Summary of Results of 1996 Experimental Flood

Glen Canyon Reach

Epilithon

- Biomass (AFDW unaffected)
- chl*a* declined 40% but recovered by July

Macrophytes (*Potamogeton, Chara*)

- Declined following flood, some beds completely scoured
- Colonization by *Potamogeton* began within about one month
- *Chara* colonized extensively by about 7 months

Epiphytic Diatoms

- Densities reduced about 66% within one week following the flood
- Large/upright diatom taxa more severely impacted than small/adnate species

Macroinvertebrates

- *Gammarus* densities declined in both cobble and depositional habitat in week following the flood
- Densities returned 7 months after the flood

Rainbow trout

- About 10% fewer small (<6") fish collected during 8,000 cfs post flood sampling than before
- Length frequency distributions similar to pre-flood by August
- Catch of small fish in November sampling indicated good recruitment
- CPUE of trout was 25% lower than pre-flood during August and November
- Percent of trout ingesting *Gammarus* declined during post-flood sampling
- Condition factor not significantly different after flood than before

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Flannelmouth sucker

- No apparent change in distribution or relative abundance based on electrofishing samples

- **McIvor and Thieme** (University of Arizona Heritage project)
  - 51 adult FMS implanted with sonic tags were not displaced from the Glen Canyon reach during the flood
  - Flood did not interefere with spawning run up Paria River
  - 29/37 adults located during the flood were in mouth of Paria which formed a large (0.7 km, up to 3 m deep) slackwater area
  - 8 other adults were near mouth of Paria in mainchannel
  - Low runoff in Paria with high mainstem flows created good rearing area at mouth that contributed to strong year-class of FMS

Grand Canyon Reach

Backwater number and size

- Video counts of backwaters increased from 31 to 39 at 8,000 flow
- Mean surface area of backwaters increased
- Ground census at mean flow of 13,405 cfs = 68 backwaters pre-flood
  Ground census at mean for of 18,149 cfs = 42 backwaters post-flood

Backwater sediments

- Backwaters substrates changed from approximately equal percentages of silt and sand to predominantly sand and reduced percentages of silt, CPOM and FPOM (exceptions included Lava Chuar backwater)

Benthic invertebrates

- Mean density of benthic invertebrates sampled in backwaters was reduced by approximately 75% and mean biomass was reduced by 86%

Zooplankton

- Total zooplankton density was greater after the flood than before.
    - Temperature in backwaters was also higher during the post flood trip (12 C) than the pre-flood trip (10 C) led to zooplankton reproduction
    - Increase also due to increased import from Lake Powell during high flow, concentration effect in backwaters after flood decreased

Fish

Distribution and abundance and habitat use

- Plains killifish numbers greatly reduced
- Fathead minnow catches decreased
- Catches of small rainbow trout increased
- Native species generally not affected
- Habitats affected included talus shorelines (cavities filled with sand)
- Catches during high flow period lower than pre-and post-flood
    - increased turbidity decreased electrofishing efficiency
    - some shifts in habitat use

Adult chub diet

- Higher incidence of Gammarus during and after the flood
- Higher incidence of terrestrial invertebrates during the flood

Adult chub movement (Valdez and Cowdell, Bio/West)

- Net movement of radiotagged adult HBC was not different from movement during interim flows
- Specific habitat use indicated during the flood, for a small triangular patch of calm water near the separation point of large recirculating eddies.
- Shifting sediment in one eddy likely caused a single fish using that eddy to move downstram
- One fish moved to the mouth of the LCR during descending flows

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INTRODUCTION

Prior to closure of Glen Canyon Dam in 1963, the Colorado River in southern Utah and north central Arizona was free flowing and seasonally warm and muddy. Large, periodic spring flooding, which was seasonally predictable, transported large amounts of sediment downstream creating and maintaining a system of backwaters (Rubin et al. 1990; Schmidt 1990). Pre-dam mean annual maximum discharge was 2439 m^3/s (86,167 cfs; Steven 1983) and reached approximately 8,490 m^3/s (300,000 cfs; Carothers and Dolan 1982). Summer and winter river discharges were low, dropping to as low as 21 m^3/s (750 cfs; Valdez and Ryel 1995). Conversely, post-dam discharges have rarely exceeded the powerplant capacity of 890 m^3/s (31,500 cfs) and, since Interim Operations began, rarely drop below 142 m^3/s (5000 cfs; Valdez and Ryel 1995). Only the occasional large tributary flood, primarily from the Little Colorado River (LCR), has given the Colorado River in Grand Canyon a more natural hydrograph.

The use of a controlled flood discharge from Glen Canyon Dam to improve conditions for native fishes was addressed by Clarkson et al. (1994) who discussed recommendations for operating Glen Canyon Dam to benefit native fishes. Beach/habitat-building flows became an element of the preferred alternative of the Glen Canyon Dam Environmental Impact Statement, "designed to rebuild high elevation sandbars, deposit nutrients, restore backwater channels, and provide some of the dynamics of a natural system" (U.S. Department of the Interior 1995). In 1996, the Bureau of Reclamation conducted a beach/habitat building test flow (Experimental Flood) of 45,000 cfs (1274 m^3/s) for seven days (27 March - 2 April 1996) from Glen Canyon Dam (U. S. Department of the Interior 1996). The entire experiment lasted from 22 March through 7 April 1996 (23 March - 8 April near the LCR) and included four days of steady 226m^3/s (8,000 cfs) flows both before and after the flood (Fig. 1). Upramping was fast (113 $m^3/s/hr$; 4,000 cfs/hr) with a slower downramp of 14 - 42 $m^3/s/hr$ (500 - 1,500 cfs/hr). As a result of this experiment it was expected that backwater habitats for juvenile native fishes would be reformed and populations of some non-native fish species would be temporarily reduced. (U.S. Department of the Interior 1996).

Backwaters are quiet pockets of water connected to the mainchannel with little or no flow, and are usually formed in eddies where scouring and aggradation occur during high flows (Schmidt and Graf 1990). As water levels drop, a reattachment sand bar is exposed, partially isolating the eddy

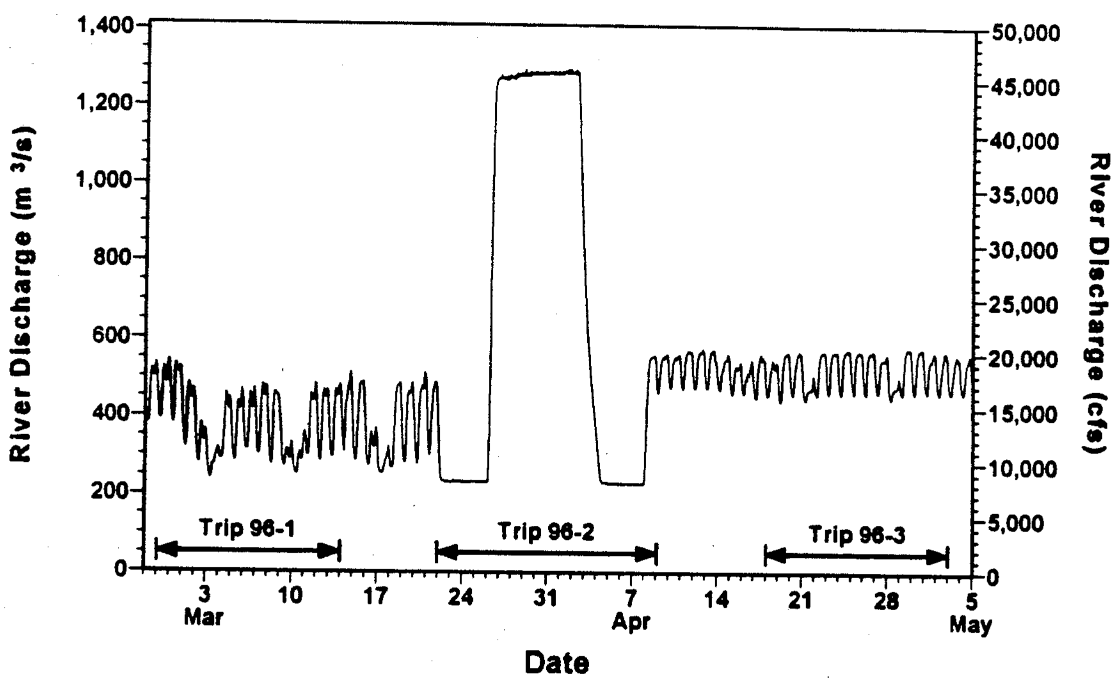
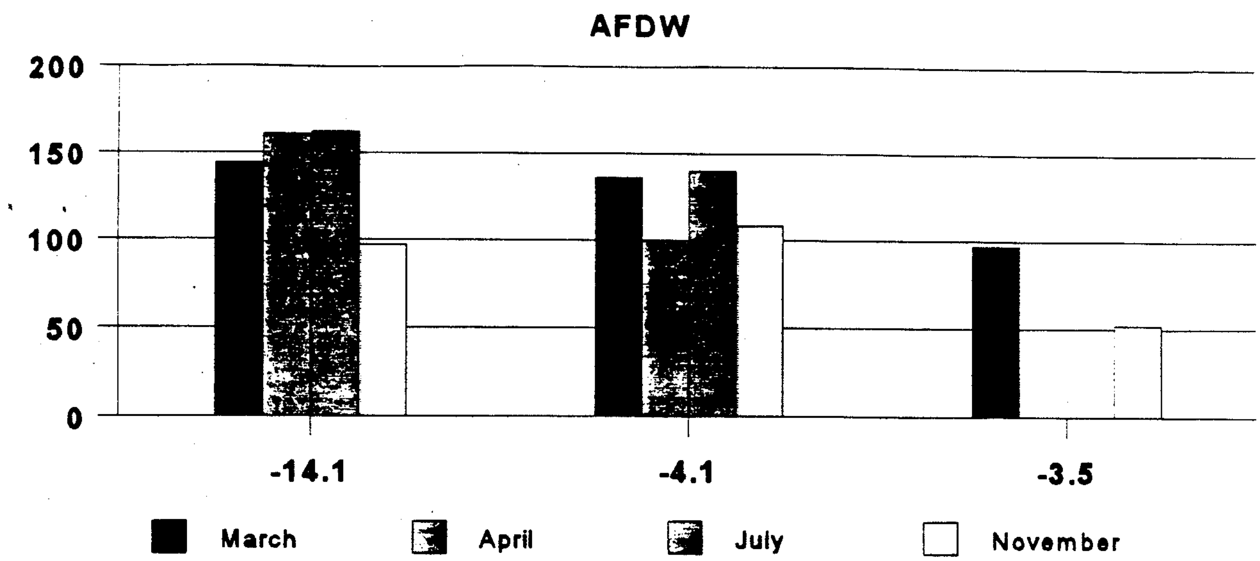
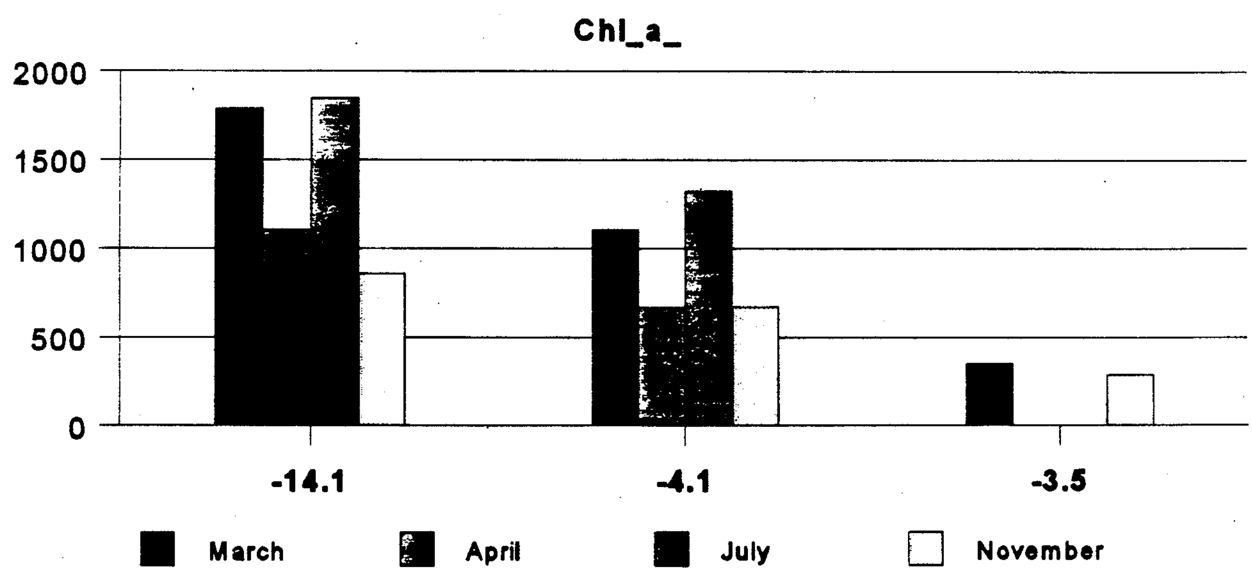


Figure 1. Colorado River discharge at Lee's Ferry, February 27 - May 5, 1996.


