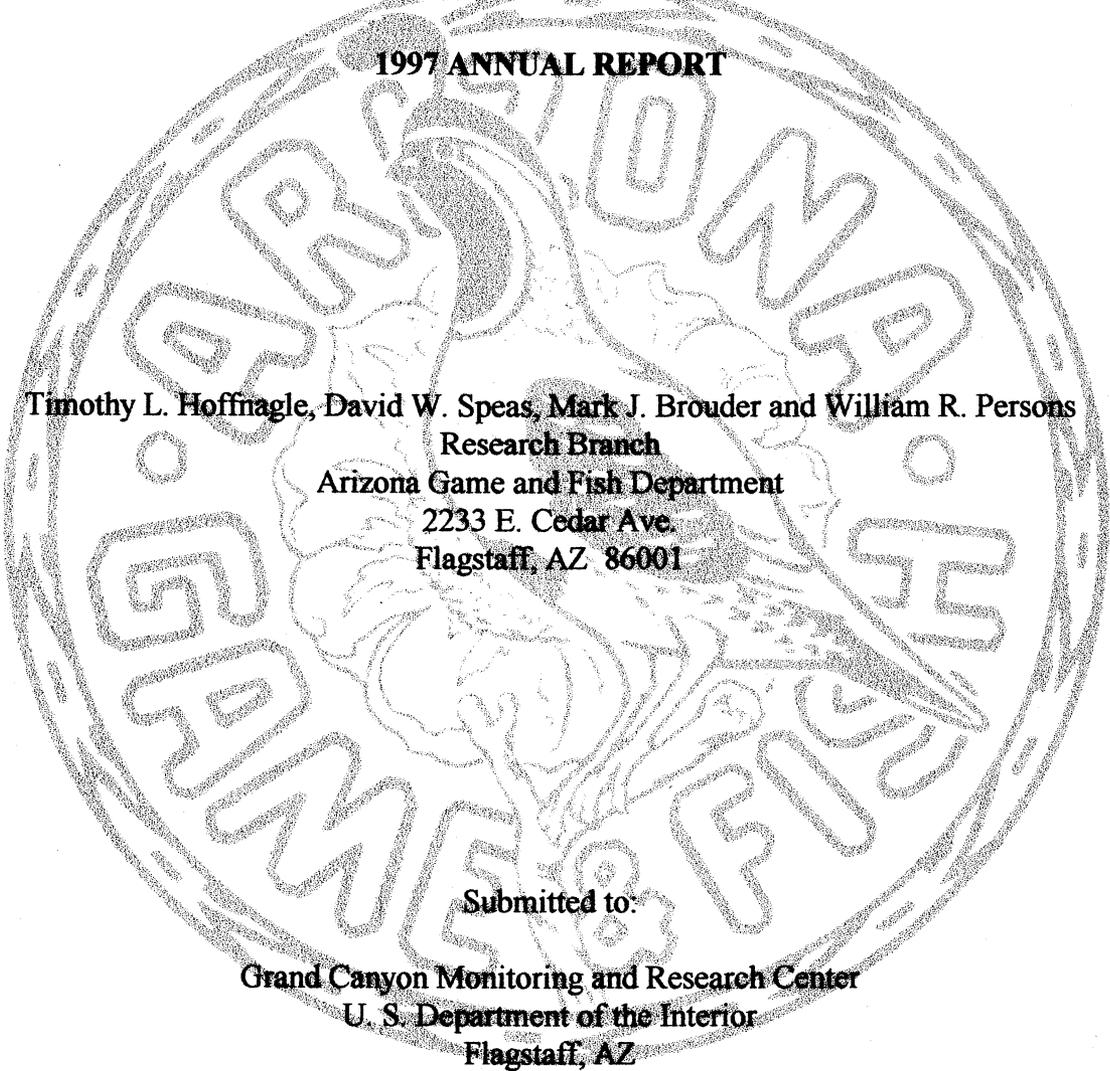


LITTLE COLORADO RIVER FISH MONITORING

13 APRIL - 16 MAY 1997

1997 ANNUAL REPORT



Timothy L. Hoffnagle, David W. Speas, Mark J. Brouder and William R. Persons
Research Branch
Arizona Game and Fish Department
2233 E. Cedar Ave.
Flagstaff, AZ 86001

Submitted to:

Grand Canyon Monitoring and Research Center
U. S. Department of the Interior
Flagstaff, AZ

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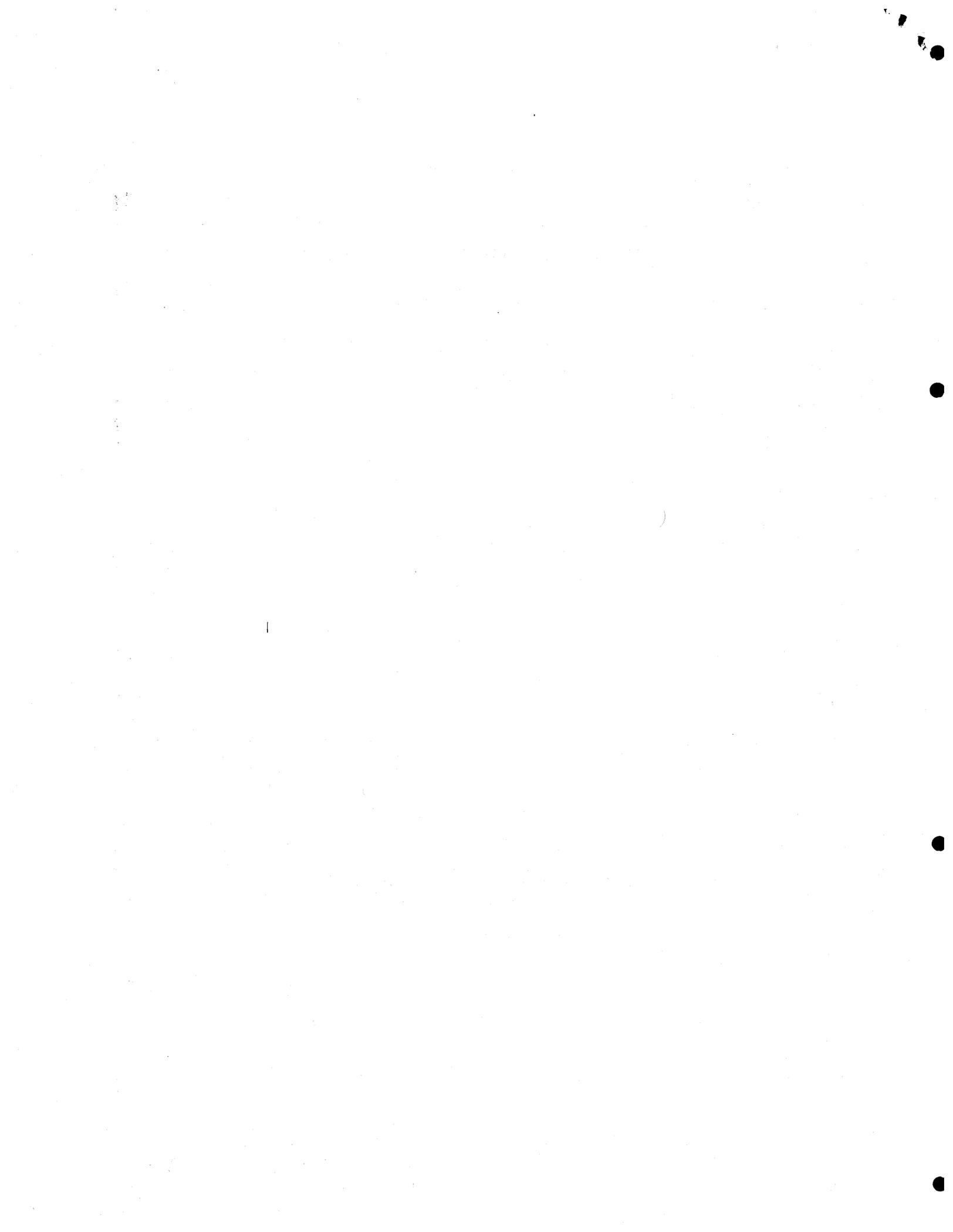
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Introduction

This report is a compilation of four trip reports and is comprised of four chapters, one from each crew sent into the Little Colorado River (LCR) to monitor the fishes there, particularly the endangered humpback chub. The monitoring design consisted of four, ten day trips from 10 April - 16 May 1997, each worked by a team of two crew members. However, bad weather forced the postponement of the entrance of the first crew into the LCR until 13 April and due to other obligations, this trip could not be lengthened. Each of the other three trips entered and exited the LCR as scheduled.

The first crew arrived in the LCR when the water level was receding from spring flooding. Flow was nearly at the LCR base of 235 cfs, but the river still carried large amounts of sediment, making the water very turbid ($>4,000$ NTU). The water gradually cleared and dropped below 10 NTU during the third monitoring trip. In addition to turbidity, spring runoff kept water temperature cool (initially 15°C), but the water warmed with the decreasing discharge and lengthening days, reaching a maximum temperature of 24°C .

Fish catches were generally low, particularly those of native species (Modification of the timing of the trips and gear used is appropriate and is discussed at the end of this report.). Exotic species, particularly fathead minnow and plains killifish were the most commonly captured species on each trip. Speckled dace were the most commonly captured native species with humpback chub being fairly common on the early trips, but less so on the later trips. Table 97-1 is a list of the common and scientific names and families of all species of fish captured during LCR monitoring in 1997.

Methods

The fish collection gear deployed during these trips consisted of 12 hoop nets, three mini-hoop nets and six minnow traps. This gear was set in the LCR between 100 m and 1300 m upstream from its confluence with the Colorado River in Grand Canyon National Park (Table 97-2). Due to high flows, turbidity and morphological changes in the river, we could not set the hoop nets in two of the "standard" sites used during previous years. Therefore, comparable sites

Table 97-1. Common, scientific and family names of all species of fish caught during AGFD Fish Monitoring Trips in the Little Colorado River, Grand Canyon, Arizona, 13 April - 16 May 1997.

