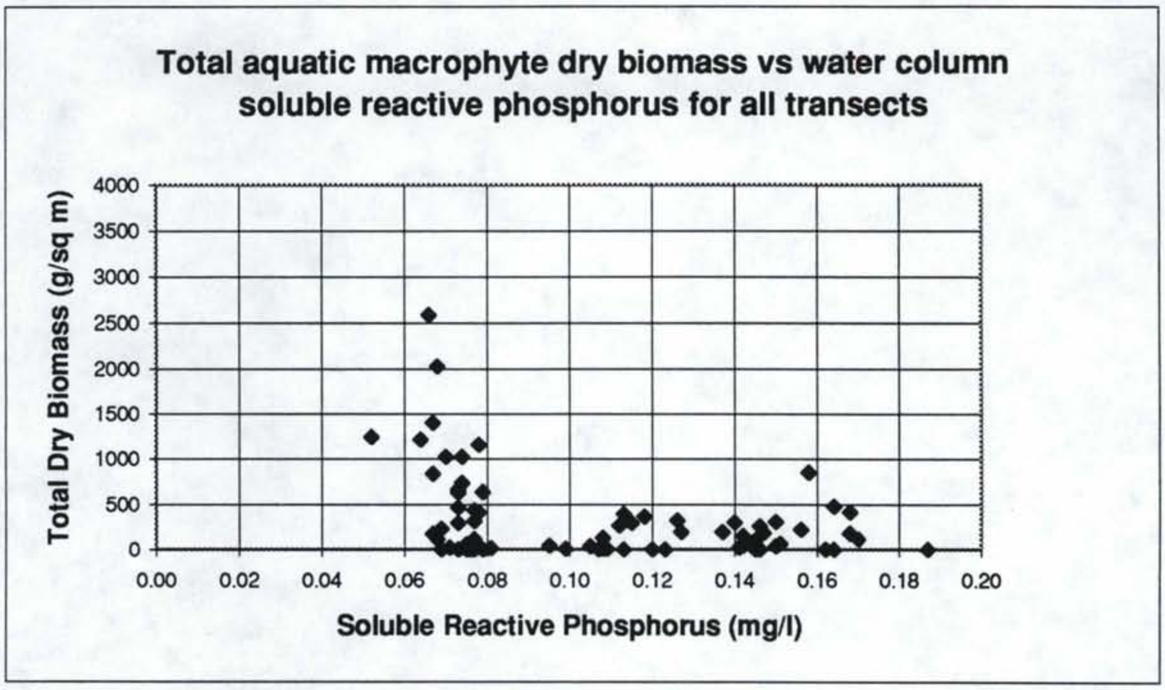
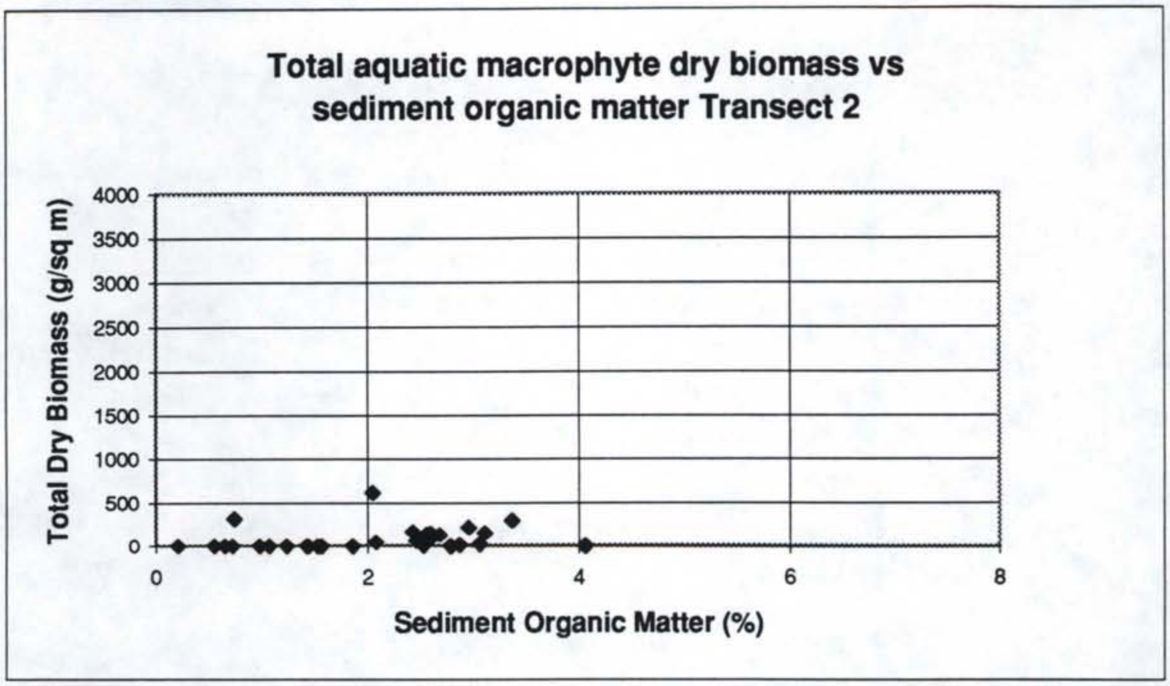


Figure 42 (continued). The relationships between total dry biomass and water column soluble reactive phosphorus plotted separately for all transects (2 through R) and for all transects combined, Crystal Springs Reach (RM 599.5-601.3), Middle Snake River, Idaho, 1994.



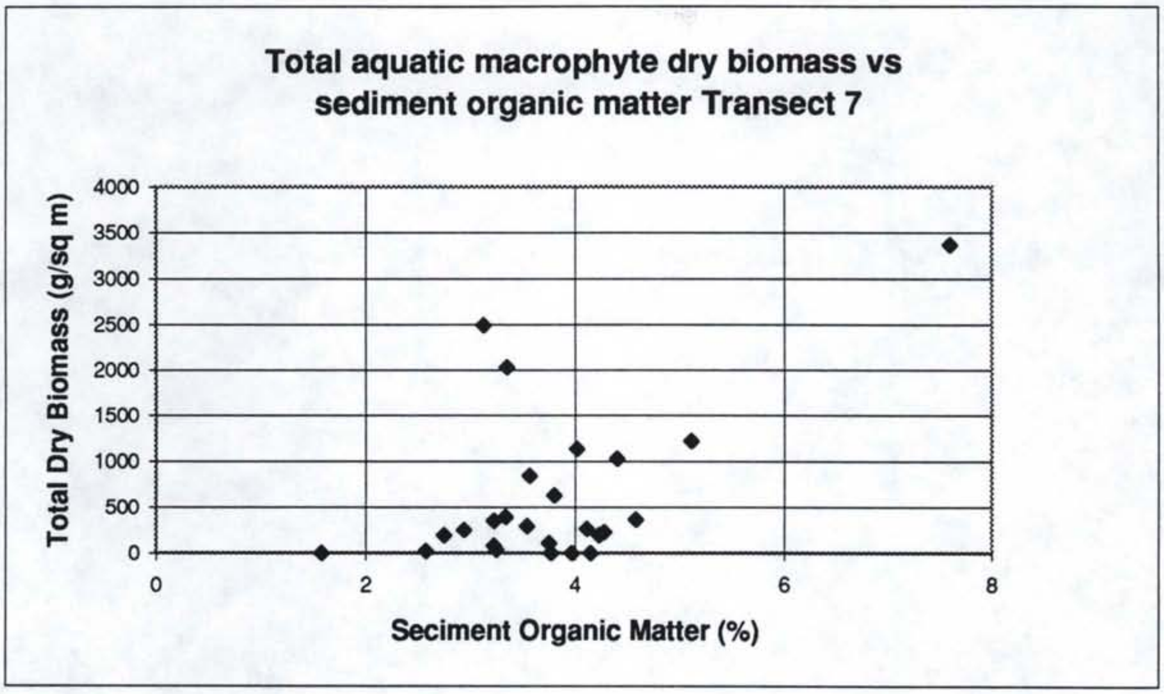
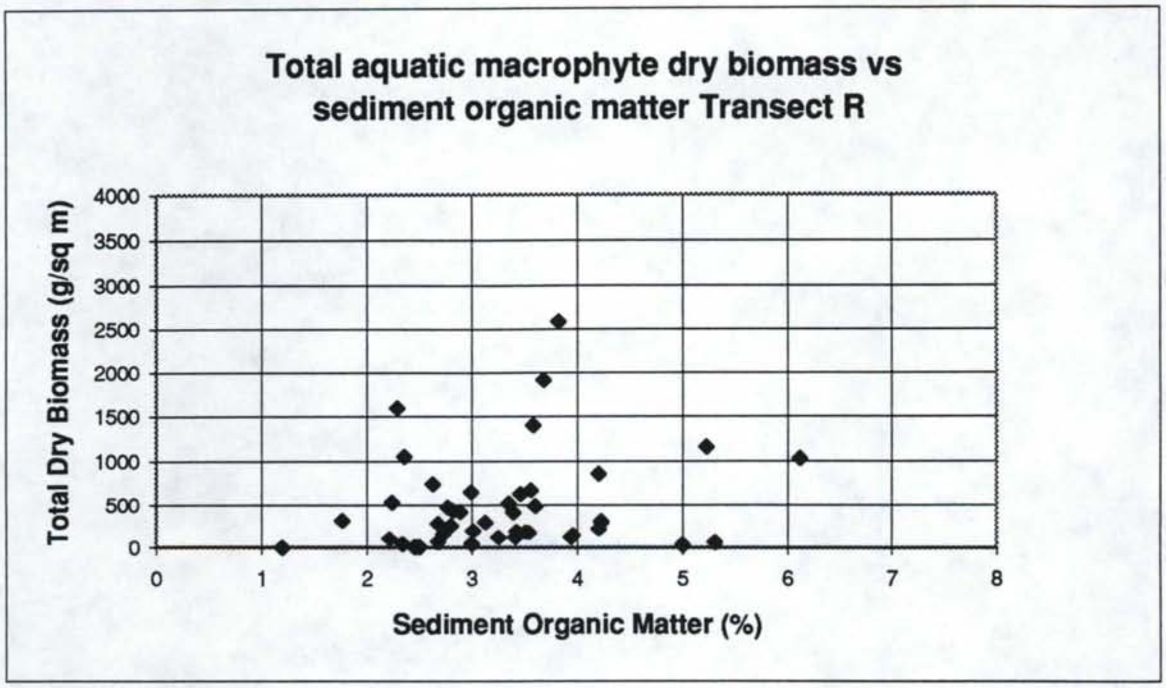


Figure 43. The relationship between total aquatic macrophyte dry biomass and sediment organic matter plotted separately for each transect (2 through R) and for all transects combined Crystal Springs Reach (RM 599.5-601.3), Middle Snake River, Idaho, 1994.



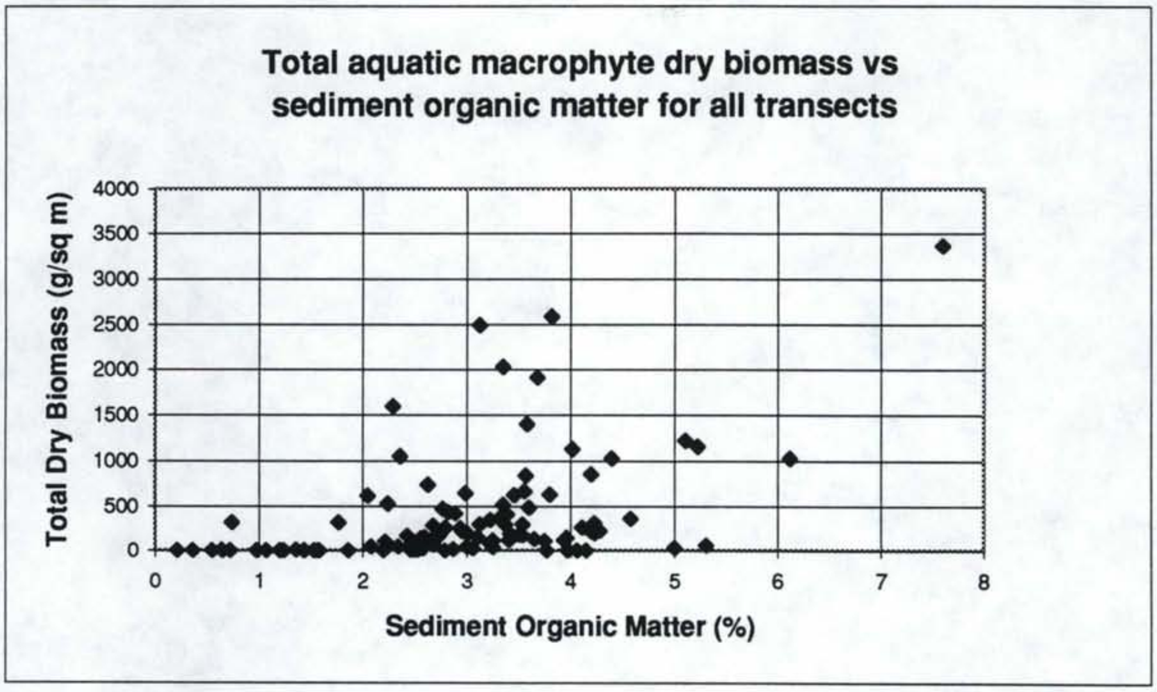
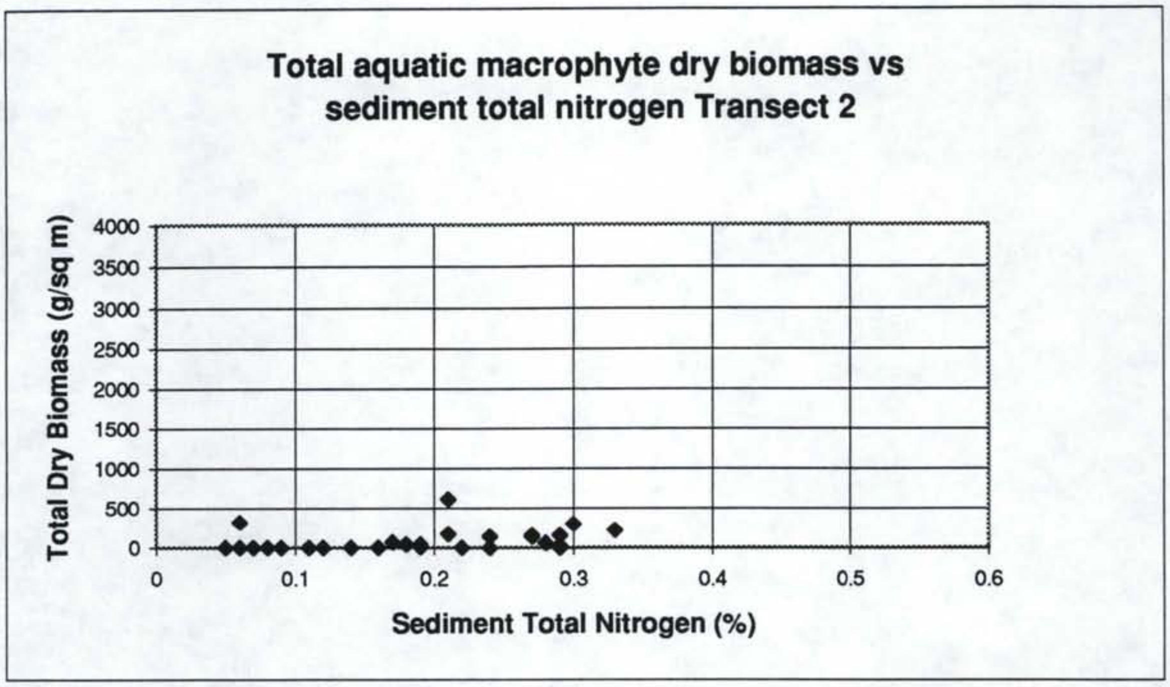


Figure 43 (continued). The relationship between total aquatic macrophyte dry biomass and sediment organic matter plotted separately for each transect (2 through R) and for all transects combined, Crystal Springs Reach (RM 599.5-601.3), Middle Snake River, Idaho, 1994.



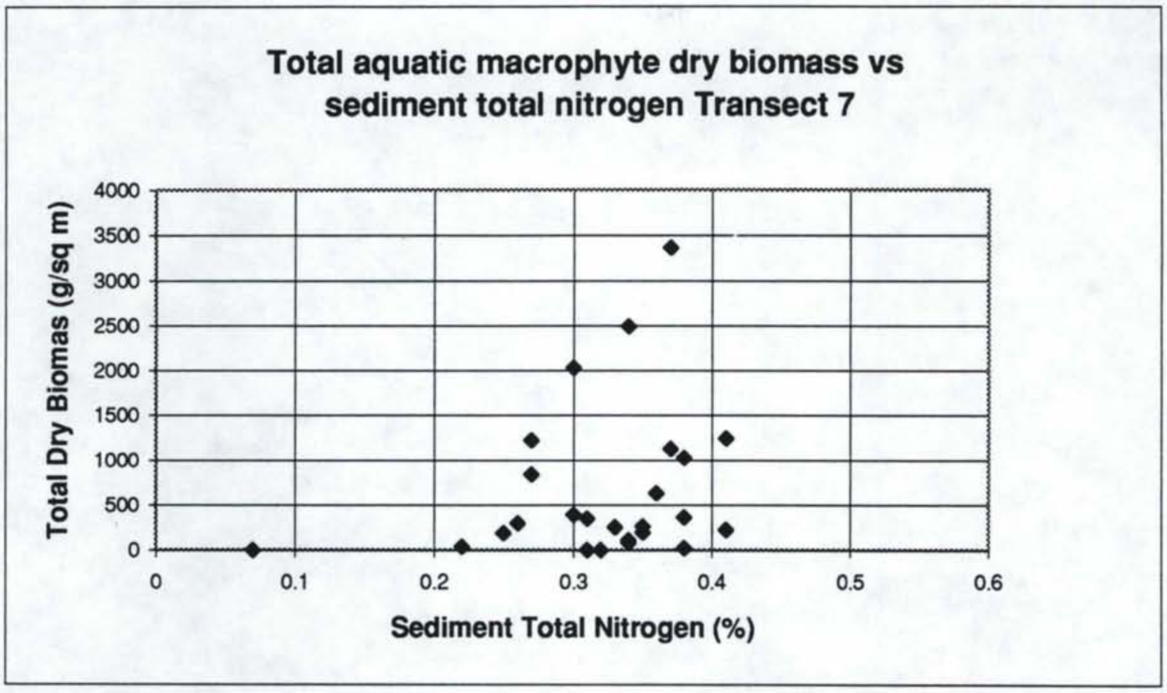
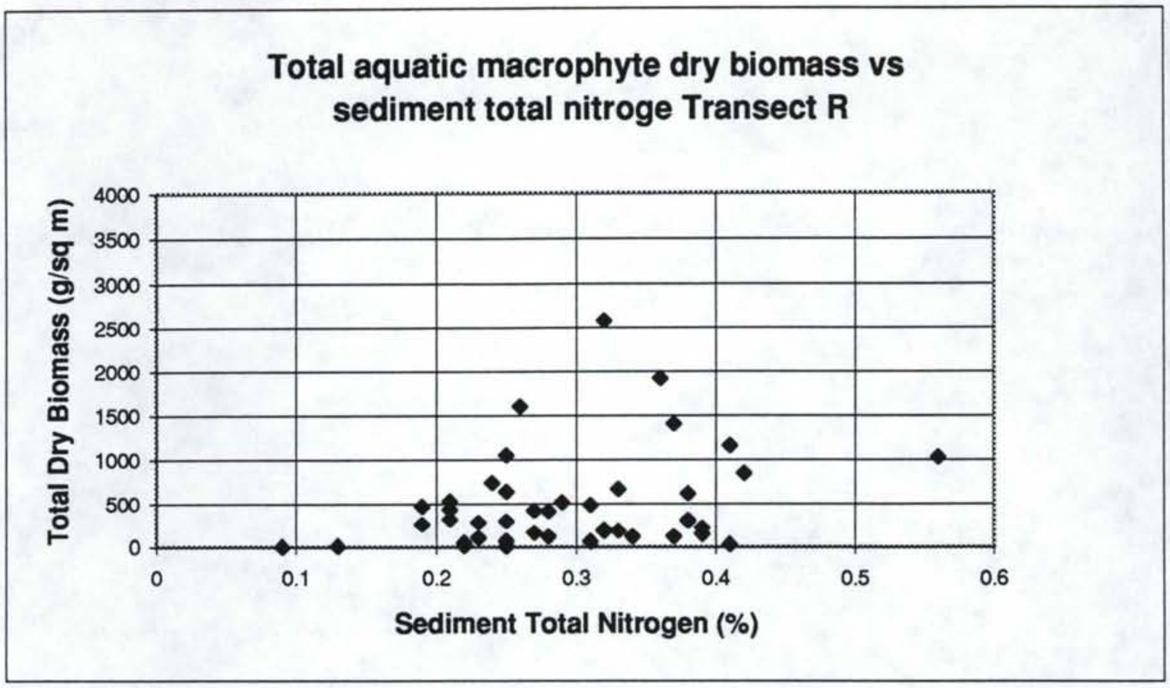


Figure 44. The relationship between total aquatic macrophyte dry biomass and sediment total nitrogen plotted separately for all transects (2 through R) and for all transects combined Crystal Springs Reach (RM 599.5-601.3) Middle Snake River, Idaho, 1994.



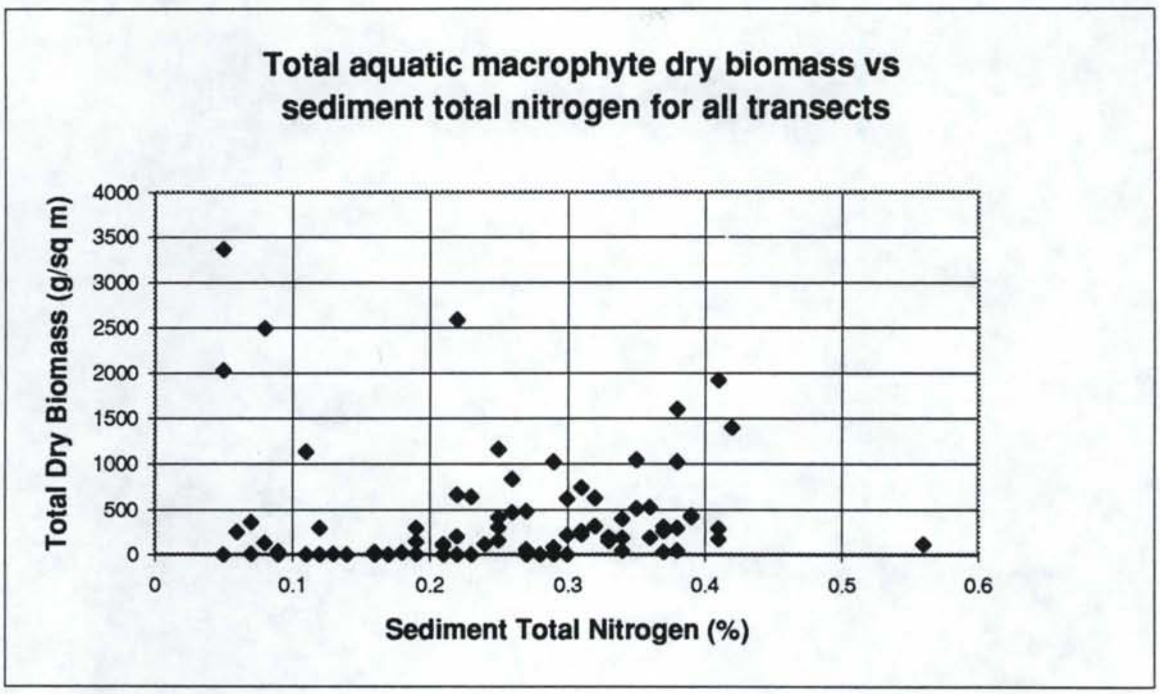
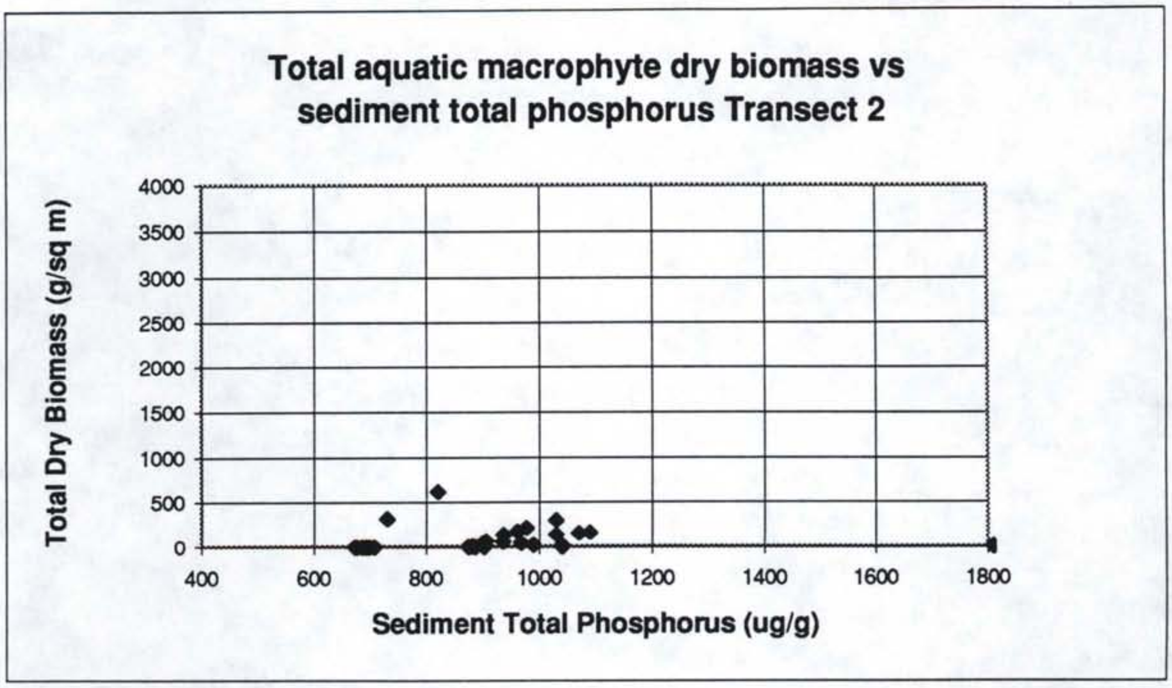


Figure 44 (continued). The relationship between total aquatic macrophyte dry biomass and sediment total nitrogen plotted separately for all transects (2 through R), and for all transects combined, Crystal Springs Reach (RM 599.5-601.3), Middle Snake River, Idaho, 1994.



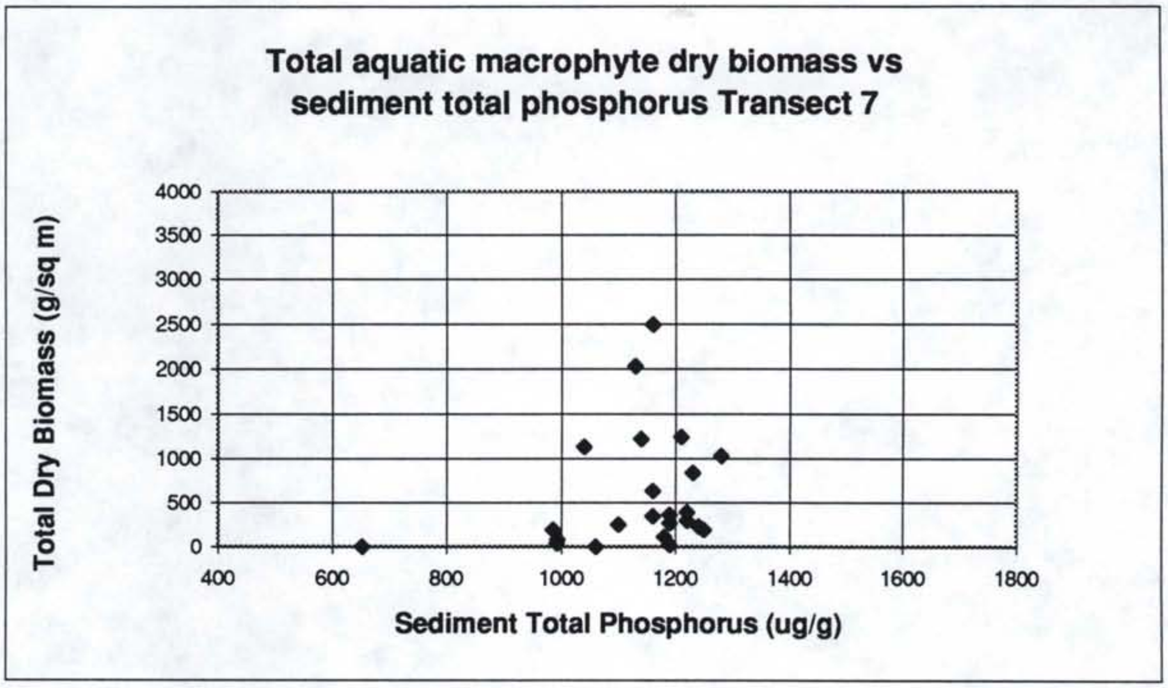
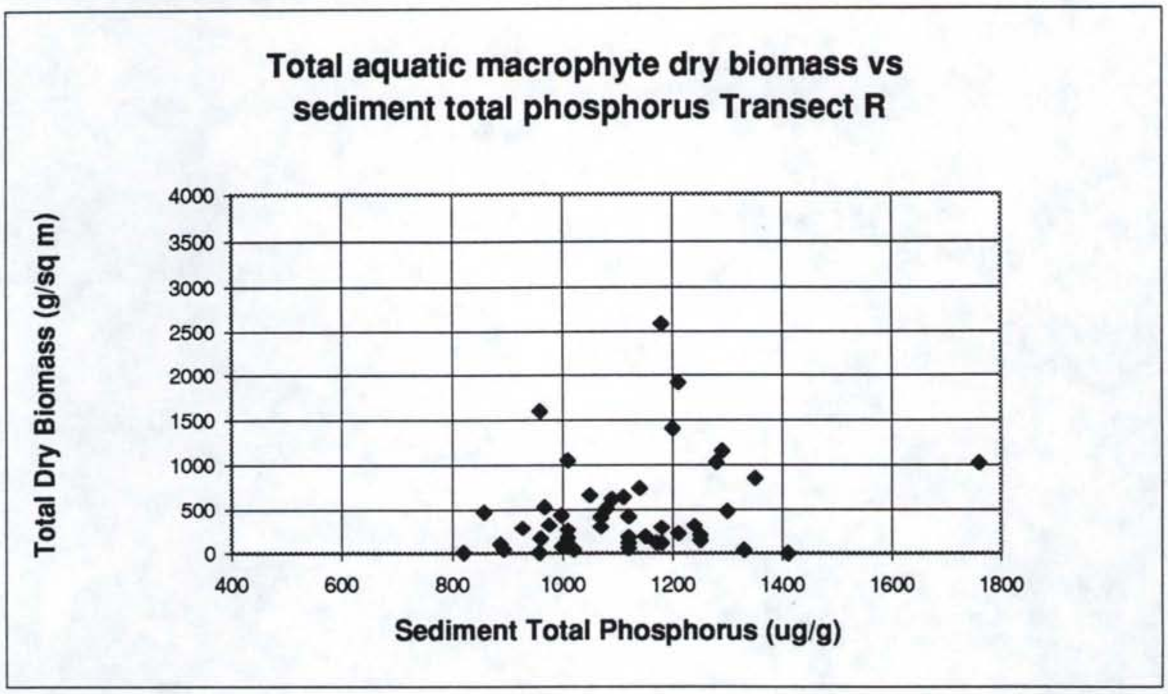


Figure 45. The relationship between total aquatic macrophyte dry biomass and sediment total phosphorus plotted separately for all transects (2 through R), and for all transects combined, Crystal Springs Reach (RM 599.5-601.3), Middle Snake River, Idaho, 1994.



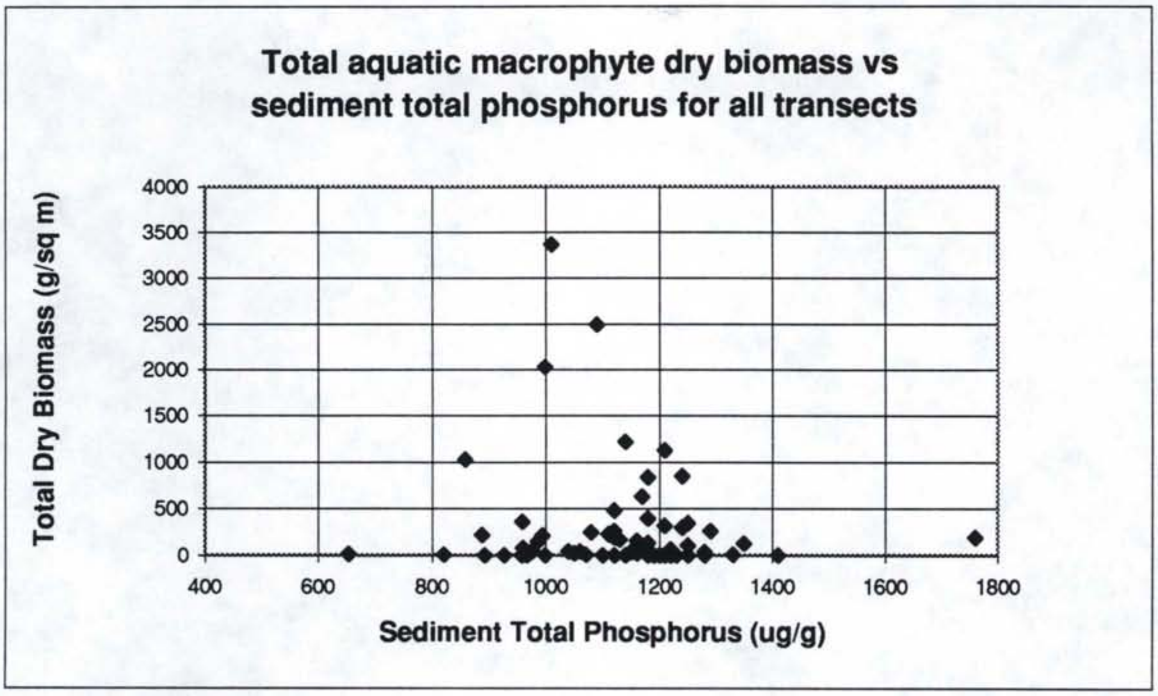
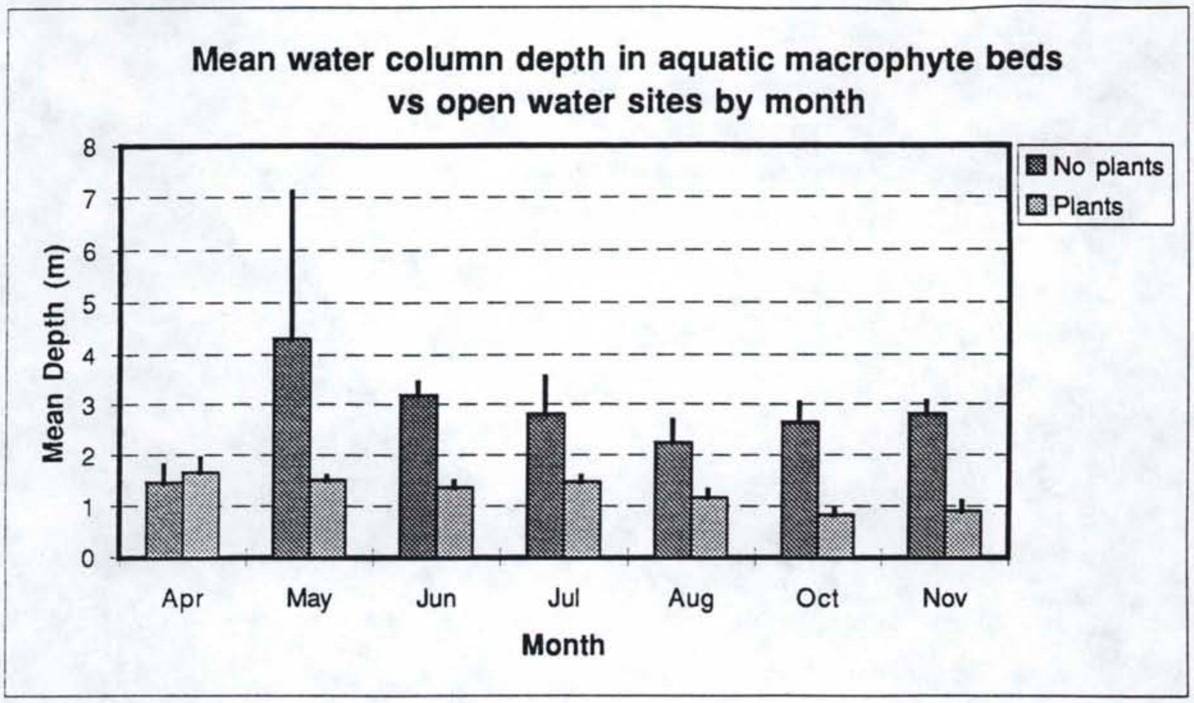


Figure 45 (continued). The relationship between total aquatic macrophyte dry biomass and sediment total phosphorus plottd separately for all transects (2 through R), and for all transects combined, Crystal Springs Reach (RM 599.5-601.3), Middle Snake River, Idaho, 1994.