AFDW
200
150
100
50
0
-14.1
-4.1
-3.5
March
April
July
November


Chl_a_
2000
1500
1000
500
0
-14.1
-4.1
-3.5
March
April
July
November

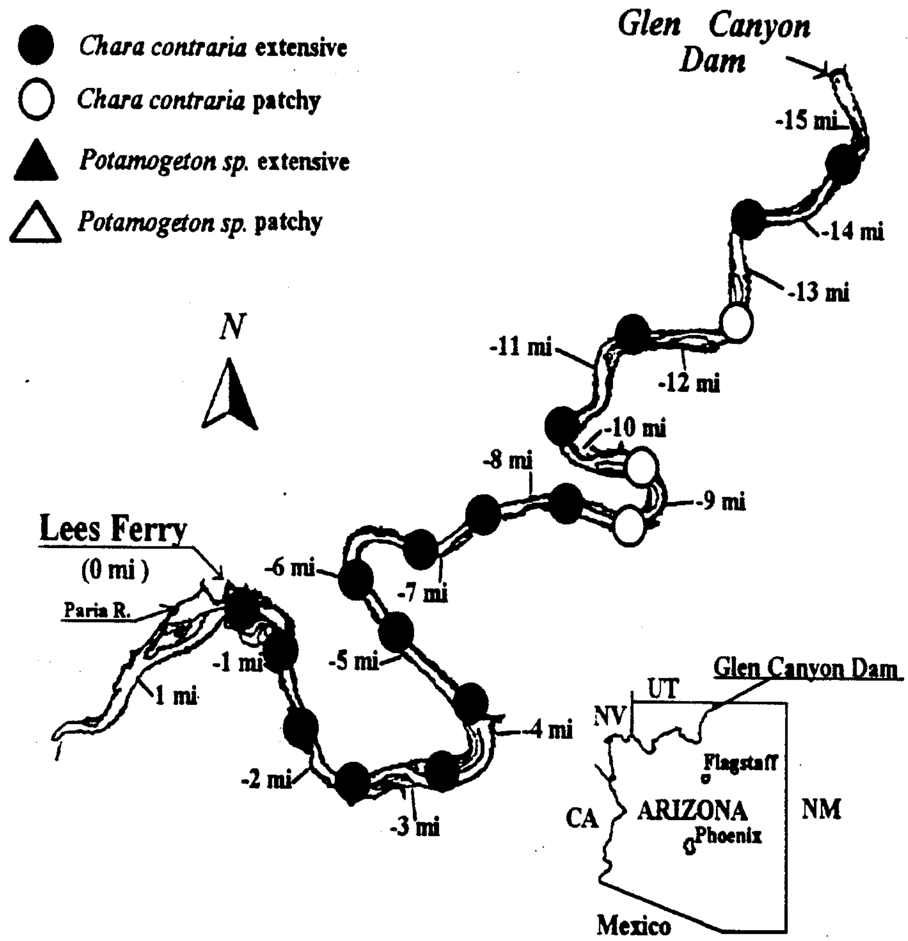


Figure 1. Distribution and relative abundance of *Chara contraria* and *Potamogeton* sp. in the Glen Canyon Dam tailwater to Lee's Ferry, March 16-17, 1996.

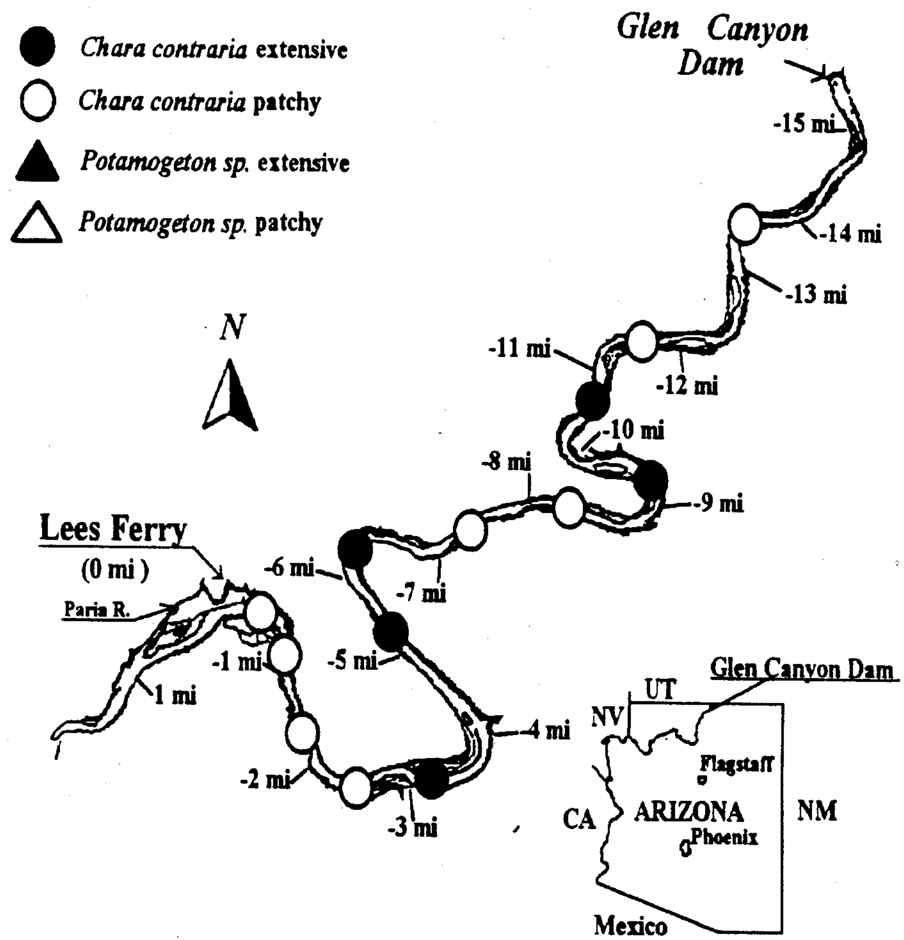


Figure 2. Distribution and relative abundance of *Chara contraria* and *Potamogeton* sp. in the Glen Canyon Dam tailwater to Lee's Ferry, April 15-16, 1996.

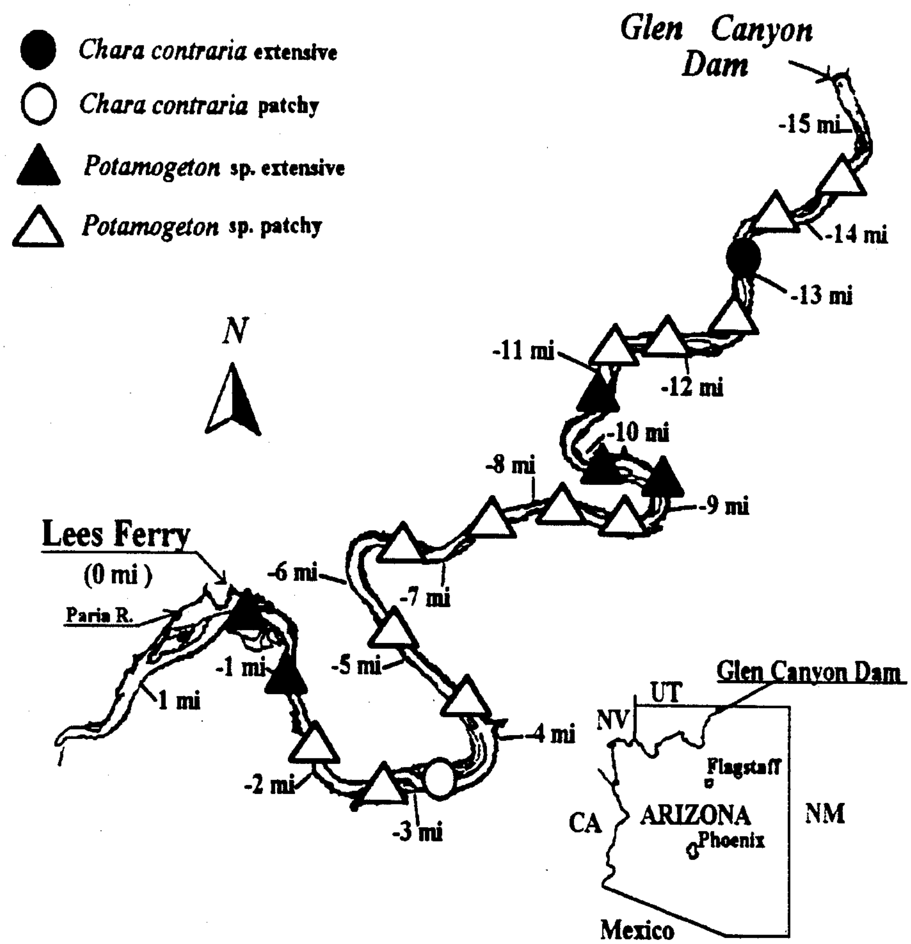


Figure 3. Distribution and relative abundance of *Chara contraria* and *Potamogeton* sp. in the Glen Canyon Dam tailwater to Lee's Ferry, July 15-16, 1996.