Common Name	Scientific Name	Family
<u>Native Species</u>		
Bluehead Sucker	<i>Catostomus discobolus</i>	Catostomidae
Flannelmouth Sucker	<i>Catostomus latipinnis</i>	Catostomidae
Humpback Chub	<i>Gila cypha</i>	Cyprinidae
Speckled Dace	<i>Rhinichthys osculus</i>	Cyprinidae
<u>Exotic Species</u>		
Channel Catfish	<i>Ictalurus punctatus</i>	Ictaluridae
Common Carp	<i>Cyprinus carpio</i>	Cyprinidae
Fathead Minnow	<i>Pimephales promelas</i>	Cyprinidae
Plains Killifish	<i>Fundulus zebrinus</i>	Cyprinodontidae
Rainbow Trout	<i>Oncorhynchus mykiss</i>	Salmonidae
Red Shiner	<i>Cyprinella lutrensis</i>	Cyprinidae
Yellow Bullhead	<i>Ameiurus natalis</i>	Ictaluridae

were selected for these two sets. Additionally, a trotline was set for four nights during Trip 97-1.

Collection gear was checked each morning and evening. Water temperature (°C) and turbidity (NTU) were measured twice daily, just before each gear check, at camp (Boulder Camp; approximately 2 km upstream from the mouth). The date and time that each net or trap was checked was recorded and effort (hours) was calculated.

All fish caught were identified to species, weighed (g) and measured for total length (mm; total and standard lengths for humpback chub; all lengths referred to in the text are total lengths). All fish were also checked for the presence of anchor worm (the external parasitic copepod *Lernaea cyprinacea*) and the number, if any, was recorded. Native fishes with total length ≥ 150 mm were checked for the presence of a PIT-tag. If no PIT-tag was present, one was

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Trip reports were written for each trip into the LCR. These reports include data collected during each ten days of sampling and are only cursory analyses of these data. More extensive analyses will be included in our 1997 annual report which will also include sampling data from the mainstem Colorado River and other major tributaries (Paria River and Shinumo, Kanab and Havasu Creeks).

Trip 97-1: 13 - 19 April 1997

Report Prepared by: Mark J. Brouder and David W. Speas

Personnel

Mark J. Brouder; AGFD, Research Branch, Flagstaff

David W. Speas; AGFD, Research Branch, Flagstaff

General Comments

The first monitoring crew entered the Little Colorado River (LCR) on 13 April 1997. The LCR was running above base flow and the water was very turbid (4,048 NTU). We deployed twelve hoop nets (3'x5'x1/2" mesh), three mini-hoop nets (1.5'x4'x3/8" mesh), six minnow traps, and one trotline between the mouth of the LCR and 1300 m. Locations of each gear type are presented in Table 97-2. Due to high flows and turbidity, two hoop nets could not be set in the standard sites and were set in comparable sites. Common carp were observed spawning along the vegetated shoreline (*Phragmites* sp. and *Juncus* sp.) on river left on several occasions throughout this trip.

Results

Water Quality

Mean water temperature was 17.2° C and increased from 14 - 21° C during this trip (Figure 97-1-1). Mean turbidity was 3304 NTU and decreased from 1800 to 4048 NTU (Figure 97-1-1).

Catch Information

Hoop nets were set at 12 sites on 13 April and run twice daily (0600 and 1800) throughout the trip. In general, catches were about equal between night (58 fish) and day (46 fish) sets. Overall effort was 1420.87 h (Table 97-1-1). The hoop net set at 250 m above the mouth caught the most fish.

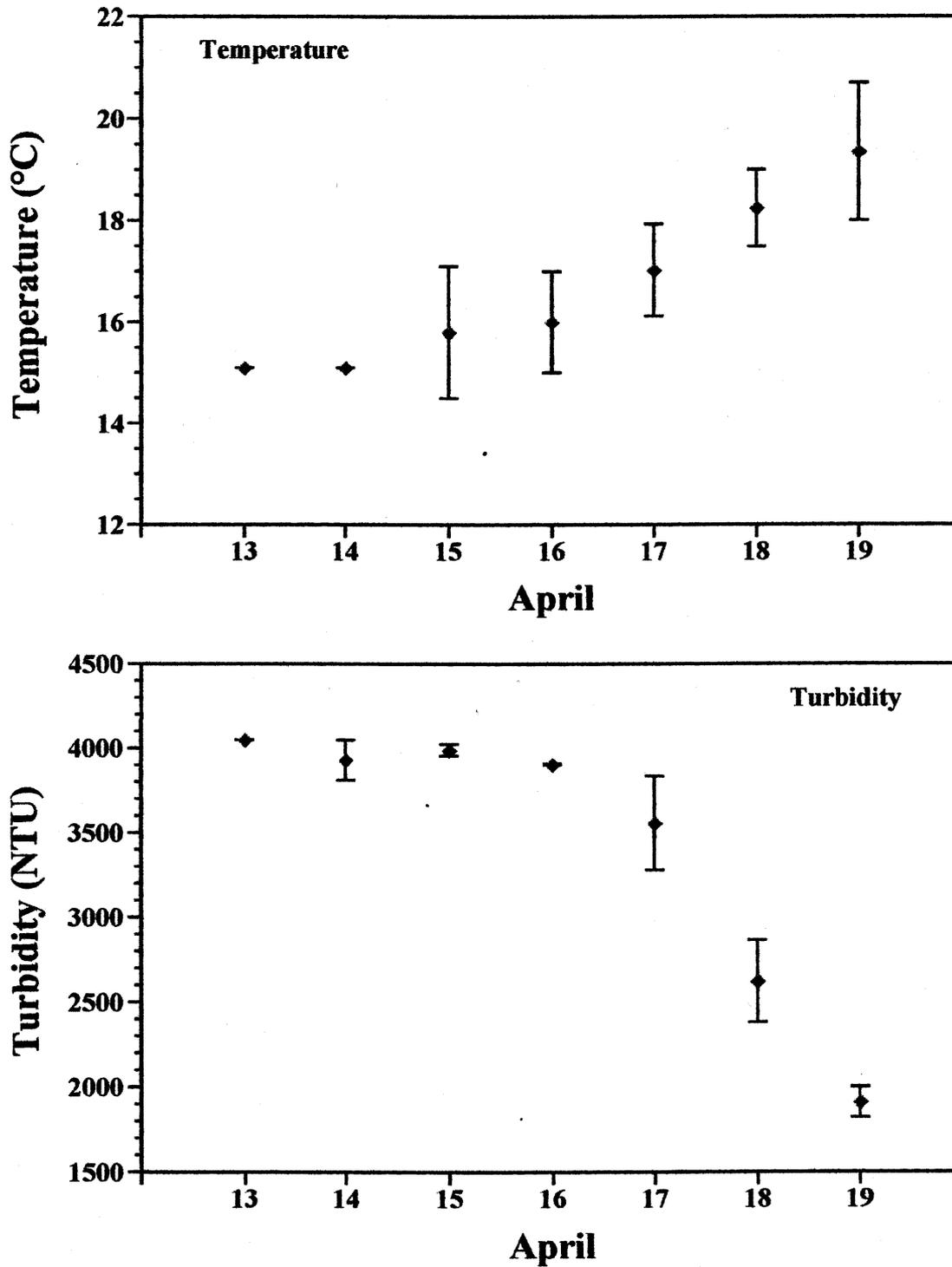


Figure 97-1-1. Mean and range of temperature and turbidity during AGFD Fish Monitoring Trip 97-1 in the Little Colorado River, Grand Canyon, Arizona, 13-19 April 1997.

Table 97-1-1. Total effort and number of sites for each type of fish collection gear used during AGFD Fish Monitoring Trip 97-1 in the Little Colorado River, Grand Canyon, Arizona, 8-15 May 1997.

Gear Type	Total Effort (hours)	Number of Sites
Hoop Net	1420.87	12
Mini-hoop Net	245.53	3
Minnow Trap	741.12	6
Set Line	49.94	1

Three mini-hoop nets were set in the LCR during Trip 97-1 for a total effort of 245.53 h (Table 97-1-1). Mini-hoop nets set during this trip caught only two fish: one flannelmouth sucker (434 mm), and one fathead minnow (52 mm).

Six minnow traps were set in the LCR for a total effort of 741.12 h (Table 97-1-1) and a catch of 13 fish. Three minnow traps were set along a vegetated shoreline downstream from Ledges Camp and three in a backwater just below Railroad Tie Rock. No fish were caught in the minnow traps downstream from Ledges Camp. All 13 fish were caught in the minnow traps set in the backwater downstream from Railroad Tie Rock.

A single trotline was set and run three times during this trip. The trotline was baited with prepared catfish bait and/or cut bait and set below the travertine dam at 1105 m. No fish were caught on the trotline.

Over the seven days we caught a total of 94 fish (Table 97-1-2). Of these fish, there were 38 (40.4 %) fathead minnows, 24 (25.5 %) humpback chubs, 18 (19.1%) speckled dace, six(6.4%) flannelmouth suckers, three (3.2%) bluehead suckers, two (2.1%) red shiners, two (2.1%) plains killifish, and one (1.1%) channel catfish.

Size Distribution of Fishes

The three bluehead sucker caught ranged in size from 210 - 230 mm and were probably one to three years of age (Figure 97-1-2, Table 97-1-3). Flannelmouth sucker ranged in size

Table 97-1-2. Total number of each species captured (N), the composition of the catch (%) and mean catch-per-unit-effort (CPUE) in each gear type and in all gears combined during AGFD Fish Monitoring Trip 97-1 in the Little Colorado River, Grand Canyon, Arizona, 13-19 April 1997.

