

**EFFECTS OF INTERIM FLOWS FROM GLEN CANYON DAM ON
THE AQUATIC RESOURCES OF THE LOWER COLORADO
RIVER FROM DIAMOND CREEK TO LAKE MEAD**

**Quarterly Report No. 8
Trip No. 8: 30 March - 11 April, 1994**

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INTRODUCTION

This report presents preliminary results from Trip 8, 1994 of the Hualapai Aquatic Resources Study. Included in the report are a summary of trip logistics, personnel, data collected, observations, and recommendations. Most information is presented in tables to provide a synopsis of trip details. These data are hand tabulated and should be considered preliminary. Data will subsequently be computerized and checked for accuracy. The purpose of these trip reports is to provide information from BIO/WEST trips as quickly as possible to aid other researchers.

LOGISTICS, RESEARCH SCHEDULE, AND PERSONNEL

Trip 8 was conducted March 30 - April 11, 1994, from Diamond Creek (RM 226) to Pearce Ferry (RM 280) on Lake Mead. Five campsites were established and sampling was conducted in the areas indicated in Table 1. Sampling was also conducted in Diamond Creek near the launch site. Table 2 is a list of personnel who participated in research activities during Trip 8.

DATA COLLECTED

Fish

A summary of fish-sampling effort by gear type is presented in Table 3. Trammel nets, gill nets, and boat-electrofishing (EL 220v DC) were used in the main channel of the Colorado River and in Lake Mead. Overall, nets appeared to be a slightly more effective means of sampling adult fish than electrofishing. Backpack electrofishing, minnow trapping, and seining were only used in tributaries. All three techniques were highly effective for collecting small fish species and juveniles of larger species, and backpack electrofishing was also effective for capturing large adults (primarily carp in deep tributary pools). Aquarium nets were also used to capture larval fish.

Multiple-pass removals (population estimate) were conducted at three sites in Spencer Creek. The two previously sampled sites (Sites 1 and 2) were resampled, and an additional site (Site 3) was established further upstream. Site 1, located near the confluence with the Colorado River, was about 30 m long with an average width of about 4 m. Site 2, located approximately 0.75 miles upstream of Site 1, was about 46 m long and 9 m wide. Site 3, which was located about 1.5 miles from the inflow, was about 21 m long and 5 m wide. Site 1 was comprised almost exclusively of riffles with some slower, deeper water in the stream margins. Sites 2 and 3 each consisted of about 80 and 20 percent riffle and pool habitat, respectively. Site 3 was located above the constricted, high-gradient portion of Spencer Creek (about 1.5 miles upstream), as discussed in the 1993 Annual Report. Preliminary sampling indicated that this high-gradient section (Site 3) of stream may be a migration barrier to nonnative fish species.

Fish species composition and relative abundance were similar to previous sampling trips (Table 4), except for one golden shiner (Notemigonus crysoleucas) captured during this trip in the main channel near Lost Creek (RM 249.0). Also, one bluehead sucker was captured at RM 230.0, only the second specimen of this species captured during this investigation. No endangered humpback chub (Gila cypha) or razorback sucker (Xyrauchen texanus) were captured or observed during Trip 8.

The total number of fish captured was low, compared to other sampling trips. Catch rates were low in the main channel and higher in Spencer and Surprise creeks. However, fish abundance was low in Surprise Creek when compared to previous sampling trips. This apparent decline in fish abundance may have been related to flash-flooding that occurred in Surprise Creek since the December sampling trip (i.e., fish were physically displaced into the main channel).

Seining in Diamond Creek near the confluence with the main channel produced speckled dace and one plains killifish. During previous sampling trips only speckled dace were captured in this tributary. Although the lower portion of this stream appeared accessible to fish from the main channel, no other species were encountered, suggesting that few small non-native species (i.e., red shiner and fathead minnow) were present in this portion of the Colorado River. In contrast, seining in Spencer and Surprise creeks resulted in high catch rates of introduced fish (Table 5).