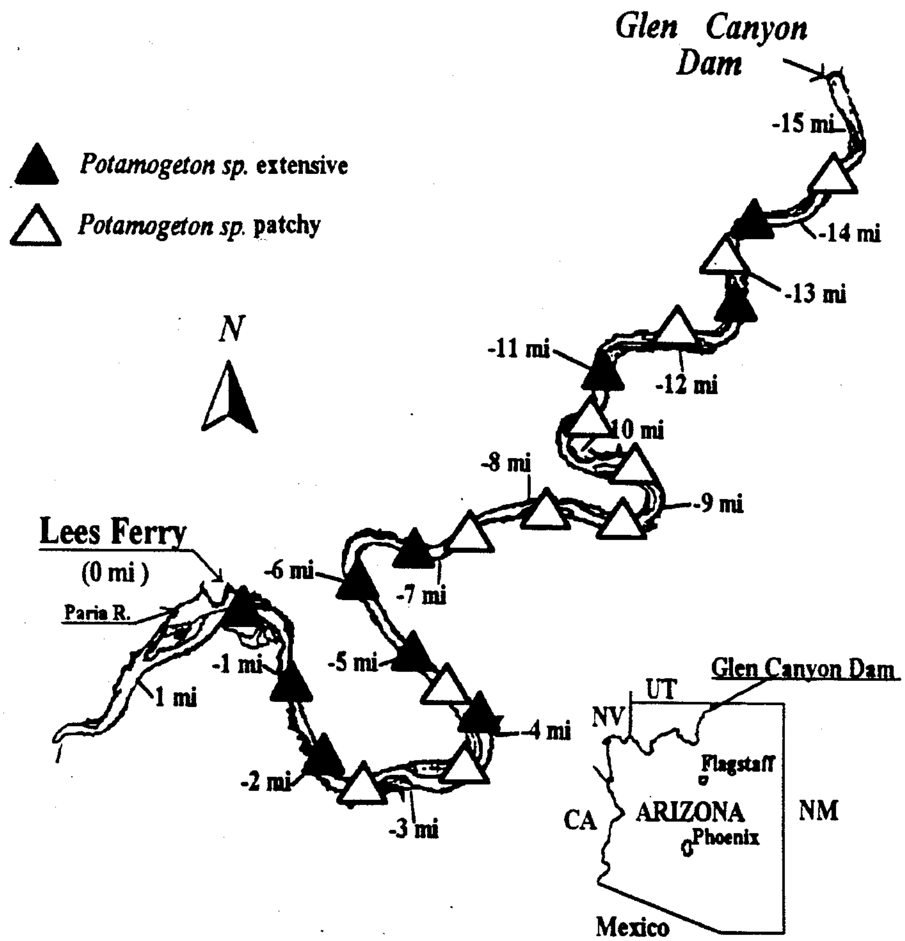


Figure 4. Distribution and relative abundance of *Potamogeton* sp. in the Lee's Ferry reach, November 13-14, 1996.

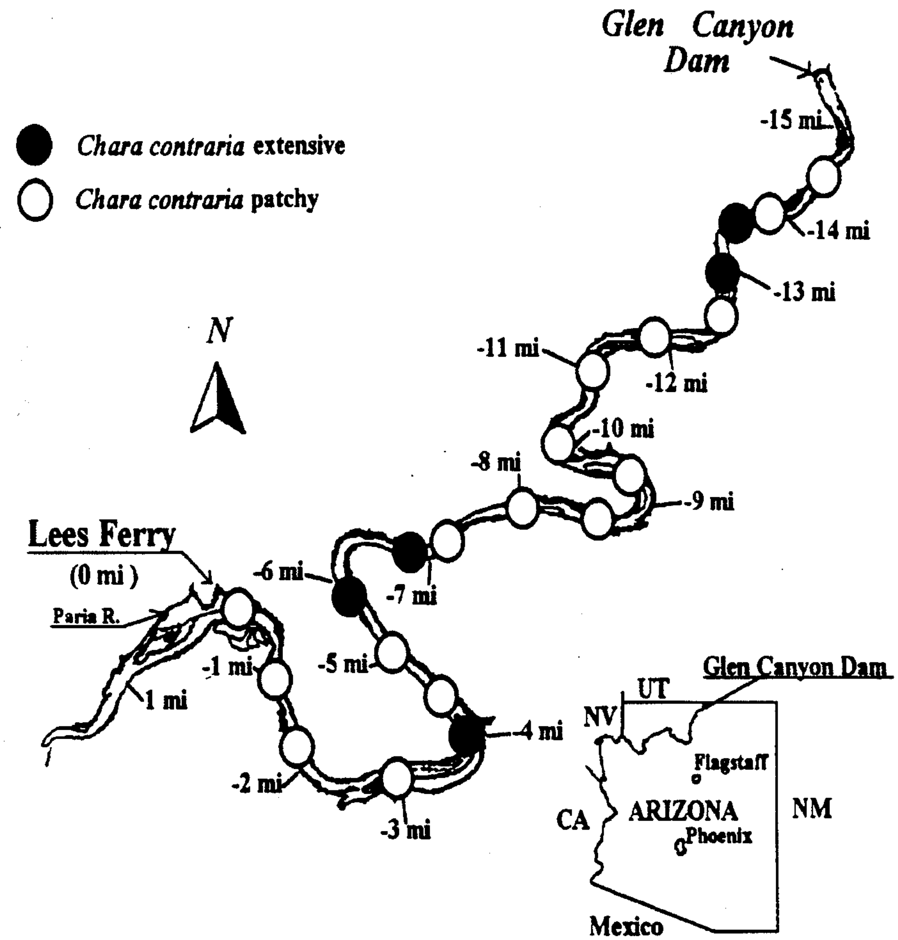


Figure 5. Distribution and abundance of *Chara contraria* in the Lee's Ferry reach, November 13-14, 1996.

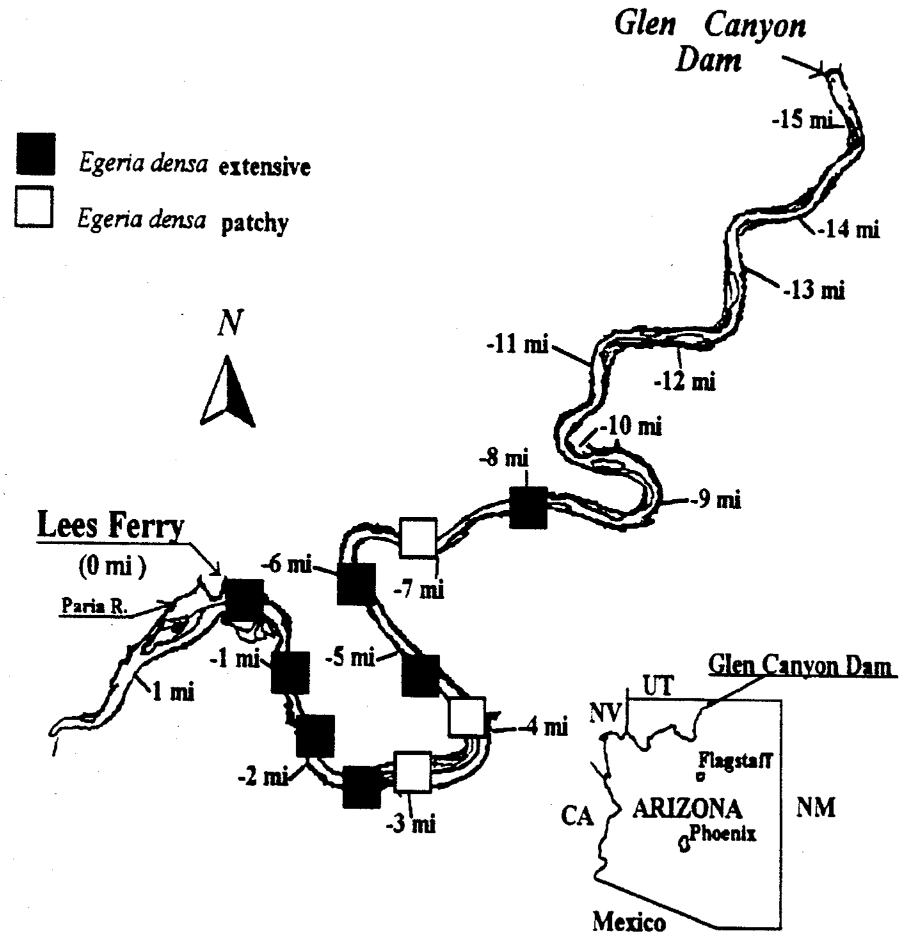
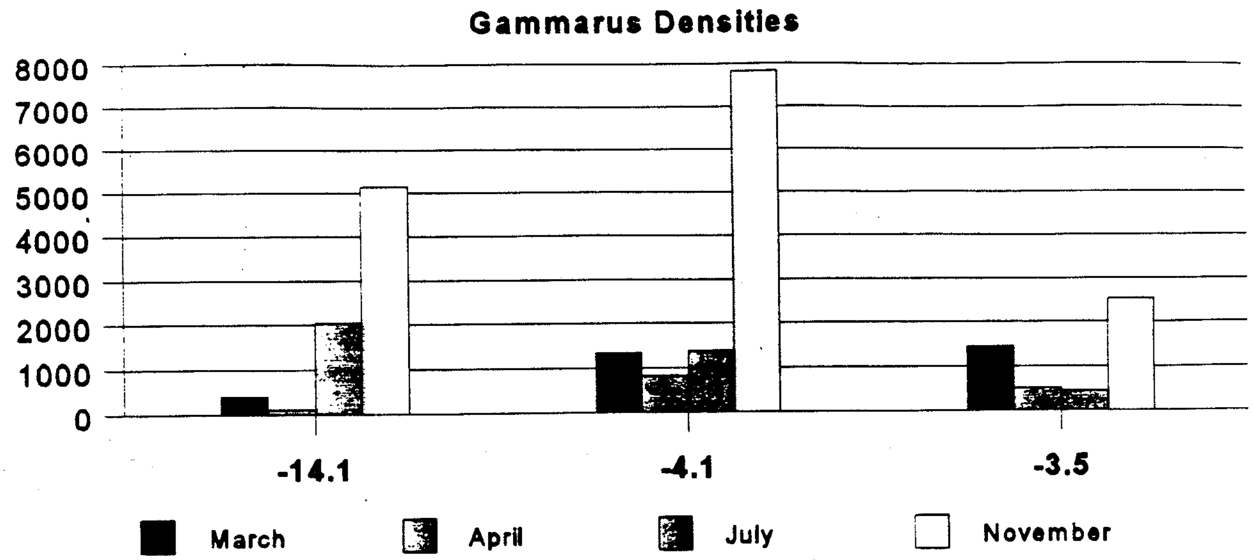
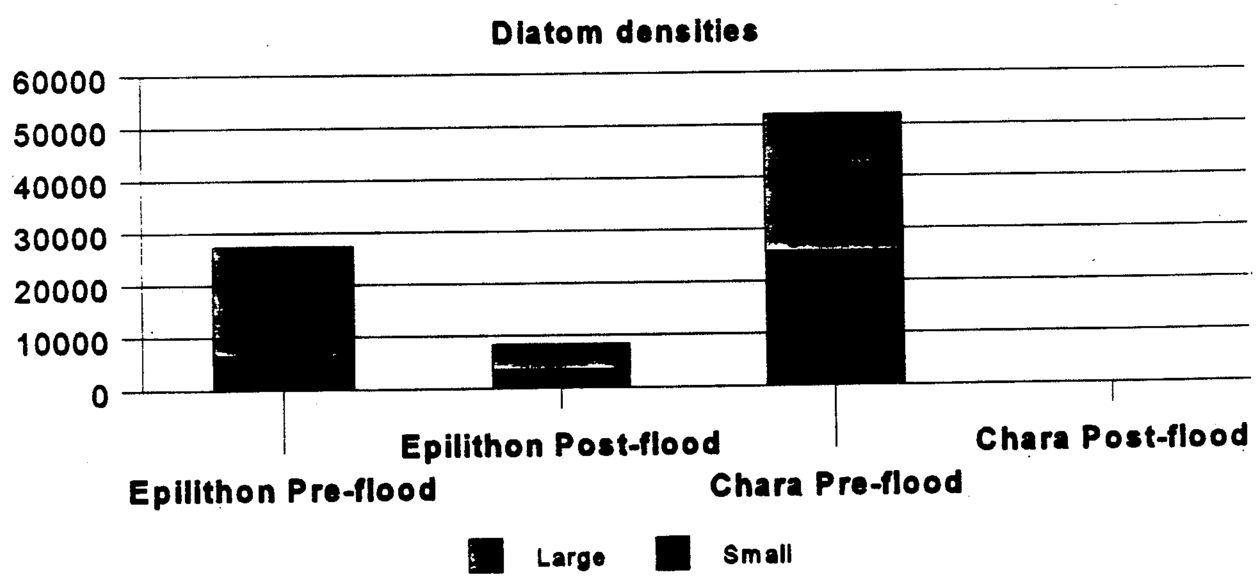


Figure 6. Distribution and relative abundance of *Egeria densa* in the Lee's Ferry reach, November 13-14, 1996.