Species	Hoop Nets			Mini-hoop Nets			Minnow Traps			Total	
	N	CPUE	%	N	CPUE	%	N	CPUE	%	N	%
Native Species											
Bluehead Sucker	3	0.026	3.7	0	0.000	0.0	0	0.000	0.0	3	3.2
Flannelmouth Sucker	6	0.053	7.4	0	0.000	0.0	0	0.000	0.0	6	6.4
Humpback Chub	18	0.159	22.2	0	0.000	0.0	6	0.099	50.0	24	25.5
Speckled Dace	<u>18</u>	<u>0.160</u>	<u>22.2</u>	<u>0</u>	<u>0.000</u>	<u>0.0</u>	<u>0</u>	<u>0.000</u>	<u>0.0</u>	<u>18</u>	<u>19.1</u>
Total Natives	45	0.383	55.5	0	0.000	0.0	6	0.099	50.0	51	54.3
Exotic Species											
Channel Catfish	1	0.008	1.2	0	0.000	0.0	0	0.000	0.0	1	1.1
Common Carp	0	0.000	0.0	0	0.000	0.0	0	0.000	0.0	0	0.0
Fathead Minnow	31	0.271	38.3	1	0.061	100.0	6	0.099	50.0	38	40.4
Plains Killifish	2	0.017	2.5	0	0.000	0.0	0	0.000	0.0	2	2.1
Red Shiner	<u>2</u>	<u>0.018</u>	<u>2.5</u>	<u>0</u>	<u>0.000</u>	<u>0.0</u>	<u>0</u>	<u>0.000</u>	<u>0.0</u>	<u>2</u>	<u>2.1</u>
Total Exotics	<u>36</u>	<u>0.314</u>	<u>44.5</u>	<u>1</u>	<u>0.061</u>	<u>100.0</u>	<u>6</u>	<u>0.099</u>	<u>50.0</u>	<u>43</u>	<u>45.9</u>
Total	81	0.703		1	0.061		12			94	

from 80 - 460 mm and represented age 1 to possible age 3 fish. Several sizes of humpback chub were captured and ranged in size from 50 - 375 mm. Speckled dace were mostly age 1 (60-90 mm), although those fish > 90 mm may have been two years of age. Fathead minnow caught during this trip were predominantly age 1. The two plains killifish captured were 40 and 48 mm and the two red shiners were 48 and 56 mm in total length. The channel catfish was 157 mm.

Maturity of Fishes

Bluehead and flannelmouth suckers were the only two species showing any evidence of spawning condition (Table 97-1-4). Two tuberculate male bluehead and flannelmouth suckers were captured while one male flannelmouth sucker was expressing milt (ripe).

Mark/Recapture of Native Fishes

Twenty-two native fish (≥ 150 mm) were captured and checked for PIT-tags. Five of 14 humpback chub were recaptured, while only one of five flannelmouth sucker were recaptured and one of three bluehead sucker were recaptured (Tables 97-1-5 and 97-1-6). Original data for one recaptured flannelmouth sucker and one humpback chub are currently unavailable. Two bluehead sucker, four flannelmouth sucker and nine humpback chub ≥ 150 mm TL were implanted with PIT-tags during Trip 97-1. One of the adult humpback chub captured had been radio-tagged by Bio/West Inc. prior to the 1996 Experimental Flood (PIT-tag # 7F7D09067B). The fish appeared to be in good condition, although the area around the antenna appeared to be slightly irritated.

Lernaea cyprinacea Infections

The parasitic copepod, *Lernaea cyprinacea*, was found on four humpback chub caught during this Trip 97-1 (Table 97-1-7). Three chub had one *Lernaea* each, while the fourth chub had two. All *Lernaea* were removed from each fish. No species other than humpback chub were found to be infected.

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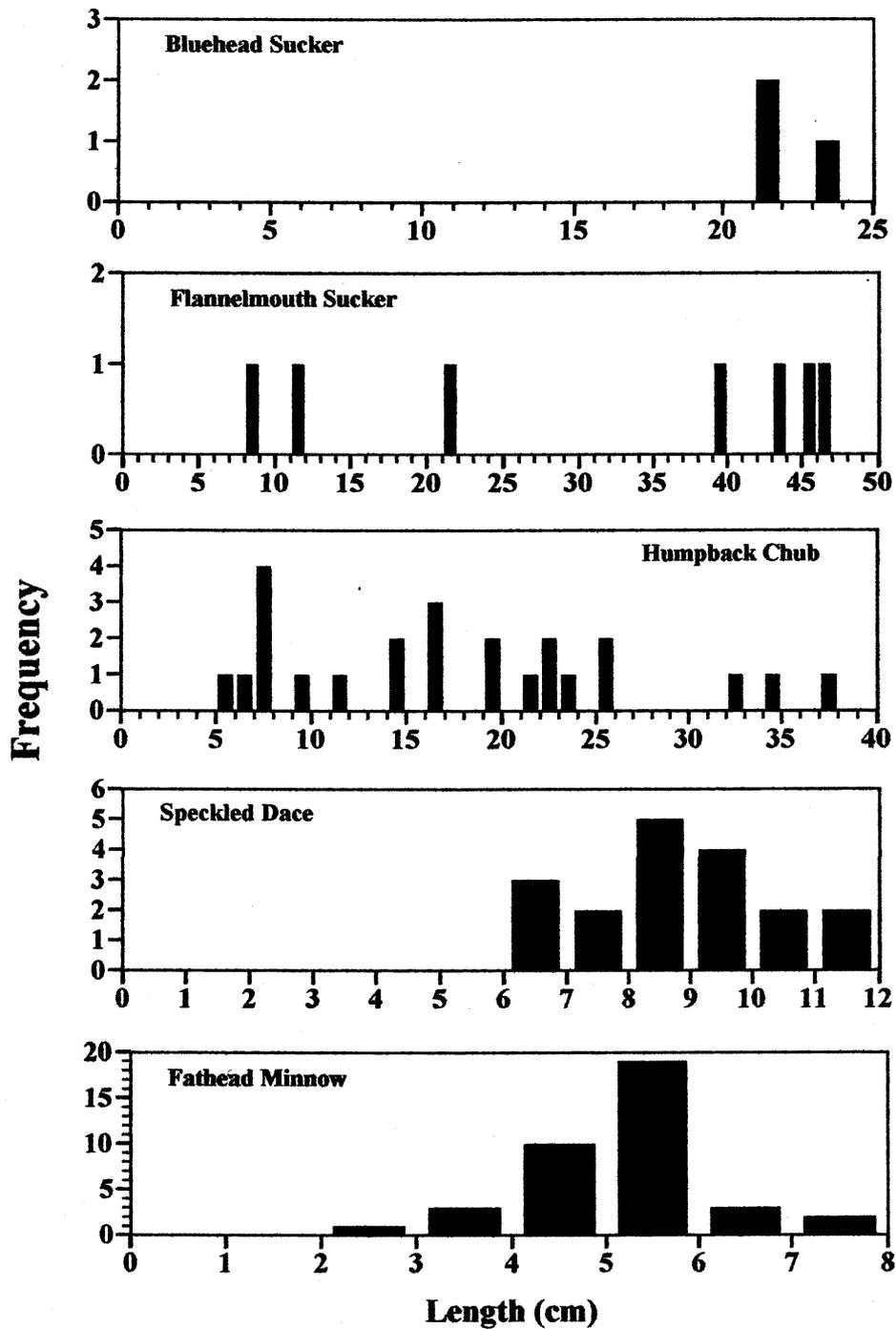


Figure 97-1-2. Length frequency plot for commonly captured species during AGFD Fish Monitoring Trip 97-1 in the Little Colorado River, Grand Canyon, Arizona, 13 - 19 April 1997.

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Table 97-1-3. Mean, minimum and maximum length (mm) and weight (g) of each species of fish captured during AGFD Fish Monitoring Trip 97-1 in the Little Colorado River, Grand Canyon, Arizona, 13-19 April 1997.

Species	Total Length (mm)			Weight (g)		
	Mean	Minimum	Maximum	Mean	Minimum	Maximum
<u>Native Species</u>						
Bluehead Sucker	218.7	210	231	101.33	78.0	131.0
Flannelmouth Sucker	307.4	82	461	447.00	4.2	942.0
Humpback Chub	177.1	56	374	100.40	1.4	528.0
Speckled Dace	87.9	67	119	7.13	2.4	16.2
<u>Exotic Species</u>						
Channel Catfish	157.0	157	157	30.20	30.2	30.2
Fathead Minnow	50.4	25	74	1.46	0.1	5.0
Plains Killifish	44.0	40	48	0.60	0.6	0.6
Red Shiner	52.0	48	56	1.80	1.4	2.2

Table 97-1-4. Number of adult fish not in obvious spawning condition and the number and percentage of adult fish in obvious spawning condition during AGFD Fish Monitoring Trip 97-1 Little Colorado River, Grand Canyon, Arizona, 13-19 April 1997.

Species	Spawn			Spawning Condition				
	No	Yes	% Yes	Gravid(♀)	Ripe (♂)	Spent(♀)	Spent (♂)	Tuberculat
Bluehead Sucker	1	2	66.6.0	0	0	0	0	2
Flannelmouth Sucker	3	3	50.0	0	1	0	0	2
Humpback Chub	9	0	0.0	0	0	0	0	0
Fathead Minnow	32	0	0.0	0	0	0	0	0

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Table 97-1-5. Date, location (meters upstream from mouth of LCR), total length, weight and sex at capture of all fish implanted with a PIT-tag during AGFD Fish Monitoring Trip 97-1 in the Little Colorado River, Grand Canyon, Arizona, 13-19 April 1997.

Species/Study	PIT-tag Number	Date	Location	Total Length (mm)	Weight (g)	Sex
<u>Bluehead Sucker</u>						
2971001	1F7833486E	14 APR 97	100	215	95.0	U
2971009	1F78381F12	18 APR 97	430	210	78.0	U
<u>Flannelmouth Sucker</u>						
2971001	1F7B017570	14 APR 97	100	216	86.0	U
2971007	1F78304B6E	13 APR 97	410	394		M
2971008	1F7843287E	15 APR 97	420	451	862.0	U
2971009	1F777D234A	15 APR 97	430	461	942.0	M
<u>Humpback Chub</u>						
2971001	1F7B0E1543	17 APR 97	100	199	74.0	F
2971001	1F7823380E	17 APR 97	100	349	406.0	M
2971006	1F7A2D3B7F	17 APR 97	380	229	128.0	F
2971009	1F780A1A45	13 APR 97	430	166	46.5	M
2971009	1F78275F63	17 APR 97	430	191	73.0	U
2971010	1F780C1944	17 APR 97	435	232	111.0	F
2971020	1F7828526F	15 APR 97	1125	165	50.0	U
2971020	1F7B0D2831	15 APR 97	1125	217	81.0	F
2971020	1F77754233	15 APR 97	1125	168	51.0	U

Table 97-1-6. Date, location (meters upstream from mouth of LCR), total length, weight and sex of all recaptured fish and the date, location, total length and weight at each of their previous captures (if known) during AGFD Fish Monitoring Trip 97-1 in the Little Colorado River, Grand Canyon, Arizona, 13-19 April 1997.