Sampling in Spencer Creek yielded non-native fish species only in about the first 1.25 miles of the tributary; only speckled dace were captured at Site 3 (about 1.5 miles upstream) (Table 5). This sampling site contained a large, deep pool in addition to riffle habitat. Introduced species that occur in Spencer Creek preferentially occupy slower water habitats. Therefore, if non-native species were present in this section of stream they likely would have been found in this sampling site. As mentioned above, the Spencer Creek channel below Site 3 is constricted for a distance of several meters and water velocities are high. Furthermore, upstream of this constricted area the channel consists of a sequence of cascading riffles that would also probably be difficult for introduced fish to negotiate.

A large number of carp and striped bass were observed staging at the mouth (in the first 30 m of the tributary) of Spencer Creek. It appeared that shallow riffles immediately above the mouth limited access to the stream. Increased flow in the main channel or Spencer Creek, however, could make it possible for these fish to move further into the tributary. We sampled the inflow by stretching a seine across the mouth of Spencer Creek (at the point where the tributary flows into the main channel) and electrofishing down to the seine from upstream. We captured two of the striped bass and some red shiners. Stomachs were removed from the striped bass to evaluate food habits, and results will be reported later.

Stomachs were also removed from striped bass and channel catfish captured in the main channel. Although stomach contents have yet to be analyzed in the laboratory, it seemed that striped bass were not feeding; stomachs appeared empty and fish condition (weight-length ratio) was low. We also took scale samples from most of the striped bass and a number of carp. These scales will be used, along with those collected on previous trips, to establish age-length relationships for these species. These relationships will be useful in understanding growth rates in the lower river.

PIT-tags were injected intraperitoneally in the bluehead sucker and two of the flannelmouth suckers captured in the main channel. No previously-tagged fish were recaptured during Trip 8. Capture location, PIT-tag numbers, and fish measurements are presented below.

Species	PIT-tag	RM	TL (mm)	Weight (g)	Sex	Recapture
Bluehead sucker	7F751F6970	230.0	310	306	M	N
Flannelmouth sucker	7F7F214927	272.2	331	353	U	N
Flannelmouth sucker	1F122C2C77	270.0	264	188	F	N

Water Quality

Water quality parameters in the main channel were measured with a Hydrolab surveyor 2 and manually recorded at each campsite. Parameters recorded included water temperature, pH, conductivity, and dissolved oxygen. Water temperature in the Colorado River ranged from 12.1 to 15.5°C during this trip.

A Hydrolab DataSonde 2 was also deployed in the tributaries to record the above parameters every 30 minutes; 4 days in Spencer Creek, 28 hours in Surprise Creek, and 26 hours in Quartermaster Creek. Water temperature in Spencer Creek varied from a low of 14.8°C at 0700 to a high of 25.3°C at 1400 hrs. Surprise Creek water temperature reached 20.2°C at 1400 hrs. Low water temperature in Surprise was 14.2°C at 0730 hrs. Quartermaster Creek showed the least diurnal temperature variation with a high of 21.7°C at 1400 and a low of 20.6°C at 0700 hrs.

The three thermographs (Ryan Temp mentors; 2 in the main channel and 1 in Spencer Creek) were successfully downloaded and maintained by GCES personnel just prior to this trip. All were re-deployed and set to record at 30-minute intervals. Temperature data from the thermographs is being processed by GCES staff.

Turbidity in the main channel of the Colorado was measured using a standard Secchi disc. Secchi readings were taken in sunlight between 1000 and 1400 hrs. Main channel turbidity was high for the duration of the trip with Secchi depths ranging from 0.1 m to 0.4 m.

During this trip Scorpion Island was surrounded by water originating from the Colorado River. This was probably due to the decreasing level of Lake Mead. Water temperature off the beach was 14.6°C while water temperature in Scorpion Bay was 18.5°C. Secchi depth near Scorpion Island was 0.3 m, while Secchi depth in Scorpion Bay was 0.6 m.

Primary/Secondary Productivity

Two sets of drift samples were taken in the main river. One set was taken just upstream of the mouth of Spencer Creek and another from RM 253.9. Stream benthos were collected using a Surber sampler in Spencer Creek at the three multiple pass sample sites and in Surprise Creek. Three Hess samples were taken near the mouth of Spencer Creek.

Incidental algae samples were collected from the main river, Spencer Creek, Surprise Creek and Travertine Falls Creek.