Gammarus Densities
8000
7000
6000
5000
4000
3000
2000
1000
0
-14.1
-4.1
-3.5
March
April
July
November


Diatom densities
60000
50000
40000
30000
20000
10000
0
Epilithon Pre-flood
Epilithon Post-flood
Chara Pre-flood
Chara Post-flood
Large
Small

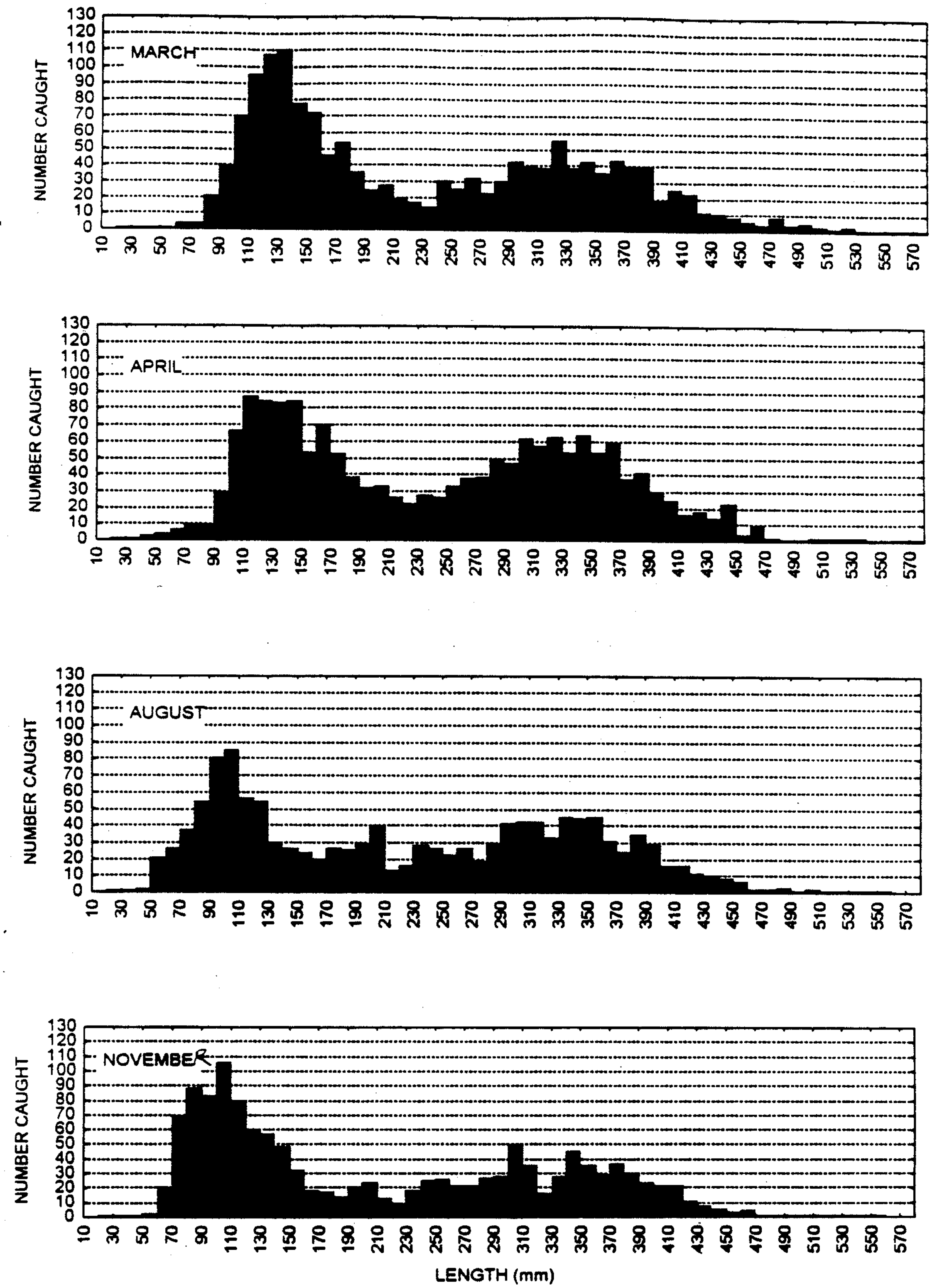
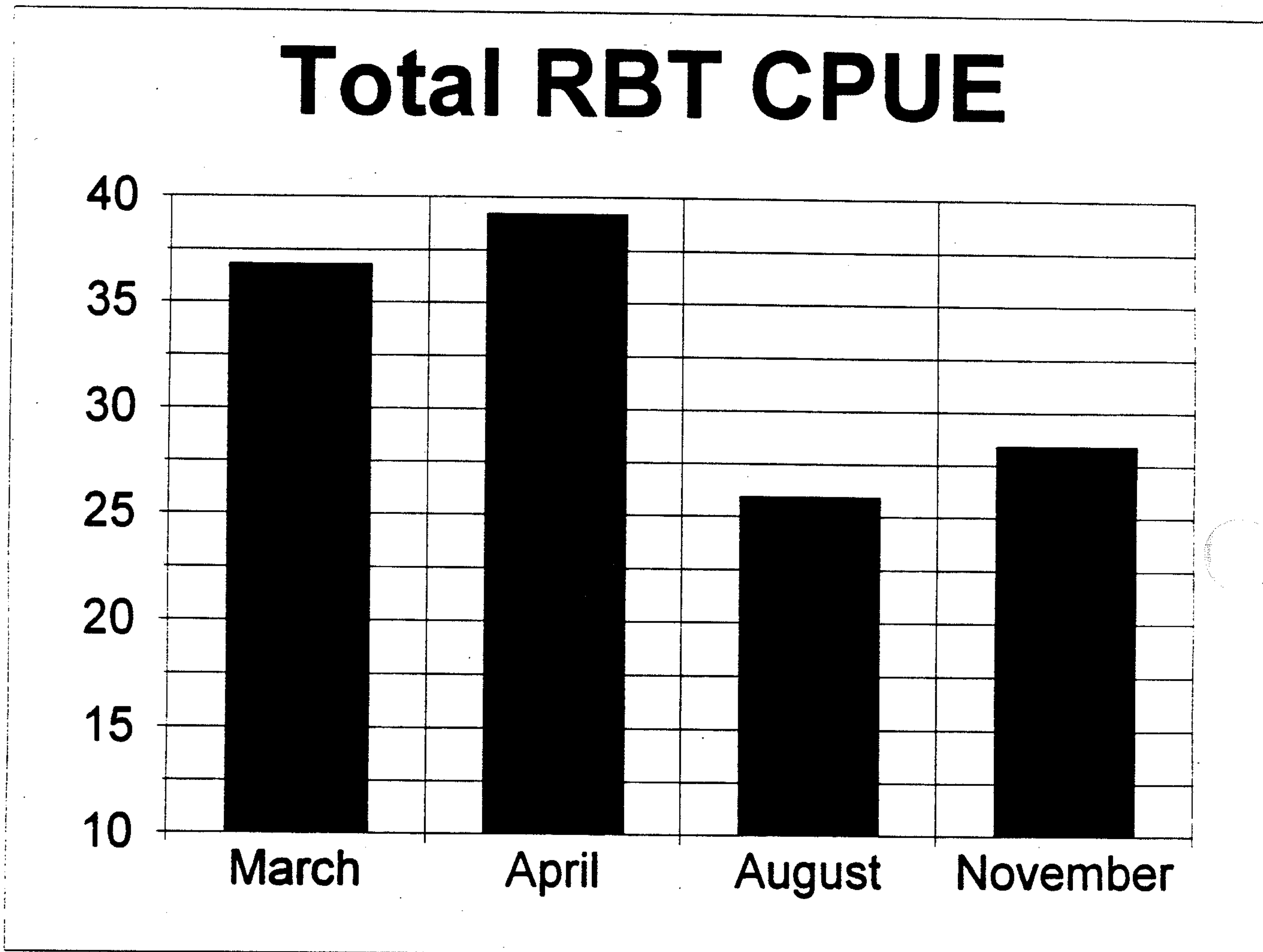
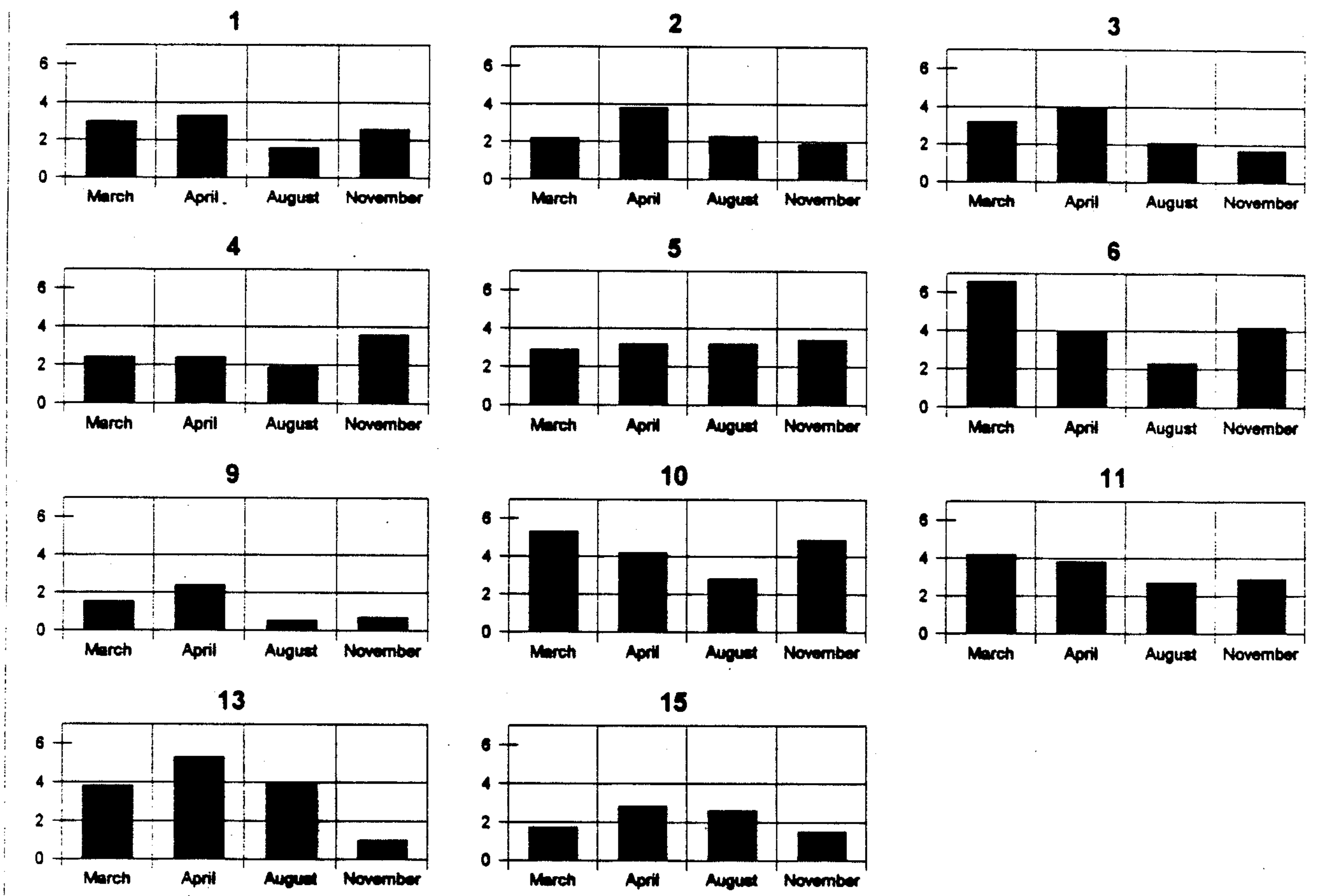