Species/ PIT-tag Number	Date	Location	Total Length (mm)	Weight (g)	Sex	Date	Location	Total Length (mm)	Weight (g)	Mark/ Recapture
<u>Bluehead Sucker</u>										
1F78250341	17 APR 97	1110	231	131	U	27 MAR 97	62.10	236	149	M
<u>Flannelmouth Sucker</u>										
1F7B5E0404	13 APR 97	535	434	775	U					
<u>Humpback Chub</u>										
7F7D09067B	17 APR 97	100	374	528	M	10 SEP 91	60.10	371	500	M
7F7D181569	17 APR 97	420	223	109	M	1 MAY 94	137	198	75	M
7F7B196F01	17 APR 97	430	324	319	M					
7F7D4C3745	18 APR 97	430	254	159	M	11 MAY 93		219	83	M
1F1F65015C	15 APR 97	1110	250	183	F	15 AUG 93		198	59	M

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Table 97-1-7. Number and percent of fish of each species infected with *Lernaea cyprinacea*, mean, minimum and maximum number of *Lernaea* per infected fish and mean number of *Lernaea* per sampled fish during AGFD Fish Monitoring Trip 97-1 in the Little Colorado River, Grand Canyon, Arizona, 13-18 April 1997.

Species	Total Sample	Number Infected	Percent Infected	Number of <i>Lernaea</i> / Infected Fish			Mean Number of <i>Lernaea</i> / Fish
				Mean	Min.	Max.	
<u>Native Species</u>							
Bluehead Sucker	3	0	0	0	0	0	0.000
Flannelmouth Sucker	7	0	0	0	0	0	0.000
Humpback Chub	24	4	16.6	2	1	3	0.166
Speckled Dace	18	0	0	0	0	0	0.000
<u>Exotic Species</u>							
Channel Catfish	1	0	0	0	0	0	0.000
Fathead Minnow	38	0	0	0	0	0	0.000
Plains Killifish	2	0	0	0	0	0	0.000
Red Shiner	3	0	0	0	0	0	0.000

Trip 97-2: 19 - 28 April 1997

Report Prepared by: William R. Persons and Timothy L. Hoffnagle

Personnel

Bill Persons; AGFD, Research Branch, Phoenix

Bill Watt; AGFD, Region II, Flagstaff

General Observations

Trip 97-2 was characterized by turbid water, cool weather, and high catches of nonnative fishes. Several age1 (~100 mm) channel catfish were caught in hoop nets near the mouth of the Little Colorado River (LCR), and small (~200 mm) carp were also collected. Of special interest was the recapture of an adult humpback chub that was originally Floy-tagged in 1986 in the LCR.

Results

Water Quality

Water temperatures ranged from 15.5 - 23°C (Figure 97-2-1). Mean water temperature was relatively steady around 20°C for the first five days. Mean temperature then decreased to approximately 16°C, followed by a steady increase back to 19.5°C by the end of the trip.

Turbidity steadily decreased during this trip (Figure 97-2-1). At the beginning of the trip, mean turbidity was relatively high at 1535 NTU. However, turbidity steadily dropped throughout the trip, reaching as low as 66 NTU by the end of the trip.

Catch Information

During LCR Trip 97-2, 2723 hours of effort were expended by hoop nets, 487 hours by mini-hoop nets and 1284 hours by minnow traps (Table 97-2-1). A total of 486 fish were captured (Table 97-2-2) of eleven species: all four extant native species and seven exotic species. Native species comprised only 38.5% of the total catch and exotic species comprised

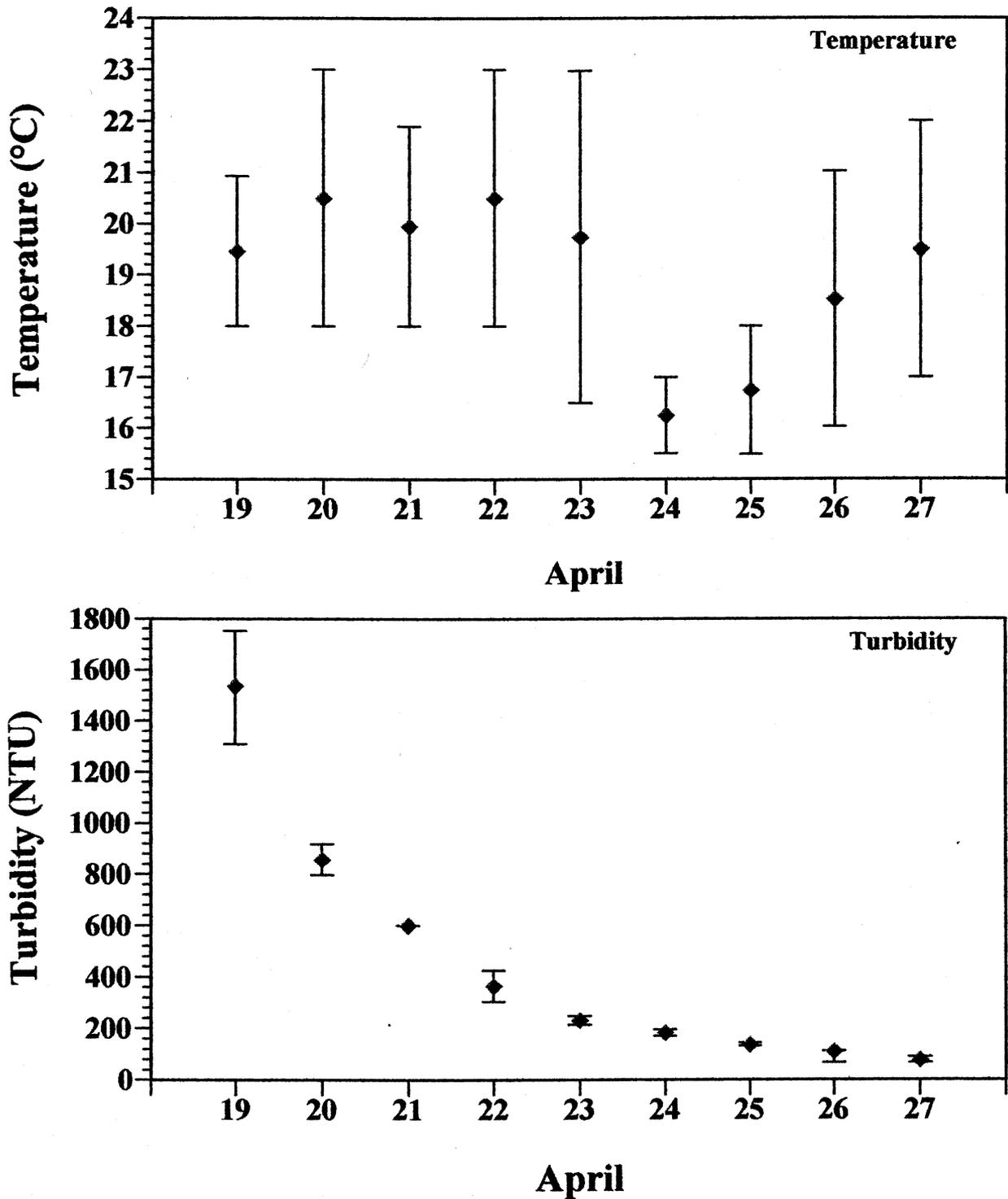


Figure 97-2-1. Mean and range of temperature and turbidity measured during AGFD Fish Monitoring Trip 97-2 in the Little Colorado River, Grand Canyon, Arizona, 19 - 27 April 1997.

Table 97-2-1. Total effort and number of sites for each type of fish collection gear used during AGFD Fish Monitoring Trip 97-2 in the Little Colorado River, Grand Canyon, Arizona, 19 - 27 April 1997.

Gear Type	Total Effort (hours)	Number of Sites
Hoop Net	2722.71	12
Mini-hoop Net	486.71	3
Minnow Trap	1283.57	6

the remaining 61.5%. Speckled dace was the most common native species and the second most numerous species captured (17.7%; Table 97-2-2). Humpback chub were also relatively abundant (10.9%) with flannelmouth (6.6%) and bluehead (3.3%) suckers being less common.

Fathead minnow was the most common species captured, comprising 53.7% of the total catch (Figure 97-2-2). Fathead minnow was also the most abundant species caught in all three gear types. Common carp comprised 2.9% of the total catch. No other exotic species comprised $\geq 2\%$ of the catch and were captured less frequently than all native species.

Mean CPUE varied with species and gear type (Table 97-2-2). Hoop nets had the highest mean catch rate (1.7 fish / 12 hour set). Minnow trap CPUE (1.1 fish / 12 hours) was lower than that of hoop nets, but they were effective at catching small exotic species, particularly fathead minnow. Mini-hoop nets were not very effective, catching only four fish (CPUE = 0.08 fish / 12 hour set). The highest mean CPUE for any species was 1.005 fathead minnows / 12 hours in minnow traps. Speckled dace were captured at a rate of 0.398 fish / 12 hours in hoop nets. Humpback chub were most effectively captured in hoop nets (0.2 fish / 12 hours).

Length and Weight of Fishes

The size range of fishes captured indicates that all fish captured were at least one year of age (Table 97-2-3). Adults of all native species were captured, but in low numbers.

Length-frequency graphs (Figures 97-2-2 and 97-2-3) show the size classes of fish captured and age classes can be discerned for some species. A few age 1 flannelmouth suckers, ranging in length from 6 - 11 cm, are represented. Two distinct age classes (ages 1 and 2) can

Table 97-2-2. Total number of each species captured (N), the composition of the catch (%) and mean catch-per-unit-effort (CPUE) in each gear type and in all gears combined during AGFD Fish Monitoring Trip 97-2 in the Little Colorado River, Grand Canyon, Arizona, 19 - 27 April 1997.