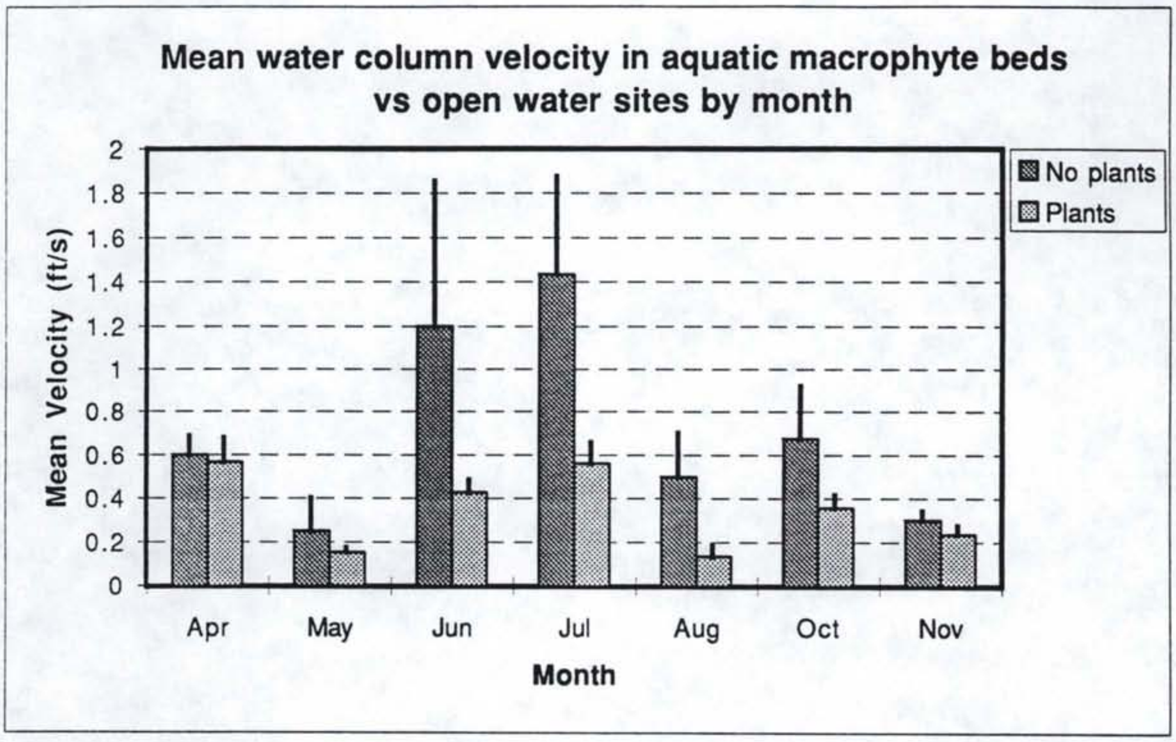
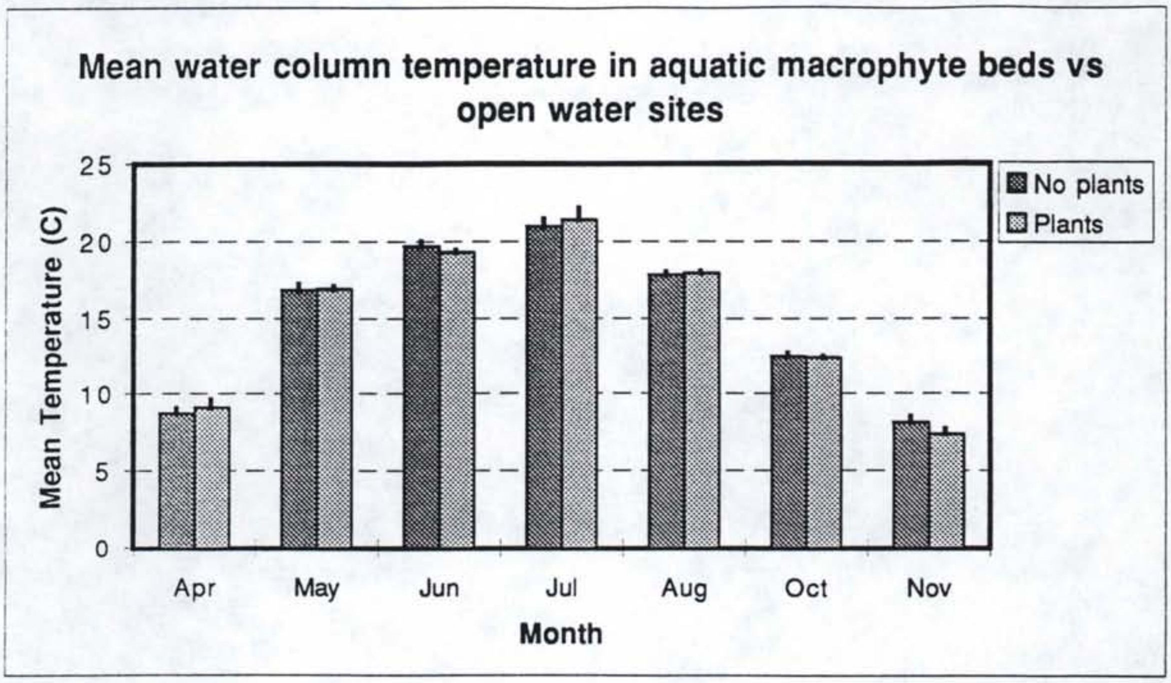


Figure 46. Mean water column depth and velocity with standard errors plotted by month for sites located in aquatic macrophyte beds and open water sites, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.



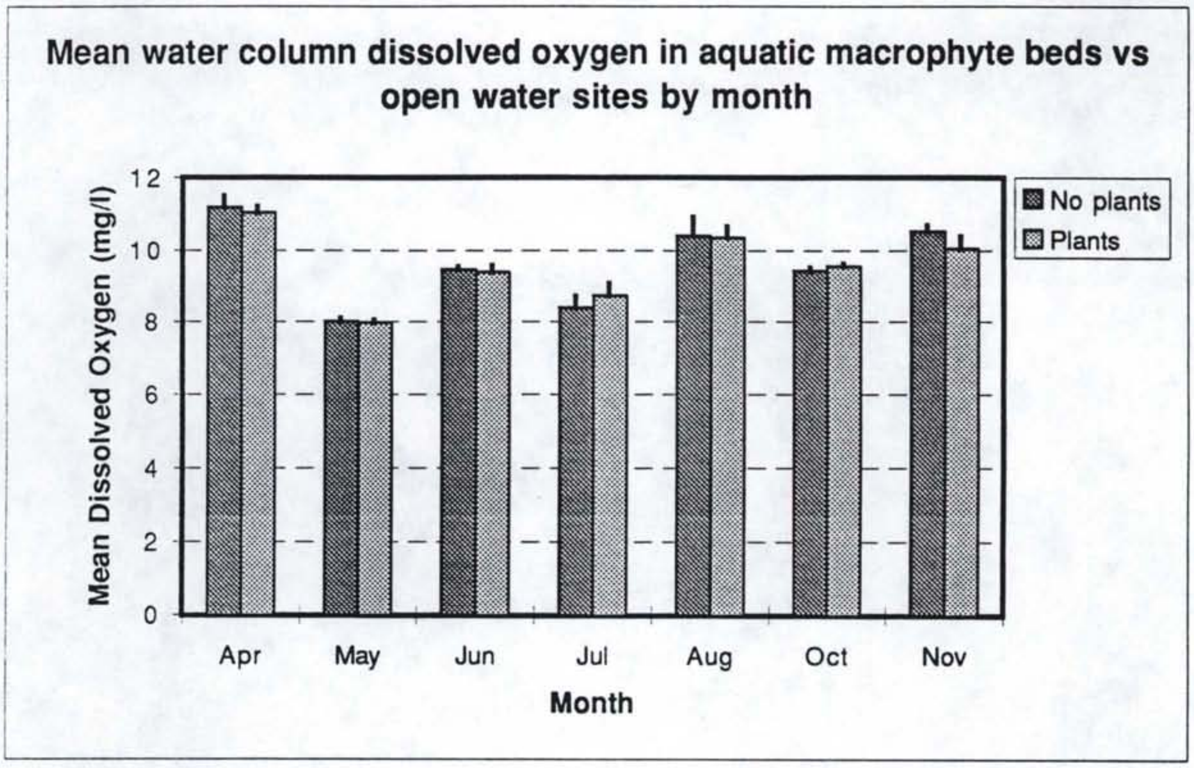
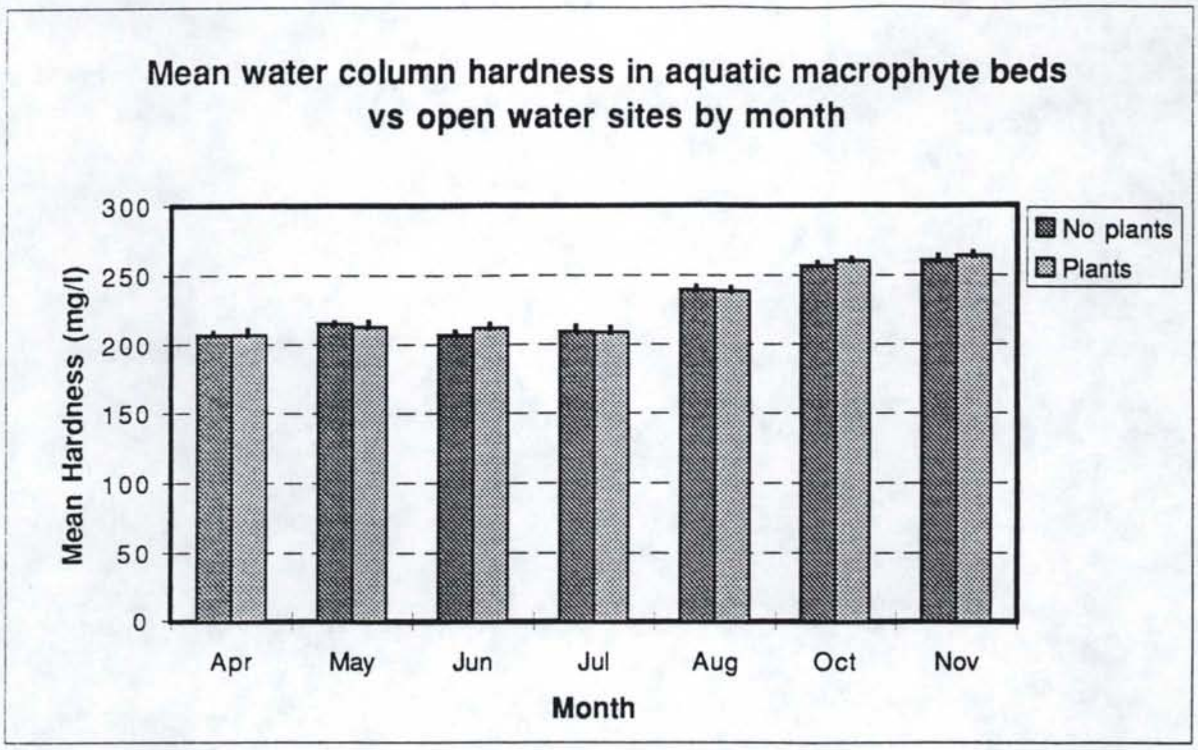


Figure 47. Mean water column temperature and mean dissolved oxygen with standard errors plotted by month for sites located in aquatic macrophyte beds and open water sites, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.



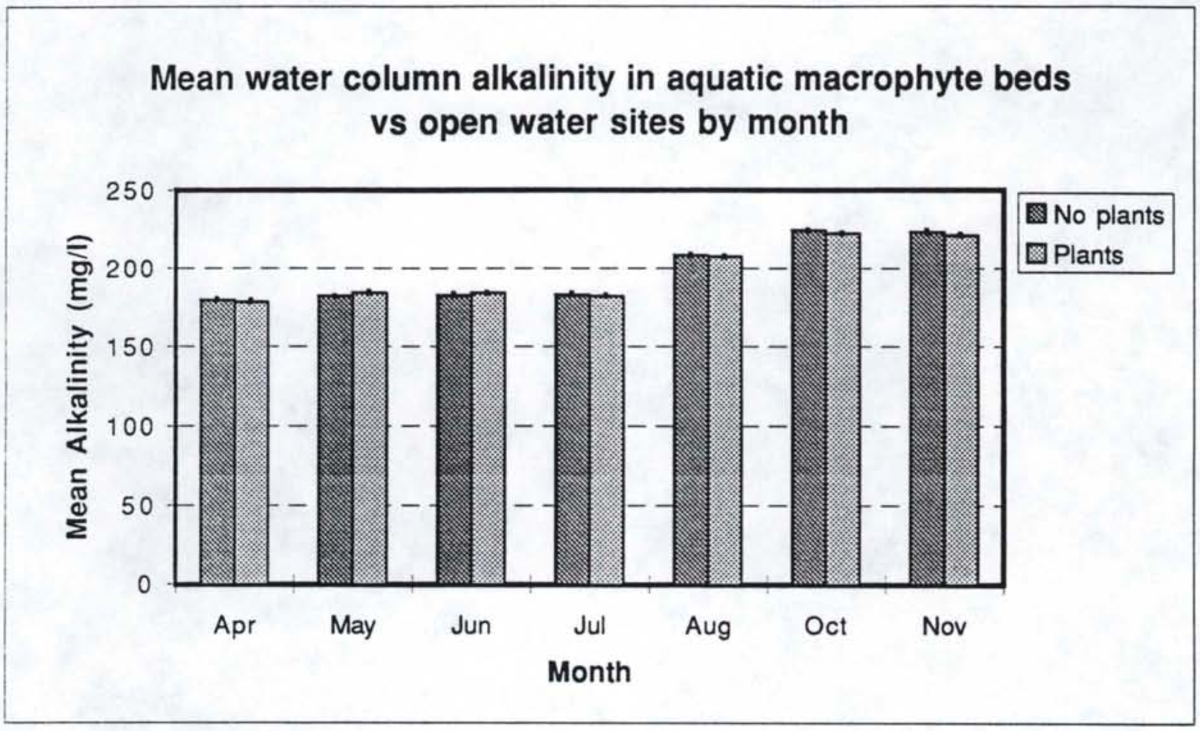
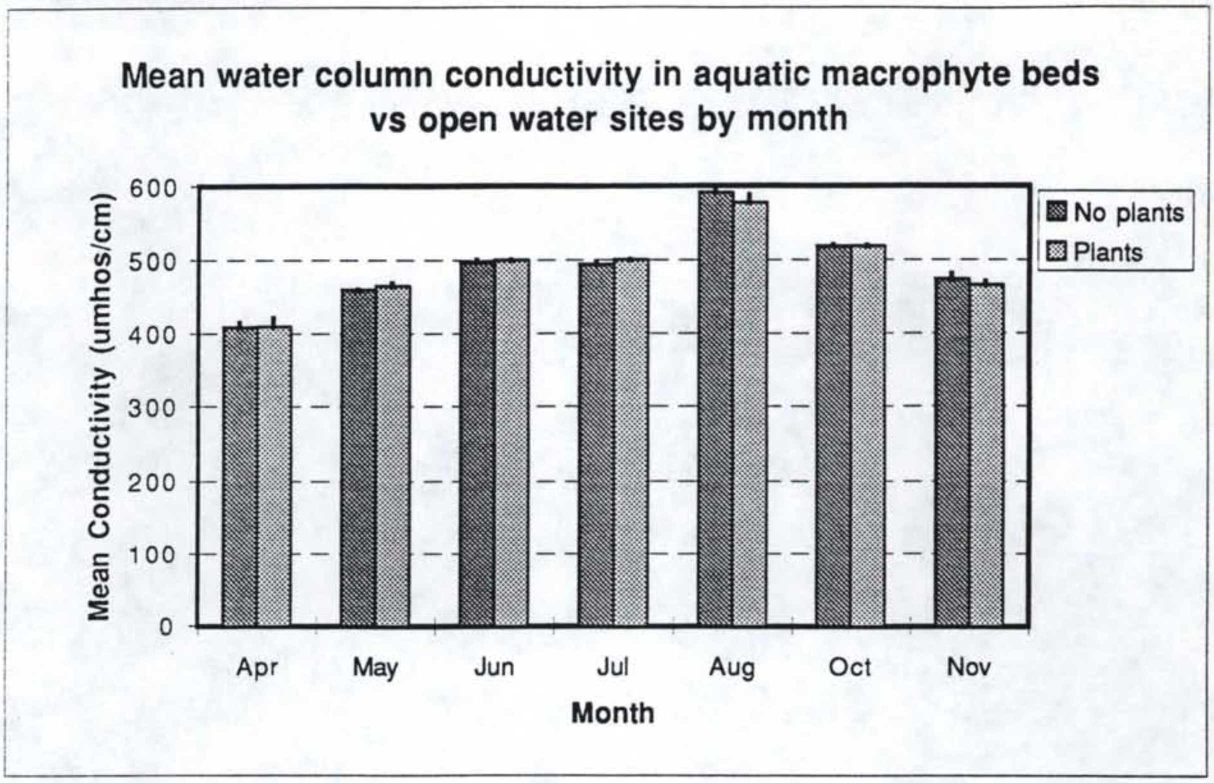


Figure 48. Mean water column hardness and alkalinity with standard errors plotted by month for sites located in aquatic macrophyte beds and open water sites, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.



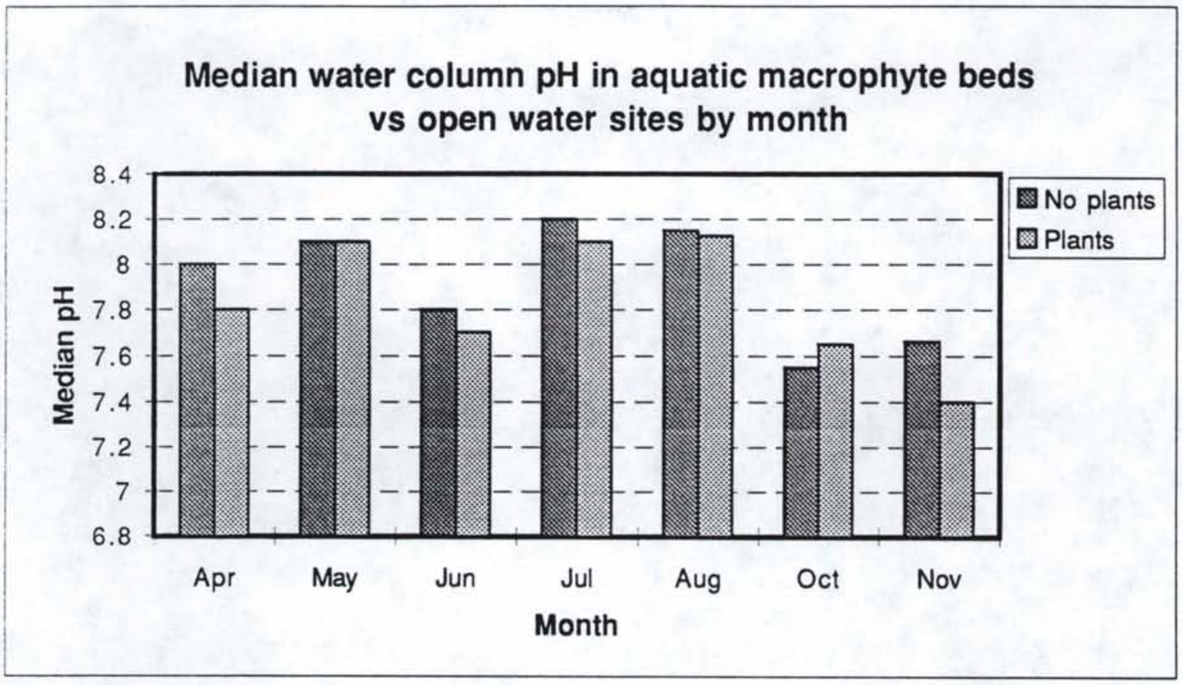
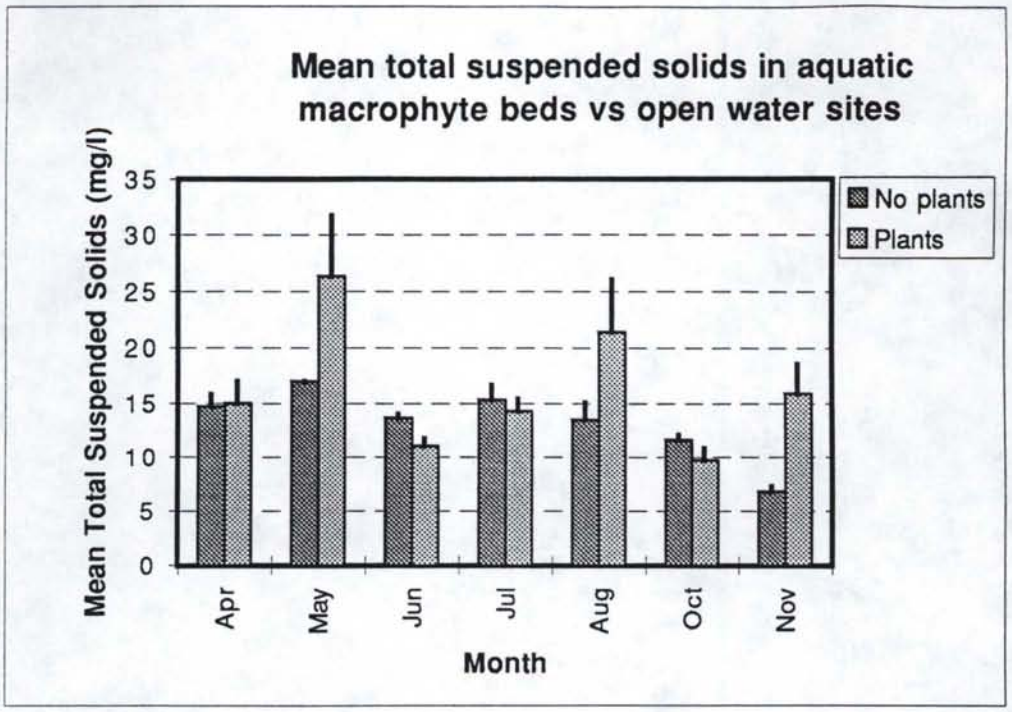


Figure 49. Mean water column conductivity with standard errors and median pH plotted by month for sites located in aquatic macrophyte beds and open water sites, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.



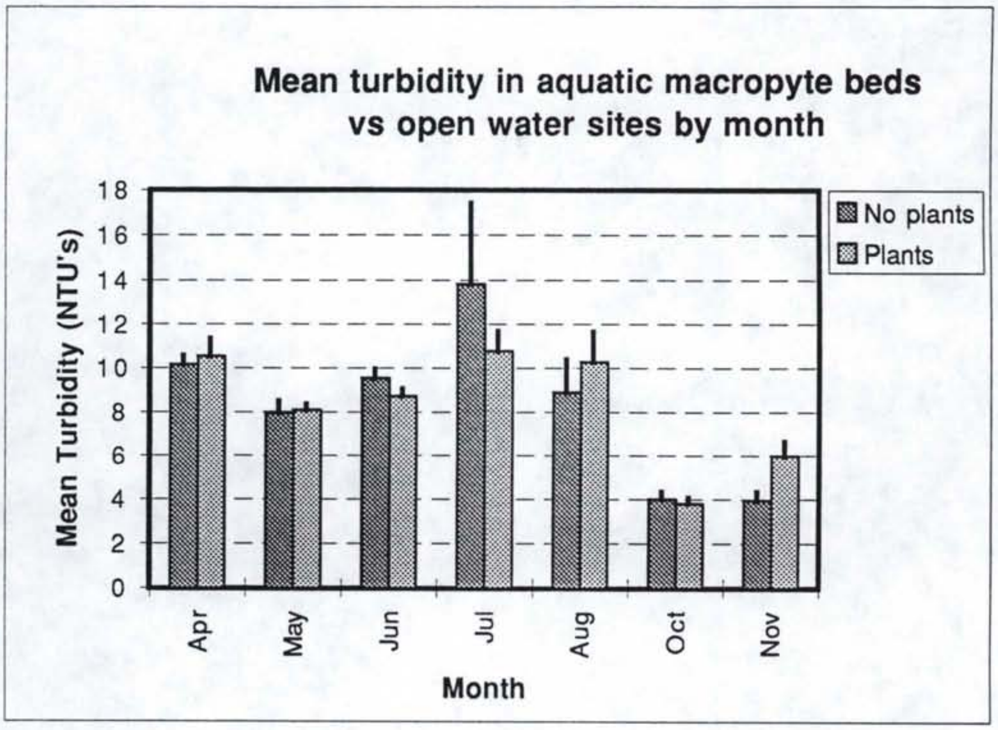
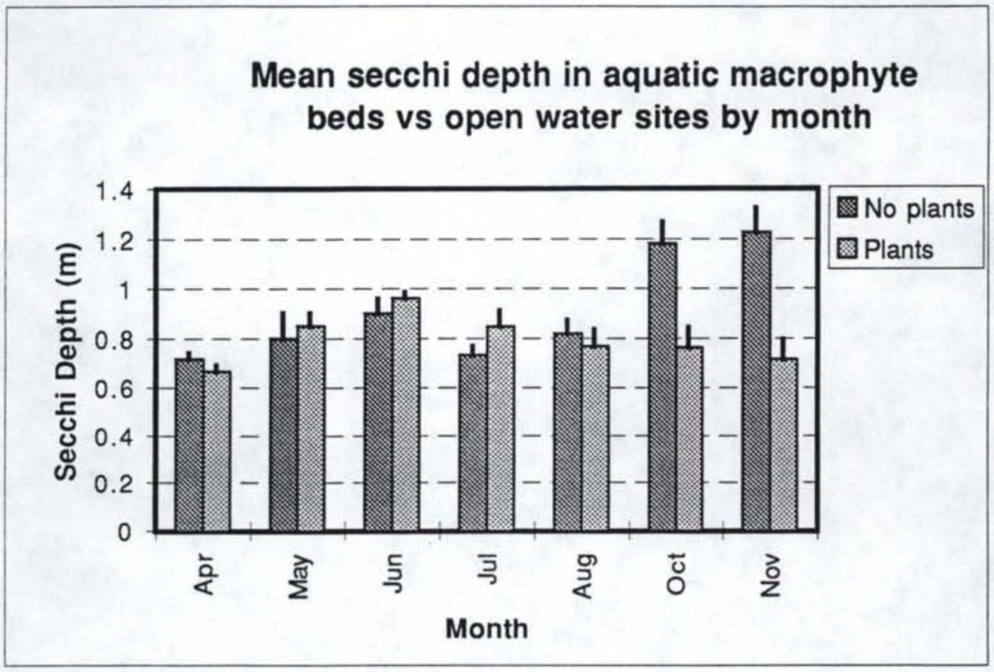


Figure 50. Mean water column total suspended solids and turbidity with standard errors plotted by month for sites located in aquatic macrophyte beds and open water sites, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.



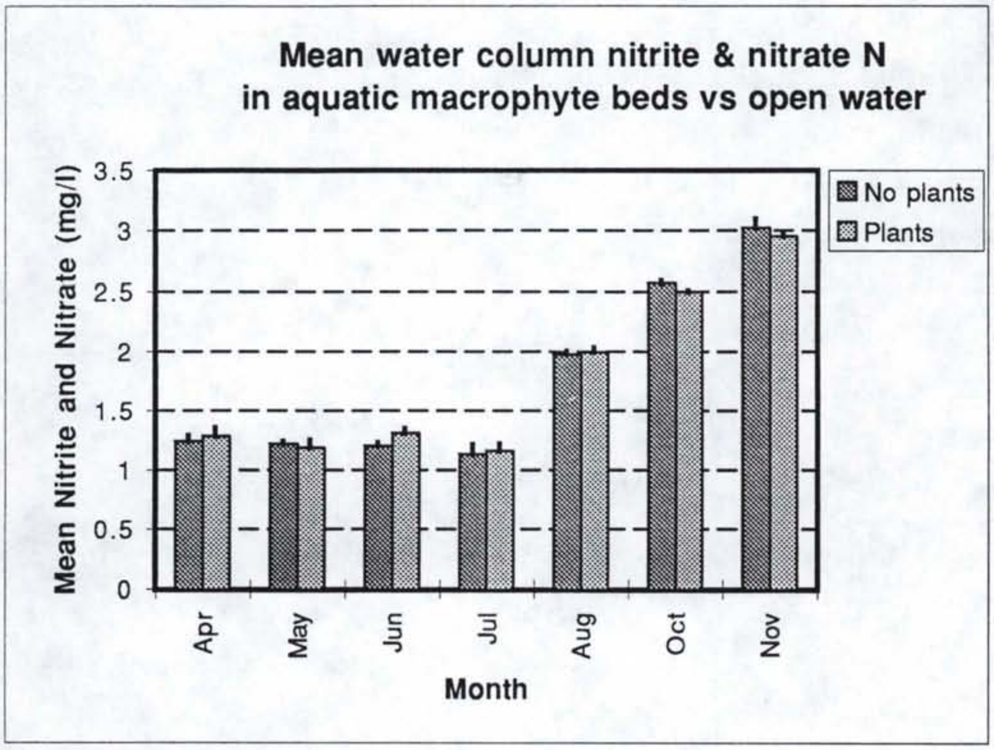
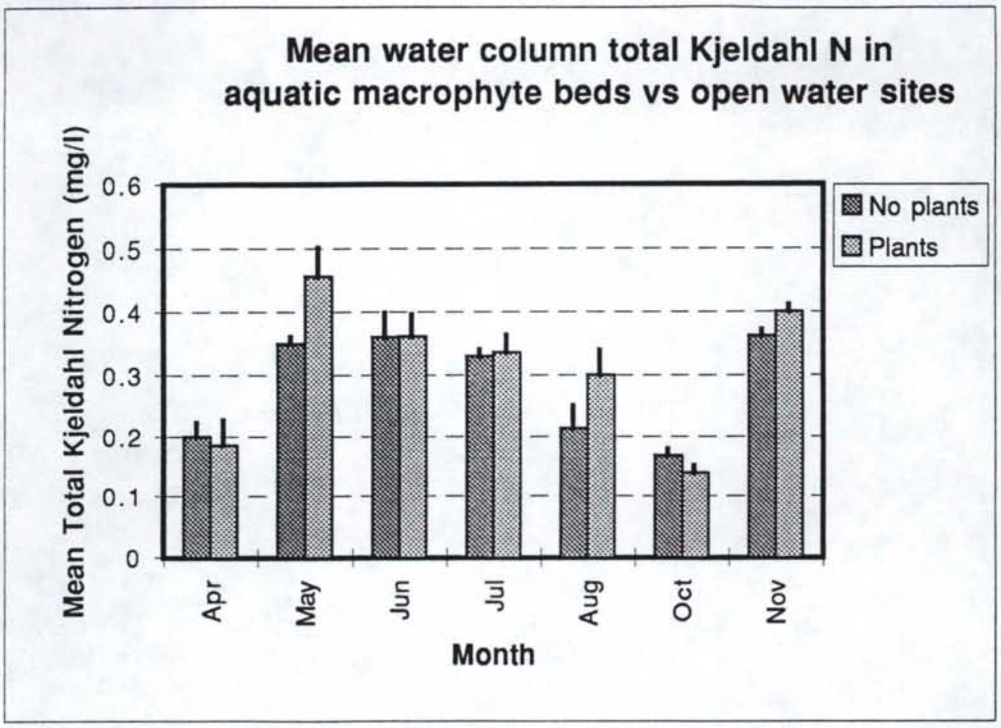


Figure 51. Mean water column secchi depth and nitrite and nitrate nitrogen with standard errors plotted by month for sites located in aquatic macrophyte beds and open water sites, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake



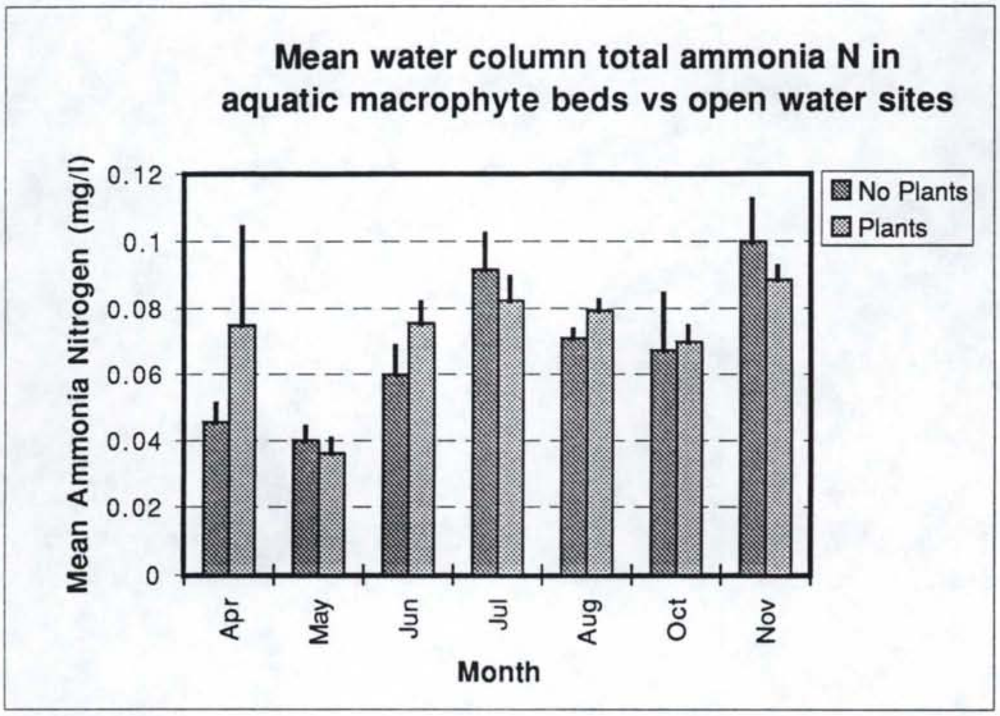
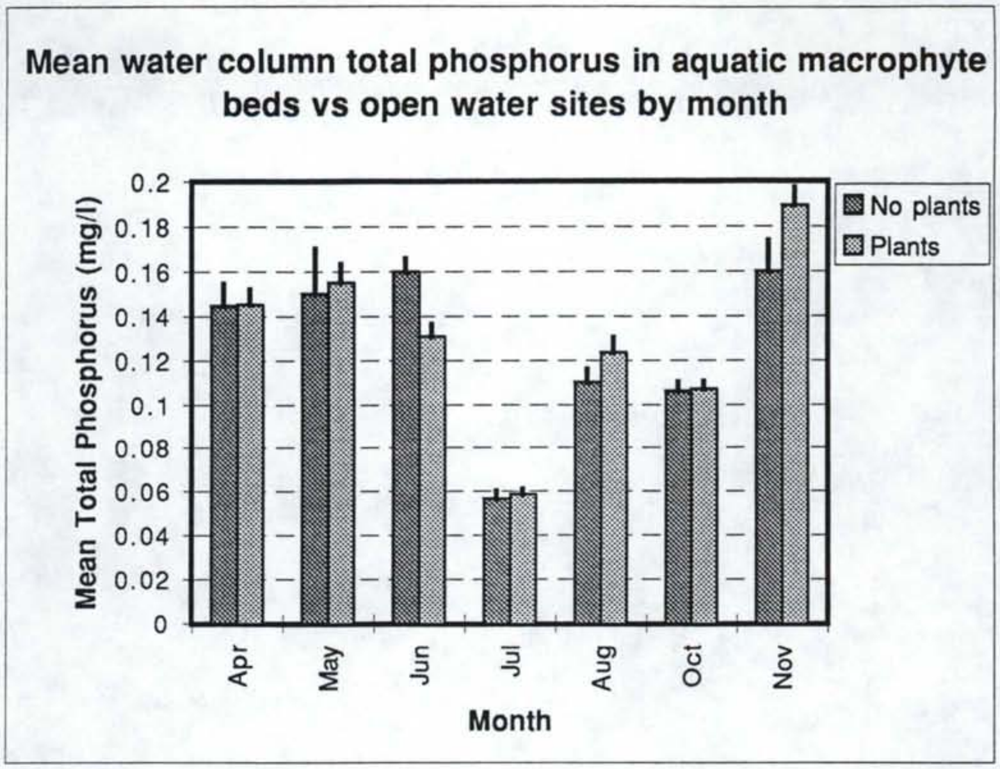


Figure 52. Mean water column total Kjeldahl nitrogen and total ammonia nitrogen with standard errors plotted by month for sites located in aquatic macrophyte beds and open water sites, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake



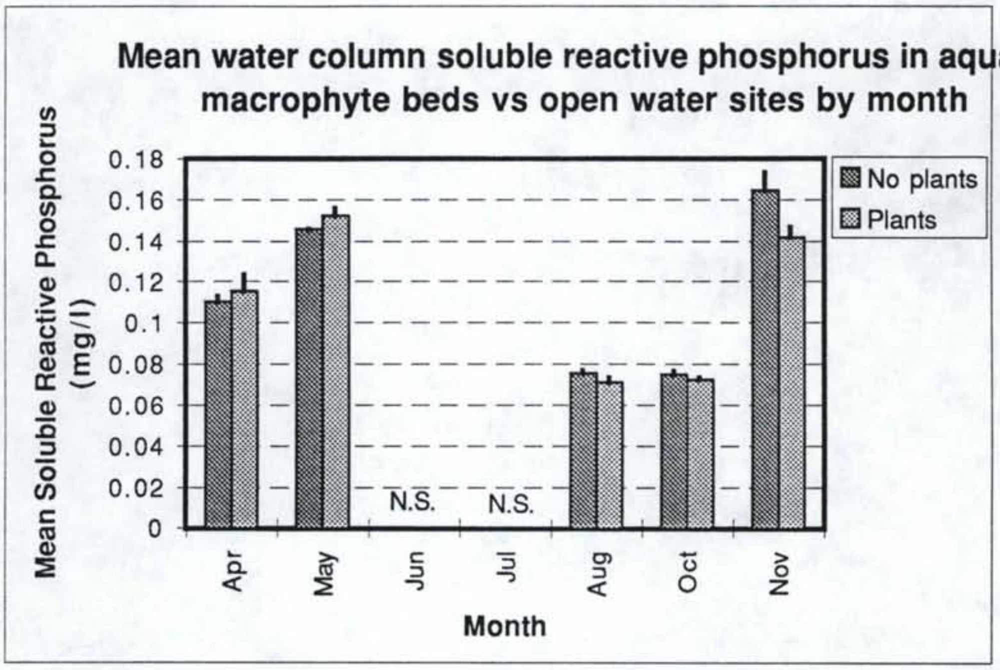


Figure 53. Mean water column total phosphorus and soluble reactive phosphorus with standard errors plotted by month for sites located in aquatic macrophyte beds and open water sites, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River,

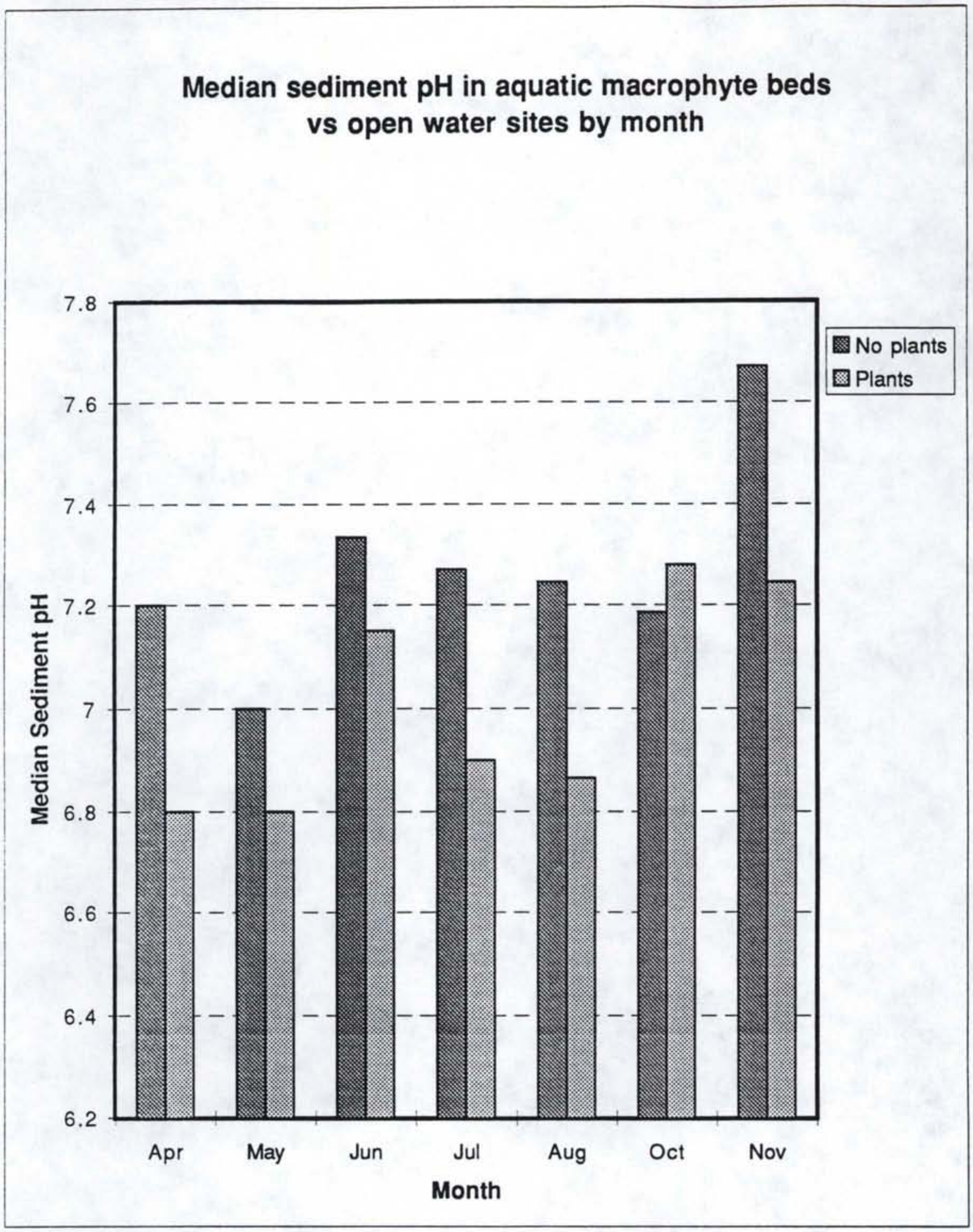
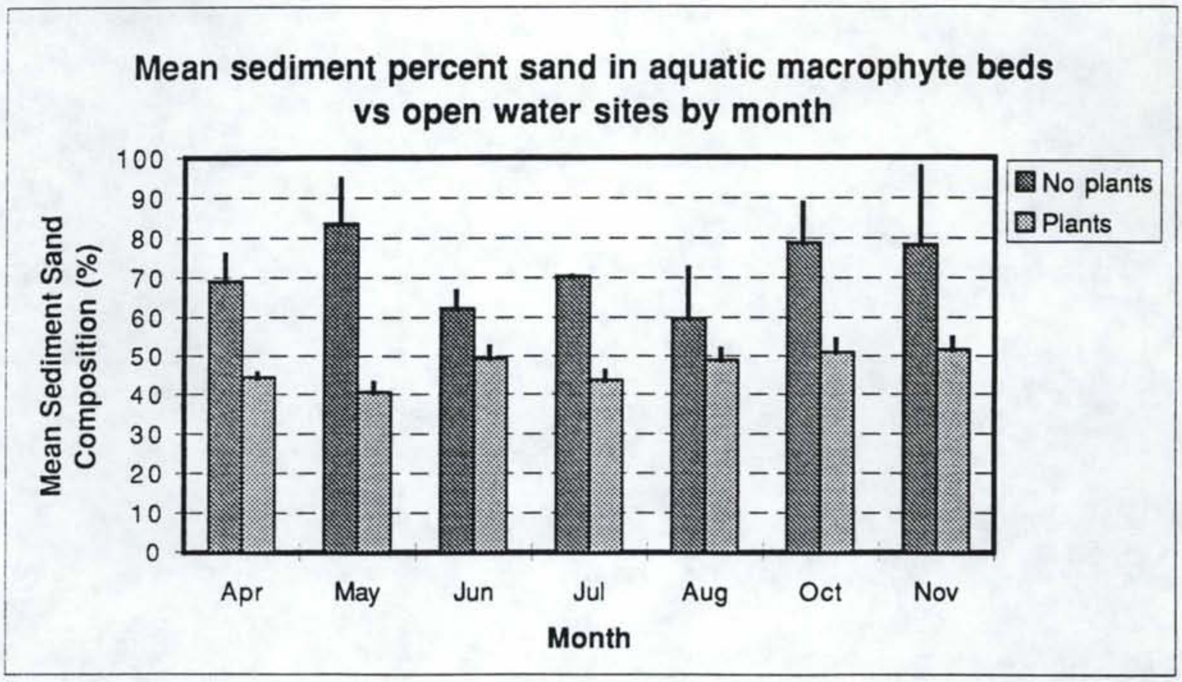


Figure 54 Median sediment pH plotted by month for sites located in aquatic macrophyte beds and open water sites, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.