Lists of common riparian and aquatic plants were compiled for each of the three multiple pass sites in Spencer Creek. Riparian vegetation from Travertine Falls Creek, Surprise Creek and areas of the mainstem were also noted.

Macroinvertebrate Sampling

Two sets of drift samples were collected in the Colorado River: one set was collected just above the mouth of Spencer Creek (RM 246.0 - 3 April) and another set at the camp above Salt Creek (RM 253.9 - 6 April). Stream benthos were collected with a Surber sampler in Surprise Creek and at the three multiple-pass sampling sites in Spencer Creek. At each site in Spencer Creek three separate Surber samples were collected (total = 9). In addition, three Hess samples were collected in the Spencer Creek inflow region.

River Stage Monitoring

River level was monitored at RM 230.5 (left) and immediately above Spencer Creek at RM 246.0 (left). At RM 230.5 river level was recorded 11 times over about a 20-hour period. At RM 246.0 28 recordings were made over about a 70-hour period. A maximum change in stage of 50 cm was recorded at both locations. This included hourly monitoring from 1600 hr on 31 March to 0800 hr on 1 April.

OBSERVATIONS

1. Fish densities were greater in Spencer Creek than in the main channel of the Colorado River, as observed in previous trips. Fish may be entering this stream in response to warmer water and greater food availability associated with the tributary inflow.
2. A number of striped bass were captured, all in very poor condition, i.e., large heads, slender body.
3. Striped bass and carp were observed staging at the mouth of Spencer Creek, but access to the tributary appeared to be limited because of shallow depths about 30 m upstream of the confluence. Increased flow in the main channel or in Spencer Creek may allow these fish to gain access to the tributary.
4. Fish densities in Surprise Creek were considerably lower than in December. These reductions may be associated with flash-flood activity that occurred between the December, 1993 and April, 1994 sampling trips.
5. Only speckled dace were captured at the upstream population estimate site (Site 3 - about 1.5 miles upstream of the Colorado River), indicating that a constricted, high-velocity section is an upstream barrier to non-native species from the main channel.
6. Largemouth bass were captured in Spencer Creek for the first time since multiple-pass sampling was initiated.
7. Channel stability in Spencer Creek has increased dramatically since Trip 5 (this tributary was disturbed by a large flood event that occurred in early Spring, 1993). Bedload has declined

substantially, and algal and associated invertebrate production have increased greatly as a result. During Trip 7 much of the braided area of Spencer Creek near the mouth was carpeted with the filamentous green alga *Cladophora*.

8. Larval fish captured from Spencer Creek appeared to be mostly cyprinids (i.e., speckled dace, red shiners, fathead minnows).
9. Surprise Creek seems to have flooded since December, 1993, and much of the sand and silt was scoured from the mouth. This stream had fewer small suckers than during the last two trips of 1993. Fathead minnows were spawning in Surprise Creek.
10. Lost Creek was low with about half the slough dry and cattail growth covering much of the area that was previously flooded.
11. Minnow traps set in the mouth of Quartermaster Creek produced no fish.

RECOMMENDATIONS

- Continue intensive fish and macroinvertebrate sampling of Spencer Creek including multiple-pass and incidental fish sampling.
- Continue monitoring main-channel sites, particularly areas where native fish have been PIT-tagged.
- Continue to sample in Diamond Creek concentrating on the confluence with the main channel.
- Continue to sample the area where the humpback chub was collected and sample similar habitats in other locations.

Table 1. Dates, campsites, and sample locations for Trip No. 8, March 30 - April 11, 1994.

Date	Camp Site	Sample Locations
Mar 30 - 31	Travertine Falls (RM 230.5)	RM 228.6 - 230.8; RM 225.7
Mar 31 - Apr 5	Spencer Creek (RM 246.0)	RM 242 - 250.1 including Spencer Creek (RM 246), Surprise Creek (RM 248.4), and the mouth of Lost Creek (RM 248.9)
Apr 5 - 6	Above Salt Creek (RM 253.9)	RM 252.0 - 254.2
Apr 6 - 8	Below Bat Cave (RM 270.1)	RM 259.9 - 272.3 including Quartermaster Creek (RM 259.8)
Apr 8 - 11	Scorpion Island (RM 279.0)	RM 274.0 - 279.0 including Lake Mead

RM = River Mile

Table 2. Personnel participating in Trip No. 8, March 30 - April 11, 1994.