Species	Hoop Nets			Mini-hoop Nets			Minnow Traps			Total	
	N	%	CPUE	N	%	CPUE	N	%	CPUE	N	%
<u>Native Species</u>											
Bluehead Sucker	16	4.5	0.074	0	0.0	0.000	0	0.0	0.000	16	3.3
Flannelmouth Sucker	32	9.0	0.149	0	0.0	0.000	0	0.0	0.000	32	6.6
Humpback Chub	46	12.9	0.216	1	25.0	0.019	6	4.8	0.056	53	10.9
Speckled Dace	<u>85</u>	<u>23.8</u>	<u>0.407</u>	<u>1</u>	<u>25.0</u>	<u>0.019</u>	<u>0</u>	<u>0.0</u>	<u>0.000</u>	<u>86</u>	<u>17.7</u>
Total Natives	179	50.1	0.847	2	50.0	0.389	6	4.8	0.056	187	38.5
<u>Exotic Species</u>											
Channel Catfish	9	2.5	0.042	0	0.0	0.000	0	0.0	0.000	9	1.9
Common Carp	14	3.9	0.075	0	0.0	0.000	0	0.0	0.000	14	2.9
Fathead Minnow	146	40.9	0.685	2	50.0	0.039	113	90.4	1.005	261	53.7
Plains Killifish	3	0.8	0.014	0	0.0	0.000	6	4.8	0.049	9	1.9
Rainbow Trout	1	0.3	0.005	0	0.0	0.000	0	0.0	0.000	1	0.2
Red Shiner	4	1.1	0.019	0	0.0	0.000	0	0.0	0.000	4	0.8
Yellow Bullhead	<u>1</u>	<u>0.3</u>	<u>0.005</u>	<u>0</u>	<u>0.0</u>	<u>0.000</u>	<u>0</u>	<u>0.0</u>	<u>0.000</u>	<u>1</u>	<u>0.2</u>
Total Exotics	<u>178</u>	<u>49.9</u>	<u>0.886</u>	<u>2</u>	<u>50.0</u>	<u>0.039</u>	<u>119</u>	<u>95.2</u>	<u>1.054</u>	<u>299</u>	<u>61.5</u>
Total	357		1.733	4		0.077	125		1.110	486	

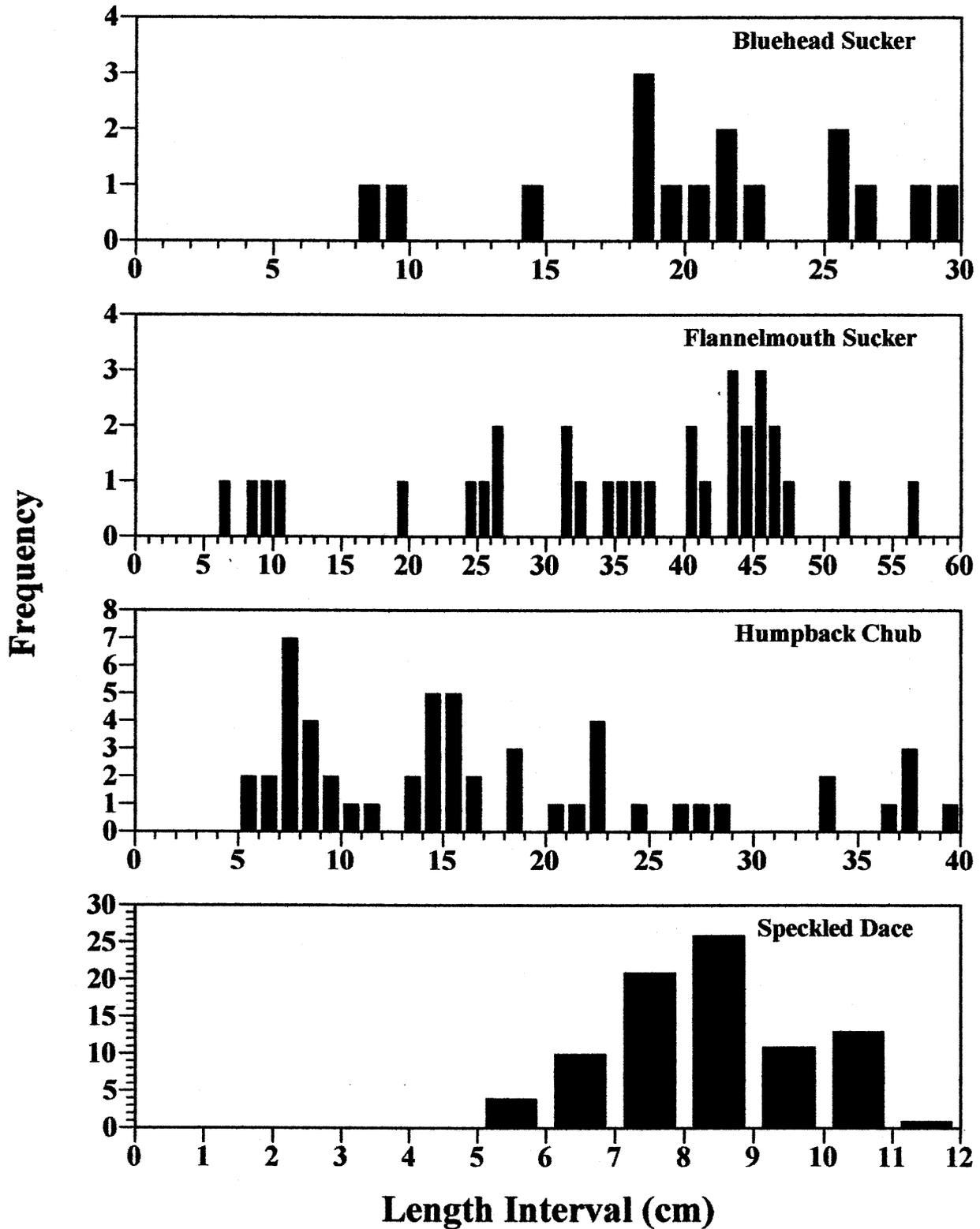


Figure 97-2-2. Length frequency plot for native species captured during AGFD Fish Monitoring Trip 97-2 in the Little Colorado River, Grand Canyon, Arizona, 19 - 27 April 1997.

Table 97-2-3. Mean, minimum and maximum length (mm) and weight (g) of each species captured during AGFD Fish Monitoring Trip 97-2 in the Little Colorado River, Grand Canyon, Arizona, 19 - 27 April 1997.

Species	Length (mm)			Weight (g)		
	Mean	Min.	Max.	Mean	Min.	Max.
<u>Native Species</u>						
Bluehead Sucker	204.3	87	296	110.00	20.0	274.0
Flannelmouth Sucker	350.0	64	566	696.00	180.0	1444.0
Humpback Chub	171.4	56	396	80.00	2.0	505.0
Speckled Dace	83.0	50	111	8.00	3.0	12.0
<u>Exotic Species</u>						
Channel Catfish	103.8	74	191	7.00	7.0	7.0
Common Carp	200.3	76	322	419.00	419.0	419.0
Fathead Minnow	55.5	32	81	.	.	.
Plains Killifish	49.4	40	55	.	.	.
Rainbow Trout	393.0	393	393	.	.	.
Red Shiner	52.8	46	59	.	.	.
Yellow Bullhead	303.0	303	303	.	.	.

be seen for humpback chub. The modal size class for the age 1 chubs is 7 cm and 14 - 15 cm for age 2 chubs. Most of the speckled dace were one year of age (5 - 10 cm), with the possibility of a few age 2 fish (10 - 12 cm) still present. All of the fathead minnow, plains killifish and red shiners probably belong to the age 1 class.

Mark/Recapture of Native Fishes

A total of 62 native fishes ≥ 150 mm total length was captured and checked for the presence of a PIT-tag. Thirteen bluehead suckers were implanted with a PIT-tag (Table 97-2-4) but none were recaptured. Seventeen flannelmouth suckers were implanted with a PIT-tag and nine were recaptured (Table 97-2-5). Only nine humpback chub were implanted with a PIT-tag and 14 were recaptured.