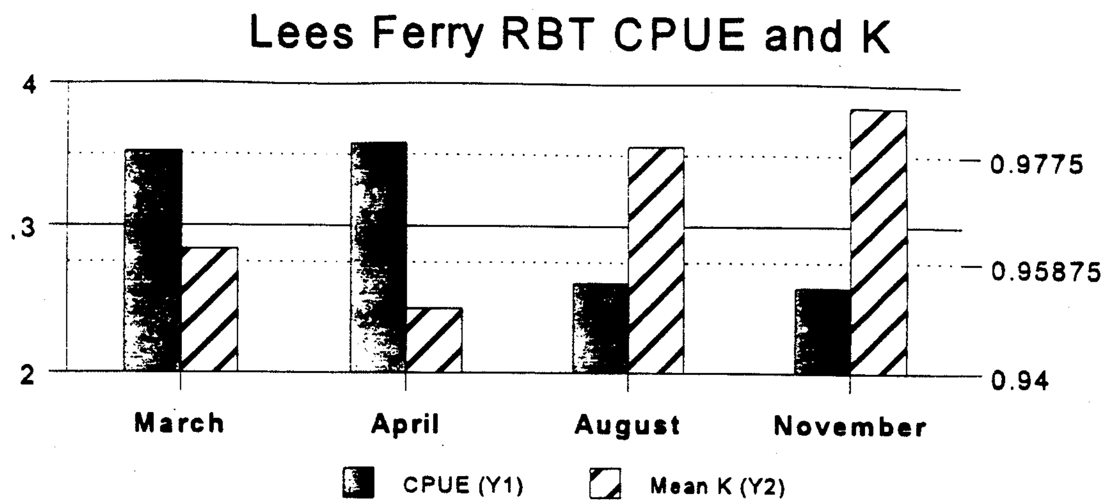
Figure 19. Length-frequency distributions of rainbow trout caught by electrofishing in the Glen Canyon Dam tailwater, March-November, 1996.



Total RBT CPUE
40
35
30
25
20
15
10
March
April
August
November

Rainbow trout CPUE





Lees Ferry RBT CPUE and K
4
3
2
0.9775
0.95875
0.94
March
April
August
November
CPUE (Y1)
Mean K (Y2)

Study Area

The overall area of study is the Colorado River in Grand Canyon, Arizona, from Lee's Ferry (RK 0) to Diamond Creek (RK 363.16; Fig. 2). (Note: river locations are denoted as distance (river kilometer; RK) below Lee's Ferry. Specific sites are also given the notation of 'L' (left) or 'R' (right), the side of the river when facing downstream.). This section of river has been divided into eight sampling reaches of varying length, based on known fish populations and the availability of backwater habitat and spawning tributaries (Table 2). These reaches were used during pre- and post-flood sampling trips which covered the entire study area. In addition, sampling was conducted during the Experimental Flood. A reach ranging from Awatubi Canyon (RK 93.71) to Lava Chuar Rapid (RK 105.40) was the only area sampled during this period. This reach includes the confluence of the Little Colorado and Colorado Rivers (RK 98.95) and is an important rearing area, since all species of native fishes remaining in the Grand Canyon spawn in the Little Colorado River (Valdez and Ryel 1995; AGFD 1996).

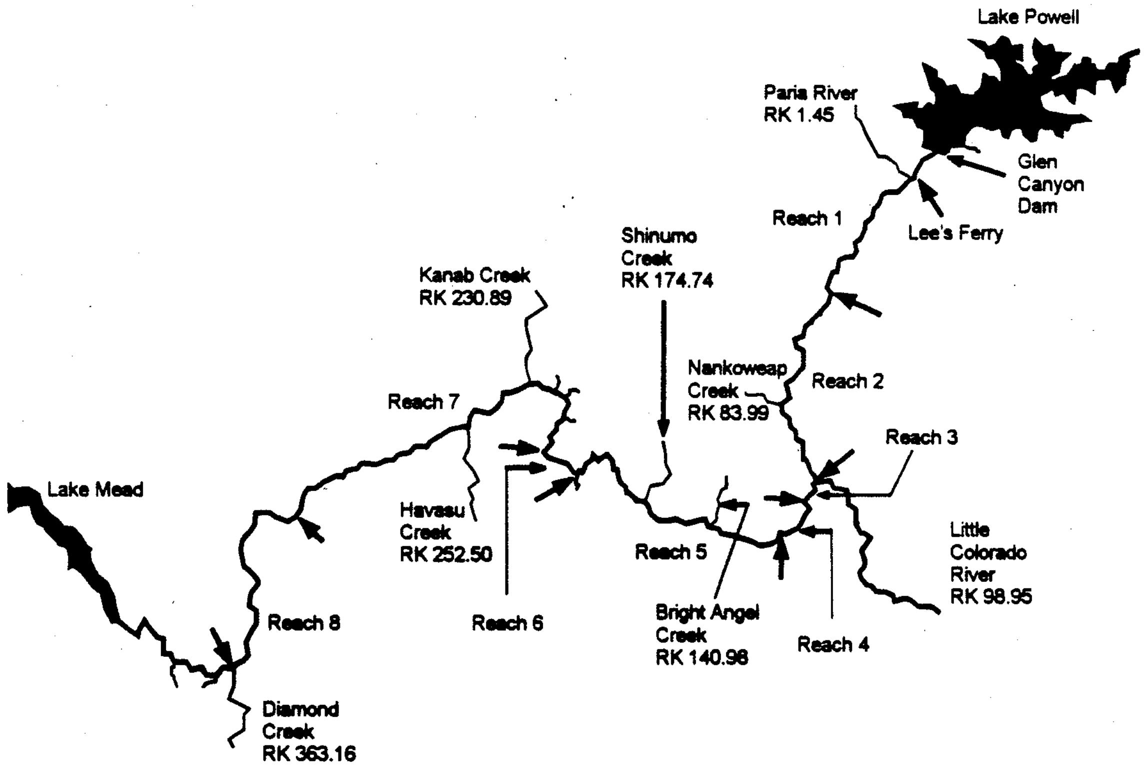
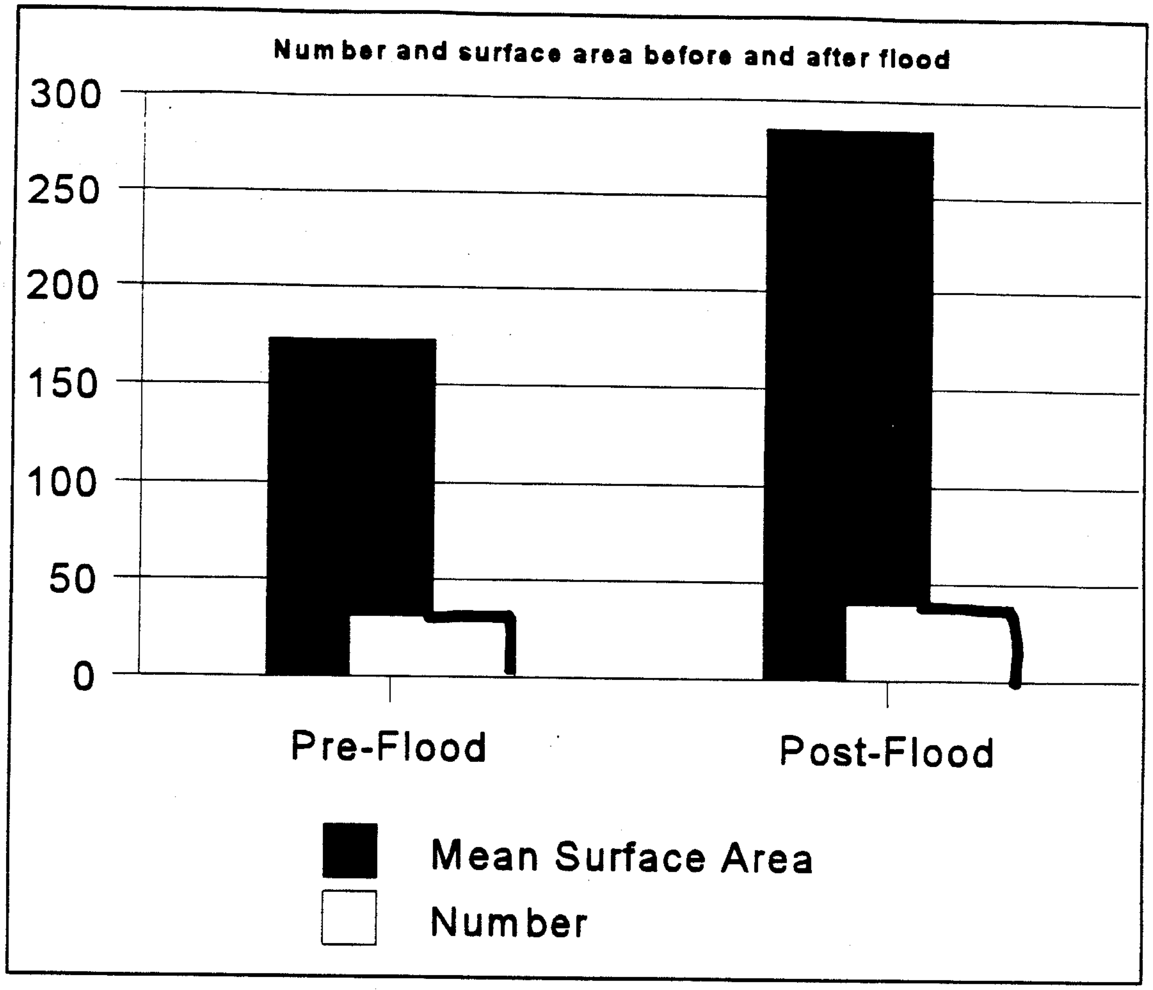


Figure 2. The Colorado River and major tributries between Lakes Powell and Mead. Large arrows indicate reach boundaries, as described in Table 2. Tributary locations are given as river kilometer (RK) below Lee's Ferry.



	Pre-Flood	Post-Flood
Number	31	39
Surface Area	172.5	285.1

Table 10. Number and mean surface area (m²) of backwaters in each reach before and after the Experimental Beach/Habitat Building Flood in the Colorado River, Grand Canyon, Arizona, 1996.

	Pre- Flood			Post-Flood		
		Aerial Census 8,000 cfs			Aerial Census 8,000 cfs	
Reach	Ground Census (13,405 cfs)*	Number	Mean Surface Area (m²)	Ground Census (18,419 cfs)*	Number	Mean Surface Area (m²)
1	1	2	243.0	1	3	342.7
2	13	7	160.6	8	11	286.9
3	3	0	-	3	4	287.8
4	9	0	-	4	1	206.0
5	0	0	-	4	2	297.0
6	2	2	186.5	4	4	273.3
7	21	9	184.7	6	5	269.2
8	19	11	154.8	12	9	296.0
Total	68	31	172.5	42	39	285.1

* Mean daily discharge from Glen Canyon Dam

Table 11. Location (RK and side) and pre-flood and post-flood surface areas (m²) of backwaters that were present both before and after the Experimental Beach/Building Flood in the Colorado River, Grand Canyon, Arizona, 1996.

Location	Pre-Flood Surface Area (m²)	Post-Flood Surface Area (m²)
35.64R	396	552
78.33R	240	159
97.90L	138	318
196.31R	190	240
285.48L	378	357
290.42R	106	539
293.64R	105	531

Table 9. Mean percentages of sand, silt, CPOM, and FPOM in backwaters sampled both before and after the Experimental Flood in the Colorado River, Grand Canyon, 1996.