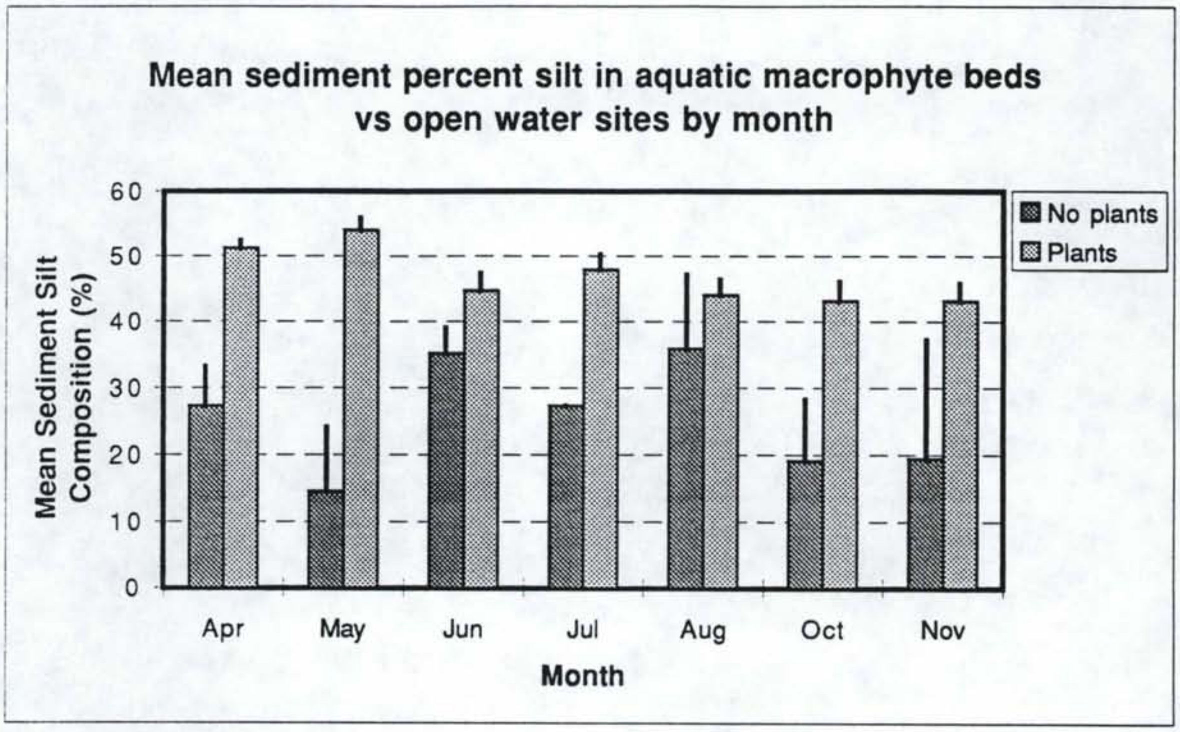
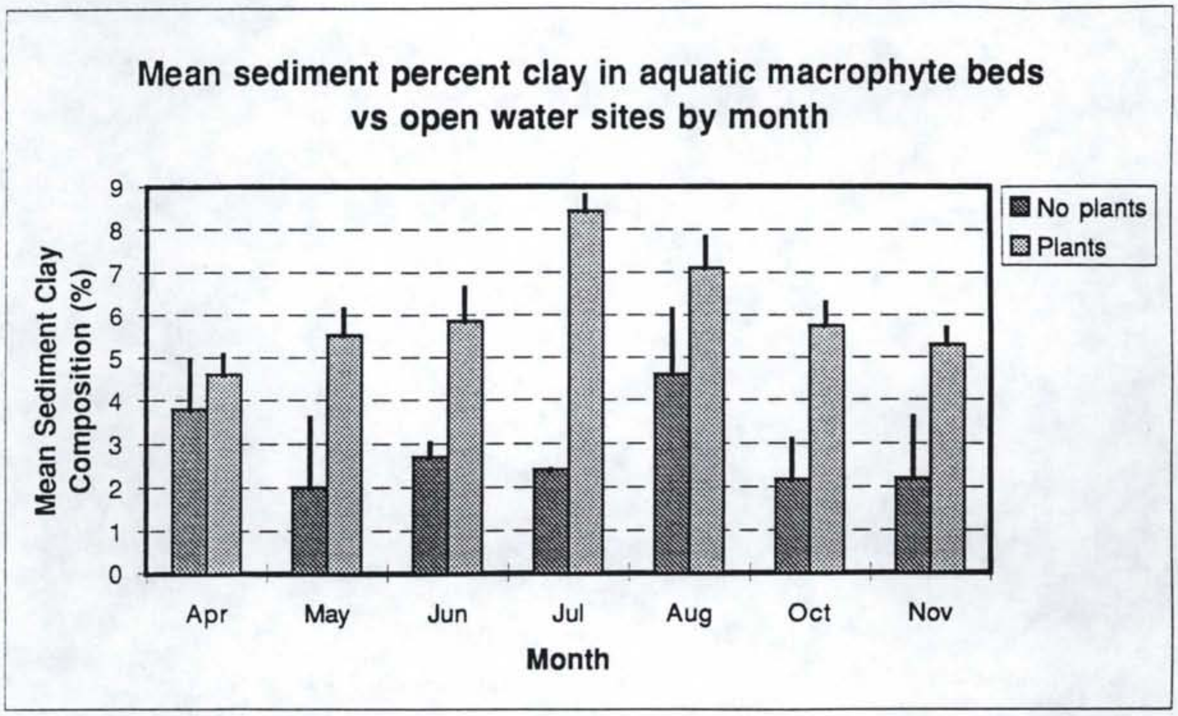


Figure 55 Mean percent sand and silt composition with standard errors plotted by month for sites located in aquatic macrophyte beds and open water sites, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.



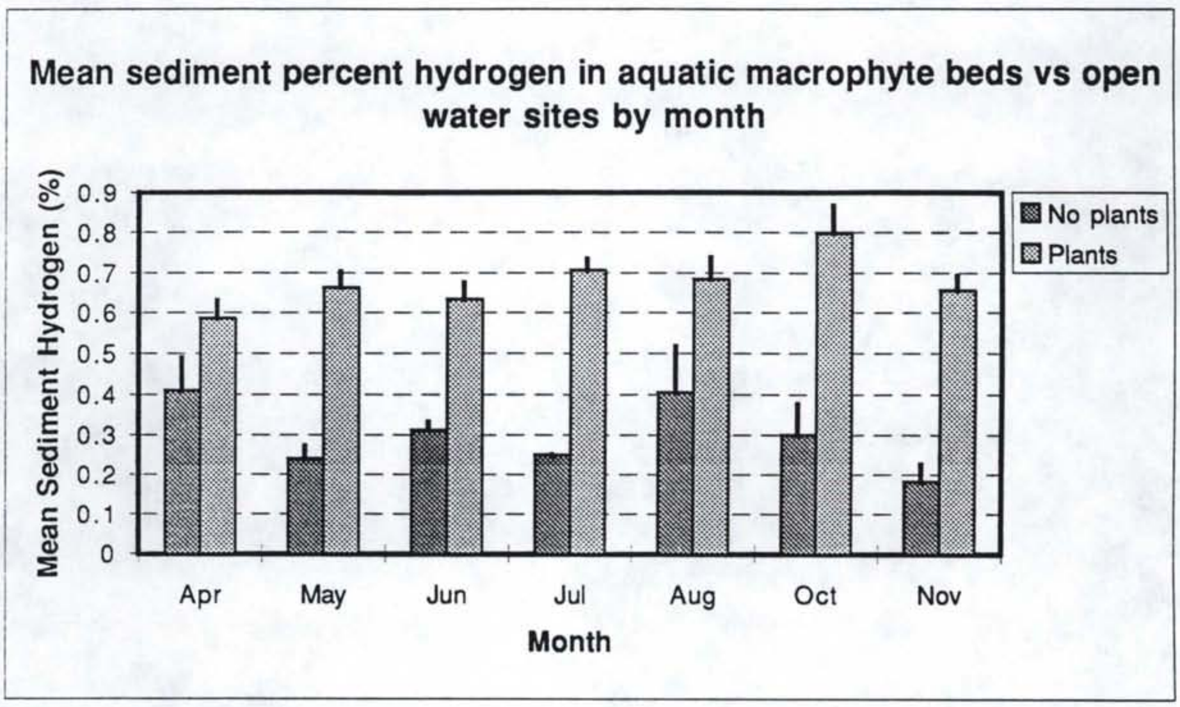
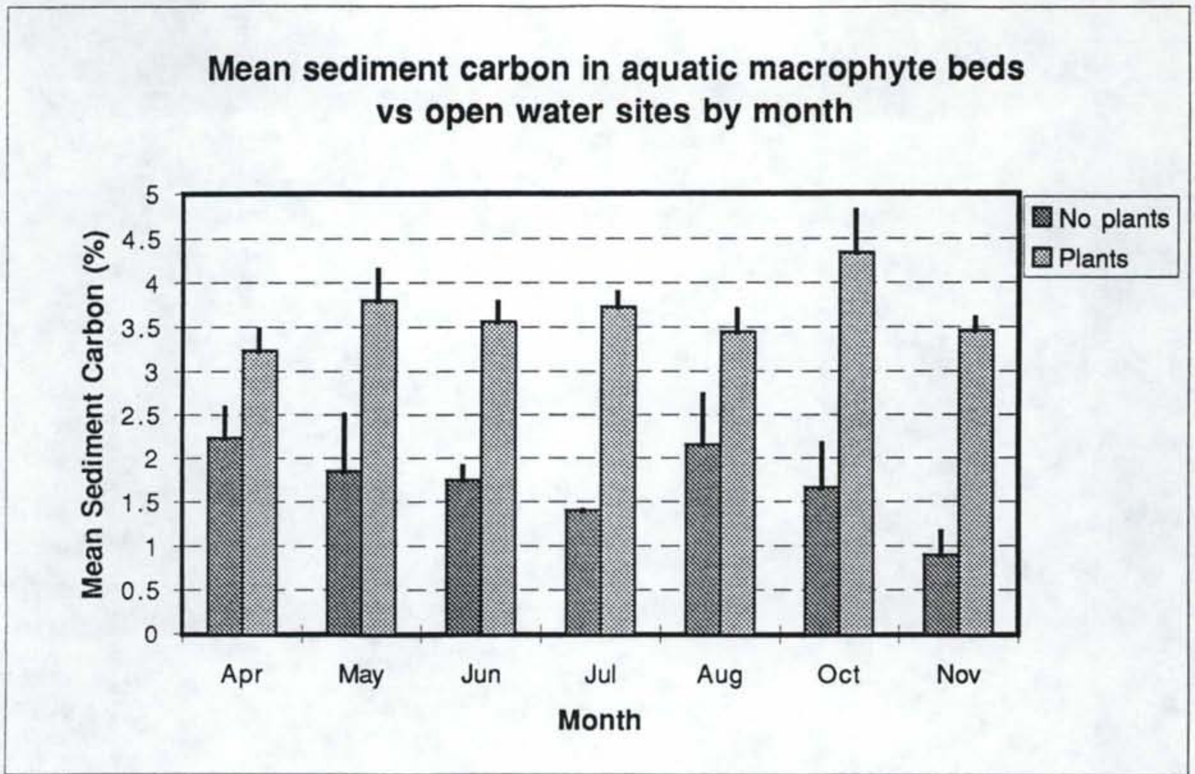


Figure 56 Mean percent clay sediment composition and mean sediment hydrogen with standard errors plotted by month for sites located in aquatic macrophyte beds and open water sites, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.



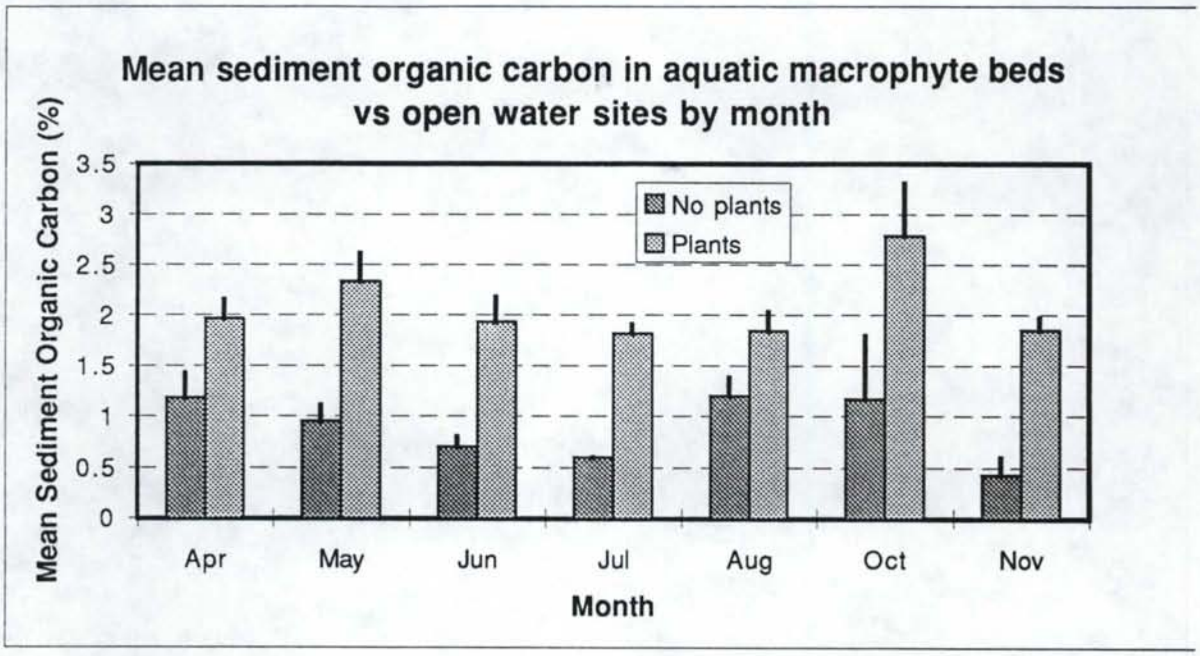
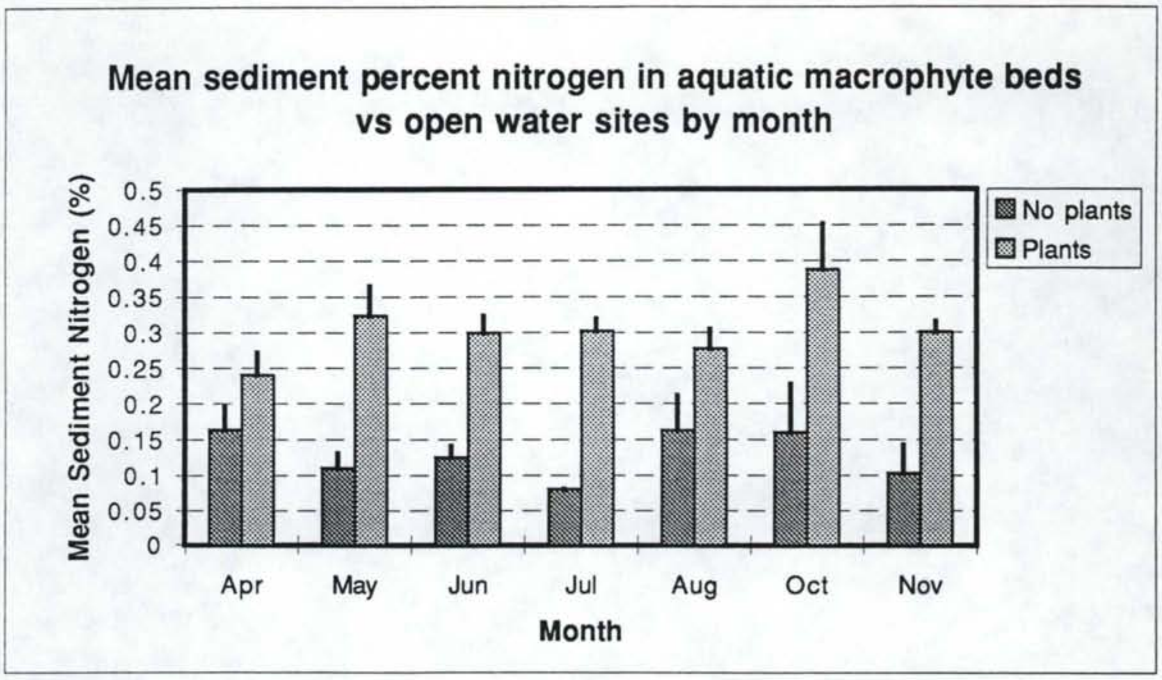


Figure 57 Mean sediment carbon and sediment organic carbon with standard errors plotted by month for sites located in aquatic macrophyte beds and open water sites, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.



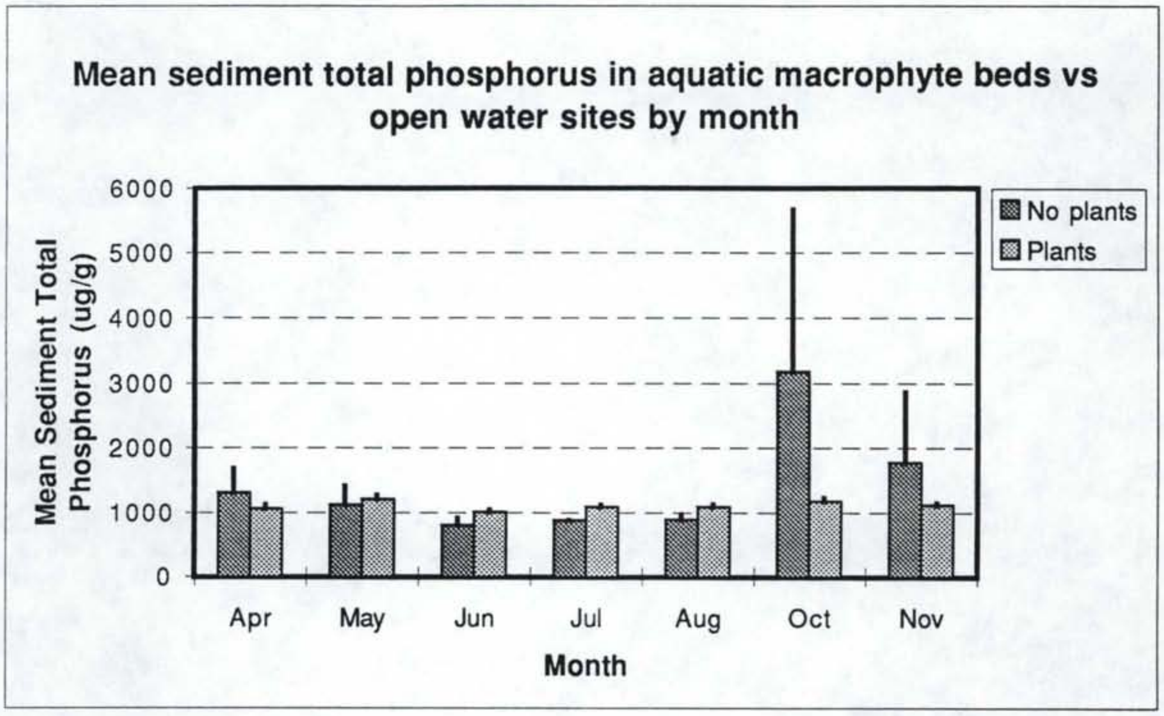


Figure 58. Mean sediment percent nitrogen and mean sediment total phosphorus with standard errors plotted by month for sites located in aquatic macrophyte beds and open water sites, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

```
                Plot of CAN2*CAN1.  Symbol is value of TSCT.
                (N = 75; 18 obs had missing values; 31 obs hidden.)
CAN2 |
  5 +
    |
    |  7 7 77 7 979   79  9 7   2     22    2 2
  0 +      779 97979799999 7799  999  9  9 2 22 222222      2 2
    |        7     97 7  9 5 9     2              2
    |          5  5            2 2
 -5 +             5
    |             5
    |
-10 +
    |
   -+-------------+-------------+-------------+-------------+-------------+-
   -4          -2           0            2            4            6

                              CAN1
```

Figure 59. Canonical analyses of 1994 Crystal Springs data showing transects relationships over all months (SAS 1987).

```
                Plot of CAN2*CAN1.  Symbol is value of MONTH.
                (N = 97; 18 obs had missing values; 36 obs hidden.)
CAN2 |
 10 +
    |        7
    |         7 7   7                 888888
    |     7   77 77677                      8 8
    |           666667 6                          111 1 (October)
  0 +            5 565   6                         1 11
    |
    |
    |                                    1
    |         4 44 4                           11111      (November)
    |        444444                              11 1
-10 +        4 4 4
 ---+----------+----------+----------+----------+----------+----------+--
  -15       -10        -5          0          5         10         15

                              CAN1
```

Figure 60. Canonical analyses of 1994 Crystal Springs data showing between months relationships over all transects (SAS 1987).

TABLES

Table 1. List of transect locations for the Middle Snake River Productivity and Nutrient Assessment Study, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Transect	Sample Sites	River Mile	Location
2	1 - 5	600.6	Across channel from dual outflow of Clear Springs Hatchery, approximately 50 meters upstream from metal pipe and floats on left bank, marked with rebar on left bank. Sample sites were spaced 30 meters apart.
5	1 - 5	600.2	Downstream end of riprap on left bank, near boat ramp behind Magic Valley Steelhead Hatchery. Sample sites were spaced 30 meters apart.
7	1 - 5	600.0	Located 200 meters downstream from transect 5. Sample sites were spaced 30 meters apart.
R (Random)	1 - 8	600.1-600.5	Randomly located samples sites between transects 2 and 7.

* Bank reference when facing downstream.

Table 2. Results summary for water quality QA/QC, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Variable	Duplicated Samples					Blank Samples				Mean of All Blanks	Units
	Pairs	Mean	Relative Std Dev	Range Coef Var%	95%C.I.	Total Obs.	Exceeding MDL: MDL	No.	%		
Ammonia - N	5	0.08	0.03	39.82	0.01	4	0.005	2	50	<0.005	mg-N/l
Nitrite & Nitrate - N	5	1.94	0.83	42.75	0.25	4	0.005	1	25	<0.005	mg-N/l
Total Kjeldahl Nitrogen - N	5	0.38	0.15	38.75	0.50	4	0.05	0	0	<0.05	mg-N/l
Total Phosphorus - P	5	0.12	0.04	31.99	0.01	4	0.05	0	0	<0.05	mg-P/l
Soluble Reactive Phosphorus - P	5	0.11	0.04	36.81	0.20	2	0.005	1	50	<0.005	mg-P/l
Total Hardness	5	232	31	13.15	9.47	4	4.0	0	0	<4.0	mg/l
Total Alkalinity	5	199	23	11.29	6.98	4	1.0	1	25	<1.0	mg/l
Suspended Solids	5	13.7	8.8	64.19	2.73	4	1.0	0	0	<1.0	mg/l
Chlorophyll *a*	1*	28.2	-	-	-	1	1.0	0	0	<1.0	µg/l

Variable	Spiked Samples			
	Obs.	Percent Recovery Mean	Std Dev	Coeff Var%
Ammonia - N	4	104.6	10.2	9.75
Nitrite & Nitrate - N	4	106.5	6.6	6.20
Total Kjeldahl Nitrogen - N	4	114.4	27.7	24.21
Total Phosphorus - P	4	104.8	10.1	9.64
Soluble Reactive Phosphorus - P	1**	92.0	-	-
Suspended Solids	4	92.4	1.7	1.84

* - Chlorophyll a samples were only duplicated once due to storage error with the remaining samples.

** - SRP was inadvertently omitted from 3 spike procedures.

Table 3. Water Year 1994 and first three months of Water Year 1995. Daily water discharge, cubic feet per second, of mainstem Snake River recorded at river mile 596.8, six miles notheast of Buhl, ID for period October 1, 1993 through December 31, 1994. Data extracted from USGS Water Data Reports ID-94-1 and unpublished USGS records (USGS 1994 and 1995).

	Month (October, 1993 - December, 1994)														
Date	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	2,410	2,240	3,660	4,250	2,920	4,060	2,930	3,300	3,410	3,140	3,300	2,370	2,920	2,210	1,960
2	2,420	2,510	3,750	4,240	2,920	3,950	2,950	3,260	3,380	3,160	3,270	2,370	2,780	3,140	2,000
3	2,470	3,180	3,740	4,240	2,890	3,650	3,090	3,270	3,360	3,190	3,220	2,370	2,750	2,460	2,210
4	2,480	3,120	3,830	4,260	2,890	3,520	3,090	3,250	3,340	3,250	3,100	2,380	2,720	2,340	2,270
5	2,430	3,030	3,920	4,310	2,880	3,440	2,780	3,270	3,330	3,280	2,990	2,430	2,860	4,750	2,260
6	2,440	3,210	3,910	4,280	2,890	3,370	2,600	3,280	3,320	3,310	2,900	2,430	2,690	2,903	2,240
7	2,460	3,220	3,910	4,230	2,910	3,530	2,410	3,230	3,320	3,290	2,840	2,400	2,740	2,330	2,220
8	2,530	3,110	3,820	4,230	2,910	4,240	2,850	3,180	3,320	3,250	2,790	2,380	2,540	2,170	2,200
9	2,550	3,050	4,030	4,220	2,880	4,240	3,940	3,140	3,270	3,250	2,690	2,360	2,610	2,420	2,230
10	2,530	3,010	4,290	4,220	2,920	4,210	4,420	3,070	3,220	3,250	2,610	2,360	2,640	2,690	2,280
11	2,500	2,990	4,300	4,210	3,480	4,080	4,820	3,060	3,200	3,280	2,580	2,400	2,650	2,560	2,320
12	2,470	3,020	4,380	4,190	3,800	3,980	4,430	3,080	3,210	3,270	2,480	2,460	2,620	2,190	2,300
13	2,420	3,010	4,250	4,190	3,790	3,930	3,560	3,100	3,220	3,270	2,440	2,450	2,640	2,110	2,260
14	2,450	2,990	4,350	4,190	3,800	3,830	3,200	3,130	3,220	3,280	2,410	2,470	2,690	2,090	2,200
15	2,430	2,960	4,350	4,180	3,710	3,630	3,050	3,120	3,230	3,290	2,340	2,430	2,690	2,050	2,210
16	2,430	2,960	4,270	4,180	3,620	3,360	3,080	3,160	3,210	3,300	2,280	2,420	2,660	2,050	2,220
17	2,480	2,970	4,260	4,140	3,700	3,200	3,510	3,210	3,180	3,320	2,260	2,420	2,650	2,050	2,220
18	2,470	2,970	4,290	4,120	3,700	3,150	3,390	3,190	3,170	3,330	2,270	2,440	2,620	2,050	2,210
19	2,440	2,930	4,330	4,140	3,550	3,240	3,130	3,190	3,180	3,310	2,270	2,460	2,570	2,020	2,210
20	2,510	3,030	4,320	4,100	3,440	3,240	3,060	3,190	3,200	3,320	2,270	2,440	2,560	2,020	2,210
21	4,080	3,610	4,310	4,120	3,420	3,560	3,030	3,170	3,140	3,320	2,290	2,420	2,580	2,010	2,220
22	4,870	3,950	4,290	4,160	3,480	3,700	3,080	3,150	3,130	3,320	2,320	2,400	2,530	1,980	2,190
23	3,200	3,830	4,260	4,170	3,480	3,630	3,140	3,130	3,120	3,330	2,320	2,410	2,470	1,960	2,190
24	2,680	3,790	4,240	4,170	3,570	3,250	3,230	3,110	2,710	3,350	2,320	2,410	2,480	1,970	2,190
25	2,450	3,720	4,250	4,110	3,580	3,030	3,450	3,090	2,090	3,390	2,320	2,430	2,480	1,980	2,220
26	2,740	3,870	4,260	4,100	3,840	2,930	3,520	3,070	2,840	3,350	2,320	2,450	2,470	1,980	2,180
27	2,590	3,880	4,260	4,010	4,150	2,760	3,230	3,140	3,170	3,360	2,320	2,440	2,420	1,980	2,180
28	2,490	3,810	4,250	3,500	4,150	2,690	2,660	3,240	3,160	3,160	2,330	2,510	2,380	1,970	2,180
29	2,290	3,720	4,230	3,370	------	2,580	3,230	3,270	3,140	2,570	2,350	2,390	2,340	1,950	2,180
30	2,280	3,660	4,240	2,930	------	2,480	3,200	3,270	3,130	3,230	2,340	2,620	2,220	1,950	2,160
31	2,300	-----	4,240	2,880	------	2,650	------	3,310	-------	3,280	2,360	------	2,220	-------	2,150
Total	81,290	97,350	128,790	125,640	95,270	107,110	98,060	98,630	94,920	101,000	78,900	72,720	80,190	68,630	68,270
Mean	2,622	3,245	4,155	4,053	3,402	3,455	3,269	3,182	3,164	3,258	2,545	2,424	2,587	2,279	2,202
Max	4,870	3,950	4,380	4,310	4,150	4,240	4,820	3,310	3,410	3,390	3,300	2,620	2,920	4,750	2,320
Min	2,280	2,240	3,660	2,880	2,880	2,480	2,410	3,060	2,090	2,570	2,260	2,360	2,220	1,950	1,960
AC-FT	161,200	193,100	255,500	249,200	189,000	212,500	194,500	195,600	188,300	200,300	156,500	144,200	159,100	135,600	135,400

Table 4. Mean daily flow, mean monthly flow (June - September), and total annual flow of mainstem Snake River recorded at river mile 596.8, six miles northeast of Buhl, ID for water years 1984 through 1994. Data extracted from USGS Water Data Reports ID-93-1 and ID-94-1 (USGS 1993 and 1994).

Water Year	Mean Daily Flow (cubic feet/sec	Mean Monthly Flow June-Sept cubic feet/sec	Total Annual Flow (acre feet)
1984	11,620	9,091	8,433,000
1985	8,625	3,579	6,245,000
1986	9,065	6,363	6,563,000
1987	5,601	2,913	4,055,000
1988	2,495	2,616	1,812,000
1989	2,404	2,753	1,741,000
1990	2,380	2,431	1,723,000
1991	2,341	2,512	1,695,000
1992	2,116	3,710	1,536,000
1993	2,752	3,860	1,993,000
1994	3,232	2,848	2,340,000

Mean total annual flow for period of record (1947 - 1994) is 3,678,000 acre ft/yr.

Mean total annual flow for drought years (1988 - 1994) is 1,834,286 acre ft/yr.