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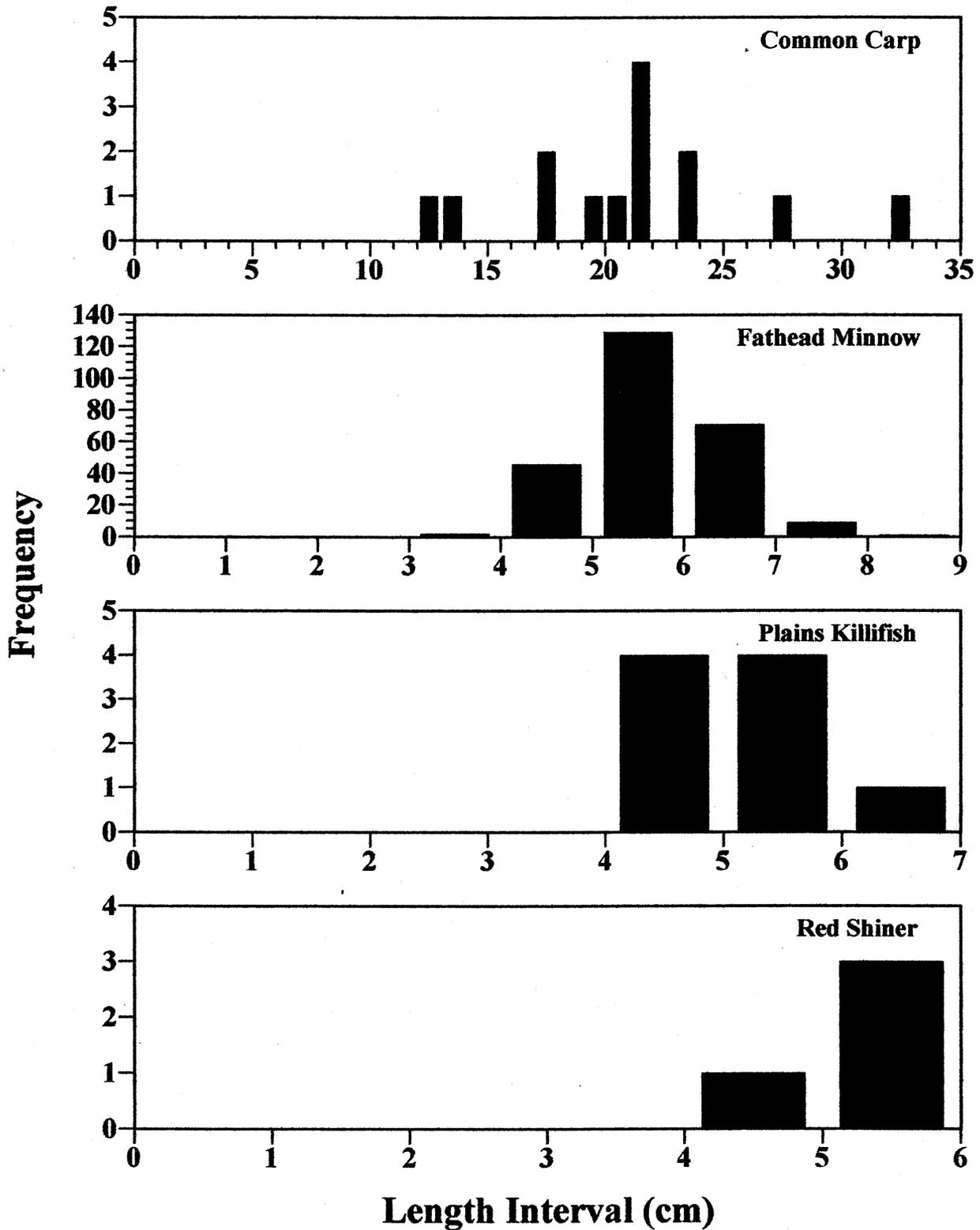


Figure 97-2-3. Length frequency plot for common exotic species captured during AGFD Fish Monitoring Trip 97-2 in the Little Colorado River, Grand Canyon, Arizona, 19 - 27 April 1997.

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Table 97-2-4. Date, location (meters upstream from mouth of LCR), total length, weight and sex at capture of all fish implanted with a PIT-tag during AGFD Fish Monitoring Trip 97-2 in the Little Colorado River, Grand Canyon, Arizona, 19 - 27 April 1997.

Study	PIT-tag Number	Date	Location	Total Length (mm)	Weight (g)	Sex
<u>Bluehead Sucker</u>						
2972002	1F1B097964	23 APR 97	119	285	.	
2972003	1F7B02085C	22 APR 97	137	184	63.1	
2972003	1F7B617114	22 APR 97	137	200	71.0	
2972007	1F7A796905	20 APR 97	410	221	100.0	
2972007	1F78276062	21 APR 97	410	214	113.0	
2972008	1F7A353002	21 APR 97	420	260	162.0	
2972009	1F7A2A5A63	20 APR 97	430	296	274.0	
2972010	1F781B6866	22 APR 97	435	250	.	
2972020	1F7B54286A	21 APR 97	1115	250	160.0	F
2972020	1F7B0B7566	21 APR 97	1115	187	69.1	
2972020	1F7B514253	22 APR 97	1115	193	68.1	
2972020	1F5C213B29	22 APR 97	1115	216	.	M
2972020	1F7829417F	23 APR 97	1115	185	.	
<u>Flannelmouth Sucker</u>						
2972004	1F7B4E0117	21 APR 97	250	315	265.0	
2972006	1F7A75571B	21 APR 97	380	465	950.0	
2972006	1F7B5B6526	22 APR 97	380	430	.	
2972007	1F78331A1C	19 APR 97	410	404	576.0	
2972007	1F777F0863	20 APR 97	410	268	180.0	
2972007	1F7B4C6832	20 APR 97	410	372	465.0	
2972008	1F78262F14	25 APR 97	420	240	.	
2972009	1F7B691C61	21 APR 97	430	350	.	
2972009	1F7B5F394E	22 APR 97	430	404	.	
2972009	1F7A2E5366	23 APR 97	430	459	.	
2972009	1F783E5E4D	25 APR 97	430	436	.	
2972010	1F7B6E2553	23 APR 97	435	417	.	M
2972020	1F78135D79	22 APR 97	1115	463	.	
2972009	1F7B165A76	26 APR 97	430	510	.	

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Table 97-2-4 (continued).

Study	PIT-tag Number	Date	Location	Total Length (mm)	Weight (g)	Sex
<u>Flannelmouth Sucker (continued)</u>						
2972020	1F7A2C0E2D	23 APR 97	1115	259	.	
2972020	1F77743343	26 APR 97	1115	317	.	
2972020	1F78354F65	26 APR 97	1115	346	.	
<u>Humpback Chub</u>						
2972004	1F7B120153	19 APR 97	250	154	61.6	
2972004	1F78095709	22 APR 97	250	208	71.0	
2972005	1F7B026D77	19 APR 97	350	217	97.8	
2972007	1F7B013134	25 APR 97	410	279	.	
2972009	1F78307B3E	19 APR 97	430	152	35.0	M
2972010	1F78064B18	19 APR 97	435	225	112.5	
2972019	1F7A3D4F5B	20 APR 97	1110	180	59.2	
2972020	1F78413573	21 APR 97	1115	187	62.0	
2972020	1F783B7F2F	22 APR 97	1115	244	118.0	

Table 97-2-5. Date, location (meters upstream from mouth of LCR), total length, weight and sex of all recaptured fish and the date, location, total length and weight at each of their previous captures (if known) during AGFD Fish Monitoring Trip 97-2 in the Little Colorado River, Grand Canyon, Arizona, 19 - 27 April 1997.

Species/ PIT-tag Number	Recapture					Previous Capture				
	Date	Location	Total Length (mm)	Weight (g)	Sex	Date	Location	Total Length (mm)	Weight (g)	Mark/Recapture
<u>Flannelmouth Sucker</u>										
1F107A1344	19 APR 97	100	452	634.0	M	18 OCT 93	LCR	390	554	M
7F7B073742	19 APR 97	100	566	1444.0		16 APR 94	LCR	553	1532	M
1F7A36052C	24 APR 97	119	443	.		23 JUN 95	KAN	332	318	M
7F7B07152A	25 APR 97	380	450	.						
1F777F0863	21 APR 97	410	266	.						
7F7D7F374F	21 APR 97	410	321	.		09 DEC 94	LCR	181	70	M
7F7F295369	20 APR 97	430	475	1082.0		14 OCT 92	LCR	445	896	M
1F7B116C69	25 APR 97	430	432	.						
1F7A7D0F5B	24 APR 97	1115	364	.						
<u>Humpback Chub</u>										
7F7F0E1740	18 APR 97	100	262	135.0	M	13 MAY 93	LCR	209	94	M
7F7D22695E	23 APR 97	100	330	.		06 JUL 91	LCR	305	200	M
						11 MAY 93	LCR	230	318	R
7F7F267523	23 APR 97	100	372	.		08 MAR 93	LCR	365	526	M
1F780A1A45	21 APR 97	119	169	.						
7F7D180075	23 APR 97	119	286	.		03 JUN 91	LCR	155	28	M

Table 97-2-5 (continued).

Species/ PIT-tag Number	Date	Recapture			Sex	Date	Location	Previous Capture		
		Location	Total Length (mm)	Weight (g)				Total Length (mm)	Weight (g)	Mark/Recapture
<u>Humpback Chub (continued)</u>										
IF78307B3E	19 APR 97	435	154	35.7						
Floy Tag Recapture, New PIT-tag Number:										
IF787C105D	21 APR 97	435	372	505.0			LCR	296	210	M
7F7D4B6759	24 APR 97	1110	336	.			LCR	299		M
IF7B0D2831	26 APR 97	1110	223	87.8						
IF78307B3E	21 APR 97	1115	154	35.0						
7F7F334532	21 APR 97	1115	396	.						
IF7B0D2831	22 APR 97	1115	220	81.5						
IF7B026D77	22 APR 97	1115	221	97.3						
7F7F331B17	26 APR 97	1115	363	.						
							LCR	364	435	

Trip 97-3: 19 April - 8 May 1997

Report Prepared by: Timothy L. Hoffnagle

Personnel

Tim Hoffnagle; AGFD, Research Branch, Flagstaff

Jodi Niccum; AGFD, Region II, Flagstaff

General Observations

Upon the arrival of the crew on 28 April, the Little Colorado River (LCR) was flowing at near base flow and was warm, but slightly turbid. Water clarity steadily improved throughout the sampling period and the catch of small fish appeared to increase with the increasing water clarity. Nine different species were captured, including all four native species still found in the lower LCR (Table 97-1). Exotic fishes comprised three quarters of the fish captured.

Results

Water Quality

Water temperatures ranged from 17.3 - 25°C (Figure 97-3-1). Mean water temperature was 21°C. The daily mean water temperature ranged from 19.5 - 22.6°C, being lower during the first half of the trip and increasing at the end of the trip

Turbidity steadily decreased during this trip from a high of 66 NTU to a low of 8.4 NTU (Figure 97-3-1). Mean turbidity for the trip was 22.6 NTU and there were three days (4 - 6 May) when mean turbidity was <10 NTU.

Catch Information

During LCR Trip 97-3, a total of 2879.77 hours of effort were expended by twelve hoop nets, 709.73 hours by three mini-hoop nets and 1497.95 hours by six minnow traps (Table 97-3-1). A total of 1370 fish were captured (Table 97-3-2). Nine species of fish were captured: all four extant native species and five exotic species. Native species comprised only 27.6% of the total catch and exotic species comprised 72.4%.