		Pre-Flood				Post-Flood			
Reach	RK	% Sand	% Silt	% CPOM	% FPOM	% Sand	% Silt	% CPOM	% FPOM
2	71.23 L	29.9	67.5	0.4	2.1	96.3	3.0	0.2	0.5
2	94.42 L	35.3	63.1	0.4	1.2	91.1	7.6	0.3	1.1
2	97.91 L	16.6	81.3	0.5	1.5	95.5	4.0	0.2	0.4
Reach 2 Mean		27.3	70.6	0.4	1.6	94.3	4.9	0.2	0.7
3	104.99 L	32.9	61.6	0.6	1.9	20.0	77.1	0.3	2.6
6	188.90 R	83.7	15.3	0.2	0.8	59.0	39.9	0.2	0.8
8	296.83 L	97.1	1.9	0.2	0.7	91.3	8.4	0.1	0.2
Overall Mean		52.2	46.1	0.4	1.4	81.4	17.7	0.2	0.8

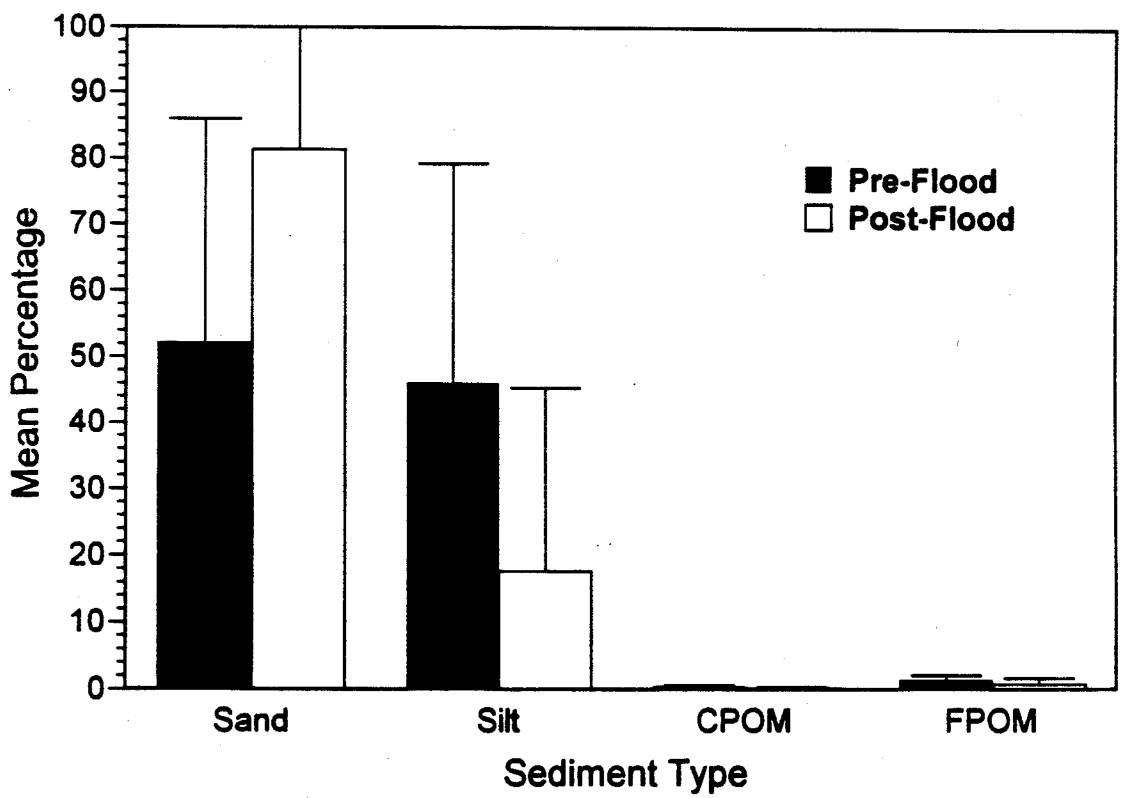
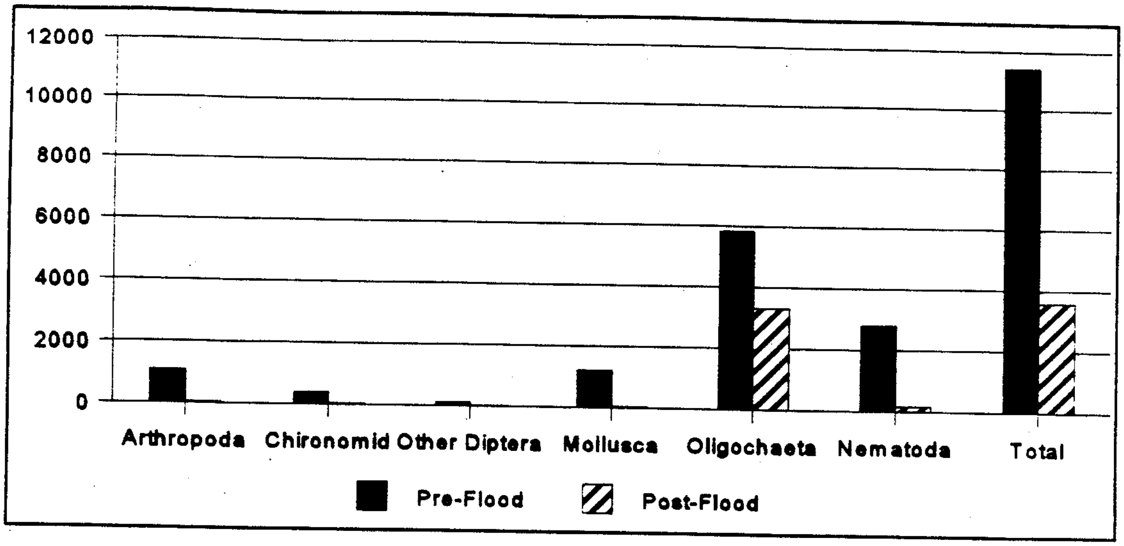
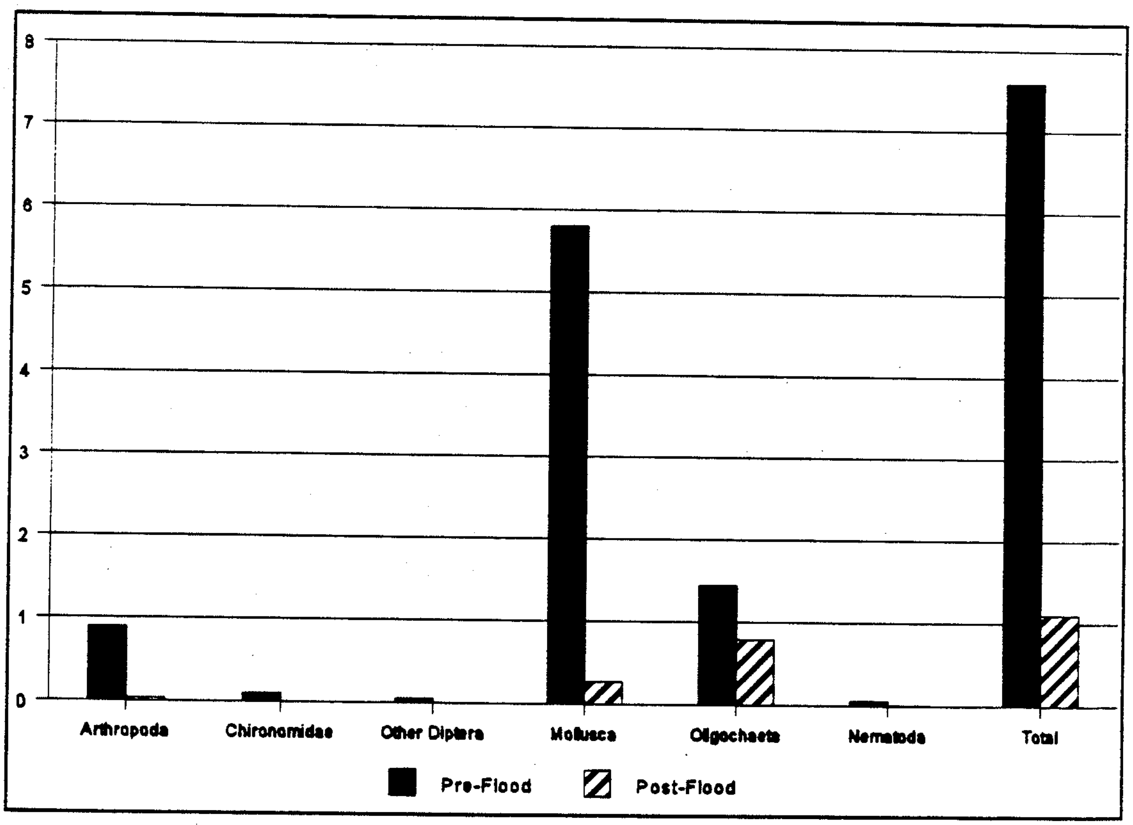


Figure 9. Mean percentage of sand, silt, CPOM, and FPOM in backwaters both before and after the Experimental Flood in the Colorado River, Grand Canyon, 1996.

Mean density (#/m²) of benthic invertebrates.



Mean biomass (g/m²) of benthic invertebrates



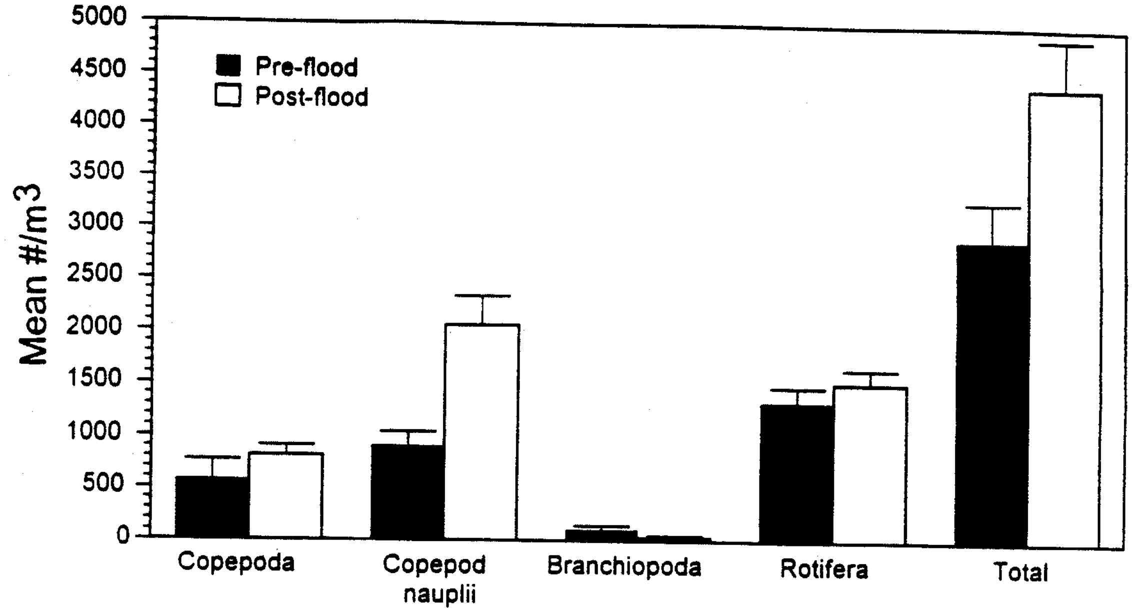


Figure 10. Mean zooplankton density (#/m^3) before and after the 1996 Experimental Flood in the Colorado River, Grand Canyon, Arizona. Pre- versus post-flood changes were significant ($P \leq 0.0420$) for all classifications except Rotifera ($P=0.3307$). Bars indicate ± 1 standard error of the mean.