Table 5. Minimum, maximum, mean, standard error, and 95% confidence intervals for water column depth, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

			WATER COLUMN DEPTH m					
MONTH	**TRANSECT**	**n**	**MIN**	**MAX**	**MEAN**	**S.E.**	**UPPER 95% C.I.**	**LOWER 95% C.I.**
April	2	5	1.3	3.7	2.2	0.5	3.0	1.3
April	5	5	0.7	2.5	1.2	0.3	1.8	0.5
April	7	5	0.8	2.3	1.3	0.3	1.8	0.8
May	R	8	1.1	7.1	2.2	0.7	3.6	0.8
June	2	5	1.5	3.6	2.4	0.4	3.2	1.6
June	7	5	1.0	2.7	1.5	0.3	2.2	0.9
June	R	8	0.8	2.1	1.3	0.1	1.6	1.0
July	2	5	1.5	3.9	2.3	0.4	3.1	1.4
July	7	5	0.9	3.1	1.7	0.4	2.4	1.0
July	R	8	1.0	1.7	1.3	0.1	1.5	1.1
August	2	5	1.1	3.4	1.9	0.4	2.8	1.0
August	7	5	0.9	3.5	1.7	0.5	2.7	0.8
August	R	8	0.8	2.3	1.1	0.2	1.4	0.8
October	2	5	1.3	3.4	2.3	0.4	3.1	1.5
October	7	5	0.5	3.1	1.3	0.5	2.3	0.3
October	R	8	0.4	1.3	0.7	0.1	0.9	0.5
November	2	5	1.1	3.1	2.5	0.4	3.2	1.7
November	7	5	0.5	2.8	1.3	0.4	2.1	0.5
November	R	8	0.4	1.0	0.6	0.1	0.7	0.5

Table 6. Minimum, maximum, mean, standard error, and 95% confidence intervals for water column velocity, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

			WATER COLUMN VELOCITY ft/s					
MONTH	**TRANSECT**	**n**	**MINIMUM**	**MAXIMUM**	**MEAN**	**S.E.**	**UPPER 95% C.I.**	**LOWER 95% C.I.**
April	2	5	0.25	0.85	0.46	0.11	0.67	0.24
April	5	5	0.35	1.05	0.57	0.13	0.82	0.32
April	7	5	0.30	0.80	0.67	0.09	0.85	0.48
May	R	8	0.05	0.40	0.14	0.04	0.22	0.06
June	2	5	0.05	0.70	0.37	0.14	0.64	0.10
June	7	5	0.20	2.45	0.90	0.40	1.68	0.12
June	R	8	0.05	0.60	0.40	0.06	0.51	0.28
July	2	5	0	0.65	0.25	0.14	0.53	0
July	7	5	0.30	2.05	0.97	0.30	1.56	0.38
July	R	8	0.10	1.55	0.68	0.17	1.02	0.33
August	2	5	0	0.55	0.20	0.12	0.44	0
August	7	5	0	1.40	0.38	0.26	0.88	0
August	R	8	0	0.60	0.18	0.07	0.31	0.05
October	2	5	0.13	0.50	0.35	0.07	0.49	0.21
October	7	5	0.10	1.40	0.51	0.23	0.97	0.05
October	R	8	0.05	0.70	0.40	0.09	0.57	0.23
November	2	5	0.05	0.35	0.22	0.05	0.31	0.12
November	7	5	0.13	0.65	0.30	0.09	0.48	0.12
November	R	8	0.15	0.28	0.19	0.02	0.22	0.16

Table 7. Minimum, maximum, mean, standard error, and 95% confidence intervals for water column total suspended solids, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

WATER COLUMN TOTAL SUSPENDED SOLIDS
mg/l

MONTH	TRANSECT	n	MINIMUM	MAXIMUM	MEAN	S.E.	UPPER 95% C.I.	LOWER 95% C.I.
April	2	5	11.0	24.0	18.4	2.25	22.8	14.0
April	5	5	13.0	14.0	13.8	0.20	14.2	13.4
April	7	5	11.0	13.0	12.2	0.37	12.9	11.5
May	R	8	13.0	46.0	24.0	4.20	32.2	15.8
June	2	5	9.0	14.0	12.6	0.98	14.5	10.7
June	7	5	5.0	14.0	11.0	1.58	14.1	7.9
June	R	8	8.0	14.0	11.1	0.72	12.5	9.7
July	2	5	9.0	21.0	15.4	2.01	19.3	11.5
July	7	5	2.0	18.0	13.2	2.89	18.9	7.5
July	R	8	11.0	17.0	14.6	0.71	16.0	13.2
August	2	5	13.0	21.0	15.8	1.39	18.5	13.1
August	7	5	4.0	63.0	25.6	10.77	46.7	4.5
August	R	8	10.0	34.0	16.4	2.82	21.9	10.9
October	2	5	10.0	12.0	11.2	0.37	11.9	10.5
October	7	5	4.0	13.0	7.6	1.69	10.9	4.3
October	R	8	4.0	15.0	11.3	1.36	13.9	8.6
November	2	5	6.0	8.0	7.0	0.45	7.9	6.1
November	7	5	4.0	12.0	9.4	1.66	12.7	6.1
November	R	8	7.0	42.0	21.0	3.63	28.1	13.9

Table 8. Minimum, maximum, mean, standard error, and 95% confidence intervals for water column turbidity, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

			WATER COLUMN TURBIDITY NTU					
MONTH	TRANSECT	n	MINIMUM	MAXIMUM	MEAN	S.E.	UPPER 95% C.I.	LOWER 95% C.I.
April	2	5	9.3	14.0	11.5	0.9	13.2	9.7
April	5	5	9.3	11.0	10.2	0.3	10.9	9.5
April	7	5	8.9	10.0	9.3	0.2	9.7	8.9
May	R	8	7.2	9.2	8.0	0.2	8.5	7.6
June	2	5	9.1	10.0	9.5	0.2	9.9	9.2
June	7	5	6.3	9.1	7.8	0.5	8.8	6.8
June	R	8	7.1	11.0	9.1	0.5	10.1	8.1
July	2	5	7.3	12.0	9.9	0.7	11.3	8.4
July	7	5	3.0	10.5	8.4	1.4	11.1	5.7
July	R	8	10.0	21.0	13.9	1.5	16.9	11.0
August	2	5	8.5	18.1	13.1	1.9	16.7	9.4
August	7	5	4.9	15.5	8.8	1.9	12.6	5.0
August	R	8	2.7	14.3	8.4	1.4	11.1	5.6
October	2	5	3.5	5.1	4.0	0.3	4.6	3.4
October	7	5	2.5	5.2	3.3	0.5	4.2	2.4
October	R	8	2.5	5.1	4.1	0.3	4.6	3.5
November	2	5	2.8	6.4	4.4	0.6	5.6	3.3
November	7	5	3.3	9.4	6.1	1.4	8.7	3.4
November	R	8	3.4	11.1	5.9	0.9	7.6	4.1

Table 9. Minimum, maximum, mean, standard error, and 95% confidence intervals for secchi depth, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

			SECCHI DEPTH m					
MONTH	**TRANSECT**	**n**	**MINIMUM**	**MAXIMUM**	**MEAN**	**S.E.**	**UPPER 95% C.I.**	**LOWER 95% C.I.**
April	2	5	0.6	0.9	0.7	0.05	0.8	0.6
April	5	5	0.7	0.8	0.7	0.02	0.7	0.7
April	7	5	0.7	0.7	0.7	0.01	0.7	0.7
May	R	8	0.7	1.0	0.8	0.04	0.9	0.8
June	2	5	0.8	1.0	0.9	0.03	1.0	0.8
June	7	5	0.8	1.1	0.9	0.05	1.0	0.8
June	R	8	0.8	1.1	1.0	0.04	1.1	0.9
July	2	5	0.5	0.8	0.6	0.05	0.7	0.5
July	7	5	0.7	1.6	1.0	0.17	1.3	0.6
July	R	8	0.8	1.0	0.9	0.03	0.9	0.8
August	2	5	0.3	0.7	0.6	0.08	0.8	0.4
August	7	5	0.5	1.2	0.9	0.12	1.1	0.6
August	R	8	0.7	1.0	0.9	0.03	0.9	0.8
October	2	5	1.0	1.5	1.2	0.09	1.4	1.1
October	7	5	0.5	1.3	0.8	0.16	1.2	0.5
October	R	8	0.4	1.0	0.7	0.06	0.8	0.6
November	2	5	0.9	1.5	1.2	0.10	1.4	1.0
November	7	5	0.5	1.3	0.9	0.13	1.2	0.7
November	R	8	0.4	0.9	0.6	0.06	0.7	0.5

Table 10. Minimum, maximum, mean, standard error, and 95% confidence intervals for water column temperature, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

			WATER COLUMN TEMPERATURE C					
MONTH	TRANSECT	n	MINIMUM	MAXIMUM	MEAN	S.E.	UPPER 95% C.I.	LOWER 95% C.I.
April	2	5	6.5	10.0	8.5	0.67	9.8	7.2
April	5	5	7.0	9.0	8.6	0.40	9.4	7.8
April	7	5	9.0	10.0	9.5	0.23	9.9	9.0
May	R	8	16.0	17.3	16.9	0.16	17.2	16.6
June	2	5	19.0	20.3	19.9	0.24	20.4	19.5
June	7	5	19.0	20.0	19.4	0.24	19.9	18.9
June	R	8	19.0	19.0	19.0	0	19.0	19.0
July	2	5	21.4	30.0	23.9	1.57	27.0	20.8
July	7	5	15.0	21.5	19.8	1.21	22.1	17.4
July	R	8	20.0	21.3	20.8	0.17	21.1	20.4
August	2	5	17.5	18.7	18.2	0.20	18.6	17.8
August	7	5	17.0	17.5	17.3	0.09	17.5	17.1
August	R	8	17.5	19.0	18.0	0.15	18.3	17.7
October	2	5	12.0	13.0	12.3	0.18	12.7	12.0
October	7	5	12.5	12.5	12.5	0	12.5	12.5
October	R	8	12.0	12.5	12.4	0.07	12.5	12.3
November	2	5	7.0	9.0	7.8	0.36	8.5	7.1
November	7	5	7.0	10.2	8.2	0.54	9.3	7.2
November	R	8	6.0	10.7	7.3	0.59	8.5	6.2

Table 11. Minimum, maximum, mean, standard error, and 95% confidence intervals for water column dissolved oxygen, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

			WATER COLUMN DISSOLVED OXYGEN mg/l					
MONTH	TRANSECT	n	MINIMUM	MAXIMUM	MEAN	S.E.	UPPER 95% C.I.	LOWER 95% C.I.
April	2	5	10.2	13.3	11.7	0.51	12.7	10.7
April	5	5	10.6	11.0	10.8	0.08	10.9	10.6
April	7	5	10.7	11.2	10.9	0.08	11.1	10.8
May	R	8	7.7	8.1	8.0	0.05	8.1	7.9
June	2	5	9.1	11.0	9.7	0.33	10.4	9.1
June	7	5	9.4	9.6	9.5	0.04	9.6	9.4
June	R	8	7.4	9.6	9.1	0.26	9.7	8.6
July	2	5	7.8	13.1	9.4	0.96	11.3	7.5
July	7	5	7.5	9.5	8.5	0.34	9.1	7.8
July	R	8	8.1	8.5	8.4	0.05	8.5	8.3
August	2	5	8.5	10.9	9.9	0.53	10.9	8.9
August	7	5	8.7	11.2	10.2	0.51	11.2	9.2
August	R	8	9.7	12.3	10.8	0.33	11.4	10.1
October	2	5	9.2	9.7	9.4	0.08	9.6	9.3
October	7	5	9.6	9.7	9.6	0.02	9.7	9.6
October	R	8	9.0	9.8	9.5	0.10	9.7	9.3
November	2	5	10.2	12.3	10.9	0.38	11.6	10.1
November	7	5	9.1	10.3	9.8	0.21	10.2	9.3
November	R	8	8.1	11.3	9.8	0.44	10.7	8.9

Table 12. Minimum, maximum, mean, standard error, and 95% confidence intervals for water column hardness, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

WATER COLUMN HARDNESS
mg CaCO3/l

MONTH	TRANSECT	n	MINIMUM	MAXIMUM	MEAN	S.E.	UPPER 95% C.I.	LOWER 95% C.I.
April	2	5	196	218	203	3.93	211	195
April	5	5	206	212	209	1.02	211	207
April	7	5	200	216	209	2.87	214	203
May	R	8	204	228	213	2.70	219	208
June	2	5	200	208	202	1.55	205	199
June	7	5	210	236	220	4.82	229	211
June	R	8	206	226	212	2.29	216	207
July	2	5	196	204	201	1.62	204	198
July	7	5	206	244	218	6.73	231	204
July	R	8	204	216	209	1.56	212	206
August	2	5	228	240	233	2.15	237	229
August	7	5	246	250	248	0.75	249	246
August	R	8	230	246	237	1.60	240	234
October	2	5	250	262	258	2.10	262	254
October	7	5	252	270	260	2.93	266	255
October	R	8	256	266	259	1.25	261	257
November	2	5	252	268	259	3.07	265	253
November	7	5	258	280	267	3.93	275	259
November	R	8	258	276	263	2.67	268	258

Table 13. Minimum, maximum, mean, standard error, and 95% confidence intervals for water column alkalinity (as CaCO3), Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

			WATER COLUMN ALKALINITY (CaCO3) mg CaCO3/l					
MONTH	TRANSECT	n	MINIMUM	MAXIMUM	MEAN	S.E.	UPPER 95% C.I.	LOWER 95% C.I.
April	2	5	174	182	177	1.34	180	174
April	5	5	176	181	179	0.97	181	177
April	7	5	180	182	181	0.45	182	180
May	R	8	181	188	183	0.75	185	182
June	2	5	181	183	182	0.40	182	181
June	7	5	182	186	185	0.77	187	183
June	R	8	182	188	184	0.71	185	183
July	2	5	173	187	181	2.24	185	176
July	7	5	180	185	183	0.86	184	181
July	R	8	176	187	182	1.21	185	180
August	2	5	208	210	210	0.40	210	209
August	7	5	204	209	207	0.87	209	206
August	R	8	202	208	207	0.82	208	205
October	2	5	223	226	225	0.51	226	224
October	7	5	219	223	221	0.75	222	219
October	R	8	218	224	223	0.68	224	221
November	2	5	221	226	223	0.86	225	222
November	7	5	216	222	220	1.29	222	217
November	R	8	217	223	221	0.68	223	220

Table 14. Minimum, maximum, mean, standard error, and 95% confidence intervals for water column conductivity, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

			WATER COLUMN CONDUCTIVITY µmhos					
MONTH	TRANSECT	n	MINIMUM	MAXIMUM	MEAN	S.E.	UPPER 95% C.I.	LOWER 95% C.I.
April	2	5	370	430	390	10.5	411	369
April	5	5	380	420	412	8.0	428	396
April	7	5	420	440	426	4.0	434	418
May	R	8	460	480	464	2.6	469	459
June	2	5	490	500	498	2.0	502	494
June	7	5	500	500	500	0	500	500
June	R	8	500	500	500	0	500	500
July	2	5	490	500	497	2.0	501	493
July	7	5	490	500	498	2.0	502	494
July	R	8	500	500	500	0	500	500
August	2	5	500	600	556	22.9	601	511
August	7	5	590	590	590	0	590	590
August	R	8	590	600	594	1.8	597	590
October	2	5	520	520	520	0	520	520
October	7	5	510	520	516	2.4	521	511
October	R	8	510	520	518	1.6	521	514
November	2	5	450	490	469	7.1	483	455
November	7	5	460	495	476	7.0	490	462
November	R	8	440	485	461	5.0	471	451

Table 15. Median water column and sediment pH, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

pH

MONTH	TRANSECT	n	MEDIAN WATER COLUMN pH	n	MEDIAN SEDIMENT pH
April	2	5	8.5	5	7.2
April	5	5	8.0	5	7.5
April	7	5	7.6	5	6.5
May	R	8	8.1	8	6.8
June	2	5	7.8	5	7.1
June	7	5	7.7	4	7.2
June	R	8	7.7	8	7.2
July	2	5	8.3	5	7.0
July	7	5	7.9	4	7.0
July	R	8	8.1	7	6.9
August	2	5	8.0	5	6.7
August	7	5	8.1	4	6.9
August	R	8	8.2	7	7.0
October	2	5	7.3	5	7.2
October	7	5	7.4	4	7.1
October	R	8	7.8	8	7.6
November	2	5	7.6	5	7.6
November	7	5	8.2	5	8.1
November	R	8	7.3	8	7.2

Table 16. Minimum, maximum, mean, standard error, and 95% confidence intervals for water column total nitrite and nitrate nitrogen, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

WATER COLUMN NITRITE AND NITRATE NITROGEN
mg/l

MONTH	TRANSECT	n	MINIMUM	MAXIMUM	MEAN	S.E.	UPPER 95% C.I.	LOWER 95% C.I.
April	2	5	1.0	1.6	1.2	0.09	1.4	1.1
April	5	5	1.3	1.3	1.3	0.01	1.3	1.3
April	7	5	1.1	1.5	1.3	0.09	1.4	1.1
May	R	8	1.1	1.5	1.2	0.05	1.3	1.1
June	2	5	1.1	1.2	1.2	0.02	1.2	1.1
June	7	5	1.2	1.6	1.4	0.08	1.6	1.3
June	R	8	1.2	1.6	1.3	0.04	1.4	1.2
July	2	5	1.0	1.0	1.0	0.01	1.0	1.0
July	7	5	1.1	1.9	1.3	0.14	1.6	1.1
July	R	8	1.0	1.4	1.1	0.04	1.2	1.1
August	2	5	1.9	2.0	1.9	0.02	2.0	1.9
August	7	5	2.0	2.2	2.1	0.04	2.2	2.1
August	R	8	1.9	2.1	1.9	0.02	2.0	1.9
October	2	5	2.5	2.7	2.6	0.02	2.6	2.5
October	7	5	2.5	2.6	2.5	0.01	2.5	2.5
October	R	8	2.5	2.6	2.5	0.01	2.5	2.5
November	2	5	2.9	3.2	3.0	0.06	3.2	2.9
November	7	5	2.9	3.0	2.9	0.02	3.0	2.9
November	R	8	2.9	3.0	2.9	0.01	3.0	2.9

Table 17. Minimum, maximum, mean, standard error, and 95% confidence intervals for water column total Kjeldahl nitrogen, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

WATER COLUMN TOTAL KJELDAHL NITROGEN
mg/l

MONTH	TRANSECT	n	MINIMUM	MAXIMUM	MEAN	S.E.	UPPER 95% C.I.	LOWER 95% C.I.
April	2	5	0.1	0.2	0.1	0.02	0.1	0.1
April	5	5	0.1	0.3	0.2	0.02	0.3	0.2
April	7	5	0.2	0.3	0.3	0.02	0.3	0.2
May	R	8	0.3	0.6	0.4	0.04	0.5	0.4
June	2	5	0.2	0.6	0.4	0.07	0.5	0.2
June	7	5	0.1	0.4	0.3	0.05	0.4	0.2
June	R	8	0.3	0.7	0.4	0.04	0.5	0.3
July	2	5	0.3	0.5	0.4	0.05	0.5	0.3
July	7	5	0.3	0.3	0.3	0.01	0.3	0.2
July	R	8	0.3	0.4	0.3	0.01	0.4	0.3
August	2	5	0.1	0.3	0.2	0.05	0.3	0.1
August	7	5	0.1	0.5	0.3	0.08	0.4	0.1
August	R	8	0.2	0.5	0.3	0.04	0.4	0.2
October	2	5	0.1	0.2	0.2	0.01	0.2	0.1
October	7	5	0.1	0.2	0.2	0.02	0.2	0.1
October	R	8	0.1	0.2	0.1	0.01	0.1	0.1
November	2	5	0.3	0.4	0.4	0.01	0.4	0.3
November	7	5	0.4	0.4	0.4	0.01	0.4	0.4
November	R	8	0.3	0.5	0.4	0.02	0.4	0.4

Table 18. Minimum, maximum, mean, standard error, and 95% confidence intervals for water column total ammonia nitrogen, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

WATER COLUMN TOTAL AMMONIA NITROGEN
mg/l

MONTH	TRANSECT	n	MINIMUM	MAXIMUM	MEAN	S.E.	UPPER 95% C.I.	LOWER 95% C.I.
April	2	5	0.02	0.22	0.08	0.04	0.15	0.01
April	5	5	0.04	0.05	0.04	0	0.04	0.04
April	7	5	0.04	0.06	0.05	0	0.06	0.04
May	R	8	0.02	0.05	0.04	0	0.04	0.03
June	2	5	0.03	0.07	0.05	0.01	0.06	0.03
June	7	5	0.06	0.10	0.09	0.01	0.10	0.07
June	R	8	0.07	0.11	0.08	0.00	0.09	0.07
July	2	5	0.05	0.12	0.08	0.01	0.11	0.06
July	7	5	0.02	0.11	0.07	0.01	0.10	0.05
July	R	8	0.07	0.13	0.09	0.01	0.10	0.08
August	2	5	0.06	0.10	0.07	0.01	0.09	0.06
August	7	5	0.07	0.09	0.08	0	0.09	0.07
August	R	8	0.06	0.09	0.08	0	0.08	0.07
October	2	5	0.02	0.13	0.06	0.02	0.10	0.02
October	7	5	0.06	0.09	0.07	0.01	0.08	0.06
October	R	8	0.06	0.09	0.07	0	0.08	0.07
November	2	5	0.07	0.12	0.09	0.01	0.12	0.07
November	7	5	0.09	0.12	0.10	0.01	0.11	0.09
November	R	8	0.07	0.10	0.08	0	0.09	0.08

Table 19. Minimum, maximum, mean, standard error, and 95% confidence intervals for water column total phosphorus, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

WATER COLUMN TOTAL PHOSPHORUS
mg/l

MONTH	TRANSECT	n	MINIMUM	MAXIMUM	MEAN	S.E.	UPPER 95% C.I.	LOWER 95% C.I.
April	2	5	0.12	0.17	0.15	0.01	0.16	0.13
April	5	5	0.13	0.17	0.16	0.01	0.17	0.14
April	7	5	0.09	0.16	0.13	0.01	0.16	0.10
May	R	8	0.13	0.19	0.15	0.01	0.17	0.14
June	2	5	0.12	0.17	0.14	0.01	0.16	0.13
June	7	5	0.11	0.18	0.15	0.01	0.17	0.12
June	R	8	0.10	0.15	0.13	0.01	0.14	0.11
July	2	5	0.05	0.07	0.06	<0.01	0.07	0.06
July	7	5	0.05	0.06	0.06	<0.01	0.05	0.04
July	R	8	0.05	0.07	0.05	<0.01	0.06	0.05
August	2	5	0.10	0.15	0.12	0.01	0.14	0.11
August	7	5	0.08	0.15	0.10	0.01	0.13	0.08
August	R	8	0.11	0.16	0.13	0.01	0.14	0.11
October	2	5	0.10	0.12	0.11	<0.01	0.11	0.10
October	7	5	0.09	0.11	0.10	<0.01	0.11	0.09
October	R	8	0.09	0.12	0.11	<0.01	0.12	0.10
November	2	5	0.12	0.23	0.17	0.02	0.21	0.14
November	7	5	0.14	0.19	0.17	0.01	0.19	0.15
November	R	8	0.15	0.23	0.20	0.01	0.22	0.18

Table 20. Minimum, maximum, mean, standard error, and 95% confidence intervals for water column soluble reactive phosphorus, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

			WATER COLUMN SOLUBLE REACTIVE PHOSPHORUS mg/l					
MONTH	**TRANSECT**	**n**	**MINIMUM**	**MAXIMUM**	**MEAN**	**S.E.**	**UPPER 95% C.I.**	**LOWER 95% C.I.**
April	2	5	0.095	0.151	0.114	0.010	0.134	0.095
April	5	5	0.107	0.123	0.111	0.003	0.117	0.105
April	7	5	0.105	0.118	0.112	0.003	0.116	0.107
May	R	8	0.142	0.164	0.151	0.003	0.156	0.146
June	2	5	-	-	-	-	-	-
June	7	5	-	-	-	-	-	-
June	R	8	-	-	-	-	-	-
July	2	5	-	-	-	-	-	-
July	7	5	-	-	-	-	-	-
July	R	8	-	-	-	-	-	-
August	2	5	0.067	0.081	0.075	0.003	0.080	0.071
August	7	5	0.052	0.076	0.066	0.003	0.074	0.058
August	R	8	0.067	0.079	0.075	0.003	0.078	0.071
October	2	5	0.071	0.079	0.075	0.003	0.077	0.072
October	7	5	0.067	0.073	0.070	0.003	0.073	0.068
October	R	8	0.066	0.078	0.074	0.003	0.076	0.071
November	2	5	0.142	0.187	0.160	0.008	0.176	0.144
November	7	5	0.112	0.141	0.126	0.006	0.138	0.114
November	R	8	0.126	0.170	0.152	0.006	0.163	0.141

Table 21. Aquatic macrophyte species, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Species
Ceratophyllaceae
Ceratophyllum demersum L.
Characeae
Chara spp.
Epiphyton
Hydrodictyon sp.
Cladophora sp.
Enteromorpha sp.
Hydrocharitaceae
Elodea canadensis Rich. in Michx.
E. nuttalii (Planch.) St. John
Haloragaceae
Myriophyllum spicatum L. var. *exalbescens* (Fern.) Jeps.
Najadaceae
Najas flexilis (Willd.) Rost. and Schmidt
Potamogetonaceae
Potamogeton crispus L.
P. foliosus Raf.
P. pectinatus L.
Ranunculaceae
Ranunculus spp.
Others
Drepanocladus spp.
Lemna minor

Table 22. Minimum, maximum, mean, standard error, and 95% confidence intervals for total dry aquatic macrophyte biomass, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

			TOTAL DRY AQUATIC MACROPHYTE BIOMASS g/m²					
MONTH	TRANSECT	n	MINIMUM	MAXIMUM	MEAN	S.E.	UPPER 95% C.I.	LOWER 95% C.I.
April	2	5	0	65	23	13	48	0
April	5	5	0	128	30	25	78	0
April	7	5	0	362	138	78	292	0
May	R	8	0	849	236	106	443	29
June	2	5	0	612	176	116	403	0
June	7	4	0	3,364	1,272	660	2,566	0
June	R	7	16	1,597	478	198	866	91
July	2	5	0	154	93	30	152	33
July	7	3	0	1,129	323	210	736	0
July	R	7	0	1,915	563	229	1,012	114
August	2	5	0	318	101	63	224	0
August	7	4	0	2,026	898	394	1,670	125
August	R	7	9	1,402	493	185	855	131
October	2	5	0	296	64	58	178	0
October	7	4	0	1,026	544	190	916	171
October	R	8	60	2,584	833	282	1,384	281
November	2	5	0	150	30	30	89	0
November	7	5	23	393	212	60	330	95
November	R	8	99	417	240	40	318	162

Table 23. Nutrient analysis of aquatic macrophytes, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Date	Lab Number	Plant Species	Sample Type	P ug/g	Mg ug/g	Ca ug/g	K ug/g	S ug/g	Na ug/g	C %	H %	N %
24-Jul-94	934	*C. dem*	leaves	2,700	6,800	31,000	30,000	3,900	4,100		-	-
24-Jul-94	935	*C. dem*	leaves	2,100	6,500	18,000	25,000	2,800	2,100	36.0	5.2	2.8
20-Aug-94	922	*C. dem*	leaves	2,800	6,600	12,000	29,000	2,400	5,100	-	-	-
20-Aug-94	926	*C. dem*	leaves	2,100	6,100	17,000	28,000	4,300	6,700	-	-	-
20-Aug-94	927	*C. dem*	leaves	3,400	3,800	36,000	27,000	3,600	3,500	34.0	4.9	3.8
20-Aug-94	928	*C. dem*	leaves	2,400	5,300	12,000	27,000	3,200	5,400	36.0	5.1	3.4
20-Aug-94	929	*C. dem*	leaves	3,300	4,800	13,000	29,000	2,700	4,500	36.0	5.2	3.5
27-Oct-94	918	*C. dem*	leaves	2,700	5,800	21,000	21,000	3,300	2,800	33.0	4.8	2.9
27-Oct-94	919	*C. dem*	leaves	2,900	5,300	52,000	24,000	3,900	2,900	30.0	4.1	3.2
27-Oct-94	920	*C. dem*	leaves	3,400	5,100	20,000	25,000	4,000	3,300	35.0	5.1	3.5
27-Oct-94	921	*C. dem*	leaves	3,800	5,700	21,000	25,000	3,900	2,900	35.0	5.2	3.7
	Mean	***C. dem***	**leaves**	**2,873**	**5,618**	**23,000**	**26,364**	**3,455**	**3,936**	**34.4**	**5.0**	**3.4**
	s			555	886	12,223	2,656	619	1,374	2.1	0.4	0.3
24-Jul-94	930	*C. dem*	shoots	4,000	8,400	13,000	28,000	2,900	5,600	-	-	-
20-Aug-94	924	*C. dem*	shoots	2,200	7,600	15,000	25,000	2,800	4,900	-	-	-
27-Oct-94	914	*C. dem*	shoots	3,400	8,200	20,000	25,000	2,700	5,200	32.0	5.1	2.2
27-Oct-94	915	*C. dem*	shoots	4,300	7,200	18,000	31,000	2,800	4,500	-	-	-
27-Oct-94	917	*C. dem*	shoots	2,800	7,100	17,000	27,000	2,300	3,900	-	-	-
	Mean	***C. dem***	**shoots**	**3,340**	**7,700**	**16,600**	**27,200**	**2,700**	**4,820**	**32.0**	**5.1**	**2.2**
	s			859	583	2,702	2,490	235	653			
24-Jul-94	870	*P. crisp*	leaves	7,200	2,900	23,000	20,000	4,600	5,500	-	-	-
24-Jul-94	871	*P. crisp*	leaves	5,500	3,500	21,000	20,000	4,300	5,900	34.0	4.8	3.4
24-Jul-94	872	*P. crisp*	leaves	5,200	2,700	18,000	19,000	3,600	5,000	38.0	5.3	4.1
24-Jul-94	873	*P. crisp*	leaves	4,800	3,600	26,000	18,000	3,900	6,600	38.0	5.4	3.3
20-Aug-94	954	*P. crisp*	leaves	6,200	2,700	16,000	16,000	4,800	6,300	-	-	-
20-Aug-94	955	*P. crisp*	leaves	5,600	2,500	13,000	16,000	4,700	6,500	-	-	-

Table 23. Nutrient analysis of aquatic macrophytes, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Date	Lab Number	Plant Species	Sample Type	P ug/g	Mg ug/g	Ca ug/g	K ug/g	S ug/g	Na ug/g	C %	H %	N %
20-Aug-94	957	*P. crisp*	leaves	4,100	2,500	14,000	15,000	4,400	7,900	39.0	5.7	4.5
27-Oct-94	967	*P. crisp*	leaves	5,400	3,100	19,000	10,000	4,300	3,600	39.0	5.5	5.2
27-Oct-94	968	*P. crisp*	leaves	5,200	3,300	17,000	10,000	4,400	3,100	-	-	-
23-Nov-94	942	*P. crisp*	leaves	6,700	2,900	13,000	13,000	4,600	4,200	40.0	5.6	5.7
	Mean	*P. crisp*	leaves	**5,590**	**2,970**	**18,000**	**15,700**	**4,360**	**5,460**	**38.0**	**5.4**	**4.4**
	s			906	395	4,346	3,743	369	1,493	2.1	0.3	1.0
24-Jul-94	874	*P. crisp*	roots	2,600	3,700	51,000	20,000	5,900	3,300	23.0	3.7	1.4
20-Aug-94	959	*P. crisp*	roots	3,000	3,700	41,000	20,000	4,600	2,500	-	-	-
27-Oct-94	971	*P. crisp*	roots	6,100	4,100	34,000	18,000	3,600	1,900	22.0	3.6	1.9
27-Oct-94	974	*P. crisp*	roots	6,600	3,700	24,000	21,000	5,400	2,900	20.0	3.2	1.9
23-Nov-94	947	*P. crisp*	roots	6,100	3,000	21,000	21,000	4,800	2,900	-	-	-
	Mean	*P. crisp*	roots	**4,880**	**3,640**	**34,200**	**20,000**	**4,860**	**2,700**	**21.7**	**3.5**	**1.7**
	s			1,915	397	12,317	1,225	871	529	2	0.3	0.3
24-Jul-94	866	*P. crisp*	shoots	3,500	2,400	15,000	47,000	3,500	4,600	35.0	5.5	2.2
24-Jul-94	869	*P. crisp*	shoots	2,600	2,200	16,000	52,000	3,500	8,400	-	-	-
20-Aug-94	950	*P. crisp*	shoots	3,500	2,300	11,000	34,000	3,100	6,500	-	-	-
20-Aug-94	953	*P. crisp*	shoots	2,200	2,100	13,000	31,000	3,200	8,500	-	-	-
27-Oct-94	962	*P. crisp*	shoots	4,600	2,300	14,000	35,000	3,700	7,200	35.0	5.2	2.6
27-Oct-94	963	*P. crisp*	shoots	5,500	2,700	14,000	28,000	4,100	4,900	-	-	-
23-Nov-94	938	*P. crisp*	shoots	5,300	2,300	12,000	29,000	3,700	5,900	36.0	5.4	3.0
	Mean	*P. crisp*	shoots	**3,886**	**2,329**	**13,571**	**36,571**	**3,543**	**6,571**	**35.3**	**5.4**	**2.6**
	s			1,285	189	1,718	9,289	336	1,560	0.6	0.2	0.4
20-Aug-94	860	*P. pect*	leaves	5,900	3,700	12,000	19,000	4,100	6,000	40.0	5.9	4.7
24-Jul-94	906	*P. pect*	leaves	7,100	4,000	14,000	26,000	6,700	9,100	-	-	-
24-Jul-94	908	*P. pect*	leaves	4,200	4,300	12,000	24,000	5,800	8,000	-	-	-

Table 23. Nutrient analysis of aquatic macrophytes, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Date	Lab Number	Plant Species	Sample Type	P ug/g	Mg ug/g	Ca ug/g	K ug/g	S ug/g	Na ug/g	C %	H %	N %
24-Jul-94	909	*P. pect*	leaves	-	-	-	-	-	-	39.0	6.0	3.9
20-Aug-94	858	*P. pect*	leaves	5,800	4,100	14,000	21,000	4,900	7,900	-	-	-
27-Oct-94	882	*P. pect*	leaves	3,200	5,700	13,000	17,000	7,800	12,000	37.0	5.7	3.6
27-Oct-94	883	*P. pect*	leaves	3,100	5,700	17,000	17,000	7,300	10,000	36.0	5.5	3.5
27-Oct-94	884	*P. pect*	leaves	3,100	5,300	29,000	9,500	5,800	6,200	37.0	5.5	3.8
27-Oct-94	885	*P. pect*	leaves	4,300	5,400	19,000	16,000	6,500	10,000	37.0	5.7	4.0
23-Nov-94	894	*P. pect*	leaves	4,100	6,100	14,000	23,000	5,600	8,500	-	-	-
23-Nov-94	897	*P. pect*	leaves	-	-	-	-	-	-	34.0	5.4	3.2
	Mean	*P. pect*	leaves	**4,533**	**4,922**	**16,000**	**19,167**	**6,056**	**8,633**	**37.1**	**5.7**	**3.8**
	s			1,427	893	5,385	5,012	1,157	1,907	2.0	0.2	0.5
24-Jul-94	910	*P. pect*	roots	2,000	5,100	30,000	14,000	3,500	1,900	26.0	4.2	1.5
24-Jul-94	911	*P. pect*	roots	1,600	3,900	23,000	18,000	3,400	2,000	-	-	-
24-Jul-94	913	*P. pect*	roots	3,500	3,300	18,000	23,000	5,300	4,400	-	-	-
20-Aug-94	862	*P. pect*	roots	1,900	4,800	43,000	12,000	2,300	2,500	27.0	4.1	1.4
20-Aug-94	865	*P. pect*	roots	3,400	3,100	22,000	28,000	63,000	6,800	-	-	-
27-Oct-94	886	*P. pect*	roots	2,400	2,400	11,000	27,000	2,500	4,300	38.0	5.9	1.2
27-Oct-94	887	*P. pect*	roots	2,200	1,900	8,700	22,000	2,600	4,600	37.0	5.8	1.4
27-Oct-94	889	*P. pect*	roots	2,200	1,900	9,500	23,000	2,400	4,100	38.0	5.8	1.3
23-Nov-94	898	*P. pect*	roots	3,600	2,100	12,000	26,000	3,000	34,000	-	-	-
23-Nov-94	900	*P. pect*	roots	4,200	2,500	15,000	32,000	4,500	6,200	-	-	-
	Mean	***P. pect***	**roots**	**2,700**	**3,100**	**19,220**	**22,500**	**9,250**	**7,080**	**33.2**	**5.2**	**1.4**
	s			889	1,169	10,790	6,294	18,911	9,598	6.1	0.9	0.1
24-Jul-94	902	*P. pect*	shoots	4,900	2,700	9,400	34,000	3,400	5,100	37.0	5.7	2.6
24-Jul-94	903	*P. pect*	shoots	2,600	2,700	8,200	39,000	2,300	5,500	37.0	5.7	2.1
24-Jul-94	905	*P. pect*	shoots	5,400	3,200	13,000	35,000	3,700	6,100	-	-	-
20-Aug-94	854	*P. pect*	shoots	4,000	3,400	14,000	31,000	4,000	9,700	36.0	5.4	2.6

Table 23. Nutrient analysis of aquatic macrophytes, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Date	Lab Number	Plant Species	Sample Type	P ug/g	Mg ug/g	Ca ug/g	K ug/g	S ug/g	Na ug/g	C %	H %	N %
20-Aug-94	857	*P. pect*	shoots	4,000	3,100	12,000	32,000	4,700	11,000	36.0	5.5	3.1
27-Oct-94	878	*P. pect*	shoots	2,600	4,700	24,000	24,000	4,800	9,700	31.0	4.8	2.4
27-Oct-94	879	*P. pect*	shoots	2,900	4,600	16,000	26,000	4,000	10,000	35.0	5.4	2.5
27-Oct-94	880	*P. pect*	shoots	2,300	4,000	15,000	28,000	3,800	9,100	35.0	5.5	2.0
27-Oct-94	881	*P. pect*	shoots	2,200	4,000	13,000	26,000	3,800	11,000	35.0	5.6	2.1
23-Nov-94	890	*P. pect*	shoots	4,900	3,500	13,000	35,000	3,200	6,600	-	-	-
23-Nov-94	892	*P. pect*	shoots	4,000	3,700	14,000	33,000	3,500	8,300	-	-	-
	Mean	***P. pect***	**shoots**	**3,618**	**3,600**	**13,782**	**31,182**	**3,745**	**8,373**	**35.3**	**5.5**	**2.4**
	s			1,150	680	4,078	4,665	688	2,186	1.9	0.3	0.4

Table 23b. Nutrient analysis of aquatic macrophytes by date, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Date	Lab Number	Plant Species	Sample Type	P ug/g	Mg ug/g	Ca ug/g	K ug/g	S ug/g	Na ug/g	C %	H %	N %
24-Jul-94	934	*C. dem*	leaves	2,700	6,800	31,000	30,000	3,900	4,100	-	-	-
24-Jul-94	935	*C. dem*	leaves	2,100	6,500	18,000	25,000	2,800	2,100	36.0	5.2	2.8
24-Jul-94	930	*C. dem*	shoots	4,000	8,400	13,000	28,000	2,900	5,600	-	-	-
24-Jul-94	870	*P. crisp*	leaves	7,200	2,900	23,000	20,000	4,600	5,500	-	-	-
24-Jul-94	871	*P. crisp*	leaves	5,500	3,500	21,000	20,000	4,300	5,900	34.0	4.8	3.4
24-Jul-94	872	*P. crisp*	leaves	5,200	2,700	18,000	19,000	3,600	5,000	38.0	5.3	4.1
24-Jul-94	873	*P. crisp*	leaves	4,800	3,600	26,000	18,000	3,900	6,600	38.0	5.4	3.3
24-Jul-94	874	*P. crisp*	roots	2,600	3,700	51,000	20,000	5,900	3,300	23.0	3.7	1.4
24-Jul-94	866	*P. crisp*	shoots	3,500	2,400	15,000	47,000	3,500	4,600	35.0	5.5	2.2
24-Jul-94	869	*P. crisp*	shoots	2,600	2,200	16,000	52,000	3,500	8,400	-	-	-
24-Jul-94	906	*P. pect*	leaves	7,100	4,000	14,000	26,000	6,700	9,100	-	-	-
24-Jul-94	908	*P. pect*	leaves	4,200	4,300	12,000	24,000	5,800	8,000	-	-	-
24-Jul-94	909	*P. pect*	leaves	-	-	-	-	-	-	39.0	6.0	3.9
24-Jul-94	910	*P. pect*	roots	2,000	5,100	30,000	14,000	3,500	1,900	26.0	4.2	1.5
24-Jul-94	911	*P. pect*	roots	1,600	3,900	23,000	18,000	3,400	2,000	-	-	-
24-Jul-94	913	*P. pect*	roots	3,500	3,300	18,000	23,000	5,300	4,400	-	-	-
24-Jul-94	902	*P. pect*	shoots	4,900	2,700	9,400	34,000	3,400	5,100	37.0	5.7	2.6
24-Jul-94	903	*P. pect*	shoots	2,600	2,700	8,200	39,000	2,300	5,500	37.0	5.7	2.1
24-Jul-94	905	*P. pect*	shoots	5,400	3,200	13,000	35,000	3,700	6,100	-	-	-
			July Mean	3,972	3,994	19,978	27,333	4,056	5,178	34.3	5.2	2.7
			s	1,688	1,689	10,116	10,466	1,176	2,079	5.4	0.7	0.9
20-Aug-94	922	*C. dem*	leaves	2,800	6,600	12,000	29,000	2,400	5,100	-	-	-
20-Aug-94	926	*C. dem*	leaves	2,100	6,100	17,000	28,000	4,300	6,700	-	-	-
20-Aug-94	927	*C. dem*	leaves	3,400	3,800	36,000	27,000	3,600	3,500	34.0	4.9	3.8
20-Aug-94	928	*C. dem*	leaves	2,400	5,300	12,000	27,000	3,200	5,400	36.0	5.1	3.4
20-Aug-94	929	*C. dem*	leaves	3,300	4,800	13,000	29,000	2,700	4,500	36.0	5.2	3.5