Personnel	Affiliation	DATES
Gloria Hardwick	BIO/WEST, Inc.	03/30 - 04/11
Randall Filbert	BIO/WEST, Inc.	03/30 - 04/11
Teresa Yates	BIO/WEST, Inc.	03/30 - 04/11
Morris Samson	Hualapai Natural Resources Division	03/30 - 04/11
Stan Dashee	Hualapai Natural Resources Division	03/30 - 04/11
Lydell Tapija	Hualapai Natural Resources Division	03/30 - 04/11
Steve Bledsoe	OARS	03/30 - 04/11
Stuart Reeder	OARS	03/30 - 04/11
Ruthie Stoner	OARS	03/30 - 04/11

Table 3. Fish sample gears, codes, descriptions, and number of samples from the Lower Grand Canyon and Lake Mead.

SAMPLE GEAR CODE - DESCRIPTION	TOTAL NUMBER SAMPLES
Electrofishing	
EL - 220-v DC (Coffelt CPS)	27
EL - Backpack Coffelt	
Multiple pass	3
Single pass	4
Trammel Nets	
TK - 75'x6'x1"x12"	26
TN - 50'x6'x1.5"x12"	64
Gill Nets	
GP - 100'x6'x1.5"	20
Minnow Traps	
MT - commercial minnow traps	33
Seines	
SA - 10'x3'x1/8" seine	4
Total	181

Table 4. Numbers of fish by species captured during Trip No. 8 in the Lower Grand Canyon and Lake Mead Inflow.

FAMILY COMMON NAME (Code)	SCIENTIFIC NAME	TOTAL CAPTURED
CYPRINIDAE (minnows)		
red shiner (RS)	<u>Cyprinella lutrensis</u>	978
fathead minnow (FH)	<u>Pimephales promelas</u>	252
common carp (CP)	<u>Cyprinus carpio</u>	77
speckled dace (SD)	<u>Rhinichthys osculus</u>	363
golden shiner (GS) ^a	<u>Notemigonus crysoleucas</u>	1
CATOSTOMIDAE (suckers)		
bluehead sucker (BH)	<u>Catostomus discobolus</u>	1
flannelmouth sucker (FM)	<u>Catostomus latipinnis</u>	16
SALMONIDAE (trout)		
rainbow trout	<u>Oncorhynchus mykiss</u>	1
PERCICHTHYIDAE (temperate basses)		
striped bass (SB)	<u>Morone saxatilis</u>	24
ICTALURIDAE (catfishes)		
channel catfish (CC)	<u>Ictalurus punctatus</u>	14
CYPRINODONTIDAE (killifish)		
plains killifish (PK)	<u>Fundulus zebrinus</u>	9
CENTRARCHIDAE (sunfishes)		
black crappie (BC)	<u>Pomoxis nigromaculatus</u>	1
bluegill (BG)	<u>Lepomis macrochirus</u>	1
green sunfish	<u>Lepomis cyanellus</u>	1
largemouth bass (LB)	<u>Micropterus salmoides</u>	6
POECILIIDAE (livebearers)		
Mosquitofish	<u>Gambusia affinis</u>	1
TOTAL		1,746

^a Tentative identification

Table 5. Numbers of fish by species captured during Trip 8 in Spencer and Surprise Creeks. Sites 1 through 3 in Spencer Creek correspond to locations of multiple-pass sampling (see text for explanation of sites).

Fish species	Spencer Creek				Surprise Creek
	Site 1	Site 2	Site 3	Other ^a	All locations
Red shiner	43	397	0	263	171
Fathead minnow	0	37	0	23	176
Common carp	0	9	0	0	4
Speckled dace	38	72	207	13	6
Flannelmouth sucker	0	13	0	0	0
Striped bass	0	0	0	2	0
Channel catfish	0	1	0	0	0
Plains killifish	0	0	0	6	2
Green sunfish	0	0	0	1	0
Largemouth bass	0	2	0	0	0
TOTAL	81	531	207	308	359

^a Includes backpack electrofishing and minnow trapping conducted within the first 250 m from the main channel