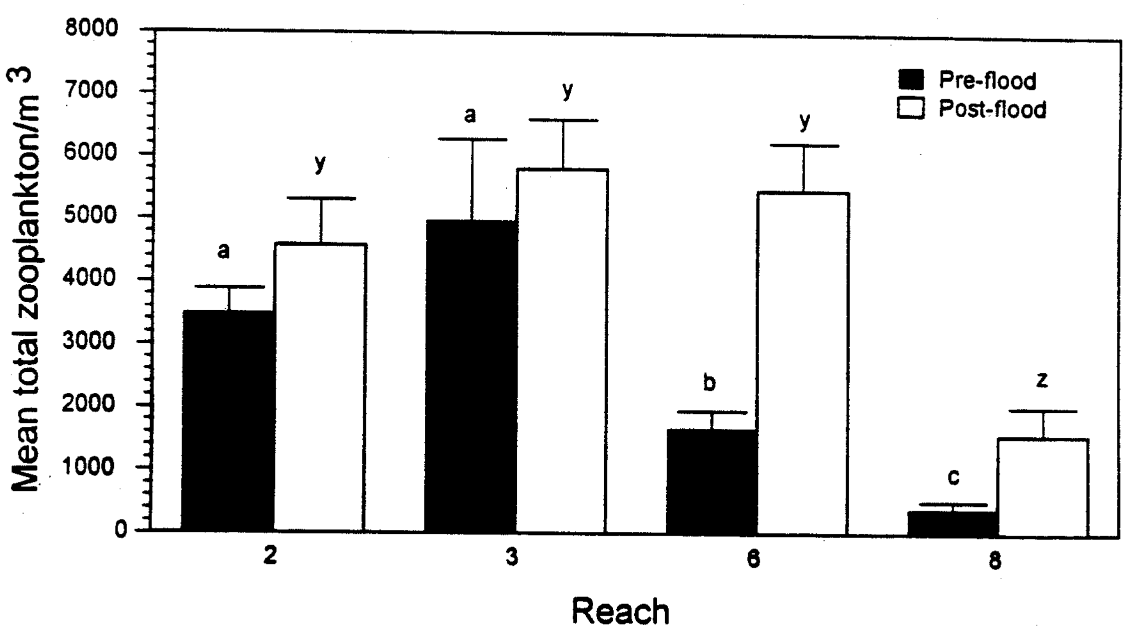


Figure 11. Mean total zooplankton densities among river reaches before and after the 1996 Experimental Flood in the Colorado River, Grand Canyon, Arizona. Means with identical lettering are not significantly different ($\alpha = 0.05$). Bars indicate ± 1 standard error of the mean.

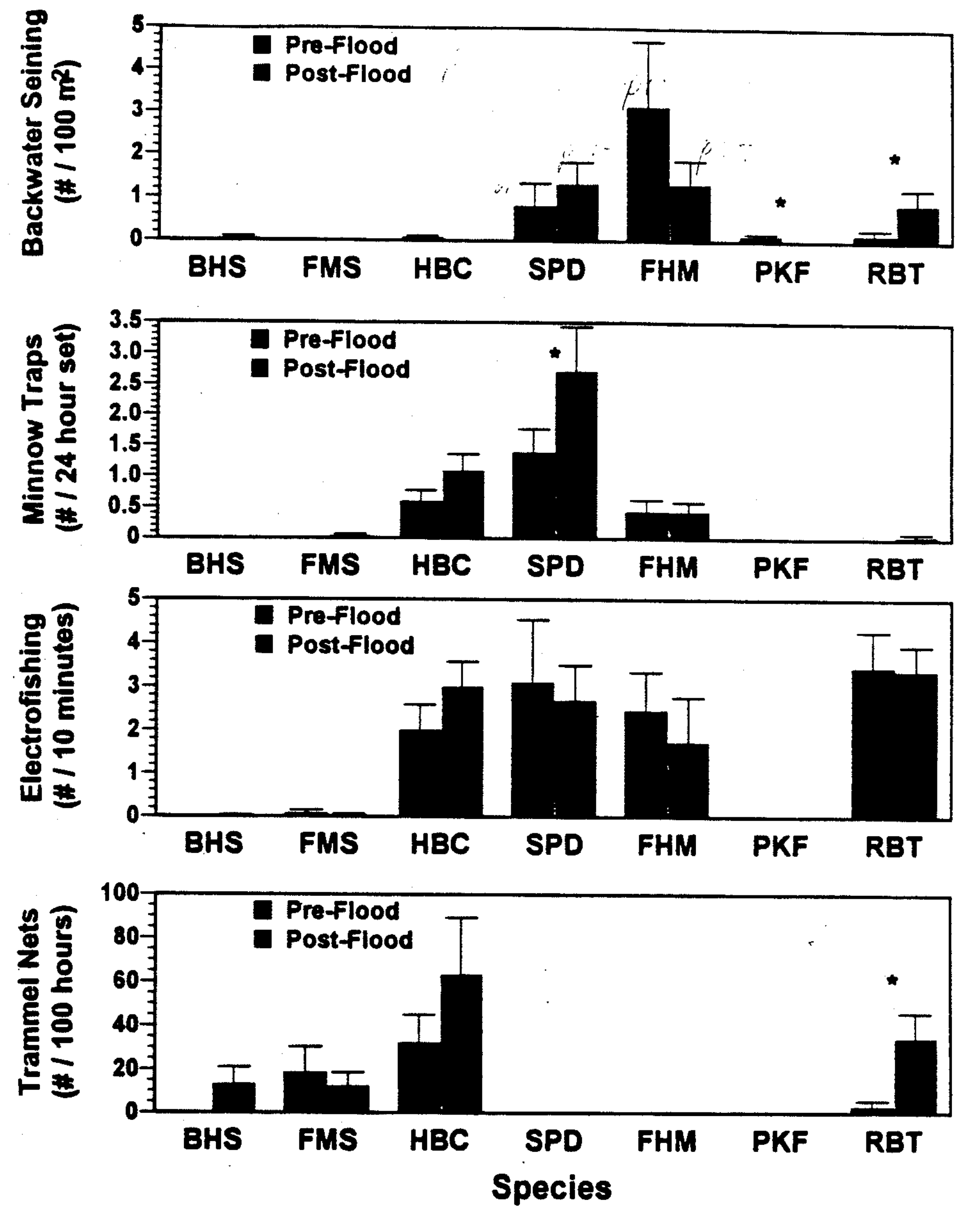


Figure 3. Mean (± standard deviation) of catch-per-unit-effort of fishes using various gear types in the vicinity of the confluence of the Colorado and Little Colorado Rivers during steady 227 m^3/s (8,000 cfs) flows immediately before and after the Experimental Flood in the Colorado River, Grand Canyon, Arizona, 1996. Species codes: BHS - bluehead sucker, FMS - flannelmouth sucker, HBC - humpback chub, SPD - speckled dace, FHM - fathead minnow, PKF - plains killifish, RBT - rainbow trout. * indicates significant difference at $\alpha = 0.05$.

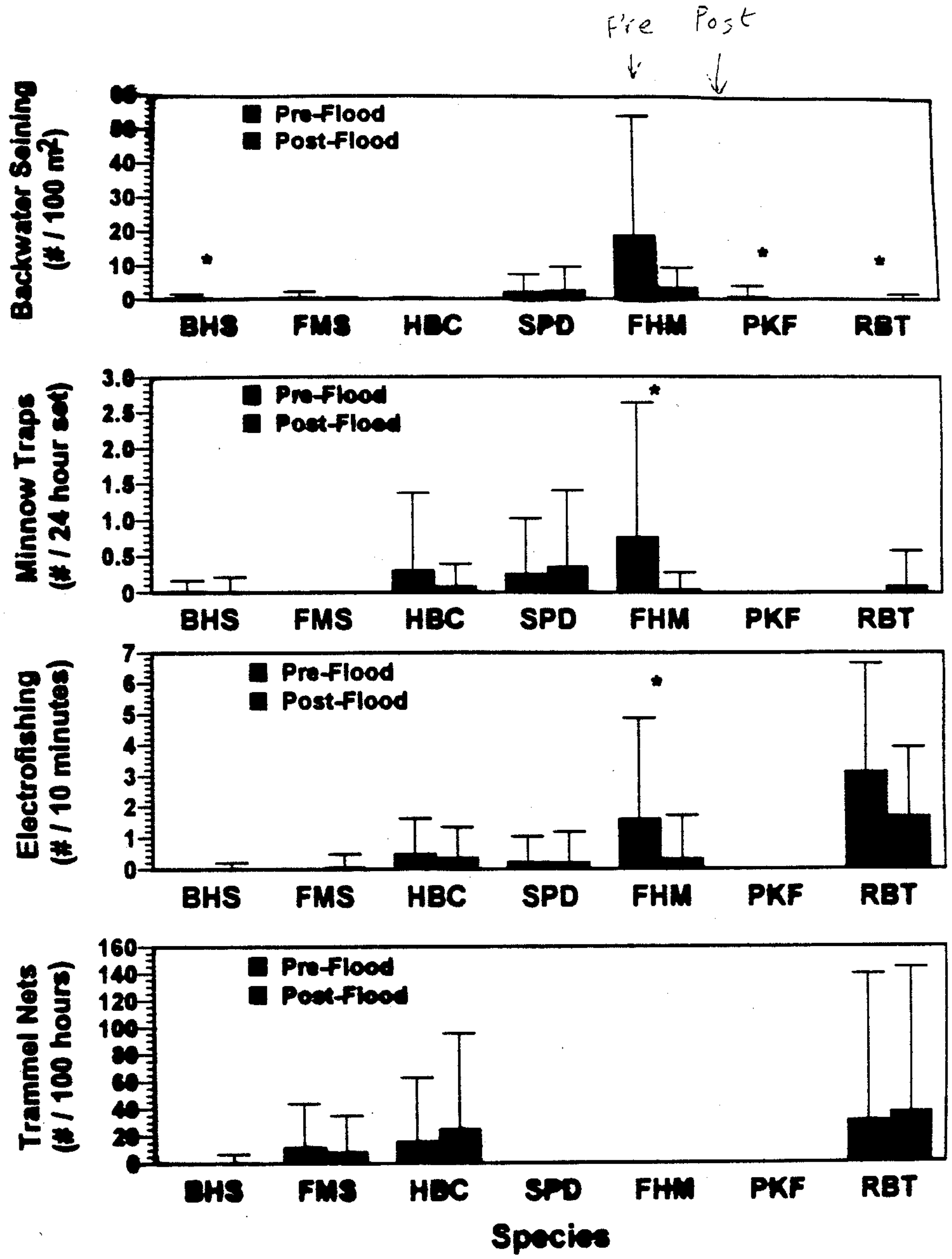


Figure 4. Mean (± standard deviation) of catch-per-unit-effort of fishes using various gear types during AGFD sampling trips before (28 February - 14 March 1996) and after (18 April - 3 May 1996) the Experimental Flood in the Colorado River, Grand Canyon, Arizona, 1996. Species codes: BHS - bluehead sucker, FMS - flannelmouth sucker, HBC - humpback chub, SPD - speckled chub, FHM - fathead minnow, PKF - plains killifish, RBT - rainbow trout. * indicates significant difference at $\alpha = 0.05$.