Table 23b. Nutrient analysis of aquatic macrophytes by date, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Date	Lab Number	Plant Species	Sample Type	P ug/g	Mg ug/g	Ca ug/g	K ug/g	S ug/g	Na ug/g	C %	H %	N %
20-Aug-94	924	*C. dem*	shoots	2,200	7,600	15,000	25,000	2,800	4,900	-	-	-
20-Aug-94	954	*P. crisp*	leaves	6,200	2,700	16,000	16,000	4,800	6,300	-	-	-
20-Aug-94	955	*P. crisp*	leaves	5,600	2,500	13,000	16,000	4,700	6,500	-	-	-
20-Aug-94	957	*P. crisp*	leaves	4,100	2,500	14,000	15,000	4,400	7,900	39.0	5.7	4.5
20-Aug-94	959	*P. crisp*	roots	3,000	3,700	41,000	20,000	4,600	2,500	-	-	-
20-Aug-94	950	*P. crisp*	shoots	3,500	2,300	11,000	34,000	3,100	6,500	-	-	-
20-Aug-94	953	*P. crisp*	shoots	2,200	2,100	13,000	31,000	3,200	8,500	-	-	-
20-Aug-94	860	*P. pect*	leaves	5,900	3,700	12,000	19,000	4,100	6,000	40.0	5.9	4.7
20-Aug-94	858	*P. pect*	leaves	5,800	4,100	14,000	21,000	4,900	7,900	-	-	-
20-Aug-94	862	*P. pect*	roots	1,900	4,800	43,000	12,000	2,300	2,500	27.0	4.1	1.4
20-Aug-94	865	*P. pect*	roots	3,400	3,100	22,000	28,000	63,000	6,800	-	-	-
20-Aug-94	854	*P. pect*	shoots	4,000	3,400	14,000	31,000	4,000	9,700	36.0	5.4	2.6
20-Aug-94	857	*P. pect*	shoots	4,000	3,100	12,000	32,000	4,700	11,000	36.0	5.5	3.1
			Aug. Mean	3,656	4,011	18,333	24,444	7,044	6,233	35.5	5.2	3.4
			s	1,395	1,572	10,353	6,697	13,992	2,279	3.9	0.6	1.0
27-Oct-94	918	*C. dem*	leaves	2,700	5,800	21,000	21,000	3,300	2,800	33.0	4.8	2.9
27-Oct-94	919	*C. dem*	leaves	2,900	5,300	52,000	24,000	3,900	2,900	30.0	4.1	3.2
27-Oct-94	920	*C. dem*	leaves	3,400	5,100	20,000	25,000	4,000	3,300	35.0	5.1	3.5
27-Oct-94	921	*C. dem*	leaves	3,800	5,700	21,000	25,000	3,900	2,900	35.0	5.2	3.7
27-Oct-94	914	*C. dem*	shoots	3,400	8,200	20,000	25,000	2,700	5,200	32.0	5.1	2.2
27-Oct-94	915	*C. dem*	shoots	4,300	7,200	18,000	31,000	2,800	4,500	-	-	-
27-Oct-94	917	*C. dem*	shoots	2,800	7,100	17,000	27,000	2,300	3,900	-	-	-
27-Oct-94	967	*P. crisp*	leaves	5,400	3,100	19,000	10,000	4,300	3,600	39.0	5.5	5.2
27-Oct-94	968	*P. crisp*	leaves	5,200	3,300	17,000	10,000	4,400	3,100	-	-	-
27-Oct-94	971	*P. crisp*	roots	6,100	4,100	34,000	18,000	3,600	1,900	22.0	3.6	1.9
27-Oct-94	974	*P. crisp*	roots	6,600	3,700	24,000	21,000	5,400	2,900	20.0	3.2	1.9
27-Oct-94	962	*P. crisp*	shoots	4,600	2,300	14,000	35,000	3,700	7,200	35.0	5.2	2.6

Table 23b. Nutrient analysis of aquatic macrophytes by date, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Date	Lab Number	Plant Species	Sample Type	P ug/g	Mg ug/g	Ca ug/g	K ug/g	S ug/g	Na ug/g	C %	H %	N %
27-Oct-94	963	*P. crisp*	shoots	5,500	2,700	14,000	28,000	4,100	4,900	-	-	-
27-Oct-94	882	*P. pect*	leaves	3,200	5,700	13,000	17,000	7,800	12,000	37.0	5.7	3.6
27-Oct-94	883	*P. pect*	leaves	3,100	5,700	17,000	17,000	7,300	10,000	36.0	5.5	3.5
27-Oct-94	884	*P. pect*	leaves	3,100	5,300	29,000	9,500	5,800	6,200	37.0	5.5	3.8
27-Oct-94	885	*P. pect*	leaves	4,300	5,400	19,000	16,000	6,500	10,000	37.0	5.7	4.0
27-Oct-94	886	*P. pect*	roots	2,400	2,400	11,000	27,000	2,500	4,300	38.0	5.9	1.2
27-Oct-94	887	*P. pect*	roots	2,200	1,900	8,700	22,000	2,600	4,600	37.0	5.8	1.4
27-Oct-94	889	*P. pect*	roots	2,200	1,900	9,500	23,000	2,400	4,100	38.0	5.8	1.3
27-Oct-94	878	*P. pect*	shoots	2,600	4,700	24,000	24,000	4,800	9,700	31.0	4.8	2.4
27-Oct-94	879	*P. pect*	shoots	2,900	4,600	16,000	26,000	4,000	10,000	35.0	5.4	2.5
27-Oct-94	880	*P. pect*	shoots	2,300	4,000	15,000	28,000	3,800	9,100	35.0	5.5	2.0
27-Oct-94	881	*P. pect*	shoots	2,200	4,000	13,000	26,000	3,800	11,000	35.0	5.6	2.1
			Oct. Mean	3,633	4,550	19,425	22,313	4,154	5,838	33.9	5.2	2.7
			s	1,316	1,705	9,065	6,547	1,485	3,145	5.0	0.7	1.0
23-Nov-94	942	*P. crisp*	leaves	6,700	2,900	13,000	13,000	4,600	4,200	40.0	5.6	5.7
23-Nov-94	947	*P. crisp*	roots	6,100	3,000	21,000	21,000	4,800	2,900	-	-	-
23-Nov-94	938	*P. crisp*	shoots	5,300	2,300	12,000	29,000	3,700	5,900	36.0	5.4	3.0
23-Nov-94	894	*P. pect*	leaves	4,100	6,100	14,000	23,000	5,600	8,500	-	-	-
23-Nov-94	897	*P. pect*	leaves	-	-	-	-	-	-	34.0	5.4	3.2
23-Nov-94	898	*P. pect*	roots	3,600	2,100	12,000	26,000	3,000	34,000	-	-	-
23-Nov-94	900	*P. pect*	roots	4,200	2,500	15,000	32,000	4,500	6,200	-	-	-
23-Nov-94	890	*P. pect*	shoots	4,900	3,500	13,000	35,000	3,200	6,600	-	-	-
23-Nov-94	892	*P. pect*	shoots	4,000	3,700	14,000	33,000	3,500	8,300	-	-	-
			Nov. Mean	4,863	3,263	14,250	26,500	4,113	9,575	36.7	5.5	4.0
			s	1,099	1,274	2,915	7,329	901	10,047	3.1	0.1	1.5

Table 24. Minimum, maximum, mean, standard error, and 95% confidence intervals of monochromatic chlorophyll *a* , Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

			MONOCHROMATIC CHLOROPHYLL *a* mg/m³					
MONTH	TRANSECT	n	MINIMUM	MAXIMUM	MEAN	S.E.	UPPER 95% C.I.	LOWER 95% C.I.
April	2	5	24.2	30.9	27.7	1.1	29.8	25.6
April	5	5	27.2	31.0	29.2	0.7	30.4	27.9
April	7	5	25.0	30.9	27.9	1.0	29.8	26.0
May	R	8	13.9	20.8	16.8	0.9	18.5	15.0
June	2	5	6.9	12.1	9.8	0.8	11.4	8.2
June	7	4	6.1	12.5	12.0	1.1	14.1	9.8
June	R	7	9.2	12.5	10.6	0.4	11.5	9.8
July	2	5	6.3	107.9	33.8	19.0	71.1	3.5
July	7	3	1.4	6.8	5.1	1.0	7.1	3.2
July	R	7	4.5	10.6	7.0	0.8	8.5	5.4
August	2	5	9.1	20.7	11.7	2.2	16.1	7.3
August	7	4	5.6	26.9	14.8	4.1	22.7	6.8
August	R	7	5.3	20.3	12.1	2.0	16.0	8.2
October	2	5	5.8	15.3	9.1	1.7	12.4	5.8
October	7	4	5.2	9.8	7.3	1.0	9.3	5.3
October	R	8	4.6	14.2	11.2	1.2	13.5	8.9
November	2	5	7.2	9.7	8.6	0.4	9.4	7.8
November	7	5	3.7	9.8	6.7	1.0	8.7	4.8
November	R	8	5.4	11.6	9.5	0.7	10.9	8.1

Table 25. Minimum, maximum, mean, standard error, and 95% confidence intervals of trichromatic chlorophyll *a* , Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

			TRICHROMATIC CHLOROPHYLL *a* mg/m^3					
MONTH	TRANSECT	n	MINIMUM	MAXIMUM	MEAN	S.E.	UPPER 95% C.I.	LOWER 95% C.I.
April	2	5	27.5	34.2	31.3	1.1	33.5	29.2
April	5	5	30.2	35.2	32.2	0.9	33.9	30.5
April	7	5	28.1	32.3	30.8	0.7	32.2	29.4
May	R	8	16.0	23.7	19.0	0.9	20.8	17.2
June	2	5	11.3	13.2	12.2	0.3	12.8	11.5
June	7	4	6.8	14.5	14.1	1.3	16.6	11.6
June	R	7	10.6	14.5	12.8	0.5	13.7	11.9
July	2	5	7.4	113.8	36.6	19.9	75.6	0
July	7	3	2.2	8.2	6.2	1.1	8.3	4.1
July	R	7	7.3	11.3	9.6	0.5	10.5	8.7
August	2	5	13.1	23.5	15.4	2.0	19.4	11.4
August	7	4	6.5	33.5	19.6	5.6	30.6	8.6
August	R	7	7.3	24.7	15.0	2.1	19.2	10.8
October	2	5	7.3	17.8	11.4	1.8	15.0	7.8
October	7	4	7.4	15.6	11.1	1.5	14.1	8.1
October	R	8	9.5	18.1	14.3	1.0	16.2	12.4
November	2	5	8.8	12.9	11.3	0.8	12.8	9.8
November	7	5	7.9	12.3	10.2	1.0	12.0	8.3
November	R	8	8.5	15.1	12.9	0.8	14.5	11.3

Table 26. Weights of sediment trap-collected sediments with minima, maxima, means, standard errors, and 95% confidence intervals of sediments, Middle Snake River, Idaho, 1994.

COLLECTION DATE	RIVER REACH	RIVER MILE	LOCATION	SEDIMENT TRAP COLLECTION RATES g/m²/day n	MINIMUM	MAXIMUM	MEAN	S.E.	UPPER 95% C.I.	LOWER 95% C.I.
24-May-94	CSR	600.9	Above ag & hatchery returns, 30m off RBk	5	124.5	162.2	139.1	8.1	154.9	123.3
13-Aug-94	CSR	600.9	Above ag & hatchery returns, 30m off RBk	5	74.2	102.5	88.4	5.3	98.7	78.1
25-Aug-94	CSR	600.9	Above ag & hatchery returns, 30m off RBk	5	432.6	477.6	460.3	9.2	478.2	442.3
08-Sep-94	CSR	600.9	Above ag & hatchery returns, 30m off RBk	5	323.7	363.9	340.8	6.6	353.7	327.9
27-Sep-94	CSR	600.9	Above ag & hatchery returns, 30m off RBk	5	339.6	427.7	389.9	16.2	421.6	358.2
13-Aug-94	CSR	600.5	0.1 RM < TR#2, < hatchery outflow and 40m off RBk	4	398.1	497.9	457.9	21.5	500.1	415.8
25-Aug-94	CSR	600.5	0.1 RM < TR#2, < hatchery outflow and 40m off RBk	5	310.1	349.8	329.0	8.3	345.3	312.8
08-Sep-94	CSR	600.5	0.1 RM < TR#2, < hatchery outflow and 40m off RBk	3	175.7	237.7	197.5	20.1	236.9	158.0
27-Sep-94	CSR	600.5	0.1 RM < TR#2, < hatchery outflow and 40m off RBk	5	108.1	125.5	118.3	3.0	124.2	112.5
13-Aug-94	CSR	600.2	TR#5, middle of AMB, mid-channel 60m off LBk	5	232.1	277.4	247.5	7.9	262.9	232.1
25-Aug-94	CSR	600.2	TR#5, middle of AMB, mid-channel 60m off LBk	5	235.2	292.7	257.1	9.7	276.0	238.2
08-Sep-94	CSR	600.2	TR#5, middle of AMB, mid-channel 60m off LBk	5	174.4	275.1	223.5	18.5	259.7	187.3
27-Sep-94	CSR	600.2	TR#5, middle of AMB, mid-channel 60m off LBk	5	58.6	86.5	69.5	4.6	78.5	60.4
24-May-94	CSR	600.0	TR#7, bottom of AMB, mid-channel 50m off LBk	5	199.6	397.5	301.8	33.2	366.9	236.7
13-Aug-94	CSR	600.0	TR#7, bottom of AMB, mid-channel 50m off LBk	5	426.3	590.8	482.2	31.5	543.9	420.5
25-Aug-94	CSR	600.0	TR#7, bottom of AMB, mid-channel 50m off LBk	5	96.0	184.4	131.7	16.0	163.0	100.3
08-Sep-94	CSR	600.0	TR#7, bottom of AMB, mid-channel 50m off LBk	5	103.7	142.1	121.3	6.2	133.6	109.1
27-Sep-94	CSR	600.0	TR#7, bottom of AMB, mid-channel 50m off LBk	5	186.4	231.2	202.6	8.0	218.2	187.1
30-Jul-94	BCR	588.7	Above plantbed, 50m off RBk	10	187.0	223.3	202.0	3.9	209.7	194.4
25-Aug-94	BCR	588.7	Above plantbed, 50m off RBk	5	74.9	97.7	87.9	4.0	95.7	80.0
08-Sep-94	BCR	588.7	Above plantbed, 50m off RBk	5	86.7	104.9	96.7	3.5	103.7	89.8
27-Sep-94	BCR	588.7	Above plantbed, 50m off RBk	5	71.5	80.7	75.3	1.6	78.4	72.2
25-Aug-94	BCR	588.5	Center of plantbed, 60m off LBk, across from hatchery	5	148.0	193.6	174.3	8.8	191.6	156.9
08-Sep-94	BCR	588.5	Center of plantbed, 60m off LBk, across from hatchery	5	119.2	155.3	139.2	5.8	150.5	127.9
27-Sep-94	BCR	588.5	Center of plantbed, 60m off LBk, across from hatchery	5	114.1	174.9	136.2	10.9	157.5	114.8
30-Jul-94	BCR	588.3	Below plantbed, 40m from LBk, above hydro plant	10	198.3	367.0	267.5	19.9	306.4	228.5
25-Aug-94	BCR	588.3	Below plantbed, 40m from LBk, above hydro plant	4	102.8	114.4	108.0	2.8	113.5	102.5
08-Sep-94	BCR	588.3	Below plantbed, 40m from LBk, above hydro plant	4	82.0	116.3	100.4	7.9	115.8	84.9
27-Sep-94	BCR	588.3	Below plantbed, 40m from LBk, above hydro plant	4	67.0	74.1	69.9	1.7	73.2	66.5
08-Sep-94	TSR	585.8	60m off RBk	5	0.1	20.4	8.7	3.8	16.2	1.2
25-Aug-94	TSR	585.6	Middle of channel	4	105.0	204.2	153.8	23.5	199.8	107.7
25-Aug-94	TSR	585.4	Middle of channel, directly across from rock bluff	3	175.7	220.8	195.9	13.2	221.8	169.9

Table 27. Nutrient content of sediment trap-collected sediments, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994 (Means where applicable).

COLLECTION DATE	RIVER REACH	RIVER MILE	LOCATION	n	SEDIMENT TRAP SEDIMENT NUTRIENTS: TOTAL P ug/g	PLANT-AVAILABLE P ug/g	PLANT-AVAILABLE K ug/g	ORGANIC C %	ORGANIC MATTER %	C %	H %	N %
24-May-94	CSR	600.9	Above ag & hatchery returns, 30m off RBk	2	1,380	-	-	3.5	6.0	5.9	0.9	0.5
13-Aug-94	CSR	600.9	Above ag & hatchery returns, 30m off RBk	1	1,350	193.0	437.0	3.6	6.2	5.6	1.0	0.5
25-Aug-94	CSR	600.9	Above ag & hatchery returns, 30m off RBk	1	859	114.0	246.0	2.1	3.6	4.1	0.8	0.8
08-Sep-94	CSR	600.9	Above ag & hatchery returns, 30m off RBk	1	1,100	125.0	255.0	2.5	4.3	4.4	0.8	0.3
27-Sep-94	CSR	600.9	Above ag & hatchery returns, 30m off RBk	1	1,200	154.0	388.0	3.1	5.3	4.4	0.8	0.3
13-Aug-94	CSR	600.5	0.1 RM <TR#2, < hatchery outflow and 40m off RBk	2	1,340	111.5	279.5	3.6	6.2	5.5	0.9	0.4
25-Aug-94	CSR	600.5	0.1 RM <TR#2, < hatchery outflow and 40m off RBk	2	1,405	125.0	245.5	2.9	4.9	5.2	0.9	0.4
08-Sep-94	CSR	600.5	0.1 RM <TR#2, < hatchery outflow and 40m off RBk	1	1,330	120.0	272.0	2.8	4.8	4.2	0.8	0.3
27-Sep-94	CSR	600.5	0.1 RM <TR#2, < hatchery outflow and 40m off RBk	1	1,640	182.0	366.0	3.8	6.5	6.7	1.0	0.7
13-Aug-94	CSR	600.2	TR#5, middle of AMB, mid-channel 60m off LBk	2	1,170	139.0	335.0	2.7	4.7	4.2	0.8	0.3
25-Aug-94	CSR	600.2	TR#5, middle of AMB, mid-channel 60m off LBk	1	1,240	138.0	414.0	2.9	5.0	5.0	1.0	0.4
08-Sep-94	CSR	600.2	TR#5, middle of AMB, mid-channel 60m off LBk	1	1,290	183.0	470.0	3.1	5.3	5.0	1.1	0.4
27-Sep-94	CSR	600.2	TR#5, middle of AMB, mid-channel 60m off LBk	1	1,820	-	-	5.9	10.2	7.7	1.5	0.9
24-May-94	CSR	600.0	TR#7, bottom of AMB, mid-channel 50m off LBk	1	1,300	114.0	233.0	2.4	4.1	3.8	0.7	0.3
13-Aug-94	CSR	600.0	TR#7, bottom of AMB, mid-channel 50m off LBk	2	1,210	100.9	232.5	2.1	3.6	3.7	0.7	0.3
25-Aug-94	CSR	600.0	TR#7, bottom of AMB, mid-channel 50m off LBk	1	1,320	142.0	295.0	2.8	4.8	4.6	1.0	0.4
08-Sep-94	CSR	600.0	TR#7, bottom of AMB, mid-channel 50m off LBk	1	1,570	-	-	3.7	6.3	5.2	1.1	0.6
27-Sep-94	CSR	600.0	TR#7, bottom of AMB, mid-channel 50m off LBk	1	1,430	238.0	720.0	3.7	6.4	5.3	1.1	0.6
30-Jul-94	BCR	588.7	Above plantbed, 50m off RBk	2	1,295	-	-	3.2	5.5	5.0	0.9	0.4
25-Aug-94	BCR	588.7	Above plantbed, 50m off RBk	2	1,230	167.0	526.0	3.7	6.3	5.2	1.1	0.5
08-Sep-94	BCR	588.7	Above plantbed, 50m off RBk	1	1,350	-	-	4.1	7.1	5.5	1.2	0.5
27-Sep-94	BCR	588.7	Above plantbed, 50m off RBk	1	1,420	-	-	4.7	8.1	5.9	1.2	0.7
25-Aug-94	BCR	588.5	Center of plantbed, 60m off LBk, across from hatchery	2	1,340	168.5	395.0	4.0	6.9	5.6	1.1	0.5
08-Sep-94	BCR	588.5	Center of plantbed, 60m off LBk, across from hatchery	1	1,380	-	-	4.3	7.4	6.0	1.3	0.7
27-Sep-94	BCR	588.5	Center of plantbed, 60m off LBk, across from hatchery	1	1,320	146.0	341.0	4.3	7.5	6.1	1.3	0.7
30-Jul-94	BCR	588.3	Below plantbed, 40m from LBk, above hydro plant	2	1,480	136.0	334.5	3.2	5.6	4.5	0.8	0.4
25-Aug-94	BCR	588.3	Below plantbed, 40m from LBk, above hydro plant	1	1,450	132.0	499.0	3.2	5.5	4.4	0.9	0.4
08-Sep-94	BCR	588.3	Below plantbed, 40m from LBk, above hydro plant	1	1,510	-	-	4.2	7.2	6.0	1.1	0.6
27-Sep-94	BCR	588.3	Below plantbed, 40m from LBk, above hydro plant	1	1,210	-	-	4.2	7.2	5.5	1.0	0.6
08-Sep-94	TSR	585.8	60m off RBk	2	NS	355.0	1060.0	5.5	9.4	7.2	1.4	0.8
25-Aug-94	TSR	585.6	Middle of channel	2	1280.0	116.7	420.5	3.2	5.8	4.9	1.0	0.5
25-Aug-94	TSR	585.4	Middle of channel, directly across from rock bluff	1	1240.0	152.0	353.0	3.1	5.4	4.5	1.0	0.5

Table 28. Mean sediment total phosphorus, plant-available phosphorus and potassium, organic carbon, organic matter, carbon, hydrogen, and nitrogen deposited in Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

							Nutrient Analysis of Sediment Trap Samples								Rates of Nutrient Accrual g/m2/day							
COLLECTION DATE	RIVER REACH	RIVER MILE	Sediment n	Number of Days Trap in Place	Mean Sedimentation Rate g/m2/day	Nutrient n	Total P ug/g	Plant Available P ug/g	Plant Available K ug/g	Organic Carbon %	Organic Matter %	C %	H %	N %	Total P	Plant Available P	Plant Available K	Organic Carbon	Organic Matter	C	H	N
24-May-94	CSR	600.9	5	8	139.1	2	1,380	-	-	3.5	6.0	5.9	0.9	0.5	0.19	-	-	4.84	8.31	8.27	1.22	0.65
13-Aug-94	CSR	600.9	5	14	88.4	1	1,350	193.0	437.0	3.6	6.2	5.6	1.0	0.5	0.12	0.02	0.04	3.16	5.44	4.98	0.92	0.42
25-Aug-94	CSR	600.9	5	12	460.3	1	859	114.0	246.0	2.1	3.6	4.1	0.8	0.8	0.40	0.05	0.11	9.53	16.39	18.73	3.64	3.59
08-Sep-94	CSR	600.9	5	14	340.8	1	1,100	125.0	255.0	2.5	4.3	4.4	0.8	0.3	0.37	0.04	0.09	8.49	14.59	14.89	2.62	1.06
27-Sep-94	CSR	600.9	5	19	389.9	1	1,200	154.0	388.0	3.1	5.3	4.4	0.8	0.3	0.47	0.06	0.15	12.01	20.66	17.00	3.04	1.25
													Mean	**=**	**0.31**	**0.04**	**0.10**	**7.60**	**13.08**	**12.77**	**2.29**	**1.39**
13-Aug-94	CSR	600.5	4	14	457.9	2	1,340	111.5	279.5	3.6	6.2	5.5	0.9	0.4	0.61	0.05	0.13	16.53	28.44	25.28	4.17	1.79
25-Aug-94	CSR	600.5	5	12	329.0	2	1,405	125.0	245.5	2.9	4.9	5.2	0.9	0.4	0.46	0.04	0.08	9.41	16.19	16.96	2.81	1.40
08-Sep-94	CSR	600.5	3	14	197.5	1	1,330	120.0	272.0	2.8	4.8	4.2	0.8	0.3	0.26	0.02	0.05	5.47	9.40	8.21	1.62	0.61
27-Sep-94	CSR	600.5	5	19	118.3	1	1,640	182.0	366.0	3.8	6.5	6.7	1.0	0.7	0.19	0.02	0.04	4.50	7.74	7.98	1.16	0.84
													Mean	**=**	**0.38**	**0.03**	**0.08**	**8.98**	**15.44**	**14.61**	**2.44**	**1.16**
13-Aug-94	CSR	600.2	5	14	247.5	2	1,170	139.0	335.0	2.7	4.7	4.2	0.8	0.3	0.29	0.03	0.08	6.71	11.53	10.39	2.03	0.84
25-Aug-94	CSR	600.2	5	12	257.1	1	1,240	138.0	414.0	2.9	5.0	5.0	1.0	0.4	0.32	0.04	0.11	7.51	12.91	12.73	2.57	1.03
08-Sep-94	CSR	600.2	5	14	223.5	1	1,290	183.0	4.7	3.1	5.3	5.0	1.1	0.4	0.29	0.04	0.00	6.93	11.91	11.17	2.41	0.96
27-Sep-94	CSR	600.2	5	19	69.5	1	1,820	-	-	5.9	10.2	7.7	1.5	0.9	0.13	-	-		7.07	5.33	1.03	0.63
													Mean	**=**	**0.26**	**0.04**	**0.06**	**7.05**	**10.85**	**9.91**	**2.01**	**0.86**
24-May-94	CSR	600.0	5	8	301.8	1	1,300	114.0	233.0	2.4	4.1	3.8	0.7	0.3	0.39	0.03	0.07	7.24	12.46	11.53	2.14	0.88
13-Aug-94	CSR	600.0	5	14	482.2	2	1,210	100.9	232.5	2.1	3.6	3.7	0.7	0.3	0.58	0.05	0.11	10.03	17.26	17.70	3.52	1.25
25-Aug-94	CSR	600.0	5	12	131.7	1	1,320	142.0	295.0	2.8	4.8	4.6	1.0	0.4	0.17	0.02	0.04	3.65	6.27	6.06	1.26	0.53
08-Sep-94	CSR	600.0	5	14	121.3	1	1,570	-	-	3.7	6.3	5.2	1.1	0.6	0.19	-	-	4.45	7.66	6.33	1.31	0.67
27-Sep-94	CSR	600.0	5	19	202.6	1	1,430	238.0	720.0	3.7	6.4	5.3	1.1	0.6	0.29	0.05	0.15	7.58	13.03	10.78	2.21	1.16
													Mean	**=**	**0.33**	**0.04**	**0.09**	**6.59**	**11.34**	**10.48**	**2.09**	**0.90**
30-Jul-94	BCR	588.7	10	8	202.0	2	1,295	-	-	3.2	5.5	5.0	0.9	0.4	0.26	-	-	6.47	11.12	10.14	1.85	0.90
25-Aug-94	BCR	588.7	5	26	87.9	2	1,230	167.0	526.0	3.7	6.3	5.2	1.1	0.5	0.11	0.01	0.05	3.22	5.53	4.57	0.93	0.45
08-Sep-94	BCR	588.7	5	14	96.7	1	1,350	-	-	4.1	7.1	5.5	1.2	0.5	0.13	-	-	4.00	6.89	5.33	1.11	0.52
27-Sep-94	BCR	588.7	5	19	75.3	1	1,420	-	-	4.7	8.1	5.9	1.2	0.7	0.11	-	-	3.56	6.13	4.42	0.89	0.53
													Mean	**=**	**0.15**	**0.01**	**0.05**	**4.31**	**7.42**	**6.12**	**1.19**	**0.60**
25-Aug-94	BCR	588.5	5	26	174.3	2	1,340	168.5	395.0	4.0	6.9	5.6	1.1	0.5	0.23	0.03	0.07	7.02	12.08	9.74	1.88	0.94
08-Sep-94	BCR	588.5	5	14	139.2	1	1,380	-	-	4.3	7.4	6.0	1.3	0.7	0.19	-	-	5.98	10.30	8.29	1.74	0.93
27-Sep-94	BCR	588.5	5	19	136.2	1	1,320	146.0	341.0	4.3	7.5	6.1	1.3	0.7	0.18	0.02	0.05	5.91	10.16	8.26	1.73	0.98
													Mean	**=**	**0.20**	**0.02**	**0.06**	**6.31**	**10.84**	**8.77**	**1.78**	**0.95**
30-Jul-94	BCR	588.3	10	8	267.5	2	1,480	136.0	334.5	3.2	5.6	4.5	0.8	0.4	0.40	0.04	0.09	8.65	14.88	11.97	2.23	1.00
25-Aug-94	BCR	588.3	4	26	108.0	1	1,450	132.0	499.0	3.2	5.5	4.4	0.9	0.4	0.16	0.01	0.05	3.44	5.93	4.76	0.99	0.42
08-Sep-94	BCR	588.3	4	14	100.4	1	1,510	-	-	4.2	7.2	6.0	1.1	0.6	0.15	-	-	4.22	7.25	5.97	1.10	0.56
27-Sep-94	BCR	588.3	4	19	69.9	1	1,210	-	-	4.2	7.2	5.5	1.0	0.6	0.08	-	-	2.91	5.00	3.83	0.73	0.41
													Mean	**=**	**0.20**	**0.02**	**0.07**	**4.80**	**8.27**	**6.63**	**1.26**	**0.60**
08-Sep-94	TSR	585.8	5	14	8.7	2	NS	355.0	1060.0	5.5	9.4	7.2	1.4	0.8	-	0.00	0.01	0.48	0.82	0.63	0.12	0.07
25-Aug-94	TSR	585.6	4	26	153.8	2	1280.0	116.7	420.5	32.3	5.8	4.9	1.0	0.5	0.20	0.02	0.06	4.97	8.92	7.53	1.54	0.77
25-Aug-94	TSR	585.4	3	26	195.9	1	1240.0	152.0	353.0	3.1	5.4	4.5	1.0	0.5	0.24	0.03	0.07	6.07	10.58	8.81	1.96	0.98
													Mean	**=**	**0.22**	**0.02**	**0.05**	**3.84**	**6.77**	**5.66**	**1.21**	**0.61**

Table 29. Sediment depth and velocity measurements taken every 5m on a river cross section, Crystal Springs Reach (RM 600.9), Middle Snake River, Idaho, July 29, 1994.

					Sediment Depth m		
Distance From Left Bank m	Sediment Type	Depth to Sediment m	Water Column Depth m	Off-Bottom Water Velocity m/s	Thickness of Organic Layer m	Thickness of Sand-Silt m	Total Thickness of Sediment m
5	organic layer	1.77	1.77	0	0.64	0.55	1.19
	sand-silt	2.41					
	rock	2.96					
10	organic layer	2.19	2.19	0	0.70	0.30	1.01
	sand-silt	2.90					
	rock	3.20					
15	organic layer	2.29	2.29	0.06	0.91	0	0.91
	sand-silt	-					
	rock	3.20					
20	organic layer	2.93	2.93	0.03	0.79	0	0.79
	sand-silt	-					
	rock	3.72					
25	organic layer	3.51	3.51	0.08	0.76	0	0.76
	sand-silt	-					
	rock	4.27					
30	organic layer	3.66	3.66	0.11	0.91	0	0.91
	sand-silt	-					
	rock	4.57					
35	organic layer	3.96	3.96	0.15	0.76	0.76	1.52
	sand-silt	4.72					
	rock	5.49					
40	organic layer	4.27	4.27	0.11	0.61	0.61	1.22
	sand-silt	4.88					
	rock	5.49					
45	organic layer	4.21	4.21	0.14	0.82	1.37	2.19
	sand-silt	5.03					
	rock	6.40					
50	organic layer	4.02	4.02	0.15	0.55	0	0.55
	sand-silt	-					
	rock	4.57					
55	organic layer	4.42	4.42	0.12	1.04	0.94	1.98
	sand-silt	5.46					
	rock	6.40					

Table 29. Sediment depth and velocity measurements taken every 5m on a river cross section, Crystal Springs Reach (RM 600.9), Middle Snake River, Idaho, July 29, 1994.

					Sediment Depth m		
Distance From Left Bank m	Sediment Type	Depth to Sediment m	Water Column Depth m	Off-Bottom Water Velocity m/s	Thickness of Organic Layer m	Thickness of Sand-Silt m	Total Thickness of Sediment m
60	organic layer	4.11	4.11	0.12	1.31	0.37	1.68
	sand-silt	5.43					
	rock	5.79					
65	organic layer	5.18	5.18	0.15	0.46	0.15	0.61
	sand-silt	5.64					
	rock	5.79					
70	organic layer	5.24	5.24	0.20	0.40	0	0.40
	sand-silt	-					
	rock	5.64					
75	organic layer	3.66	3.66	0.21	0.46	0	0.46
	sand-silt	-					
	rock	4.11					
80	organic layer	3.05	3.05	0.11	0.67	0	0.67
	sand-silt	-					
	rock	3.72					
85	organic layer	2.13	2.13	0.02	0.61	0	0.61
	sand-silt	-					
	rock	2.74					
90	organic layer	1.07	1.07	0	0.61	0.61	1.22
	sand-silt	1.68					
	rock	2.29					
95	organic layer	0.76	0.76	0.02	0.30	1.46	1.77
	sand-silt	1.07					
	rock	2.53					
100	organic layer	0.61	0.61	0	0.30	0	0.30
	sand-silt	-					
	rock	0.91					
Means:			3.15	0.09	0.68	0.36	1.04

Table 30. Sediment depth and velocity measurements taken every 5m on a river cross section, Crystal Springs Reach (RM 600.5), Middle Snake River, Idaho, July 30, 1994.

					Sediment Depth m		
Distance From Left Bank m	Sediment Type	Depth to Sediment m	Water Column Depth m	Off-Bottom Water Velocity m/s	Thickness of Organic Layer m	Thickness of Sand-Silt m	Total Thickness of Sediment m
5	organic layer	0.55	0.55	0.02	1.28	0.58	1.86
	sand-silt	1.83					
	rock	2.41					
10	organic layer	1.19	1.19	0	0.94	0.24	1.19
	sand-silt	2.13					
	rock	2.38					
15	organic layer	1.28	1.28	0.01	0.82	0.18	1.01
	sand-silt	2.10					
	rock	2.29					
20	organic layer	1.28	1.28	0	0.85	0.30	1.16
	sand-silt	2.13					
	rock	2.44					
25	organic layer	1.34	1.34	0	0.76	0.67	1.43
	sand-silt	2.10					
	rock	2.77					
30	organic layer	1.31	1.31	0	0.82	0.03	0.85
	sand-silt	2.13					
	rock	2.16					
35	organic layer	1.28	1.28	0	0.79	0.06	0.85
	sand-silt	2.07					
	rock	2.13					
40	organic layer	1.22	1.22	0	0.88	0.03	0.91
	sand-silt	2.10					
	rock	2.13					
45	organic layer	1.31	1.31	0.01	0.76	0.37	1.13
	sand-silt	2.07					
	rock	2.44					
50	organic layer	1.83	1.83	0.04	0.30	0.37	0.67
	sand-silt	2.13					
	rock	2.50					

Table 30. Sediment depth and velocity measurements taken every 5m on a river cross section, Crystal Springs Reach (RM 600.5), Middle Snake River, Idaho, July 30, 1994.

					Sediment Depth m		
Distance From Left Bank m	Sediment Type	Depth to Sediment m	Water Column Depth m	Off-Bottom Water Velocity m/s	Thickness of Organic Layer m	Thickness of Sand-Silt m	Total Thickness of Sediment m
55	organic layer	1.83	1.83	0.09	0.46	0.27	0.73
	sand-silt	2.29					
	rock	2.56					
60	organic layer	1.83	1.83	0.14	0.58	0.27	0.85
	sand-silt	2.41					
	rock	2.68					
65	organic layer	2.32	2.32	0.17	0.24	0.18	0.43
	sand-silt	2.56					
	rock	2.74					
70	organic layer	2.13	2.13	0.16	0.37	0.85	1.22
	sand-silt	2.50					
	rock	3.35					
75	organic layer	2.47	2.47	0.18	0.34	0.61	0.94
	sand-silt	2.80					
	rock	3.41					
80	organic layer	2.44	2.44	0.04	0.61	0.55	1.16
	sand-silt	3.05					
	rock	3.60					
85	organic layer	2.74	2.74	0.17	0.61	0.67	1.28
	sand-silt	3.35					
	rock	4.02					
90	organic layer	3.29	3.29	0.19	0.37	1.52	1.89
	sand-silt	3.66					
	rock	5.18					
95	organic layer	3.35	3.35	0.20	0.30	1.22	1.52
	sand-silt	3.66					
	rock	4.88					
100	organic layer	3.20	3.20	0.16	0.43	-	0.43
	sand-silt	-					
	rock	3.63					

Table 30. Sediment depth and velocity measurements taken every 5m on a river cross section, Crystal Springs Reach (RM 600.5), Middle Snake River, Idaho, July 30, 1994.