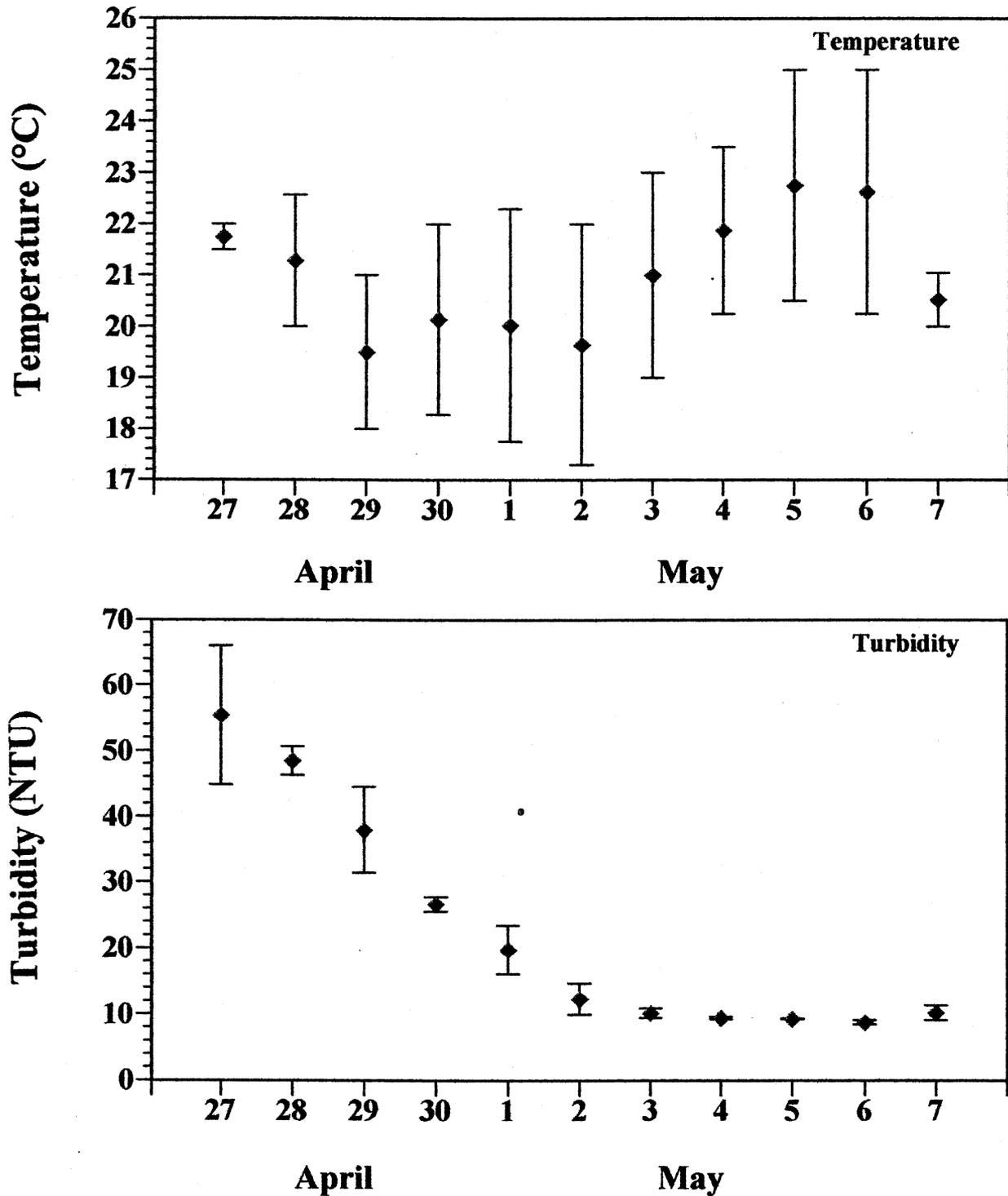


Figure 97-3-1. Mean and range of temperature and turbidity during AGFD Fish Monitoring Trip 97-3 in the Little Colorado River, Grand Canyon, Arizona, 28 April - 8 May 1997.

Table 97-3-1. Total effort and number of sites for each type of fish collection gear used during AGFD Fish Monitoring Trip 97-3 in the Little Colorado River, Grand Canyon, Arizona, 28 April - 8 May 1997.

Gear Type	Total Effort (hours)	Number of Sites
Hoop Net	2879.77	12
Mini-hoop Net	709.73	3
Minnow Trap	1497.95	6

Speckled dace was the most abundant native species and the second most common species captured (18.5%; Table 97-3-2). The remaining native species were relatively rare, comprising only 9% of the catch, combined and each species comprising <4% of the total catch: humpback chub comprised 3.9%, flannelmouth sucker 3.3% and bluehead sucker 1.8%.

Fathead minnow was the most common species captured, comprising 47.1% of the total catch (Table 97-3-2) as well as the most abundant species sampled in all three gear types. Plains killifish (17.4%) was also frequently captured, particularly in pools among boulders, but also in the relatively fast and turbulent water immediately below a travertine dam. Red shiner (6.5%) was another commonly captured exotic species. Common carp (1.2%) and channel catfish were also sampled, but uncommon.

Mean catch-per-unit-effort (CPUE) varied with species and gear type (Table 97-3-2). Minnow traps had the highest mean catch rate (3.572 fish / 12 hour set), largely from those set in pools among large boulders, where fathead minnow and plains killifish were commonly caught. Hoop nets were nearly as effective as minnow traps, catching 3.500 fish / 12 hours. However, hoop net catch varied greatly, with some nets rarely catching fish and others reliably catching tens of fish, probably due to the location of the set. Mini-hoop nets were one third as effective as the other gears with a mean CPUE of 1.386 fish / 12 hour set. The highest mean CPUE for any species was 1.674 fathead minnows / 12 hours in minnow traps. Catches of fathead minnows in hoop nets (1.631 fish / 12 hours) and plains killifish in minnow traps (1.554 fish / 12 hours) were also high. Speckled dace were captured at a rate of 0.970 fish / 12 hours in hoop nets. Humpback chub were most effectively captured using hoop nets (0.188 fish / 12 hours).

Table 97-3-2. Total number of each species captured (N), the composition of the catch (%) and mean catch-per-unit-effort (CPUE) in each gear type and in all gears combined during AGFD Fish Monitoring Trip 97-3 in the Little Colorado River, Grand Canyon, Arizona, 28 April - 8 May 1997.

Species	Hoop Nets		Mini-hoop Nets		Minnow Traps		Total	
	N	CPUE %	N	CPUE %	N	CPUE %	N	%
<u>Native Species</u>								
Bluehead Sucker	20	0.083	4	0.067	1	0.008	25	1.8
Flannelmouth Sucker	43	0.180	2	0.033	0	0.000	45	3.3
Humpback chub	45	0.188	7	0.117	2	0.016	54	3.9
Speckled Dace	<u>234</u>	<u>0.970</u>	<u>12</u>	<u>0.200</u>	<u>8</u>	<u>0.064</u>	<u>254</u>	<u>18.5</u>
Total Natives	342	1.420	25	0.417	11	0.087	378	27.6
<u>Exotic Species</u>								
Channel Catfish	1	0.004	0	0.000	0	0.000	1	0.1
Common carp	13	0.054	3	0.050	1	0.008	17	1.2
Fathead Minnow	391	1.631	42	0.701	212	1.674	645	47.1
Plains Killifish	44	0.182	4	0.067	191	1.554	239	17.4
Red Shiner	<u>49</u>	<u>0.205</u>	<u>9</u>	<u>0.150</u>	<u>31</u>	<u>0.249</u>	<u>89</u>	<u>6.5</u>
Total Exotics	<u>499</u>	<u>2.080</u>	<u>58</u>	<u>0.969</u>	<u>435</u>	<u>3.485</u>	<u>992</u>	<u>72.4</u>
Total	841	3.500	83	1.386	446	3.572	1370	

Table 97-3-3. Mean, minimum and maximum length (mm) and weight (g) of each species of fish captured during AGFD Fish Monitoring Trip 97-3 in the Little Colorado River, Grand Canyon, Arizona, 28 April - 8 May 1997.

Species	Total Length (mm)			Weight (g)		
	Mean	Minimum	Maximum	Mean	Minimum	Maximum
<u>Native Species</u>						
Bluehead Sucker	140.9	95	249	30.50	7.1	162.0
Flannelmouth Sucker	227.0	11	531	236.77	5.0	1321.0
Humpback chub	132.9	36	416	35.48	0.4	539.0
Speckled Dace	77.2	45	111	4.50	0.9	51.0
<u>Exotic Species</u>						
Channel Catfish	84.0	84	84	4.80	4.8	4.8
Common carp	179.2	77	270	84.44	6.8	223.0
Fathead Minnow	55.0	30	79	1.80	0.3	5.2
Plains Killifish	44.5	27	63	0.97	0.1	3.2
Red Shiner	46.4	34	66	1.12	0.4	2.8

Length and Weight of Fishes

The size range of fishes captured indicates that nearly all fish captured were at least one year of age (Table 97-3-3). Probable exceptions are an 11 mm flannelmouth sucker and a 36 mm humpback chub. Adults of all native species were captured, but in low numbers.

Length-frequency graphs (Figures 97-3-2 and 97-3-3) show the size classes of the fish captured and age classes can be discerned for some species. Most bluehead suckers captured (90 - 160 mm) were sub-adults, probably 2 - 3 years of age. The 11 mm flannelmouth sucker was certainly a young-of-the-year (YOY) fish. Otherwise, the flannelmouth sucker catch was comprised of a few fish of each age class. The humpback chub catch was comprised mostly of age 1 fish (approximately 50 - 100 mm), with a possible YOY (36 mm) and probably some age 2 fish (approximately 100 - 160 mm). Most of the speckled dace were one year of age (40 - 90 mm) with the possibility of a few age 2 fish (90 - 120 mm) still present. All of the fathead minnow, plains killifish and red shiners probably belong to the age 1 class.