CHANGES IN CATCH AND DISTRIBUTION OF FISHES AND THEIR RECOVERY FOLLOWING THE 1996 BEACH/HABITAT-BUILDING FLOOD IN THE COLORADO RIVER, GRAND CANYON

Timothy L. Hoffnagle, Research Branch, Arizona Game and Fish Department, 2233 E. Cedar Ave., Flagstaff, AZ 86004

The beach/habitat-building flood in the Colorado River, Grand Canyon, 22 March - 7 April 1996, was designed to improve habitat for larval and juvenile native fishes. This study examined the changes in distribution and population size of native and exotic fishes, as indicated by changes in catch-per-unit-effort (CPUE) in backwater seining, minnow trapping, trammel netting, and electrofishing. Data were collected on two time scales and river discharge conditions: 1) complete river trips (Lee's Ferry to Diamond Creek) conducted before and after the flood under fluctuating flows, and 2) sampling in the vicinity of the Little Colorado River (LCR) during the steady 8,000 cfs flows immediately before and after the flood. Data were also collected on complete river trips during the summer and early fall to examine recovery of changes in distribution or populations. Native fishes were unaffected by the high flows while some exotic species were dispersed downstream. Plains killifish were removed from the mainstem Colorado River. Fathead minnows CPUE decreased in reaches immediately below the Little Colorado River. Rainbow trout were dispersed from the upper to lower reaches. However, these changes appear to have been short-lived. Plains killifish have reinvaded from tributary refugia and fathead minnows numbers have also increased. The affects of the Grand Canyon Experimental Flood on habitat for larval and juvenile stages of native species are more likely to be critical to fish populations.

CHANGES IN THE NUMBER, MORPHOLOGY, AND SEDIMENT COMPOSITION OF BACKWATERS AND THEIR RECOVERY IN THE COLORADO RIVER, GRAND CANYON, FOLLOWING THE 1996 EXPERIMENTAL HABITAT/BEACH BUILDING FLOOD

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This study examined the immediate changes in backwater size, morphology, and sediment composition caused by the 1996 Experimental Habitat/Beach Building Flood. Backwaters have become increasingly important as rearing areas for larval and juvenile native fishes in the Colorado River system due to changes in mainstem habitat, primarily decreased water temperatures caused by dams. Backwater habitats are more suitable for larval and juvenile native fishes than the Colorado River mainstem. Backwaters also have more stable substrates than mainchannel beachfaces which allows for higher densities of benthic invertebrates, a major food source for juvenile native fishes. Immediately following the flood, there were more backwaters present than immediately before the flood. However, the number of backwaters present has steadily decreased through July. Backwaters after the flood had a significantly greater ($P=0.0002$) mean surface area (285.1 m^2) than backwaters before the flood (172.5 m^2). Of the seven backwaters present both before and after the flood, five significantly ($P=0.0367$) increased in surface area. The sediment composition of backwaters also changed after the flood. Prior to the flood, sand and silt each comprised approximately 50% of the sediments with fine and coarse organic matter (FPOM and CPOM, respectively) comprising < 2%, combined. After the flood, the percentage of sand (81.4%) increased significantly. Conversely, the flood significantly reduced ($P \leq 0.0244$) the percentages of silt (17.7%), CPOM (0.2%), and FPOM (0.8%) in the backwaters by about 50% each. Long-term changes in backwater size, morphology, and sediments are also addressed.

RESISTANCE AND RECOVERY OF THE BENTHIC INVERTEBRATE COMMUNITY FOLLOWING AN EXPERIMENTAL FLOOD ON THE COLORADO RIVER, GRAND CANYON, ARIZONA.

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Benthic invertebrates provide an important food source for juvenile native fishes in the Colorado River, Grand Canyon. Backwaters, because they are warmer, have lower velocities, and more stable sediments, provide a better habitat for many benthic invertebrates such as chironomids and oligochaetes which are consumed by native fishes. The objective of this study was to examine changes in benthic invertebrate density and biomass prior to, after, and at 2.5 and 4.0 month intervals caused by the Beach/Habitat Building Experimental Flood to monitor the recolonization of backwaters by benthic invertebrates during summer (June) and fall (September) sampling trips. Mean total invertebrate density was significantly lower ($P=0.0001$) during the post-flood effort (10,805 individuals/m^2) than other sampling periods. Mean total invertebrate density was highest prior to the flood (34,174 individuals/m^2), followed by the summer (20,145 individuals/m^2) and fall samples (16,087 individuals/m^2). Mean individual invertebrate density was also significantly different among sampling efforts ($P \leq 0.0019$). Generally, mean individual invertebrate density was lowest during the post-flood sampling effort. Oligochaete and nematode density did not significantly decrease after the flood, but decreases were observed in their density during the summer and fall sampling efforts. Increases in the densities of arthropods and chironomids were observed during summer and fall. Density of mollusks and other dipterns (Simuliidae and Ceratopogonidae) varied by sampling effort. Mean total invertebrate biomass was significantly higher ($P=0.0039$) during the pre-flood sampling (24.8 g/m^2) and lowest during the summer sample (0.6 g/m^2). Mean individual biomass of all taxa was lowest during the summer sampling effort, except chironomids and other dipterns. During the fall sampling effort, mean individual biomass of all taxa increased with the exception of nematodes. Detrital biomass was significantly different among sampling efforts ($P=0.0001$): highest post-flood (792.0 g/m^2) and lowest during the summer (43.7 g/m^2). Short-term effects of the experimental flood on benthic invertebrates appear to be negative. Monitoring of benthic invertebrate density and biomass indicates recovery rates are highly variable by taxonomic group and at four months following the experimental flood, benthic invertebrates had still not attained pre-flood levels.

CHANGES IN ZOOPLANKTON DENSITY AND COMMUNITY COMPOSITION FOLLOWING AN EXPERIMENTAL FLOOD IN THE COLORADO RIVER, GRAND CANYON, ARIZONA

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Zooplankton are an important food resource for larval native fishes in the Colorado River, Grand Canyon. I compared zooplankton density and community composition in the Colorado River, Grand Canyon, before and after the 1996 experimental beach-building flood, among river reaches, and between backwater and mainchannel habitats. Zooplankton were collected from seven connected backwaters and their adjacent mainchannel habitats before (29 February-12 March 1996) and after (19-30 April 1996) the experimental flood. Total zooplankton density was significantly greater ($P=0.0013$) after the flood (4174/m^3) than before the flood (2733/m^3). No significant difference in zooplankton density was found between habitat types ($P=0.5173$). Zooplankton density significantly ($P=0.0001$) declined in river reaches below river kilometer (RK) 105.00 before the flood, but following the flood no significant decline was observed until below RK 265.49. Rotifers comprised 54.8% of the plankton before the flood and their percentage fell significantly ($P=0.0014$) to 37.4% despite no significant ($P=0.5715$) change in density. Copepods and copepod nauplii increased significantly both in density ($P \leq 0.0003$) and percentage of total zooplankton ($P \leq 0.0156$) after the flood. Branchiopods were significantly reduced in number ($P=0.0434$) and percent of total zooplankton ($P=0.0345$) after the flood. Eleven zooplankton taxa (mostly littoral and/or phytophytic genera) were observed before but not after the flood, whereas only two limnetic taxa were unique to post flood samples. Total zooplankton density in June 1996 (5239/m^3) did not differ significantly from post-flood density ($P=0.5511$), but declined significantly ($P=0.0001$) to 1300/m^3 in September. Patterns of longitudinal decline in zooplankton density were not consistent among sampling periods ($P=0.0030$). The flood may have been a factor of the post-flood pulse in zooplankton density in the Colorado River, but this increase could also be due to population dynamics of zooplankton (particularly winter forms such as copepods) in Lake Powell and/or environmental variables. Analysis of covariance indicated that seasonal fluctuations in zooplankton density were significantly related to changes in water temperature, and response surface regression analysis indicated that specific conductance and pH may account for 32.4% of the total variation in zooplankton density in 1996. Results from the experimental flood must be interpreted with reference to the entire 1996 sampling season, environmental covariates, and, perhaps more critically, to zooplankton population dynamics in Lake Powell.

ELECTROFISHING: EFFECTS OF AN EXPERIMENTAL FLOOD IN THE TAILWATER OF GLEN CANYON DAM, ARIZONA

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Electrofishing was conducted in the Glen Canyon Dam tailwater on the Colorado River prior to, during and following one week of experimental flooding. Results during the flood varied with habitat and fish species. Compared to success during pre- and post-flood steady flows, catch per unit of sampling effort (CPUE) for rainbow trout decreased during the flood. Catch per unit effort for flannelmouth suckers changed little, and CPUE for carp increased. Trout tended during the flood to move into shallower zones with slower current velocity and brushy cover but tended to move out of temporary backwaters. Trout caught during the flood tended to be larger than those caught just prior to or after the spate. No downstream displacement of fish was apparent due to the flood. Length-frequency histograms and CPUE for trout were similar prior to and following flooding.

EXPERIMENTAL FLOODING: EFFECTS ON PERIPHYTON, *GAMMARUS LACUSTRIS* AND RAINBOW TROUT IN THE TAILWATER OF A REGULATED RIVER.

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Periphyton, *Gammarus lacustris* and rainbow trout were investigated in the tailwater of Glen Canyon Dam on the Colorado River, Arizona, prior to and following experimental flooding. Standing stock of submerged aquatic macrophytes was reduced by the flood. Biomass (AFDW) of epilithon was unaffected within one week following the flood, but density of chlorophyll *a* declined. Colonization of exposed sand substrate by macrophytes began within about one month after the flood, and *Potamogeton* succeeded *Chara* as the dominant taxon. Densities of *Gammarus lacustris* were reduced at most sites in the week after the flood but returned to pre-flood levels in cobble habitat after about four months. Densities of the amphipod remained low in depositional habitat. Relative abundance, condition and distribution of rainbow trout were unaffected during four months after the flood. Frequency of empty stomachs of trout doubled in the week following flooding but was below pre-flood levels four months later. During the week following flooding, trout consumed larger quantities of *Gammarus*, but frequency of consumption was lower, than that a week prior to the spate.

EFFECTS OF THE COLORADO RIVER EXPERIMENTAL FLOOD ON MACROPHYTE DISTRIBUTION AND COMPOSITION, AND RAINBOW TROUT HEALTH IN THE GLEN CANYON DAM TAILWATER.

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Underwater visual and photographic assessments of the composition and percent coverage of macrophytes at seven selected sites in the tailwater of Glen Canyon Dam on the Colorado River, Arizona, were done prior to and after the experimental flood. Prior to the flood *Chara* sp. was the dominant macrophyte at six of the seven sites. These sites were characterized by low water velocity and a relatively shallow depth (0.7-1.5 m). *Chara* had high densities of epiphytic diatoms and *Cladophora glomerata* was epiphytic on the surface of the Chara beds. Chara beds ranged from 10 - 20 cm depth, and covered 40 - 85% of the substrate. *Potamogeton* sp. was the dominant macrophyte at two of the nine sites. These sites had higher water velocities and greater depth (1 - 2 m). *Potamogeton* sp. had no visible epiphytes, beds were approximately 40 cm deep and covered 60 % of the substrate. *Egeria densa* was found in patches at sites with *Potamogeton* sp. and at a depth of 3.7 m. After the flood all macrophytes had been removed from two sites and reduced the *Chara* and *Potamogeton* biomass by approximately 60 - 70% at all other sites. In addition, the small patches of *Chara* sp. that remained had been striped of most of the epiphytic algae. Fish health condition assessments were conducted on the rainbow trout (RBT) fishery prior to and after the flood. Health of RBT was within a normal range during all sampling periods. Mean normality indices exceeded 90%, and severity indices were below 1.75%. The percentage of fish which likely had fed within the past 24 hr (gall bladder empty or partially full) declined from pre-flood (73.3%) to post-flood (42.9%) as did the percentage that had fed in the last week from pre-flood (74.3%) to post flood (65.7%). However, the percentage of fish with significant fat reserves (50% - 100% coverage of pyloric caeca) increased from pre-flood (16.7%) to post-flood (25.7%).