Distance From Left Bank m	Sediment Type	Depth to Sediment m	Water Column Depth m	Off-Bottom Water Velocity m/s	Sediment Depth m: Thickness of Organic Layer m	Thickness of Sand-Silt m	Total Thickness of Sediment m
105	organic layer	2.90	2.90	0.21	0.46	-	0.46
	sand-silt	-					
	rock	3.35					
110	organic layer	2.74	2.74	0.20	0.30	-	0.30
	sand-silt	-					
	rock	3.05					
115	organic layer	2.74	2.74	0.24	0.30	-	0.30
	sand-silt	-					
	rock	3.05					
120	organic layer	2.74	3.20	0.21	0.30	-	0.30
	sand-silt	-					
	rock	3.05					
125	organic layer	-	3.20	0.17	-	-	-
	sand-silt	-					
	rock	3.20					
130	organic layer	2.71	2.71	0.09	0.40	-	0.40
	sand-silt	-					
	rock	3.11					
135	organic layer	2.38	2.38	0.13	0.37	0.46	0.82
	sand-silt	2.74					
	rock	3.20					
140	organic layer	2.41	2.41	0.08	0.76	-	0.76
	sand-silt	-					
	rock	3.17					
145	organic layer	1.22	1.22	0	1.83	-	1.83
	sand-silt	-					
	rock	3.05					
150	organic layer	0.61	0.61	0	2.38	-	2.38
	sand-silt	-					
	rock	2.99					
Means:			**2.08**	**0.10**	**0.65**	**0.31**	**0.97**

Table 31. Sediment depth and velocity measurements taken every 5m on a river cross section, Crystal Springs Reach (RM 600.0), Middle Snake River, Idaho, July 30, 1994.

Distance From Left Bank m	Sediment Type	Depth to Sediment m	Water Column Depth m	Sediment Depth m: Thickness of Organic Layer m	Thickness of Sand-Silt m	Total Thickness of Sediment m
5	organic layer	-	0.94	0	0	0
	sand-silt	-				
	rock	0.94				
10	organic layer	-	0.61	0	0	0
	sand-silt	-				
	rock	0.61				
15	organic layer	-	2.62	0	0	0
	sand-silt	-				
	rock	2.62				
20	organic layer	-	2.80	0	0	0
	sand-silt	-				
	rock	2.80				
25	organic layer	-	3.26	0	0	0
	sand-silt	-				
	rock	3.26				
30	organic layer	-	3.23	0	0	0
	sand-silt	-				
	rock	3.23				
35	organic layer	-	2.90	0	0	0
	sand-silt	-				
	rock	2.90				
40	organic layer	-	2.74	0	0	0
	sand-silt	-				
	rock	2.74				
45	organic layer	-	2.74	0	0	0
	sand-silt	-				
	rock	2.74				

Table 31. Sediment depth and velocity measurements taken every 5m on a river cross section, Crystal Springs Reach (RM 600.0), Middle Snake River, Idaho, July 30, 1994.

Distance From Left Bank m	Sediment Type	Depth to Sediment m	Water Column Depth m	Sediment Depth m: Thickness of Organic Layer m	Thickness of Sand-Silt m	Total Thickness of Sediment m
50	organic layer	-	2.53	0	0.40	0.40
	sand-silt	2.53				
	rock	2.93				
55	organic layer	2.32	2.32	0.30	0.21	0.52
	sand-silt	2.62				
	rock	2.83				
60	organic layer	2.01	2.01	0.27	0.15	0.43
	sand-silt	2.29				
	rock	2.44				
65	organic layer	1.86	1.86	0.37	0.18	0.55
	sand-silt	2.23				
	rock	2.41				
70	organic layer	1.83	1.83	0.30	0.06	0.37
	sand-silt	2.13				
	rock	2.19				
75	organic layer	1.74	1.74	0.18	0.03	0.21
	sand-silt	1.92				
	rock	1.95				
80	organic layer	1.65	1.65	0.15	0.03	0.18
	sand-silt	1.80				
	rock	1.83				
85	organic layer	1.01	1.01	0.73	0.06	0.79
	sand-silt	1.74				
	rock	1.80				
90	organic layer	1.22	1.22	0.40	0.03	0.43
	sand-silt	1.62				
	rock	1.65				

Table 31. Sediment depth and velocity measurements taken every 5m on a river cross section, Crystal Springs Reach (RM 600.0), Middle Snake River, Idaho, July 30, 1994.

				Sediment Depth m		
Distance From Left Bank m	Sediment Type	Depth to Sediment m	Water Column Depth m	Thickness of Organic Layer m	Thickness of Sand-Silt m	Total Thickness of Sediment m
95	organic layer	1.16	1.16	0.30	0.03	0.34
	sand-silt	1.46				
	rock	1.49				
100	organic layer	1.37	1.37	0.03	0.03	0.06
	sand-silt	1.40				
	rock	1.43				
105	organic layer	1.31	1.31	0.12	0.03	0.15
	sand-silt	1.43				
	rock	1.46				
110	organic layer	-	1.34	0	0.12	0.12
	sand-silt	1.34				
	rock	1.46				
115	organic layer	-	1.34	0	0.09	0.09
	sand-silt	1.34				
	rock	1.43				
120	organic layer	1.13	1.13	0.18	0.03	0.21
	sand-silt	1.31				
	rock	1.34				
125	organic layer	1.13	1.13	0.06	0.03	0.09
	sand-silt	1.19				
	rock	1.22				
130	organic layer		1.22	0	0.03	0.03
	sand-silt	1.22				
	rock	1.25				
135	organic layer	1.19	1.19	0.21	0.03	0.24
	sand-silt	1.40				
	rock	1.43				

Table 31. Sediment depth and velocity measurements taken every 5m on a river cross section, Crystal Springs Reach (RM 600.0), Middle Snake River, Idaho, July 30, 1994.

Distance From Left Bank m	Sediment Type	Depth to Sediment m	Water Column Depth m	Sediment Depth m Thickness of Organic Layer m	Thickness of Sand-Silt m	Total Thickness of Sediment m
140	organic layer	1.37	1.37	0.21	0.03	0.24
	sand-silt	1.58				
	rock	1.62				
145	organic layer	1.40	1.40	0.40	0.03	0.43
	sand-silt	1.80				
	rock	1.83				
150	organic layer	1.65	1.65	0.24	0.03	0.27
	sand-silt	1.89				
	rock	1.92				
155	organic layer	1.52	1.52	0.40	0.03	0.43
	sand-silt	1.92				
	rock	1.95				
160	organic layer	1.65	1.65	0.24	0.03	0.27
	sand-silt	1.89				
	rock	1.92				
165	organic layer	1.58	1.58	0.43	0.15	0.58
	sand-silt	2.01				
	rock	2.16				
170	organic layer	1.55	1.55	0.40	0.03	0.43
	sand-silt	1.95				
	rock	1.98				
175	organic layer	1.37	1.37	1.10	0.15	1.25
	sand-silt	2.47				
	rock	2.62				
180	organic layer	1.34	1.34	0.30	0.15	0.46
	sand-silt	1.65				
	rock	1.80				

Table 31. Sediment depth and velocity measurements taken every 5m on a river cross section, Crystal Springs Reach (RM 600.0), Middle Snake River, Idaho, July 30, 1994.

Distance From Left Bank m	Sediment Type	Depth to Sediment m	Water Column Depth m	Sediment Depth m: Thickness of Organic Layer m	Thickness of Sand-Silt m	Total Thickness of Sediment m
185	organic layer	0.88	0.88	0	0	0
	sand-silt	-				
	rock	2.16				
190	organic layer	0.55	0.55	1.28	0.85	2.13
	sand-silt	1.83				
	rock	2.68				
Means			**1.69**	**0.23**	**0.08**	**0.31**

Table 32. Minimum, maximum, mean, standard error, and 95% confidence intervals for percent sand, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

			SAND %					
MONTH	**TRANSECT**	**n**	**MINIMUM**	**MAXIMUM**	**MEAN**	**S.E.**	**UPPER 95% C.I.**	**LOWER 95% C.I.**
April	2	5	40.4	92.2	60.1	11.0	81.7	38.5
April	5	5	46.4	92.2	72.1	8.0	87.9	56.3
April	7	5	44.4	47.4	45.0	0.6	46.2	43.8
May	R	7	35.2	94.6	52.8	8.4	69.3	36.2
June	2	5	34.4	66.4	46.7	6.5	59.4	34.0
June	7	4	42.4	54.4	47.9	2.5	52.8	43.0
June	R	7	42.4	70.2	55.8	3.8	63.2	48.5
July	2	5	30.4	70.4	43.4	7.1	57.3	29.5
July	7	3	44.4	60.4	49.7	5.3	60.2	39.3
July	R	7	32.4	54.4	45.0	3.0	50.9	39.1
August	2	5	29.6	65.6	46.4	7.2	60.6	32.2
August	7	4	51.6	90.8	65.3	9.0	83.0	47.6
August	R	7	36.4	56.4	47.3	2.8	52.8	41.7
October	2	5	35.2	89.6	61.8	11.7	84.8	38.7
October	7	4	49.2	59.2	52.7	2.2	57.0	48.4
October	R	7	37.2	77.2	54.3	4.8	63.8	44.9
November	2	3	39.2	97.6	65.3	17.1	98.9	31.7
November	7	4	45.2	61.2	54.2	3.4	60.9	47.5
November	R	8	41.2	79.2	51.8	4.2	60.1	43.5

Table 33. Minimum, maximum, mean, standard error, and 95% confidence intervals for percent silt, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

			SILT %					
MONTH	**TRANSECT**	**n**	**MINIMUM**	**MAXIMUM**	**MEAN**	**S.E.**	**UPPER 95% C.I.**	**LOWER 95% C.I.**
April	2	5	1.8	5.6	3.28	1.58	0.71	4.66
April	5	5	0.8	5.6	2.68	1.93	0.86	4.37
April	7	5	3.6	9.6	6.40	3.03	1.36	9.06
May	R	7	0.4	6.8	4.51	2.25	0.85	6.18
June	2	5	2.4	9.6	4.84	2.92	1.31	7.40
June	7	4	8.4	10.4	8.90	1.00	0.50	9.88
June	R	7	1.6	7.6	3.71	2.34	0.88	5.45
July	2	5	2.4	8.4	6.80	2.61	1.17	9.09
July	7	3	6.4	10.4	8.40	2.00	1.15	10.66
July	R	7	6.4	10.4	8.97	1.51	0.57	10.09
August	2	5	1.6	9.6	6.00	3.29	1.47	8.88
August	7	4	0.8	5.6	4.40	2.40	1.20	6.75
August	R	7	6.4	10.4	8.11	1.80	0.68	9.45
October	2	5	0.8	9.6	4.74	3.76	1.68	8.04
October	7	4	3.6	7.6	5.60	1.63	0.82	7.20
October	R	7	3.6	7.6	4.51	1.51	0.57	5.63
November	2	3	3.6	7.6	3.73	2.83	1.63	6.93
November	7	4	3.6	5.6	3.20	1.15	0.58	4.33
November	R	8	3.6	7.6	5.35	1.28	0.45	6.24

Table 34. Minimum, maximum, mean, standard error, and 95% confidence intervals for percent clay, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

			CLAY %					
MONTH	TRANSECT	n	MINIMUM	MAXIMUM	MEAN	S.E.	UPPER 95% C.I.	LOWER 95% C.I.
April	2	5	6.0	56.0	36.6	10.4	57.0	16.2
April	5	5	7.0	48.0	25.2	7.2	39.4	11.0
April	7	5	46.0	52.0	48.6	1.2	50.9	46.3
May	R	7	5.0	58.0	42.7	7.7	57.8	27.6
June	2	5	31.2	60.0	48.4	5.8	59.8	37.1
June	7	4	37.2	47.2	43.2	2.2	47.4	39.0
June	R	7	32.0	52.0	36.2	2.8	41.7	30.8
July	2	5	27.2	63.2	49.8	6.2	61.9	37.7
July	7	3	33.2	47.2	41.9	4.4	50.4	33.3
July	R	7	37.2	59.2	46.1	3.3	52.5	39.6
August	2	5	30.8	62.8	47.6	6.0	59.4	35.8
August	7	4	8.4	42.8	30.3	7.9	45.8	14.8
August	R	7	37.2	53.2	44.6	2.5	49.5	39.7
October	2	5	8.6	55.2	33.6	10.1	53.4	13.7
October	7	4	33.2	45.2	41.7	2.9	47.3	36.1
October	R	7	19.2	57.2	35.0	5.0	44.7	25.3
November	2	3	37.2	53.2	30.1	6.5	42.9	17.3
November	7	4	35.2	49.2	31.9	3.5	38.8	25.0
November	R	8	17.2	53.2	42.8	4.0	50.6	35.0

Table 35. Minimum, maximum, mean, standard error, and 95% confidence intervals for percent sediment organic carbon, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

SEDIMENT ORGANIC CARBON

%

MONTH	TRANSECT	n	MINIMUM	MAXIMUM	MEAN	S.E.	UPPER 95% C.I.	LOWER 95% C.I.
April	2	5	0.83	1.50	1.27	0.13	1.53	1.01
April	5	5	0.21	2.12	0.95	0.35	1.63	0.28
April	7	5	1.89	2.66	2.22	0.13	2.48	1.97
May	R	8	0.75	2.95	1.97	0.30	2.56	1.38
June	2	5	0.62	1.72	1.16	0.20	1.55	0.77
June	7	4	1.71	4.42	2.97	0.57	4.10	1.85
June	R	7	1.30	3.56	1.82	0.31	2.42	1.22
July	2	5	0.57	1.56	1.27	0.18	1.63	0.91
July	7	3	1.88	2.34	2.13	0.13	2.40	1.87
July	R	7	1.37	2.30	1.87	0.12	2.11	1.63
August	2	5	0.43	1.67	1.21	0.24	1.67	0.74
August	7	4	0.92	2.97	2.06	0.43	2.91	1.21
August	R	7	1.43	2.29	1.81	0.12	2.04	1.58
October	2	5	0.38	2.36	1.44	0.38	2.18	0.70
October	7	4	2.07	2.56	2.33	0.12	2.56	2.11
October	R	8	1.61	9.29	3.22	0.89	4.96	1.48
November	2	5	0.12	1.81	0.71	0.30	1.30	0.12
November	7	5	1.50	2.46	1.98	0.20	2.36	1.59
November	R	8	1.03	2.46	1.78	0.16	2.08	1.47

Table 36. Minimum, maximum, mean, standard error, and 95% confidence intervals for percent sediment organic matter, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

SEDIMENT ORGANIC MATTER
%

MONTH	TRANSECT	n	MINIMUM	MAXIMUM	MEAN	S.E.	UPPER 95% C.I.	LOWER 95% C.I.
April	2	5	1.43	2.58	2.19	0.23	2.64	1.73
April	5	5	0.36	3.65	1.64	0.59	2.81	0.48
April	7	5	3.25	4.58	3.82	0.22	4.26	3.38
May	R	8	1.29	5.07	3.39	0.52	4.41	2.37
June	2	5	1.07	2.96	2.00	0.34	2.66	1.33
June	7	4	2.94	7.60	5.11	0.99	7.05	3.17
June	R	7	2.24	6.12	1.39	0.49	3.71	1.78
July	2	5	0.98	2.68	2.18	0.32	2.80	1.56
July	7	3	3.23	4.02	3.67	0.23	4.12	3.21
July	R	7	2.36	3.96	3.21	0.21	3.63	2.80
August	2	5	0.74	2.87	2.08	0.41	2.88	1.28
August	7	4	1.58	5.11	3.55	0.75	5.01	2.08
August	R	7	2.46	3.94	3.12	0.20	3.52	2.72
October	2	5	0.65	4.06	2.48	0.65	3.75	1.20
October	7	4	3.56	4.40	4.01	0.20	4.40	3.62
October	R	8	2.77	15.98	5.54	1.52	8.52	2.55
November	2	5	0.21	3.11	1.22	0.52	2.24	0.21
November	7	5	2.58	4.23	3.40	0.34	4.07	2.74
November	R	8	1.77	4.23	3.05	0.27	3.59	2.52

Table 37. Minimum, maximum, mean, standard error, and 95% confidence intervals for percent sediment carbon, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

			SEDIMENT CARBON %					
MONTH	TRANSECT	n	MIN	MAX	MEAN	S.E.	UPPER 95% C.I.	LOWER 95% C.I.
April	2	5	1.50	2.80	2.28	0.25	2.77	1.79
April	5	5	1.10	3.50	1.96	0.44	2.82	1.10
April	7	5	3.20	4.10	3.66	0.17	4.00	3.32
May	R	8	1.20	5.00	3.31	0.42	4.14	2.48
June	2	5	1.60	3.70	2.64	0.41	3.44	1.84
June	7	4	3.60	4.20	4.88	0.12	5.12	4.63
June	R	8	2.70	6.00	3.48	0.38	4.22	2.73
July	2	5	1.40	3.40	2.82	0.38	3.56	2.08
July	7	3	4.10	4.50	4.23	0.13	4.49	3.97
July	R	7	2.90	4.60	3.83	0.22	4.26	3.39
August	2	5	1.30	3.50	2.54	0.45	3.43	1.65
August	7	4	0.82	4.30	3.11	0.78	4.64	1.57
August	R	7	2.90	4.40	3.54	0.24	4.02	3.06
October	2	5	0.87	3.60	2.43	0.55	3.51	1.35
October	7	4	3.70	4.40	4.05	0.16	4.35	3.75
October	R	8	2.30	10.00	4.66	0.82	6.27	3.05
November	2	5	0.24	3.60	1.44	0.58	2.57	0.31
November	7	5	2.90	4.40	3.68	0.27	4.21	3.15
November	R	8	2.70	4.00	3.35	0.17	3.68	3.02

Table 38. Minimum, maximum, mean, standard error, and 95% confidence intervals for percent sediment nitrogen, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

SEDIMENT NITROGEN
%

MONTH	TRANSECT	n	MINIMUM	MAXIMUM	MEAN	S.E.	UPPER 95% C.I.	LOWER 95% C.I.
April	2	5	0.12	0.19	0.16	0.01	0.19	0.14
April	5	5	0.05	0.23	0.12	0.03	0.19	0.05
April	7	5	0.22	0.38	0.30	0.03	0.35	0.24
May	R	8	0.09	0.42	0.27	0.05	0.36	0.18
June	2	5	0.11	0.33	0.21	0.04	0.29	0.13
June	7	4	0.32	0.37	0.43	0.01	0.44	0.41
June	R	7	0.21	0.56	0.29	0.04	0.37	0.21
July	2	5	0.08	0.27	0.21	0.04	0.28	0.14
July	7	3	0.31	0.37	0.34	0.02	0.37	0.31
July	R	7	0.25	0.39	0.32	0.02	0.36	0.28
August	2	5	0.06	0.29	0.18	0.04	0.26	0.09
August	7	4	0.07	0.41	0.26	0.07	0.40	0.12
August	R	7	0.21	0.37	0.29	0.03	0.34	0.24
October	2	5	0.07	0.30	0.21	0.05	0.31	0.12
October	7	4	0.27	0.41	0.36	0.03	0.41	0.30
October	R	8	0.19	1.19	0.43	0.11	0.64	0.21
November	2	5	0.05	0.29	0.14	0.05	0.24	0.04
November	7	5	0.25	0.38	0.33	0.02	0.37	0.28
November	R	8	0.21	0.38	0.29	0.02	0.32	0.25

Table 39. Minimum, maximum, mean, standard error, and 95% confidence intervals for percent sediment hydrogen, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

SEDIMENT HYDROGEN
%

MONTH	TRANSECT	n	MINIMUM	MAXIMUM	MEAN	S.E.	UPPER 95% C.I.	LOWER 95% C.I.
April	2	5	0.25	0.53	0.41	0.05	0.52	0.31
April	5	5	0.13	0.61	0.33	0.09	0.51	0.16
April	7	5	0.57	0.79	0.70	0.05	0.79	0.60
May	R	8	0.21	0.83	0.56	0.08	0.70	0.41
June	2	5	0.29	0.73	0.50	0.09	0.66	0.33
June	7	4	0.65	0.82	0.89	0.03	0.95	0.82
June	R	8	0.34	1.00	0.60	0.07	0.73	0.46
July	2	5	0.25	0.70	0.55	0.08	0.71	0.39
July	7	3	0.73	0.83	0.77	0.03	0.83	0.72
July	R	7	0.54	0.90	0.72	0.04	0.81	0.64
August	2	5	0.23	0.68	0.49	0.10	0.67	0.30
August	7	4	0.16	0.91	0.62	0.16	0.94	0.31
August	R	7	0.54	0.88	0.70	0.05	0.81	0.59
October	2	5	0.17	0.73	0.47	0.11	0.69	0.25
October	7	4	0.58	0.85	0.76	0.06	0.87	0.64
October	R	8	0.47	1.60	0.84	0.12	1.07	0.61
November	2	5	0.06	0.73	0.29	0.11	0.52	0.07
November	7	5	0.48	0.77	0.65	0.05	0.76	0.54
November	R	8	0.36	0.83	0.65	0.05	0.76	0.54

Table 40. Minimum, maximum, mean, standard error, and 95% confidence intervals for total sediment phosphorus, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

			SEDIMENT TOTAL PHOSPHORUS µg/g					
MONTH	TRANSECT	n	MINIMUM	MAXIMUM	MEAN	S.E.	UPPER 95% C.I.	LOWER 95% C.I.
April	2	5	881	4,110	1,735	619	2,947	523
April	5	5	601	1,090	791	88	964	619
April	7	5	992	1,220	1,102	44	1,188	1,017
May	R	8	821	1,410	1,181	74	1,326	1,037
June	2	5	685	977	864	52	965	763
June	7	4	994	1,160	1,351	38	1,425	1,277
June	R	7	893	1,280	875	46	964	785
July	2	5	874	1,090	966	41	1,046	886
July	7	3	1,040	1,180	1,127	44	1,212	1,041
July	R	7	999	1,250	1,127	41	1,207	1,047
August	2	5	731	1,040	932	58	1,045	818
August	7	4	653	1,210	1,033	128	1,284	782
August	R	7	958	1,200	1,108	36	1,178	1,038
October	2	5	698	8,140	2,313	1,458	5,171	0
October	7	4	1,160	1,280	1,228	25	1,276	1,179
October	R	8	858	1,760	1,189	93	1,371	1,006
November	2	5	673	5,050	1,632	858	3,314	0
November	7	5	986	1,250	1,167	47	1,259	1,076
November	R	8	888	1,240	1,086	38	1,161	1,010

APPENDICES

Appendix Table A. Physical and chemical water quality, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Transcect	Site	Date	Sample Depth m	Water Depth m	Water Temp C	Dissolved Oxygen mg/l	Velocity ft/s	Secchi Depth m	Conductivity umhos/cm	Water pH	Turbidity NTU	Sediment pH
2	1	Apr-15-94	0	1.3	10.0	14.4	0.30	0.6	370	8.6	14.0	6.9
			1.0		9.0	8.0	0.20					
2	2	Apr-15-94	0	1.3	9.0	13.4	0.30	0.7	380	8.0	13.0	7.0
			1.0		7.0	13.4	0.25					
			1.2		6.0	13.0						
2	3	Apr-15-94	0	1.9	6.5	10.4	0.90	0.7	380	8.0	11.0	7.5
			1.0		6.5	12.0	0.80					
			1.8		6.5	12.8						
2	4	Apr-15-94	0	3.7	9.0	10.6	0.60	0.8	390	8.5	10.0	7.2
			1.0		9.0	12.6	0.40					
			2.0		9.0	12.6						
			3.0		9.0	12.4						
			3.6		9.0	12.0						
2	5	Apr-15-94	0	2.6	10.0	10.0	0.50	0.9	430	8.6	9.3	8.0
			1.0		10.0	10.2	0.30					
			2.0		10.0	10.2						
			2.5		10.0	10.2						
5	3	Apr-15-94	0	1.0	7.0	10.6	0.50	0.8	380	8.5	9.7	6.4
			0.9		7.0	11.4	0.50					
5	4	Apr-15-94	0	0.9	9.0	10.6	0.40	0.7	420	8.0	11.0	7.4
			0.8		9.0	10.6	0.30					

Appendix Table A. Physical and chemical water quality, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Transect	Site	Date	Sample Depth m	Water Depth m	Water Temp C	Dissolved Oxygen mg/l	Velocity ft/s	Secchi Depth m	Conductivity umhos/cm	Water pH	Turbidity NTU	Sediment pH
5	5	Apr-15-94	0	2.5	9.0	11.2	0.40	0.7	420	8.0	11.0	7.5
			1.0		9.0	11.0	0.30					
			2.0		9.0	10.6						
			2.4		9.0	10.6						
5	6	Apr-15-94	0	0.7	9.0	10.6	0.70	0.7	420	8.0	10.0	7.6
			0.6		9.0	10.6	0.50					
5	7	Apr-15-94	0	0.7	9.0	11.2	1.10	0.7	420	8.0	9.3	7.9
			0.6		9.0	10.6	1.00					
7	3	Apr-15-94	0	2.3	10.0	10.6	0.70	0.7	420	7.6	9.4	6.4
			1.0		9.0	10.6	0.65					
			2.0		9.0	11.0						
7	4	Apr-15-94	0	1.2	9.0	11.2	0.80	0.7	420	7.6	10.0	7.0
			1.0		9.0	10.6	0.80					
7	5	Apr-15-94	0	1.0	9.0	11.8	0.80	0.7	420	7.6	9.2	6.4
			0.9		9.0	10.6	0.70					
7	6	Apr-15-94	0	1.1	10.0	11.2	0.90	0.7	430	7.6	9.0	6.5
			1.0		10.0	10.6	0.70					
7	7	Apr-15-94	0	0.8	10.0	11.2	0.30	0.7	440	7.6	8.9	6.7
			0.7		10.0	10.6	0.30					
R	1	May-25-94	0	1.6	17.0	8.0	0.10	0.9	470	8.5	8.2	6.9
			1.0		16.0	8.1	0.10					
			1.5		15.0	8.1						

Appendix Table A. Physical and chemical water quality, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Transect	Site	Date	Sample Depth m	Water Depth m	Water Temp C	Dissolved Oxygen mg/l	Velocity ft/s	Secchi Depth m	Conductivity umhos/cm	Water pH	Turbidity NTU	Sediment pH
R	2	May-25-94	0	1.7	18.0	7.6	0.10	0.7	460	8.2	9.2	6.8
			1.0		17.0	7.8	0					
			1.6		16.0	8.0						
R	3	May-25-94	0	7.1	17.0	7.5	0.05	0.7	460	8.1	7.4	7.1
			1.0		17.0	7.8	0.05					
			2.0		17.0	8.0						
			3.0		16.0	8.0						
			4.0		16.0	8.0						
			5.0		16.0	8.0						
			6.0		16.0	8.0						
			7.0		16.0	8.0						
R	4	May-25-94	0	1.5	17.0	7.6	0.20	0.9	460	8.1	7.8	6.8
			1.0		17.0	7.8	0.10					
			1.4		17.0	7.8						
R	5	May-25-94	0	1.6	17.0	8.0	0.20	0.9	460	8.0	7.8	6.8
			1.0		17.0	8.0	0.10					
			1.5		17.0	8.0						
R	6	May-25-94	0	1.5	17.5	8.0	0.50	0.9	460	8.1	8.5	6.9
			1.0		17.0	8.1	0.30					
			1.4		17.0	8.1						
R	7	May-25-94	0	1.1	17.0	8.0	0.10	1.0	480	8.0	7.2	6.8
			0.9		17.0	8.1	0.05					
			1.0		17.0	8.1						

Appendix Table A. Physical and chemical water quality, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Transect	Site	Date	Sample Depth m	Water Depth m	Water Temp C	Dissolved Oxygen mg/l	Velocity ft/s	Secchi Depth m	Conductivity umhos/cm	Water pH	Turbidity NTU	Sediment pH
R	8	May-25-94	0	1.5	18.0	8.0	0.20	0.7	460	8.1	8.2	6.7
			1.0		17.0	8.1	0.10					
			1.4		17.0	8.1						
2	1	Jun-27-94	0	1.7	21.0	12.0	0.05	1.0	500	7.9	9.1	7.1
			1.0		20.0	11.0	0.05					
			1.6		20.0	10.0						
2	2	Jun-27-94	0	1.5	21.0	9.8	0.05	0.9	500	7.7	9.3	7.0
			1.0		20.0	9.8	0.05					
			1.4		20.0	9.8						
2	3	Jun-27-94	0	2.2	20.0	9.0	0.60	0.9	500	7.7	9.3	7.0
			1.0		20.0	9.2	0.70					
			2.0		20.0	9.2						
2	4	Jun-27-94	0	3.2	20.0	9.2	0.40	0.9	490	7.8	10.0	7.3
			1.0		20.0	9.4	0.40					
			2.0		20.0	9.4						
			3.0		20.0	9.4						
2	5	Jun-27-94	0	3.6	19.0	9.4	0.70	0.8	500	7.8	9.9	7.4
			1.0		19.0	9.4	0.70					
			2.0		19.0	9.4						
			3.0		19.0	9.4						
			3.5		19.0	9.4						

Appendix Table A. Physical and chemical water quality, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Transect	Site	Date	Sample Depth m	Water Depth m	Water Temp C	Dissolved Oxygen mg/l	Velocity ft/s	Secchi Depth m	Conductivity umhos/cm	Water pH	Turbidity NTU	Sediment pH
7	1	Jun-27-94	0	2.7	20.0	9.5	2.50	1.0	500	7.8	8.7	-
			1.0		20.0	9.6	2.40					
			2.0		20.0	9.6						
			2.6		20.0	9.6						
7	3	Jun-27-94	0	1.2	20.0	9.5	0.30	0.9	500	7.7	9.1	7.3
			1.0		20.0	9.5	0.10					
7	5	Jun-27-94	0	1.0	19.0	9.4	0.90	0.8	500	7.8	7.7	7.2
			0.9		19.0	9.4	0.60					
7	7	Jun-27-94	0	1.1	19.0	9.4	0.90	0.9	500	7.7	7.3	7.3
			1.0		19.0	9.4	0.20					
7	9	Jun-27-94	0	1.7	19.0	9.4	0.50	1.1	500	7.7	6.3	7.1
			1.0		19.0	9.6	0.60					
			1.6		19.0	9.8						
R	1	Jun-27-94	0	0.8	19.0	9.2	0.60	0.8	500	7.7	8.4	7.1
			0.7		19.0	9.2	0.30					
R	2	Jun-27-94	0	1.0	19.0	9.2	0.50	1.0	500	7.7	8.6	7.1
			0.9		19.0	9.4	0.30					
R	3	Jun-27-94	0	1.2	19.0	9.4	0.40	1.0	500	7.7	7.8	7.3
			1.0		19.0	9.4	0.35					
			1.1		19.0	9.2						
R	4	Jun-27-94	0	1.1	19.0	9.4	0.70	1.1	500	7.6	7.1	7.2
			1.0		19.0	9.4	0.50					

Appendix Table A. Physical and chemical water quality, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Transect	Site	Date	Sample Depth m	Water Depth m	Water Temp C	Dissolved Oxygen mg/l	Velocity ft/s	Secchi Depth m	Conductivity umhos/cm	Water pH	Turbidity NTU	Sediment pH
R	5	Jun-27-94	0	1.5	19.0	9.5	0.25	1.0	500	7.7	9.1	7.2
			1.0		19.0	9.7	0.35					
			1.4		19.0	9.7						
R	6	Jun-27-94	0	1.1	19.0	7.2	0.70	1.1	500	7.6	11.0	7.5
			1.0		19.0	7.5	0.30					
R	7	Jun-27-94	0	2.1	19.0	9.1	0.50	1.0	500	7.8	9.6	7.2
			1.0		19.0	9.3	0.50					
			2.0		19.0	9.5						
R	8	Jun-27-94	0	1.2	19.0	9.5	0.05	0.9	500	7.6	11.0	6.9
			1.0		19.0	9.7	0.05					
2	1	Jul-23-94	0	1.7	30.0	13.2	0.00	0.6	495	9.0	7.3	6.7
			1.0		30.0	13.0	0.00					
			1.6		30.0	13.0						
2	2	Jul-23-94	0	1.5	25.0	9.6	0.00	0.5	500	8.6	10.0	6.8
			1.0		24.0	9.0	0.00					
			1.4		22.0							
2	3	Jul-23-94	0	1.7	23.0	9.0	0.05	0.8	500	8.3	12.0	7.2
			1.0		22.0	8.8	0.05					
			1.6		22.0	8.8						

Appendix Table A. Physical and chemical water quality, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Transect	Site	Date	Sample Depth m	Water Depth m	Water Temp C	Dissolved Oxygen mg/l	Velocity ft/s	Secchi Depth m	Conductivity umhos/cm	Water pH	Turbidity NTU	Sediment pH
2	4	Jul-23-94	0	2.5	22.0	8.0	0.60	0.6	500	8.1	10.0	7.0
			1.0		22.0	8.0	0.70					
			2.0		22.0	7.8						
			2.4		22.0	7.8						
2	5	Jul-23-94	0	3.9	22.0	8.0	0.50	0.7	490	8.2	10.0	7.3
			1.0		22.0	8.0	0.60					
			2.0		21.0	7.8						
			3.0		21.0	7.6						
			3.8		21.0	7.6						
7	2	Jul-23-94	0	3.1	22.0	8.8	2.10	0.7	490	8.2	10.5	-
			1.0		22.0	9.0	2.00					
			2.0		21.0	8.8						
			3.0		21.0	8.8						
7	4	Jul-23-94	0	1.4	21.0	8.2	0.80	0.7	500	8.0	9.7	7.3
			1.0		21.0	8.2	0.70					
			1.3		21.0	8.2						
7	6	Jul-23-96	0	0.9	21.0	7.5	0.40	0.9	500	7.7	9.9	7.0
			0.8		21.0	7.5	0.20					
7	8	Jul-23-94	0	1.5	21.0	8.1	1.30	0.9	500	7.7	9.1	
			1.0		20.0	8.4	1.00					
			1.4		20.0	8.4						
7	10	Jul-23-94	0	1.6	15.0	9.4	0.70	1.6	500	7.9	3.0	6.9
			1.0		15.0	9.6	0.50					
			1.5		15.0	9.6						

Appendix Table A. Physical and chemical water quality, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Transcect	Site	Date	Sample Depth m	Water Depth m	Water Temp C	Dissolved Oxygen mg/l	Velocity ft/s	Secchi Depth m	Conductivity umhos/cm	Water pH	Turbidity NTU	Sediment pH
R	1	Jul-23-94	0	1.0	21.5	8.4	0.40	0.8	500	8.1	10.0	6.6
			0.9		21.0	8.4	0.40					
R	2	Jul-23-94	0	1.5	21.0	8.4	1.20	0.8	500	8.2	14.0	6.9
			1.0		21.0	8.5	1.30					
			1.4		21.0	8.4						
R	3	Jul-23-94	0	1.3	21.0	8.3	0.50	0.9	500	7.7	11.0	6.5
			1.0		21.0	8.2	0.70					
			1.2		21.0	8.2						
R	4	Jul-23-94	0	1.6	21.0	8.3	0.10	0.9	500	8.2	15.5	7.0
			1.0		21.0	8.5	0.10					
			1.5		21.0	8.5						
R	5	Jul-23-94	0	1.1	21.0	8.4	0.80	0.9	500	8.1	11.0	6.9
			1.0		21.0	8.6	0.60					
R	6	Jul-23-94	0	1.7	21.0	8.3	0.70	0.8	500	8.0	19.0	6.9
			1.0		21.0	8.5	0.40					
			1.6		21.0	8.5						
R	7	Jul-23-94	0	1.4	20.0	8.4	1.60	0.8	500	7.9	21.0	-
			1.0		20.0	8.5	1.50					
			1.3		20.0	8.5						
R	8	Jul-23-94	0	1.0	20.0	8.0	0.30	1.0	500	8.1	10.0	6.8
			0.9		20.0	8.1	0.20					

Appendix Table A. Physical and chemical water quality, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Transect	Site	Date	Sample Depth m	Water Depth m	Water Temp C	Dissolved Oxygen mg/l	Velocity ft/s	Secchi Depth m	Conductivity umhos/cm	Water pH	Turbidity NTU	Sediment pH
2	1	Aug-19-94	0	1.4	18.0	8.8	0	0.3	500	7.9	8.5	6.6
			1.0		18.0	8.8	0					
			1.3		18.0	8.4						
2	2	Aug-19-94	0	1.1	19.0	11.0	0	0.6	500	7.8	14.6	6.7
			1.0		18.0	10.2	0					
2	3	Aug-19-94	0	1.2	20.0	10.8	0	0.7	600	8.0	9.0	6.7
			1.0		18.0	11.0	0					
			1.1		18.0	10.9						
2	4	Aug-19-94	0	2.5	19.0	10.8	0.60	0.7	590	8.0	18.1	7.1
			1.0		18.0	10.8	0.50					
			2.0		18.0	11.0						
			2.4		18.0	10.6						
2	5	Aug-19-94	0	3.4	18.0	8.5	0.40	0.7	590	8.1	15.2	7.3
			1.0		18.0	8.6	0.50					
			2.0		17.5	8.8						
			3.0		17.0	8.4						
			3.3		17.0	8.4						
7	1	Aug-19-94	0	3.5	18.0	9.3	1.30	0.7	590	8.2	5.5	-
			1.0		18.0	9.2	1.50					
			2.0		17.0	9.2						
			3.0		17.0	9.2						
			3.4		17.0	9.2						

Appendix Table A. Physical and chemical water quality, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Transect	Site	Date	Sample Depth m	Water Depth m	Water Temp C	Dissolved Oxygen mg/l	Velocity ft/s	Secchi Depth m	Conductivity umhos/cm	Water pH	Turbidity NTU	Sediment pH
7	3	Aug-19-94	0	2.0	18.0	10.8	0.20	1.0	590	8.1	7.8	7.4
			1.0		17.5	11.2	0.30					
			1.9		17.0	11.2						
7	5	Aug-19-94	0	0.9	17.5	10.4	0	0.9	590	8.2	10.5	6.8
			0.8		17.0	7.0	0					
7	7	Aug-19-94	0	1.0	18.0	11.6	0.05	0.5	590	7.6	15.5	7.0
			0.9		17.0	10.8	0.10					
7	9	Aug-19-94	0	1.2	17.0	10.6	0.20	1.2	590	7.5	4.9	6.2
			1.0		17.0	10.8	0.10					
			1.1		17.0	10.6						
R	1	Aug-19-94	0	0.9	18.0	11.4	0	0.7	600	9.0	2.7	7.0
			0.8		17.0	10.8	0					
R	2	Aug-19-94	0	1.0	18.0	11.8	0.25	0.9	590	8.2	10.5	7.2
			0.9		18.0	11.8	0.10					
R	3	Aug-19-94	0	1.0	18.0	10.2	0.10	0.9	600	8.3	10.4	7.3
			0.9		18.0	10.4	0					
R	4	Aug-19-94	0	1.0	18.0	9.6	0.30	0.8	600	8.2	14.3	7.2
			0.9		18.0	9.8	0.05					
R	5	Aug-19-94	0	2.3	18.0	11.2	0.50	0.9	590	8.2	5.3	-
			1.0		18.0	10.8	0.70					
			2.0		17.5	10.8						
			2.2		17.5	10.6						

Appendix Table A. Physical and chemical water quality, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Transect	Site	Date	Sample Depth m	Water Depth m	Water Temp C	Dissolved Oxygen mg/l	Velocity ft/s	Secchi Depth m	Conductivity umhos/cm	Water pH	Turbidity NTU	Sediment pH
R	6	Aug-19-94	0	1.0	19.0	10.2	0.05	1.0	590	8.2	4.3	6.7
			0.9		19.0	10.0	0					
R	7	Aug-19-94	0	0.8	18.0	13.0	0.20	0.8	590	8.1	8.3	6.9
			0.7		18.0	11.6	0.05					
R	8	Aug-19-94	0	1.1	18.0	10.0	0.40	0.8	590	8.2	11.1	6.8
			1.0		18.0	10.0	0.10					
2	1	Oct-26-94	0	1.4	12.0	9.5	0.45	1.3	520	7.3	5.1	6.9
			1.0		12.0	9.7	0.25					
			1.3		12.0	9.9						
2	2	Oct-26-94	0	1.3	12.5	9.2	0.20	1.1	520	7.3	3.6	6.9
			1.0		12.0	9.5	0.05					
			1.2		12.0	9.6						
2	3	Oct-26-94	0	2.5	12.5	9.2	0.50	1.0	520	7.3	3.5	7.2
			1.0		12.0	9.4	0.50					
			2.0		12.0	9.5						
			2.4		12.0	9.7						
2	4	Oct-26-94	0	3.4	13.0	9.1	0.50	1.2	520	7.6	4.0	7.2
			1.0		12.5	9.4	0.50					
			2.0		12.0	9.5						
			3.0		12.0	9.5						
			3.3		12.0	9.5						

Appendix Table A. Physical and chemical water quality, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Transect	Site	Date	Sample Depth m	Water Depth m	Water Temp C	Dissolved Oxygen mg/l	Velocity ft/s	Secchi Depth m	Conductivity umhos/cm	Water pH	Turbidity NTU	Sediment pH
2	5	Oct-26-94	0	2.9	13.0	9.2	0.20	1.5	520	7.6	3.7	7.4
			1.0		13.0	9.2	0.30					
			2.0		13.0	9.2						
			2.8		13.0	9.2						
7	1	Oct-26-94	0	3.1	12.5	9.5	1.60	1.1	510	7.8	5.2	-
			1.0		12.5	9.6	1.20					
			2.0		12.5	9.6						
			3.0		12.5	9.7						
7	3	Oct-26-94	0	1.6	12.5	9.7	0.60	1.3	510	7.3	3.2	6.9
			1.0		12.5	9.5	0.40					
			1.5		12.5	9.7						
7	5	Oct-26-94	0	0.5	12.5	9.7	0.60	0.5	520	7.4	2.9	7.1
			0.4		12.5	9.7	0.20					
7	7	Oct-26-94	0	0.5	12.5	9.5	0.20	0.5	520	7.4	2.8	7.1
			0.4		12.5	9.7	0.10					
7	9	Oct-26-94	0	0.8	12.5	9.7	0.20	0.8	520	7.4	2.5	7.3
			0.7		12.5	9.7	0					
R	1	Oct-26-94	0	0.4	12.5	9.7	0.10	0.4	520	7.5	2.5	7.2
			0.3		12.5	9.9	0					
R	2	Oct-26-94	0	0.6	12.5	9.2	0.25	0.6	520	7.7	3.4	7.5
			0.5		12.5	8.8	0					

Appendix Table A. Physical and chemical water quality, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Transect	Site	Date	Sample Depth m	Water Depth m	Water Temp C	Dissolved Oxygen mg/l	Velocity ft/s	Secchi Depth m	Conductivity umhos/cm	Water pH	Turbidity NTU	Sediment pH
R	3	Oct-26-94	0	0.6	12.5	9.7	0.30	0.6	520	7.7	3.8	7.3
			0.5		12.5	9.8	0.10					
R	4	Oct-26-94	0	0.7	12.5	9.6	1.00	0.7	520	7.8	4.1	7.7
			0.6		12.0	9.9	0.10					
R	5	Oct-26-94	0	0.8	12.5	9.5	0.70	0.8	520	7.9	4.8	7.6
			0.7		12.5	9.0	0.10					
R	6	Oct-26-94	0	0.6	12.5	9.5	0.70	0.6	520	7.9	4.6	7.6
			0.5		12.5	9.7	0.45					
R	7	Oct-26-94	0	0.8	12.5	9.5	1.30	0.8	510	8.0	5.1	7.7
			0.7		12.5	9.3	0.10					
R	8	Oct-26-94	0	1.3	12.0	9.5	0.70	1.0	510	8.0	4.3	7.8
			1.0		12.0	9.5	0.50					
			1.2		12.0	9.3						
2	1	Nov-21-94	0	1.1	7.0	12.6	0.10	0.9	450	7.3	6.4	7.1
			1.0		7.0	12.0	0					
2	2	Nov-21-94	0	2.1	7.5	10.8	0.15	1.1	460	7.4	4.3	7.6
			1.0		7.0	11.0	0.21					
			2.0		7.0	11.0						
2	3	Nov-21-94	0	3.1	8.0	10.0	0.30	1.1	465	7.6	4.2	7.6
			1.0		8.0	10.2	0.40					
			2.0		8.0	10.4						
			3.0		8.0	10.4						

Appendix Table A. Physical and chemical water quality, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Transect	Site	Date	Sample Depth m	Water Depth m	Water Temp C	Dissolved Oxygen mg/l	Velocity ft/s	Secchi Depth m	Conductivity umhos/cm	Water pH	Turbidity NTU	Sediment pH
2	4	Nov-21-94	0	3.1	8.0	10.0	0.20	1.2	480	7.8	4.5	7.7
			1.0		8.0	10.1	0.30					
			2.0		8.0	10.4						
			3.0		8.0	10.3						
2	5	Nov-21-94	0	2.9	9.0	10.8	0.25	1.5	490	7.8	2.8	7.8
			1.0		9.0	11.0	0.25					
			2.0		9.0	10.4						
			2.8		9.0	10.4						
7	2	Nov-21-94	0	2.8	7.5	11.0	0.90	1.0	460	8.2	4.9	8.3
			1.0		8.0	10.0	0.40					
			2.0		8.0	10.1						
			2.7		8.0	10.2						
7	4	Nov-21-94	0	1.0	8.0	10.0	0.40	1.0	465	8.2	9.4	8.2
			0.9		8.0	10.0	0.20					
7	6	Nov-21-94	0	0.8	8.0	9.8	0.30	0.8	470	8,09	9.3	8.0
			0.7		8.0	10.0	0.10					
7	8	Nov-21-94	0	0.5	7.0	9.4	0.35	0.5	490	8.0	3.3	8.1
			0.4		7.0	9.4	0.10					
7	10	Nov-21-94	0	1.5	10.1	9.2	0.20	1.3	495	8.2	3.4	8.0
			1.0		10.6	9.1	0.05					
			1.4		10.0	9.1						

Appendix Table A. Physical and chemical water quality, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Transect	Site	Date	Sample Depth m	Water Depth m	Water Temp C	Dissolved Oxygen mg/l	Velocity ft/s	Secchi Depth m	Conductivity umhos/cm	Water pH	Turbidity NTU	Sediment pH
R	1	Nov-22-94	0	0.5	8.0	8.2	0.30	0.5	450	6.9	5.0	6.8
			0.4		8.0	8.4	0.10					
R	2	Nov-22-94	0	0.4	8.0	9.1	0.25	0.4	485	6.9	3.4	6.9
			0.3		8.0	8.8	0.10					
R	3	Nov-22-94	0	1.0	8.0	8.2	0.40	0.9	450	7.2	8.1	7.2
			0.9		8.2	8.0	0.15					
R	4	Nov-22-94	0	0.6	6.0	9.4	0.25	0.6	440	7.3	4.5	7.2
			0.5		6.0	9.7	0.15					
R	5	Nov-22-94	0	0.8	6.0	10.8	0.20	0.6	460	7.4	5.3	7.1
			0.7		6.0	10.8	0.10					
R	6	Nov-22-94	0	0.5	6.0	11.0	0.20	0.5	460	7.4	4.8	7.3
			0.4		6.0	11.1	0.10					
R	7	Nov-22-94	0	0.4	6.0	11.4	0.35	0.4	470	7.4	11.1	7.2
			0.3		6.0	11.2	0.10					
R	8	Nov-22-94	0	0.7	6.0	11.6	0.25	0.7	470	7.4	4.6	7.3
			0.6		6.0	11.4	0.05					
			1.4		20.0	8.0						

Appendix Table B. Water chemistry data, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Transect	Site	Date	Total Ammonia as N (mg/l)	Nitrite Nitrate as N (mg/l)	Total Kjeldahl Nitrogen as N (mg/l)	Total Phosphorus as P (mg/l)	Soluble Reactive Phosphorus as P (mg/l)	Hardness as CaCO3 (mg/l)	Alkalinity as CaCO3 (mg/l)	Total Suspended Solids (mg/l)
2	1	Apr-18-94	0.220	1.28	0.13	0.16	0.095	196	176	24
2	2		0.020	1.04	0.07	0.17	0.099	200	176	22
2	3		0.031	1.12	<.05	0.13	0.151	198	174	17
2	3dup		0.027	1.06	<.05	0.19	0.149	198	175	15
2	3blk		<.005	<.005	<.05	<.05	<.005	<4	<1	<1
2	3spk		0.309	9.65	2.88	2.44	0.610	-	-	640
2	4		0.040	1.15	0.12	0.12	0.107	202	177	18
2	5		0.081	1.55	0.18	0.15	0.120	218	182	11
5	3	Apr-18-94	0.040	1.29	0.26	0.17	0.123	212	176	14
5	4		0.040	1.26	0.19	0.16	0.109	208	180	14
5	5		0.045	1.27	0.13	0.13	0.108	210	177	13
5	6		0.044	1.29	0.22	0.17	0.108	210	181	14
5	7		0.043	1.25	0.24	0.16	0.107	206	180	14
7	3	Apr-18-94	0.042	1.09	0.22	0.13	0.105	208	180	13
7	4		0.043	1.25	0.28	0.11	0.107	200	181	13
7	5		0.058	1.08	0.24	0.09	0.113	206	182	12
7	6		0.055	1.43	0.34	0.16	0.115	214	180	12
7	7		0.056	1.52	0.24	0.16	0.118	216	182	11
R	1	May-25-94	0.024	1.08	0.55	0.15	0.146	204	183	28
R	2		0.025	1.06	0.58	0.19	0.142	204	184	37
R	3		0.044	1.24	0.36	0.13	0.146	214	182	17
R	4		0.038	1.14	0.35	0.15	0.150	216	183	18

Appendix Table B. Water chemistry data, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Transect	Site	Date	Total Ammonia as N (mg/l)	Nitrite Nitrate as N (mg/l)	Total Kjeldahl Nitrogen as N (mg/l)	Total Phosphorus as P (mg/l)	Soluble Reactive Phosphorus as P (mg/l)	Hardness as CaCO3 (mg/l)	Alkalinity as CaCO3 (mg/l)	Total Suspended Solids (mg/l)
R	5		0.042	1.24	0.41	0.16	0.158	212	184	16
R	6		0.036	1.20	0.34	0.17	0.146	216	182	17
R	7		0.051	1.49	0.52	0.15	0.156	228	188	46
R	8		0.037	1.11	0.33	0.13	0.164	212	181	13
2	1	Jun-28-94	0.035	1.10	0.45	0.12	-	200	181	9
2	2		0.039	1.11	0.58	0.14	-	200	183	12
2	3		0.032	1.16	0.20	0.13	-	200	182	14
2	4		0.045	1.16	0.30	0.15	-	202	181	14
2	5		0.074	1.23	0.35	0.17	-	208	181	14
7	1	Jun-28-94	0.061	1.23	0.43	0.16	-	210	185	13
7	3		0.075	1.26	0.36	0.18	-	210	182	11
7	5		0.095	1.43	0.36	0.13	-	222	186	14
7	7		0.102	1.52	0.34	0.15	-	222	186	12
7	9		0.094	1.63	0.14	0.11	-	236	186	5
R	1	Jun-28-94	0.069	1.24	0.40	0.14	-	208	182	12
R	2		0.090	1.24	0.35	0.11	-	206	184	11
R	3		0.077	1.27	0.42	0.15	-	206	183	13
R	4		0.108	1.58	0.65	0.13	-	226	188	9
R	5		0.090	1.33	0.27	0.10	-	214	185	14
R	6		0.076	1.27	0.30	0.11	-	212	185	10
R	7		0.073	1.27	0.26	0.11	-	210	183	8
R	8		0.078	1.24	0.33	0.15	-	210	182	12

Appendix Table B. Water chemistry data, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Transect	Site	Date	Total Ammonia as N (mg/l)	Nitrite Nitrate as N (mg/l)	Total Kjeldahl Nitrogen as N (mg/l)	Total Phosphorus as P (mg/l)	Soluble Reactive Phosphorus as P (mg/l)	Hardness as CaCO3 (mg/l)	Alkalinity as CaCO3 (mg/l)	Total Suspended Solids (mg/l)
2	1	Jul-23-94	0.119	0.96	0.51	0.07	-	196	173	9
2	1dup		0.088	0.94	0.56	0.08	-	198	174	10
2	1blk		<.005	0.01	<.05	<.05	-	<4	<1	<1
2	1spk		0.370	8.95	3.15	2.31	-	-	-	598
2	2		0.053	1.00	0.27	0.06	-	198	187	15
2	3		0.100	1.02	0.49	0.07	-	204	181	18
2	4		0.056	1.00	0.35	0.07	-	204	182	21
2	5		0.086	1.02	0.34	0.05	-	202	181	14
7	2	Jul-23-94	0.077	1.09	0.34	0.06	-	212	182	18
7	4		0.078	1.12	0.33	0.05	-	206	183	17
7	6		0.093	1.28	0.29	0.05	-	212	180	14
7	8		0.105	1.33	0.34	0.05	-	214	185	15
7	10		0.019	1.89	<.05	<.05	-	244	184	2
R	1	Jul-23-94	0.084	1.10	0.35	<.05	-	208	182	11
R	2		0.081	1.10	0.33	0.05	-	206	182	16
R	3		0.083	1.09	0.34	0.06	-	210	180	16
R	4		0.070	1.02	0.37	0.06	-	208	182	16
R	5		0.073	1.10	0.34	0.05	-	204	176	14
R	6		0.095	1.06	0.35	0.07	-	204	187	17
R	7		0.112	1.29	0.31	0.06	-	214	185	14
R	8		0.125	1.37	0.34	0.07	-	216	185	13

Appendix Table B. Water chemistry data, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Transect	Site	Date	Total Ammonia as N (mg/l)	Nitrite Nitrate as N (mg/l)	Total Kjeldahl Nitrogen as N (mg/l)	Total Phosphorus as P (mg/l)	Soluble Reactive Phosphorus as P (mg/l)	Hardness as CaCO3 (mg/l)	Alkalinity as CaCO3 (mg/l)	Total Suspended Solids (mg/l)
2	1	Aug-19-94	0.098	1.87	0.33	0.15	0.081	230	208	14
2	2		0.081	1.86	0.17	0.12	0.067	228	210	13
2	3		0.070	1.95	0.34	0.13	0.075	232	210	15
2	4		0.056	1.93	0.15	0.12	0.077	240	210	21
2	5		0.067	1.96	0.11	0.10	0.076	236	210	16
7	1	Aug-19-94	0.077	1.98	0.24	0.11	0.076	246	208	18
7	3		0.072	2.12	0.13	0.09	0.069	248	208	8
7	5		0.089	2.18	0.47	0.09	0.068	248	208	35
7	5dup		0.094	2.16	0.41	0.11	0.071	246	208	18
7	5blk		<.005	0.01	<.05	<.05	<.005	<4	1	<1
7	5spk		0.423	10.40	2.78	1.99	-	-	-	714
7	7		0.084	2.18	0.43	0.15	0.064	250	209	63
7	9		0.076	2.17	0.09	0.08	0.052	246	204	4

Appendix Table B. Water chemistry data, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Transect	Site	Date	Total Ammonia as N (mg/l)	Nitrite Nitrate as N (mg/l)	Total Kjeldahl Nitrogen as N (mg/l)	Total Phosphorus as P (mg/l)	Soluble Reactive Phosphorus as P (mg/l)	Hardness as CaCO3 (mg/l)	Alkalinity as CaCO3 (mg/l)	Total Suspended Solids (mg/l)
R	1	Aug-19-94	0.093	2.06	0.43	0.13	0.067	238	204	18
R	2		0.062	1.91	0.17	0.11	0.077	236	206	10
R	3		0.077	1.98	0.34	0.12	0.077	246	208	10
R	4		0.075	1.94	0.20	0.12	0.074	238	208	20
R	5		0.078	1.94	0.29	0.12	0.079	238	208	14
R	6		0.073	1.87	0.46	0.16	0.068	236	202	34
R	7		0.072	1.98	0.17	0.12	0.077	230	208	12
R	8		0.075	1.91	0.36	0.12	0.079	234	208	13
2	1	Oct-26-94	0.021	2.50	0.22	0.10	0.071	260	226	11
2	3		0.023	2.54	0.14	0.11	0.073	250	225	12
2	5		0.061	2.58	0.15	0.10	0.077	260	225	11
2	7		0.068	2.65	0.18	0.10	0.073	262	224	12
2	7dup		0.072	2.60	0.16	0.10	0.073	254	224	12
2	7blk		0.008	<.005	<.05	<.05	-	<4	2	<1
2	7spk		0.357	10.40	1.97	2.11	-	-	-	542
2	9		0.128	2.57	0.19	0.12	0.079	258	223	10
7	1	Oct-26-94	0.056	2.50	0.18	0.10	0.073	252	223	13
7	3		0.063	2.47	0.12	0.11	0.073	258	221	10
7	5		0.079	2.50	0.17	0.10	0.069	262	221	6
7	7		0.085	2.55	0.20	0.10	0.067	260	219	5
7	9		0.081	2.54	0.08	0.09	0.070	270	219	4

Appendix Table B. Water chemistry data, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Transect	Site	Date	Total Ammonia as N (mg/l)	Nitrite Nitrate as N (mg/l)	Total Kjeldahl Nitrogen as N (mg/l)	Total Phosphorus as P (mg/l)	Soluble Reactive Phosphorus as P (mg/l)	Hardness as CaCO3 (mg/l)	Alkalinity as CaCO3 (mg/l)	Total Suspended Solids (mg/l)
R	1	Oct-26-94	0.093	2.53	0.09	0.09	0.066	266	218	4
R	2		0.078	2.55	0.11	0.09	0.073	256	223	7
R	3		0.059	2.51	0.12	0.11	0.073	258	224	12
R	4		0.070	2.48	0.14	0.12	0.075	260	224	12
R	5		0.067	2.45	0.14	0.12	0.073	258	223	15
R	6		0.073	2.47	0.13	0.12	0.078	256	223	15
R	7		0.071	2.50	0.15	0.12	0.074	262	222	13
R	8		0.067	2.48	0.13	0.12	0.078	256	223	12
2	1	Nov-21-94	0.069	3.14	0.42	0.23	0.142	252	224	8
2	2		0.071	3.24	0.34	0.12	0.187	256	223	7
2	3		0.087	2.98	0.37	0.18	0.162	268	226	8
2	4		0.117	2.95	0.38	0.17	0.164	254	222	6
2	5		0.124	2.92	0.36	0.17	0.145	264	221	6
7	2	Nov-21-94	0.093	2.96	0.41	0.18	0.141	258	222	12
7	4		0.090	2.95	0.39	0.18	0.137	280	222	12
7	6		0.093	2.92	0.41	0.19	0.113	270	221	12
7	8		0.110	2.87	0.36	0.15	0.112	260	217	4
7	8dup		0.116	2.87	0.35	0.15	0.149	264	217	5
7	8blk		0.007	<.005	<.05	<.05	-	<4	<1	<1
7	8spk		0.456	10.30	2.20	2.00	-	-	-	600
7	10		0.118	2.90	0.35	0.14	0.127	268	216	7

Appendix Table B. Water chemistry data, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Transect	Site	Date	Total Ammonia as N (mg/l)	Nitrite Nitrate as N (mg/l)	Total Kjeldahl Nitrogen as N (mg/l)	Total Phosphorus as P (mg/l)	Soluble Reactive Phosphorus as P (mg/l)	Hardness as CaCO3 (mg/l)	Alkalinity as CaCO3 (mg/l)	Total Suspended Solids (mg/l)
R	1	Nov-22-94	0.073	3.00	0.43	0.21	0.168	258	222	22
R	2		0.104	2.86	0.35	0.15	0.126	274	217	7
R	3		0.076	2.98	0.42	0.23	0.168	276	222	22
R	4		0.093	2.96	0.41	0.20	0.147	258	221	14
R	5		0.084	2.94	0.45	0.20	0.150	260	221	26
R	6		0.079	2.94	0.39	0.18	0.140	262	223	17
R	7		0.077	2.94	0.48	0.23	0.145	258	222	42
R	8		0.079	2.93	0.33	0.18	0.170	258	223	18

Appendix Table C. Monochromatic chlorophyll *a*, trichromatic chlorophyll *a*, and pheophyton, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Transect	Site	Date	Monochromatic Chlorophyll *a* mg/cu. m	Pheophyton mg/cu. m	Trichromatic Chlorophyll *a* mg/cu. m
2	1	Apr-15-94	30.9	10.2	34.2
2	2		27.6	5.2	31.6
2	3		28.2	27.6	31.9
2	3dup		28.2	6.3	31.9
2	3blk		0.8	6.3	1.7
2	4		27.6	24.9	31.5
2	5		24.2	5.3	27.5
5	3	Apr-15-94	28.2	5.5	30.8
5	4		29.4	13.4	35.2
5	5		27.2	5.4	30.2
5	6		31.0	17.1	32.1
5	7		29.9	4.6	32.7
7	3	Apr-15-94	28.2	4.8	31.3
7	4		28.5	3.8	31.2
7	5		30.9	26.2	32.3
7	6		26.9	17.6	31.1
7	7		25.0	4.7	28.1
R	1	25-May-94	14.4	3.1	16.7
R	2		20.8	3.6	23.7
R	3		15.3	2.6	17.4
R	4		17.8	1.7	19.5
R	5		13.9	2.8	16.0
R	6		15.5	3.7	18.3
R	7		16.6	2.9	18.9
R	8		19.9	2.3	21.9
2	1	27-Jun-94	9.6	2.3	11.3
2	2		10.4	3.2	12.6
2	3		10.0	2.2	11.7
2	4		12.1	1.1	13.2
2	5		6.9	8.6	12.2
7	1	27-Jun-94	12.5	2.0	14.1
7	3		10.3	3.0	12.4
7	5		8.8	4.9	12.0
7	7		9.6	1.2	10.7
7	9		6.1	1.0	6.8

Appendix Table C. Monochromatic chlorophyll *a* , trichromatic chlorophyll *a* , and pheophyton, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Transect	Site	Date	Monochromatic Chlorophyll *a* mg/cu. m	Pheophyton mg/cu. m	Trichromatic Chlorophyll *a* mg/cu. m
R	1	27-Jun-94	12.5	2.8	14.5
R	2		10.4	3.1	12.6
R	3		11.3	2.2	12.9
R	4		-	-	-
R	5		11.3	3.2	13.6
R	6		9.9	4.8	13.1
R	7		9.8	0.8	10.6
R	8		9.2	4.5	12.2
2	1	23-Jul-94	31.8	5.5	35.6
2	2		13.8	1.8	15.1
2	3		107.9	6.8	113.8
2	4		9.2	2.6	11.0
2	5		6.3	1.5	7.4
7	2	23-Jul-94	6.2	2.2	7.6
7	4		6.8	2.0	8.2
7	6		5.0	0.9	5.6
7	8		6.5	1.2	7.4
7	10		1.4	1.3	2.2
R	1	23-Jul-94	6.7	4.5	9.5
R	2		7.8	4.2	10.6
R	3		8.6	1.9	10.1
R	4		4.7	5.7	8.3
R	5		4.5	23.1	9.4
R	6		8.2	3.3	10.4
R	7		10.6	0.4	11.3
R	8		4.5	4.3	7.3
2	1	19-Aug-94	9.1	7.0	13.4
2	2		9.4	6.0	13.2
2	3		20.7	4.0	23.5
2	4		10.4	3.9	13.1
2	5		9.1	7.7	13.9
7	1	19-Aug-94	11.6	4.1	14.4
7	3		8.3	4.5	11.1
7	5		21.5	17.2	32.4
7	7		26.9	9.7	33.5
7	9		5.6	1.2	6.5

Appendix Table C. Monochromatic chlorophyll *a* , trichromatic chlorophyll *a* , and pheophyton, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Transect	Site	Date	Monochromatic Chlorophyll *a* mg/cu. m	Pheophyton mg/cu. m	Trichromatic Chlorophyll *a* mg/cu. m
R	1	19-Aug-94	20.3	6.8	24.7
R	2		5.7	8.0	10.6
R	3		5.3	3.2	7.3
R	4		14.9	2.3	16.8
R	5		10.9	5.5	14.6
R	6		11.2	2.3	12.8
R	7		19.1	4.8	22.4
R	8		9.3	2.0	10.9
2	1	26-Oct-94	15.3	3.4	17.8
2	3		9.6	2.1	11.2
2	5		6.9	2.4	8.5
2	7		5.8	2.2	7.3
2	9		7.9	6.9	12.3
7	1	26-Oct-94	9.8	4.3	12.7
7	3		9.8	9.2	15.6
7	5		5.2	10.7	11.7
7	7		5.7	2.5	7.4
7	9		6.1	3.1	8.1
R	1	26-Oct-94	4.6	7.9	9.5
R	2		8.7	7.2	13.2
R	3		13.8	3.5	16.3
R	4		13.3	2.8	15.4
R	5		10.4	3.4	12.7
R	6		13.9	6.4	18.1
R	7		14.2	2.7	16.2
R	8		10.8	3.4	13.1
2	1	21-Nov-94	9.1	5.3	12.5
2	2		8.7	6.6	12.9
2	3		9.7	3.3	11.9
2	4		8.4	2.6	10.2
2	5		7.2	2.3	8.8
7	2	21-Nov-94	7.2	7.9	12.1
7	4		9.8	3.5	12.3
7	6		6.7	6.1	10.6
7	8		3.7	6.7	7.9
7	10		6.2	2.7	7.9

Appendix Table C. Monochromatic chlorophyll *a* , trichromatic chlorophyll *a* , and pheophyton, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

Transect	Site	Date	Monochromatic Chlorophyll *a* mg/cu. m	Pheophyton mg/cu. m	Trichromatic Chlorophyll *a* mg/cu. m
R	1	22-Nov-94	11.1	6.2	15.1
R	2		5.4	5.1	8.5
R	3		11.6	5.0	15.0
R	4		8.0	4.8	11.1
R	5		10.1	5.1	13.4
R	6		9.7	4.3	12.6
R	7		10.6	6.7	14.9
R	8		9.4	5.0	12.7

Appendix Table D. Dry biomass and percent composition for aquatic macrophytes, Crystal Springs Reach (RM 599.5-601.3), Middle Snake River, Idaho, 1994.

Transect	Site	Date	Species	Dry Biomass g/m²	Species Percent Composition %	Total Dry Biomass g/m²
2	1	15-Apr-94	*P. crispus*	39.5	100.0	**39.5**
2	2	15-Apr-94	*P. crispus*	9.1	100.0	**9.1**
2	3	15-Apr-94	*P. crispus*	65.5	100.0	**65.5**
2	4	15-Apr-94	-------------	0	0	**0**
2	5	15-Apr-94	-------------	0	0	**0**
5	3	15-Apr-94	*C. demersum*	1.9	82.8	
5	3	15-Apr-94	*P. pectinatus*	0.4	17.2	**2.4**
5	4	15-Apr-94	*P. crispus*	8.6	90.8	
5	4	15-Apr-94	*P. pectinatus*	0.9	9.2	**9.4**
5	5	15-Apr-94	*P. crispus*	12.5	9.8	
5	5	15-Apr-94	*C. demersum*	115.1	90.2	**127.6**
5	6	15-Apr-94	*P. crispus*	9.5	100.0	**9.5**
5	7	15-Apr-94	-------------	0	0	**0**
7	3	15-Apr-94	*P. crispus*	27.9	81.7	
7	3	15-Apr-94	*P. pectinatus*	6.2	18.3	**34.1**
7	4	15-Apr-94	*P. crispus*	2.0	100.0	**2.0**
7	5	15-Apr-94	-------------	0	0	**0**
7	6	15-Apr-94	*P. crispus*	293.6	100.0	**293.6**
7	7	15-Apr-94	*C. demersum*	339.8	93.8	
7	7	15-Apr-94	*P. pectinatus*	17.8	4.9	
7	7	15-Apr-94	*P. crispus*	3.4	0.9	
7	7	15-Apr-94	*Cladophora*	1.1	0.3	**362.0**

Appendix Table D. Dry biomass and percent composition for aquatic macrophytes, Crystal Springs Reach (RM 599.5-601.3), Middle Snake River, Idaho, 1994.

Transect	Site	Date	Species	Dry Biomass g/m²	Species Percent Composition %	Total Dry Biomass g/m²
R*	1	25-May-94	*C. demersum*	9.4	3.6	
R	1	25-May-94	*P. crispus*	99.3	38.3	
R	1	25-May-94	*P. pectinatus*	148.7	57.3	
R	1	25-May-94	*Hydrodictyon*	2.0	0.8	**259.4**
R	2	25-May-94	*P. crispus*	21.6	53.7	
R	2	25-May-94	*C. demersum*	10.5	26.1	
R	2	25-May-94	*P. pectinatus*	8.2	20.2	**40.3**
R	3	25-May-94	-------------	0	0	**0**
R	4	25-May-94	*P. pectinatus*	6.2	19.1	
R	4	25-May-94	*P. crispus*	26.2	80.9	**32.4**
R	5	25-May-94	*P. crispus*	846.4	99.7	
R	5	25-May-94	*P. pectinatus*	2.3	0.3	
R	5	25-May-94	*C. demersum*	0.2	0.0	**848.9**
R	6	25-May-94	*P. crispus*	4.2	100.0	**4.2**
R	7	25-May-94	*P. pectinatus*	65.8	30.0	
R	7	25-May-94	*C. demersum*	1.6	0.7	
R	7	25-May-94	*P. crispus*	150.5	68.6	
R	7	25-May-94	*E. canadensis*	1.4	0.6	**219.4**
R	8	25-May-94	*P. pectinatus*	9.4	2.0	
R	8	25-May-94	*C. demersum*	5.7	1.2	
R	8	25-May-94	*Cladophora*	8.6	1.8	
R	8	25-May-94	*P. crispus*	457.9	95.1	**481.5**
2	1	27-Jun-94	*Cladophora*	44.6	20.8	
2	1	27-Jun-94	*P. pectinatus*	43.2	20.2	
2	1	27-Jun-94	*P. crispus*	11.7	5.5	
2	1	27-Jun-94	*C. demersum*	98.5	46.0	
2	1	27-Jun-94	*E. nuttallii*	16.3	7.6	**214.3**
2	2	27-Jun-94	*E. nuttallii*	0.5	0.9	
2	2	27-Jun-94	*P. crispus*	31.0	56.4	
2	2	27-Jun-94	*C. demersum*	23.5	42.7	**55.0**

Appendix Table D. Dry biomass and percent composition for aquatic macrophytes, Crystal Springs Reach (RM 599.5-601.3), Middle Snake River, Idaho, 1994.

Transect	Site	Date	Species	Dry Biomass g/m²	Species Percent Composition %	Total Dry Biomass g/m²
2	3	27-Jun-94	*C. demersum*	567.2	92.7	
2	3	27-Jun-94	*P. crispus*	11.3	1.9	
2	3	27-Jun-94	*E. nuttallii*	1.4	0.2	
2	3	27-Jun-94	*Enteromorpha*	3.5	0.6	
2	3	27-Jun-94	*Cladophora*	28.5	4.7	**611.9**
2	4	27-Jun-94	-------------	0	0	**0**
2	5	27-Jun-94	-------------	0	0	**0**
7	1	27-Jun-94	-------------	0	0	**0**
7	3	27-Jun-94	*P. crispus*	47.8	61.0	
7	3	27-Jun-94	*P. pectinatus*	19.9	25.4	
7	3	27-Jun-94	*Drepanocladus*	1.8	2.3	
7	3	27-Jun-94	*Cladophora*	8.3	10.6	
7	3	27-Jun-94	*C. demersum*	0.5	0.6	**78.3**
7	5	27-Jun-94	*E. nuttallii*	0.5	0.0	
7	5	27-Jun-94	*Enteromorpha*	5.3	0.2	
7	5	27-Jun-94	*Cladophora*	1,195.1	47.9	
7	5	27-Jun-94	*C. demersum*	245.4	9.8	
7	5	27-Jun-94	*P. pectinatus*	428.3	17.2	
7	5	27-Jun-94	*P. crispus*	619.8	24.8	
7	5	27-Jun-94	*Ranunculus*	0.1	0.0	**2,494.4**
7	7	27-Jun-94	*Enteromorpha*	19.1	0.6	
7	7	27-Jun-94	*C. demersum*	190.7	5.7	
7	7	27-Jun-94	*P. pectinatus*	233.3	6.9	
7	7	27-Jun-94	*E. nuttallii*	21.3	0.6	
7	7	27-Jun-94	*Cladophora*	1,821.6	54.2	
7	7	27-Jun-94	*P. crispus*	1,077.8	32.0	**3,363.8**
7	9	27-Jun-94	*Enteromorpha*	0.1	0	
7	9	27-Jun-94	*Cladophora*	106.5	42.5	
7	9	27-Jun-94	*P. crispus*	144.0	57.5	**250.6**
R	1	27-Jun-94	*Cladophora*	25.2	14.7	
R	1	28-Jun-98	*Enteromorpha*	2.4	1.4	
R	1	28-Jun-98	*P. crispus*	1.3	0.8	
R	1	27-Jun-94	*P. pectinatus*	142.8	83.1	**171.8**

Appendix Table D. Dry biomass and percent composition for aquatic macrophytes, Crystal Springs Reach (RM 599.5-601.3), Middle Snake River, Idaho, 1994.

Transect	Site	Date	Species	Dry Biomass g/m²	Species Percent Composition %	Total Dry Biomass g/m²
R	2	27-Jun-94	*Cladophora*	98.5	9.6	
R	2	27-Jun-94	*Enteromorpha*	8.4	0.8	
R	2	27-Jun-94	*E. nuttallii*	0.3	0	
R	2	27-Jun-94	*C. demersum*	0.1	0	
R	2	27-Jun-94	*P. crispus*	293.4	28.6	
R	2	27-Jun-94	*P. pectinatus*	625.6	61.0	**1,026.3**
R	3	27-Jun-94	*Enteromorpha*	0.7	0.1	
R	3	27-Jun-94	*Cladophora*	84.1	16.0	
R	3	27-Jun-94	*P. pectinatus*	178.4	33.9	
R	3	27-Jun-94	*P. crispus*	263.5	50.0	**526.8**
R	4	27-Jun-94	*Cladophora*	87.7	30.8	
R	4	27-Jun-94	*C. demersum*	14.1	5.0	
R	4	27-Jun-94	*E. canadensis*	1.5	0.5	
R	4	27-Jun-94	*P. crispus*	181.5	63.7	**284.8**
R	5	27-Jun-94	*P. crispus*	12.4	79.7	
R	5	27-Jun-94	*Cladophora*	3.0	19.1	
R	5	27-Jun-94	*P. pectinatus*	0.2	1.2	**15.5**
R	6	27-Jun-94	*Cladophora*	24.6	1.5	
R	6	27-Jun-94	*Enteromorpha*	0.3	0	
R	6	27-Jun-94	*P. crispus*	431.5	27.0	
R	6	27-Jun-94	*P. pectinatus*	1,140.4	71.4	**1,596.8**
R	7	27-Jun-94	*P. crispus*	43.2	100.0	**43.2**
R	8	27-Jun-94	*C. demersum*	2.2	1.4	
R	8	27-Jun-94	*Enteromorpha*	14.6	9.1	
R	8	27-Jun-94	*P. pectinatus*	2.4	1.5	
R	8	27-Jun-94	*P. crispus*	126.5	79.1	
R	8	27-Jun-94	*Cladophora*	14.2	8.9	**159.9**

Appendix Table D. Dry biomass and percent composition for aquatic macrophytes, Crystal Springs Reach (RM 599.5-601.3), Middle Snake River, Idaho, 1994.

Transect	Site	Date	Species	Dry Biomass g/m²	Species Percent Composition %	Total Dry Biomass g/m²
2	1	23-Jul-94	*P. pectinatus*	1.5	1.0	
2	1	23-Jul-94	*C. demersum*	11.1	7.2	
2	1	23-Jul-94	*P. crispus*	8.0	5.2	
2	1	23-Jul-94	*Enteromorpha*	3.6	2.3	
2	1	23-Jul-94	*Cladophora*	48.4	31.5	
2	1	23-Jul-94	*Hydrodictyon*	39.6	25.8	
2	1	23-Jul-94	*E. nuttallii*	41.5	27.0	**153.6**
2	2	23-Jul-94	*Cladophora*	63.9	48.7	
2	2	23-Jul-94	*P. crispus*	6.8	5.2	
2	2	23-Jul-94	*C. demersum*	59.9	45.6	
2	2	23-Jul-94	*E. nuttallii*	0.6	0.5	**131.2**
2	3	23-Jul-94	*P. crispus*	5.3	3.9	
2	3	23-Jul-94	*Cladophora*	32.7	23.9	
2	3	23-Jul-94	*C. demersum*	99.0	72.2	**137.1**
2	4	23-Jul-94	*P. crispus*	32.0	77.1	
2	4	23-Jul-94	*E. canadensis*	2.2	5.2	
2	4	23-Jul-94	*P. pectinatus*	3.6	8.7	
2	4	23-Jul-94	*Enteromorpha*	1.2	2.9	
2	4	23-Jul-94	*Cladophora*	2.5	6.1	**41.5**
2	5	23-Jul-94	------------	0	0	**0**
7	2	23-Jul-94	------------	0	0	**0**
7	4	23-Jul-94	*Enteromorpha*	1.5	0.4	
7	4	23-Jul-94	*Cladophora*	43.3	12.5	
7	4	23-Jul-94	*P. crispus*	5.6	1.6	
7	4	23-Jul-94	*P. pectinatus*	296.4	85.5	**346.8**
7	6	23-Jul-94	*Cladophora*	79.4	73.4	
7	6	23-Jul-94	*P. crispus*	16.5	15.3	
7	6	23-Jul-94	*C. demersum*	11.0	10.2	
7	6	23-Jul-94	*E. canadensis*	0.6	0.6	
7	6	23-Jul-94	*P. pectinatus*	0.5	0.5	**108.1**

Appendix Table D. Dry biomass and percent composition for aquatic macrophytes, Crystal Springs Reach (RM 599.5-601.3), Middle Snake River, Idaho, 1994.

Transect	Site	Date	Species	Dry Biomass g/m²	Species Percent Composition %	Total Dry Biomass g/m²
7	8	23-Jul-94	*Cladophora*	25.1	79.9	
7	8	23-Jul-94	*P. pectinatus*	0.6	1.8	
7	8	23-Jul-94	*Enteromorpha*	1.1	3.6	
7	8	23-Jul-94	*P. crispus*	4.2	13.5	
7	8	23-Jul-94	*C. demersum*	0.4	1.3	**31.4**
7	10	23-Jul-94	*P. pectinatus*	41.8	3.7	
7	10	23-Jul-94	*E. canadensis*	0.2	0.0	
7	10	23-Jul-94	*Enteromorpha*	0.3	0.0	
7	10	23-Jul-94	*Hydrodictyon*	0.2	0.0	
7	10	23-Jul-94	*Cladophora*	882.9	78.2	
7	10	23-Jul-94	*P. crispus*	203.7	18.0	**1,129.1**
R	1	23-Jul-94	*P. crispus*	19.3	3.1	
R	1	23-Jul-94	*E. nuttallii*	0.4	0.1	
R	1	23-Jul-94	*C. demersum*	16.7	2.7	
R	1	23-Jul-94	*Enteromorpha*	2.0	0.3	
R	1	23-Jul-94	*P. pectinatus*	3.4	0.6	
R	1	23-Jul-94	*Cladophora*	575.6	93.2	**617.5**
R	2	23-Jul-94	*Cladophora*	2.2	0.2	
R	2	23-Jul-94	*Enteromorpha*	1.2	0.1	
R	2	23-Jul-94	*E. canadensis*	0.1	0	
R	2	23-Jul-94	*P. crispus*	1.7	0.2	
R	2	23-Jul-94	*P. pectinatus*	1,042.5	99.5	**1,047.8**
R	3	23-Jul-94	*Enteromorpha*	3.1	0.6	
R	3	23-Jul-94	*E. canadensis*	2.0	0.4	
R	3	23-Jul-94	*Cladophora*	137.9	27.0	
R	3	23-Jul-94	*Hydrodictyon*	0.1	0	
R	3	23-Jul-94	*P. crispus*	1.3	0.2	
R	3	23-Jul-94	*C. demersum*	2.5	0.5	
R	3	23-Jul-94	*P. pectinatus*	363.3	71.2	**510.2**
R	4	23-Jul-94	*C. demersum*	38.3	56.0	
R	4	23-Jul-94	*P. crispus*	4.7	6.8	
R	4	23-Jul-94	*Cladophora*	25.4	37.1	**68.4**
R	5	23-Jul-94	*Cladophora*	16.4	11.5	
R	5	23-Jul-94	*P. pectinatus*	46.5	32.5	
R	5	23-Jul-94	*P. crispus*	80.2	56.0	**143.2**

Appendix Table D. Dry biomass and percent composition for aquatic macrophytes, Crystal Springs Reach (RM 599.5-601.3), Middle Snake River, Idaho, 1994.

Transect	Site	Date	Species	Dry Biomass g/m²	Species Percent Composition %	Total Dry Biomass g/m²
R	6	23-Jul-94	*Enteromorpha*	0.1	0.1	
R	6	23-Jul-94	*Cladophora*	1.5	0.7	
R	6	23-Jul-94	*E. canadensis*	0.2	0.1	
R	6	23-Jul-94	*P. crispus*	21.4	10.8	
R	6	23-Jul-94	*P. pectinatus*	175.2	88.3	**198.5**
R	7	23-Jul-94	------------	0	0	**0**
R	8	23-Jul-94	*E. canadensis*	0.2	0	
R	8	23-Jul-94	*Enteromorpha*	1.0	0.1	
R	8	23-Jul-94	*Cladophora*	1,193.5	62.3	
R	8	23-Jul-94	*C. demersum*	191.6	10.0	
R	8	23-Jul-94	*P. pectinatus*	260.2	13.6	
R	8	23-Jul-94	*P. crispus*	268.4	14.0	**1,914.9**
2	1	19-Aug-94	*C. demersum*	1.7	10.0	
2	1	19-Aug-94	*Hydrodictyon*	5.9	34.3	
2	1	19-Aug-94	*P. crispus*	9.6	55.7	**17.2**
2	2	19-Aug-94	*C. demersum*	52.9	31.4	
2	2	19-Aug-94	*P. crispus*	32.1	19.0	
2	2	19-Aug-94	*E. canadensis*	0.4	0.2	
2	2	19-Aug-94	*Hydrodictyon*	1.3	0.8	
2	2	19-Aug-94	*Cladophora*	82.0	48.6	**168.7**
2	3	19-Aug-94	------------	0	0	**0**
2	4	19-Aug-94	*E. canadensis*	0.7	0.2	
2	4	19-Aug-94	*P. crispus*	19.2	6.0	
2	4	19-Aug-94	*Enteromorpha*	0.5	0.1	
2	4	19-Aug-94	*Hydrodictyon*	12.5	3.9	
2	4	19-Aug-94	*Cladophora*	158.4	49.8	
2	4	19-Aug-94	*C. demersum*	126.6	39.8	**317.8**
2	5	19-Aug-94	------------	0	0	**0**
7	1	19-Aug-94	------------	0	0	**0**
7	3	19-Aug-94	------------	0	0	**0**
7	5	19-Aug-94	*C. demersum*	1,310.7	64.7	

Appendix Table D. Dry biomass and percent composition for aquatic macrophytes, Crystal Springs Reach (RM 599.5-601.3), Middle Snake River, Idaho, 1994.

Transect	Site	Date	Species	Dry Biomass g/m²	Species Percent Composition %	Total Dry Biomass g/m²
7	5	19-Aug-94	*Cladophora*	525.8	25.9	
7	5	19-Aug-94	*E. canadensis*	4.1	0.2	
7	5	19-Aug-94	*P. crispus*	14.5	0.7	
7	5	19-Aug-94	*P. pectinatus*	165.3	8.2	
7	5	19-Aug-94	*Hydrodictyon*	1.7	0.1	
7	5	19-Aug-94	*L. minor*	0.5	0	
7	5	19-Aug-94	*Ranunculus*	0.5	0	
7	5	19-Aug-94	*Enteromorpha*	3.2	0.2	**2,026.3**
7	7	19-Aug-94	*Enteromorpha*	0.1	0	
7	7	19-Aug-94	*E. canadensis*	0.2	0	
7	7	19-Aug-94	*P. crispus*	1.9	0.2	
7	7	19-Aug-94	*P. pectinatus*	6.7	0.6	
7	7	19-Aug-94	*Cladophora*	71.1	5.8	
7	7	19-Aug-94	*Hydrodictyon*	0.2	0	
7	7	19-Aug-94	*C. demersum*	1,139.0	93.4	**1,219.2**
7	9	19-Aug-94	*P. pectinatus*	0.5	0	
7	9	19-Aug-94	*E. nuttallii*	0.4	0	
7	9	19-Aug-94	*E. canadensis*	2.7	0.2	
7	9	19-Aug-94	*Ranunculus*	10.7	0.9	
7	9	19-Aug-94	*P. crispus*	47.0	3.8	
7	9	19-Aug-94	*Cladophora*	821.6	66.2	
7	9	19-Aug-94	*C. demersum*	359.1	28.9	**1,242.0**
R	1	19-Aug-94	*Cladophora*	718.7	51.3	
R	1	19-Aug-94	*Hydrodictyon*	5.0	0.4	
R	1	19-Aug-94	*L. minor*	0.2	0	
R	1	19-Aug-94	*E. canadensis*	1.9	0.1	
R	1	19-Aug-94	*P. crispus*	25.6	1.8	
R	1	19-Aug-94	*Enteromorpha*	0.8	0.1	
R	1	19-Aug-94	*P. pectinatus*	164.3	11.7	
R	1	19-Aug-94	*C. demersum*	485.1	34.6	**1,401.6**
R	2	19-Aug-94	*Cladophora*	5.7	66.4	
R	2	19-Aug-94	*P. pectinatus*	1.6	18.8	
R	2	19-Aug-94	*P. crispus*	1.3	14.8	**8.6**
R	3	19-Aug-94	*P. pectinatus*	323.0	74.4	
R	3	19-Aug-94	*P. crispus*	111.0	25.6	**434.0**
R	4	19-Aug-94	*E. nuttallii*	0.4	0.1	

Appendix Table D. Dry biomass and percent composition for aquatic macrophytes, Crystal Springs Reach (RM 599.5-601.3), Middle Snake River, Idaho, 1994.

Transect	Site	Date	Species	Dry Biomass g/m²	Species Percent Composition %	Total Dry Biomass g/m²
R	4	19-Aug-94	*Enteromorpha*	2.6	0.4	
R	4	19-Aug-94	*P. crispus*	2.1	0.3	
R	4	19-Aug-94	*Cladophora*	60.5	8.2	
R	4	19-Aug-94	*P. pectinatus*	343.5	46.5	
R	4	19-Aug-94	*C. demersum*	330.2	44.7	**739.4**
R	6	19-Aug-94	*P. pectinatus*	2.4	2.1	
R	6	19-Aug-94	*P. crispus*	85.3	73.6	
R	6	19-Aug-94	*C. demersum*	22.1	19.1	
R	6	19-Aug-94	*Cladophora*	6.1	5.3	**116.0**
R	7	19-Aug-94	*C. demersum*	27.9	24.8	
R	7	19-Aug-94	*P. crispus*	58.7	52.2	
R	7	19-Aug-94	*Cladophora*	24.6	21.9	
R	7	19-Aug-94	*P. pectinatus*	1.2	1.1	**112.5**
R	8	19-Aug-94	*Enteromorpha*	2.0	0.3	
R	8	19-Aug-94	*Cladophora*	384.1	60.1	
R	8	19-Aug-94	*P. crispus*	6.2	1.0	
R	8	19-Aug-94	*P. pectinatus*	86.4	13.5	
R	8	19-Aug-94	*C. demersum*	159.2	24.9	
R	8	19-Aug-94	*E. canadensis*	1.1	0.2	
R	8	19-Aug-94	-------------	0.6	0.1	**639.6**
2	1	26-Oct-94	*C. demersum*	3.1	13.0	
2	1	26-Oct-94	*P. pectinatus*	1.3	5.4	
2	1	26-Oct-94	*Cladophora*	6.4	26.6	
2	1	26-Oct-94	*P. crispus*	13.3	55.0	**24.2**
2	2	26-Oct-94	*Enteromorpha*	14.9	5.0	
2	2	26-Oct-94	*P. crispus*	15.3	5.2	
2	2	26-Oct-94	*Cladophora*	126.1	42.7	
2	2	26-Oct-94	*C. demersum*	139.3	47.1	**295.6**
2	3	26-Oct-94	-------------	0	0	**0**
2	4	26-Oct-94	-------------	0	0	**0**
2	5	26-Oct-94	-------------	0	0	**0**
7	1	26-Oct-94	-------------	0	0	**0**

Appendix Table D. Dry biomass and percent composition for aquatic macrophytes, Crystal Springs Reach (RM 599.5-601.3), Middle Snake River, Idaho, 1994.

Transect	Site	Date	Species	Dry Biomass g/m^2	Species Percent Composition %	Total Dry Biomass g/m^2
7	3	26-Oct-94	*C. demersum*	7.6	1.2	
7	3	26-Oct-94	*Enteromorpha*	0.1	0.0	
7	3	26-Oct-94	*Cladophora*	2.1	0.3	
7	3	26-Oct-94	*P. crispus*	26.4	4.2	
7	3	26-Oct-94	*P. pectinatus*	593.4	94.3	**629.5**
7	5	26-Oct-94	*P. crispus*	90.2	39.8	
7	5	26-Oct-94	*C. demersum*	90.7	40.1	
7	5	26-Oct-94	*Cladophora*	45.3	20.0	
7	5	26-Oct-94	*Hydrodictyon*	0.2	0.1	**226.4**
7	7	26-Oct-94	*E. canadensis*	0.6	0.1	
7	7	26-Oct-94	*P. crispus*	10.4	1.2	
7	7	26-Oct-94	*P. pectinatus*	2.4	0.3	
7	7	26-Oct-94	*Cladophora*	594.8	71.1	
7	7	26-Oct-94	*C. demersum*	228.9	27.3	**837.1**
7	9	26-Oct-94	*C. demersum*	391.7	38.2	
7	9	26-Oct-94	*Ranunculus*	2.7	0.3	
7	9	26-Oct-94	*P. crispus*	28.1	2.7	
7	9	26-Oct-94	*P. pectinatus*	0.8	0.1	
7	9	26-Oct-94	*Cladophora*	602.5	58.7	**1,025.9**
R	1	26-Oct-94	*Enteromorpha*	0.3	0	
R	1	26-Oct-94	*P. crispus*	3.7	0.1	
R	1	26-Oct-94	*P. pectinatus*	2.6	0.1	
R	1	26-Oct-94	*C. demersum*	487.6	18.9	
R	1	26-Oct-94	*Cladophora*	2,090.0	80.9	**2,584.3**
R	2	26-Oct-94	*P. crispus*	6.6	1.4	
R	2	26-Oct-94	*C. demersum*	6.2	1.3	
R	2	26-Oct-94	*P. pectinatus*	409.1	87.5	
R	2	26-Oct-94	*Cladophora*	45.5	9.7	**467.4**
R	3	26-Oct-94	*P. pectinatus*	72.7	11.0	
R	3	26-Oct-94	*C. demersum*	34.4	5.2	
R	3	26-Oct-94	*E. canadensis*	0.6	0.1	
R	3	26-Oct-94	*Hydrodictyon*	0.8	0.1	
R	3	26-Oct-94	*Enteromorpha*	0.5	0.1	
R	3	26-Oct-94	*Cladophora*	40.6	6.1	
R	3	26-Oct-94	*P. crispus*	512.4	77.4	**662.0**

Appendix Table D. Dry biomass and percent composition for aquatic macrophytes, Crystal Springs Reach (RM 599.5-601.3), Middle Snake River, Idaho, 1994.

Transect	Site	Date	Species	Dry Biomass g/m²	Species Percent Composition %	Total Dry Biomass g/m²
R	4	26-Oct-94	*Cladophora*	24.1	40.3	
R	4	26-Oct-94	*P. pectinatus*	15.0	25.1	
R	4	26-Oct-94	*P. crispus*	20.7	34.7	**59.8**
R	5	26-Oct-94	*Cladophora*	55.2	18.8	
R	5	26-Oct-94	*P. pectinatus*	12.8	4.4	
R	5	26-Oct-94	*Enteromorpha*	1.3	0.4	
R	5	26-Oct-94	*E. canadensis*	1.0	0.3	
R	5	26-Oct-94	*C. demersum*	5.0	1.7	
R	5	26-Oct-94	*P. crispus*	218.3	74.4	**293.5**
R	6	26-Oct-94	*C. demersum*	665.7	57.5	
R	6	26-Oct-94	*Enteromorpha*	9.1	0.8	
R	6	26-Oct-94	*P. crispus*	55.1	4.8	
R	6	26-Oct-94	*E. canadensis*	0.5	0	
R	6	26-Oct-94	*P. pectinatus*	207.8	18.0	
R	6	26-Oct-94	*Cladophora*	219.3	18.9	**1,157.5**
R	7	26-Oct-94	*E. canadensis*	0.6	0.1	
R	7	26-Oct-94	*P. crispus*	0.5	0	
R	7	26-Oct-94	*Enteromorpha*	0.4	0	
R	7	26-Oct-94	*P. pectinatus*	2.9	0.3	
R	7	26-Oct-94	*Cladophora*	281.3	27.5	
R	7	26-Oct-94	*C. demersum*	738.6	72.1	**1,024.2**
R	8	26-Oct-94	*P. pectinatus*	3.2	0.8	
R	8	26-Oct-94	*Cladophora*	148.7	36.1	
R	8	26-Oct-94	*P. crispus*	260.3	63.2	**412.2**
2	1	21-Nov-94	*Cladophora*	79.0	52.7	
2	1	21-Nov-94	*C. demersum*	56.8	37.9	
2	1	21-Nov-94	*E. canadensis*	0.8	0.5	
2	1	21-Nov-94	*P. crispus*	13.0	8.7	
2	1	21-Nov-94	*P. pectinatus*	0.3	0.2	**149.9**
2	2	21-Nov-94	------------	0	0	**0**
2	3	21-Nov-94	------------	0	0	**0**
2	4	21-Nov-94	------------	0	0	**0**
2	5	21-Nov-94	------------	0	0	**0**

Appendix Table D. Dry biomass and percent composition for aquatic macrophytes, Crystal Springs Reach (RM 599.5-601.3), Middle Snake River, Idaho, 1994.

Transect	Site	Date	Species	Dry Biomass g/m²	Species Percent Composition %	Total Dry Biomass g/m²
7	2	21-Nov-94	*P. crispus*	4.0	17.0	
7	2	21-Nov-94	*Cladophora*	19.5	83.0	**23.4**
7	4	21-Nov-94	*C. demersum*	11.8	6.2	
7	4	21-Nov-94	*P. pectinatus*	153.8	81.0	
7	4	21-Nov-94	*P. crispus*	24.2	12.8	
7	4	21-Nov-94	*Enteromorpha*	0.1	0	**189.9**
7	6	21-Nov-94	*P. pectinatus*	1.6	0.4	
7	6	21-Nov-94	*L. minor*	0.1	0	
7	6	21-Nov-94	*P. crispus*	21.1	5.4	
7	6	21-Nov-94	*Cladophora*	248.3	63.2	
7	6	21-Nov-94	*C. demersum*	121.6	30.9	
7	6	21-Nov-94	*Enteromorpha*	0.3	0.1	**393.0**
7	8	21-Nov-94	*Cladophora*	82.5	31.5	
7	8	21-Nov-94	*E. canadensis*	0.7	0.2	
7	8	21-Nov-94	*P. pectinatus*	0.7	0.3	
7	8	21-Nov-94	*P. crispus*	18.3	7.0	
7	8	21-Nov-94	*C. demersum*	159.9	61.0	**262.1**
7	10	21-Nov-94	*Cladophora*	141.2	73.4	
7	10	21-Nov-94	*C. demersum*	11.9	6.2	
7	10	21-Nov-94	*P. crispus*	36.1	18.8	
7	10	21-Nov-94	*P. pectinatus*	2.9	1.5	
7	10	21-Nov-94	*Enteromorpha*	0.2	0.1	**192.3**
R	1	22-Nov-94	*Cladophora*	118.0	28.3	
R	1	22-Nov-94	*P. pectinatus*	71.3	17.1	
R	1	22-Nov-94	*C. demersum*	133.6	32.1	
R	1	22-Nov-94	*P. crispus*	93.8	22.5	**416.7**
R	2	22-Nov-94	*E. canadensis*	2.2	0.7	
R	2	22-Nov-94	*Cladophora*	191.4	59.9	
R	2	22-Nov-94	*P. pectinatus*	2.5	0.8	
R	2	22-Nov-94	*C. demersum*	109.8	34.4	
R	2	22-Nov-94	*P. crispus*	13.5	4.2	**319.4**

Appendix Table D. Dry biomass and percent composition for aquatic macrophytes, Crystal Springs Reach (RM 599.5-601.3), Middle Snake River, Idaho, 1994.

Transect	Site	Date	Species	Dry Biomass g/m²	Species Percent Composition %	Total Dry Biomass g/m²
R	3	22-Nov-94	*E. canadensis*	0.3	0.2	
R	3	22-Nov-94	*C. demersum*	114.2	64.0	
R	3	22-Nov-94	*Cladophora*	22.5	12.6	
R	3	22-Nov-94	*Enteromorpha*	0.8	0.4	
R	3	22-Nov-94	*P. crispus*	23.7	13.3	
R	3	22-Nov-94	*P. pectinatus*	17.1	9.6	**178.6**
R	4	22-Nov-94	*C. demersum*	66.8	36.2	
R	4	22-Nov-94	*P. pectinatus*	6.5	3.5	
R	4	22-Nov-94	*P. crispus*	111.1	60.3	**184.3**
R	5	22-Nov-94	*C. demersum*	1.5	0.5	
R	5	22-Nov-94	*P. crispus*	2.9	0.9	
R	5	22-Nov-94	*Enteromorpha*	0.4	0.1	
R	5	22-Nov-94	*P. pectinatus*	98.9	32.0	
R	5	22-Nov-94	*Cladophora*	205.2	66.4	**308.8**
R	6	22-Nov-94	*E. nuttallii*	0.1	0	
R	6	22-Nov-94	*C. demersum*	0.2	0.1	
R	6	22-Nov-94	*Enteromorpha*	0.1	0	
R	6	22-Nov-94	*P. crispus*	0.2	0.1	
R	6	22-Nov-94	*P. pectinatus*	298.8	99.8	**299.4**
R	7	22-Nov-94	*P. pectinatus*	63.1	63.7	
R	7	22-Nov-94	*Cladophora*	0.6	0.7	
R	7	22-Nov-94	*P. crispus*	2.0	2.1	
R	7	22-Nov-94	*C. demersum*	33.1	33.4	
R	7	22-Nov-94	*Enteromorpha*	0.1	0.1	**99.0**
R	8	22-Nov-94	*Cladophora*	14.2	12.6	
R	8	22-Nov-94	*Enteromorpha*	0.7	0.6	
R	8	22-Nov-94	*E. canadensis*	2.6	2.3	
R	8	22-Nov-94	*P. crispus*	14.1	12.5	
R	8	22-Nov-94	*P. pectinatus*	7.9	7.0	
R	8	22-Nov-94	*C. demersum*	73.1	64.9	**112.7**

Appendix Table E. Particle size distributions, texture, organic carbon (OC), organic matter (OM), carbon (C), hydrogen (H), nitrogen (N), and total phosphorus (TP) for sediments, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994. OM% = OC% x 1.72.

			Particle Size Distribution			Texture	OC	OM	C	N	H	TP
Transect	Site	Date	% Sand	% Clay	% Silt	USDA 1950	%	%	%	%	%	ug/g
2	1	16-Apr-94	42.4	5.6	52.0	silt loam	1.47	2.53	2.8	0.18	0.53	968
2	2	16-Apr-94	44.4	3.6	52.0	silt loam	1.47	2.53	2.7	0.19	0.49	881
2	3	16-Apr-94	40.4	3.6	56.0	silt loam	1.50	2.58	2.5	0.17	0.46	906
2	4	16-Apr-94	81.2	1.8	17.0	loamy sand	0.83	1.43	1.5	0.12	0.25	1,810
2	5	16-Apr-94	92.2	1.8	6.0	sand	1.08	1.86	1.9	0.16	0.33	4,110
5	3	16-Apr-94	64.4	3.6	32.0	sandy loam	1.28	2.20	2.3	0.16	0.44	878
5	4	16-Apr-94	72.4	1.6	26.0	loamy sand	0.79	1.36	1.7	0.11	0.32	732
5	5	16-Apr-94	46.4	5.6	48.0	sandy loam	2.12	3.65	3.5	0.23	0.61	1,090
5	6	16-Apr-94	85.2	1.8	13.0	loamy sand	0.37	0.64	1.2	0.05	0.16	655
5	7	16-Apr-94	92.2	0.8	7.0	sand	0.21	0.36	1.1	0.05	0.13	601
7	3	16-Apr-94	47.4	3.6	49.0	sandy loam	1.89	3.25	3.2	0.22	0.57	992
7	4	16-Apr-94	44.4	9.6	46.0	loam	2.19	3.77	3.8	0.32	0.77	1,060
7	5	16-Apr-94	44.4	9.6	46.0	loam	2.31	3.97	3.9	0.31	0.79	1,050
7	6	16-Apr-94	44.4	3.6	52.0	silt loam	2.06	3.54	3.3	0.26	0.58	1,220
7	7	16-Apr-94	44.4	5.6	50.0	silt loam	2.66	4.58	4.1	0.38	0.77	1,190
R	1	26-May-94	35.2	6.8	58.0	silt loam	1.50	2.58	2.8	0.19	0.56	1,010
R	2	26-May-94	35.2	6.8	58.0	silt loam	1.53	2.63	3.0	0.22	0.60	1,020
R	3	26-May-94	94.6	0.4	5.0	sand	1.09	1.87	1.2	0.09	0.21	1,410
R	4	26-May-94	41.2	4.8	54.0	silt loam	2.95	5.07	5.0	0.41	0.83	1,330
R	5	26-May-94	44.4	3.6	52.0	silt loam	2.50	4.30	4.2	0.42	0.68	1,350
R	6	26-May-94	72.4	3.6	24.0	sandy loam	0.75	1.29	2.5	0.13	0.27	821
R	7	26-May-94	-	-	-	-	2.89	4.97	4.2	0.39	0.70	1,210
R	8	26-May-94	46.4	5.6	48.0	sandy loam	2.56	4.40	3.6	0.31	0.60	1,300

Appendix Table E. Particle size distributions, texture, organic carbon (OC), organic matter (OM), carbon (C), hydrogen (H), nitrogen (N), and total phosphorus (TP) for sediments, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

			Particle Size Distribution			Texture	OC	OM	C	N	H	TP
Transect	Site	Date	% Sand	% Clay	% Silt	USDA 1950	%	%	%	%	%	ug/g
2	1	28-Jun-94	38.4	9.6	52.0	silt loam	1.72	2.96	3.7	0.33	0.73	977
2	2	28-Jun-94	34.4	5.6	60.0	silt loam	1.43	2.46	3.4	0.28	0.64	935
2	3	28-Jun-94	36.4	3.6	60.0	silt loam	1.19	2.05	2.6	0.21	0.49	820
2	4	28-Jun-94	66.4	2.4	31.2	loam	0.62	1.07	1.6	0.11	0.29	685
2	5	28-Jun-94	58.0	3.0	39.0	sandy loam	0.84	1.44	1.9	0.14	0.33	902
7	3	28-Jun-94	42.4	10.4	47.2	loam	1.88	3.23	4.0	0.34	0.73	994
7	5	28-Jun-94	54.4	8.4	37.2	sandy loam	1.82	3.13	4.0	0.34	0.68	1,160
7	7	28-Jun-94	48.4	8.4	43.2	loam	4.42	7.60	4.2	0.37	0.82	1,140
7	9	28-Jun-94	46.4	8.4	45.2	loam	1.71	2.94	3.7	0.33	0.65	1,100
R	1	28-Jun-94	42.4	5.6	52.0	silt loam	2.06	3.54	3.6	0.32	0.66	1,010
R	2	28-Jun-94	50.4	7.6	42.0	loam	3.56	6.12	6.0	0.56	1.00	1,280
R	3	28-Jun-94	62.4	1.6	36.0	sandy loam	1.30	2.24	3.1	0.21	0.47	967
R	4	28-Jun-94	64.4	3.6	32.0	sandy loam	1.56	2.68	2.9	0.23	0.51	927
R	6	28-Jun-94	50.5	2.0	47.5	sandy loam	1.33	2.29	3.5	0.26	0.62	959
R	7	28-Jun-94	50.4	5.6	44.0	sandy loam	1.36	2.34	2.7	0.22	0.54	893
R	8	28-Jun-94	70.2	1.8	28.0	sandy loam	1.59	2.73	3.3	0.27	0.62	960
2	1	24-Jul-94	44.4	8.4	47.2	loam	1.51	2.60	3.4	0.27	0.70	1,090
2	2	24-Jul-94	35.4	8.4	56.2	silt loam	1.56	2.68	3.2	0.24	0.61	936
2	3	24-Jul-94	36.4	8.4	55.2	silt loam	1.49	2.56	3.4	0.27	0.66	1,030
2	4	24-Jul-94	30.4	6.4	63.2	silt loam	1.21	2.08	2.7	0.19	0.52	900
2	5	24-Jul-94	70.4	2.4	27.2	sandy loam	0.57	0.98	1.4	0.08	0.25	874
7	4	24-Jul-94	44.4	10.4	45.2	loam	1.88	3.23	4.1	0.31	0.76	1,160
7	6	24-Jul-94	44.4	8.4	47.2	loam	2.18	3.75	4.1	0.34	0.83	1,180
7	10	24-Jul-94	60.4	6.4	33.2	sandy loam	2.34	4.02	4.5	0.37	0.73	1,040

Appendix Table E. Particle size distributions, texture, organic carbon (OC), organic matter (OM), carbon (C), hydrogen (H), nitrogen (N), and total phosphorus (TP) for sediments, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

			Particle Size Distribution			Texture	OC	OM	C	N	H	TP
Transect	Site	Date	% Sand	% Clay	% Silt	USDA 1950	%	%	%	%	%	ug/g
R	1	24-Jul-94	52.4	10.4	37.2	sandy loam	2.01	3.46	4.1	0.38	0.79	1,090
R	2	24-Jul-94	42.4	6.4	51.2	silt loam	1.37	2.36	2.9	0.25	0.54	1,010
R	3	24-Jul-94	54.4	8.4	37.2	sandy loam	1.95	3.35	3.5	0.29	0.67	1,080
R	4	24-Jul-94	32.4	8.4	59.2	silt loam	1.56	2.68	3.5	0.25	0.66	999
R	5	24-Jul-94	44.4	10.4	45.2	loam	2.30	3.96	4.6	0.39	0.90	1,250
R	6	24-Jul-94	38.4	8.4	53.2	silt loam	1.75	3.01	3.8	0.32	0.72	1,250
R	8	24-Jul-94	50.4	10.4	39.2	loam	2.14	3.68	4.4	0.36	0.78	1,210
2	1	20-Aug-94	39.6	9.6	50.8	silt loam	1.67	2.87	3.5	0.29	0.68	1,040
2	2	20-Aug-94	35.6	7.6	56.8	silt loam	1.41	2.43	3.0	0.21	0.60	961
2	3	20-Aug-94	29.6	7.6	62.8	silt loam	1.62	2.79	3.3	0.24	0.64	1,040
2	4	20-Aug-94	61.6	1.6	36.8	sandy loam	0.43	0.74	1.3	0.06	0.23	731
2	5	20-Aug-94	65.6	3.6	30.8	sandy loam	0.91	1.57	1.6	0.09	0.28	886
7	3	20-Aug-94	90.8	0.8	8.4	sand	0.92	1.58	0.8	0.07	0.16	653
7	5	20-Aug-94	51.6	5.6	42.8	sandy loam	2.41	4.15	3.9	0.30	0.73	1,130
7	7	20-Aug-94	53.6	5.6	40.8	sandy loam	1.95	3.35	3.4	0.27	0.69	1,140
7	9	20-Aug-94	65.2	5.6	29.2	sandy loam	2.97	5.11	4.3	0.41	0.91	1,210
R	1	20-Aug-94	52.4	8.4	39.2	sandy loam	2.08	3.58	4.2	0.37	0.86	1,200
R	2	20-Aug-94	52.4	6.4	41.2	sandy loam	1.43	2.46	2.9	0.25	0.54	958
R	3	20-Aug-94	46.4	6.4	47.2	sandy loam	1.64	2.82	3.0	0.21	0.56	998
R	4	20-Aug-94	56.4	6.4	37.2	sandy loam	1.53	2.63	2.9	0.24	0.58	1,140
R	6	20-Aug-94	48.4	10.4	41.2	loam	2.29	3.94	4.4	0.37	0.88	1,180
R	7	20-Aug-94	36.4	10.4	53.2	silt loam	1.98	3.41	4.0	0.34	0.78	1,170
R	8	20-Aug-94	38.4	8.4	53.2	silt loam	1.74	2.99	3.4	0.25	0.70	1,110
2	1	27-Oct-94	37.2	7.6	55.2	silt loam	1.78	3.06	3.6	0.29	0.73	989
2	2	27-Oct-94	35.2	9.6	55.2	silt loam	1.96	3.37	3.6	0.30	0.71	1,030
2	3	27-Oct-94	59.2	3.9	37.2	sandy loam	0.72	1.24	1.5	0.12	0.30	707

Appendix Table E. Particle size distributions, texture, organic carbon (OC), organic matter (OM), carbon (C), hydrogen (H), nitrogen (N), and total phosphorus (TP) for sediments, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

			Particle Size Distribution			**Texture**	**OC**	**OM**	**C**	**N**	**H**	**TP**
Transect	**Site**	**Date**	**% Sand**	**% Clay**	**% Silt**	**USDA 1950**	**%**	**%**	**%**	**%**	**%**	**ug/g**
2	4	27-Oct-94	89.6	1.8	8.6	sand	0.38	0.65	0.9	0.07	0.17	698
2	5	27-Oct-94	87.6	0.8	11.6	sand	2.36	4.06	2.6	0.29	0.43	8,140
7	3	27-Oct-94	49.2	5.6	45.2	sandy loam	2.21	3.80	3.9	0.36	0.80	1,160
7	5	27-Oct-94	59.2	7.6	33.2	sandy loam	2.49	4.28	4.2	0.41	0.85	1,240
7	7	27-Oct-94	51.2	5.6	43.2	sandy loam	2.07	3.56	3.7	0.27	0.58	1,230
7	9	27-Oct-94	51.2	3.6	45.2	sandy loam	2.56	4.40	4.4	0.38	0.79	1,280
R	1	27-Oct-94	45.2	7.6	47.2	loam	2.22	3.82	4.0	0.32	0.78	1,180
R	2	27-Oct-94	77.2	3.6	19.2	loamy sand	1.61	2.77	2.3	0.19	0.47	858
R	3	27-Oct-94	51.2	5.6	43.2	sandy loam	2.07	3.56	3.7	0.33	0.73	1,050
R	4	27-Oct-94	51.2	3.6	45.2	sandy loam	3.09	5.31	4.5	0.31	0.74	1,120
R	5	27-Oct-94	61.2	5.6	33.2	sandy loam	2.46	4.23	5.2	0.38	0.91	1,180
R	6	27-Oct-94	37.2	5.6	57.2	silt loam	3.04	5.23	4.3	0.41	0.79	1,290
R	7	27-Oct-94	-	-	-	-	9.29	15.98	10.0	1.19	1.60	1,760
R	8	27-Oct-94	57.2	3.6	39.2	sandy loam	1.97	3.39	3.3	0.28	0.70	1,070
2	1	22-Nov-94	39.2	7.6	53.2	silt loam	1.81	3.11	3.6	0.29	0.73	1,070
2	2	22-Nov-94	59.2	3.6	37.2	sandy loam	0.42	0.72	1.2	0.08	0.25	673
2	3	22-Nov-94	-	-	-	-	0.32	0.55	0.7	0.05	0.20	693
2	4	22-Nov-94	-	-	-	-	0.12	0.21	0.2	0.06	0.06	676
2	5	22-Nov-94	97.6	0.8	1.6	sand	0.89	1.53	1.4	0.22	0.22	5,050
7	2	22-Nov-94	-	-	-	-	1.50	2.58	3.3	0.38	0.48	1,190
7	4	22-Nov-94	53.2	3.6	43.2	sandy loam	1.60	2.75	2.9	0.25	0.57	986
7	6	22-Nov-94	45.2	5.6	49.2	sandy loam	1.94	3.34	3.7	0.30	0.69	1,220
7	8	22-Nov-94	61.2	3.6	35.2	sandy loam	2.39	4.11	4.4	0.35	0.77	1,190
7	10	22-Nov-94	57.2	5.6	37.2	sandy loam	2.46	4.23	4.1	0.35	0.74	1,250

Appendix Table E. Particle size distributions, texture, organic carbon (OC), organic matter (OM), carbon (C), hydrogen (H), nitrogen (N), and total phosphorus (TP) for sediments, Crystal Springs Reach (RM 599.5 - 601.3), Middle Snake River, Idaho, 1994.

			Particle Size Distribution			Texture	OC	OM	C	N	H	TP
Transect	Site	Date	% Sand	% Clay	% Silt	USDA 1950	%	%	%	%	%	ug/g
R	1	22-Nov-94	41.2	5.6	53.2	silt loam	1.68	2.89	3.3	0.27	0.63	1,120
R	2	22-Nov-94	79.2	3.6	17.2	loamy sand	1.03	1.77	2.8	0.21	0.36	976
R	3	22-Nov-94	49.2	7.6	43.2	loam	2.04	3.51	3.9	0.33	0.82	1,120
R	4	22-Nov-94	53.2	5.6	41.2	sandy loam	1.99	3.42	3.5	0.33	0.71	1,150
R	5	22-Nov-94	51.2	5.6	43.2	sandy loam	2.46	4.23	4.0	0.38	0.83	1,240
R	6	22-Nov-94	43.2	5.6	51.2	silt loam	1.82	3.13	3.1	0.25	0.64	1,070
R	7	22-Nov-94	53.2	3.6	43.2	sandy loam	1.29	2.22	2.7	0.23	0.52	888
R	8	22-Nov-94	44.2	5.6	50.2	silt loam	1.89	3.25	3.5	0.28	0.68	1,120