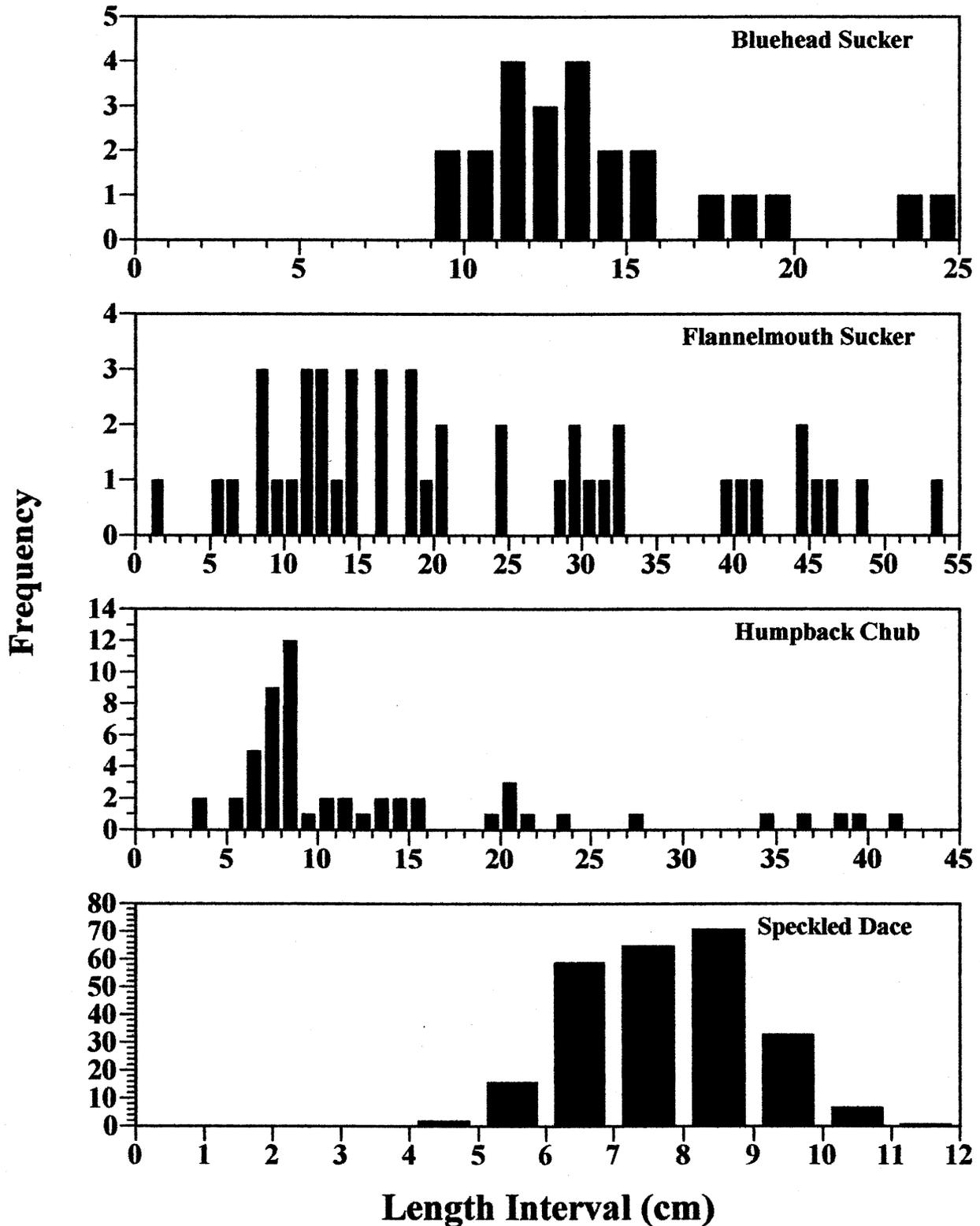


Figure 97-3-2. Length frequency plot for native species captured during AGFD Fish Monitoring Trip 97-3 in the Little Colorado River, Grand Canyon, Arizona, 28 April - 8 May 1997.

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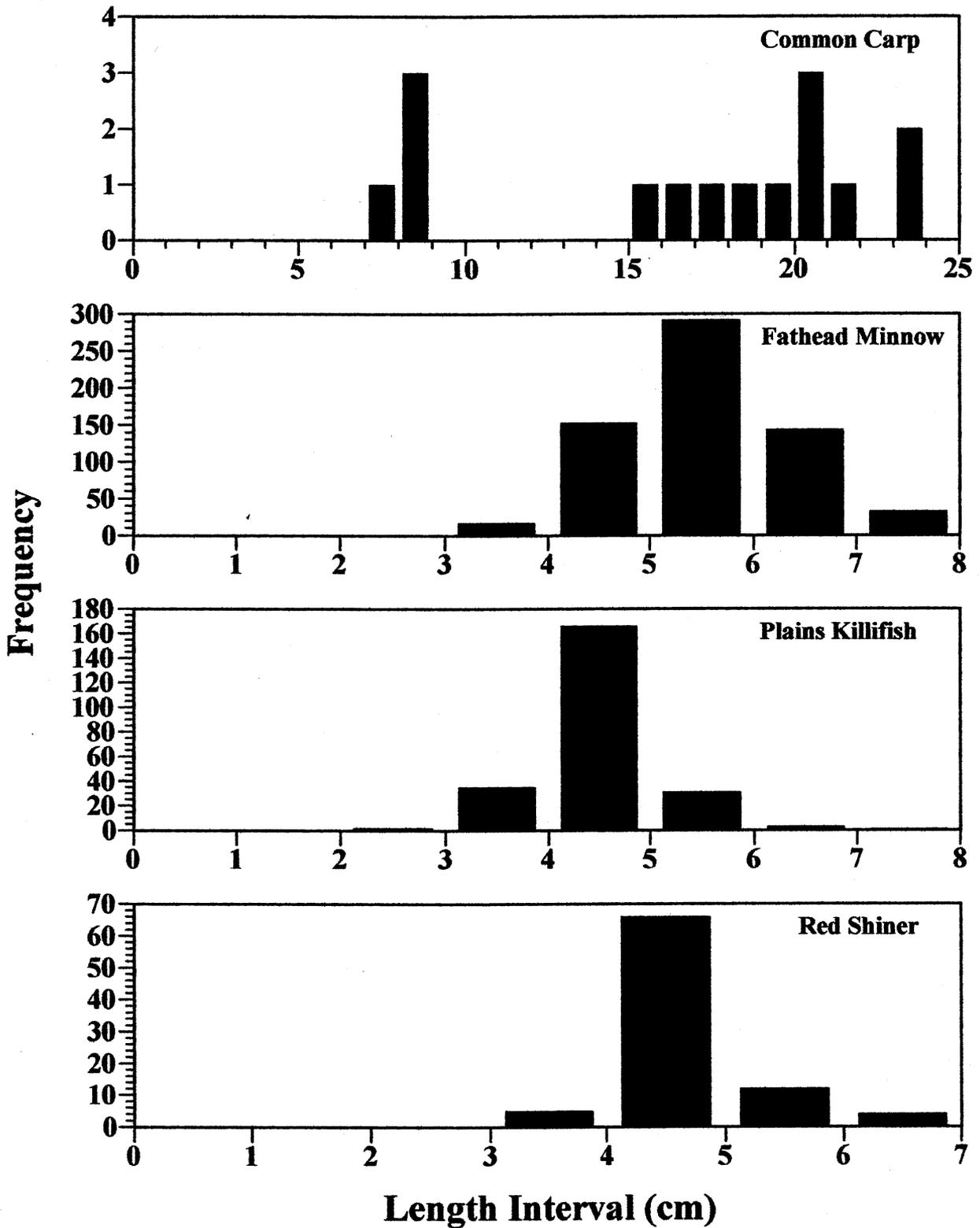


Figure 97-3-3. Length frequency plot for common exotic species captured during AGFD Fish Monitoring Trip 97-3 in the Little Colorado River, Grand Canyon, Arizona, 28 April - 8 May 1997.

Table 97-3-4. Number of adult fish not in obvious spawning condition and the number and percentage of adult fish in obvious spawning condition during AGFD Fish Monitoring Trip 97-3 in the Little Colorado River, Grand Canyon, Arizona, 28 April - 8 May 1997.

Species	Spawn			Spawning Condition			
	No	Yes	% Yes	Gravid (♀)	Ripe (♂)	Spent (♀)	Tuberculate
Bluehead Sucker	4	3	42.9	0	3	0	0
Flannelmouth Sucker	16	0	0	0	0	0	0
Humpback chub	8	3	27.3	0	2	1	0
Fathead Minnow	551	71	11.4	2	8	1	60

Maturity of Fishes

Some bluehead sucker, humpback chub and many fathead minnow displayed signs of spawning condition (Table 97-3-4; speckled dace were also showing spawning coloration, however, this was not consistently noted, so no number are reported here). Data from the large native species indicates that the spawning season had ended or was nearly so. Only one spent female humpback chub was captured and no captured females of any species were gravid. Three bluehead suckers and two humpback chubs were ripe males. No flannelmouth suckers showed any signs of spawning condition. The spawning season for fathead minnow was beginning, with 60 tuberculate males, eight ripe males, two gravid females and one spent female being captured. Additionally, many large fathead minnows appeared to be gravid females, but since no gametes were expressible, they were not noted as such.

Mark/Recapture of Native Fishes

Forty-eight native fishes ≥ 150 mm were captured and checked for the presence of a PIT-tag. Seven bluehead suckers captured were large enough to be implanted with a PIT-tag, but none were recaptures and all were subsequently marked at this capture (Table 97-3-5). Twenty-seven flannelmouth suckers ≥ 150 mm were captured. We implanted PIT-tags into 23 of them and the remaining four were recaptures (Table 97-3-6). Fourteen humpback chubs ≥ 150 mm were captured: eight were recaptures and we tagged the remaining six.

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Table 97-3-5. Date, location (meters upstream from mouth of LCR), total length, weight and sex at capture of all fish implanted with a PIT-tag during AGFD Fish Monitoring Trip 97-3 in the Little Colorado River, Grand Canyon, Arizona, 28 April - 8 May 1997.

<u>Species/Study</u>	<u>PIT-tag Number</u>	<u>Date</u>	<u>Location</u>	<u>Total Length (mm)</u>	<u>Weight (g)</u>	<u>Sex</u>	
<u>Bluehead Sucker</u>							
	2973001	1F7B56652B	3 MAY 97	100	235	124.0	M
	2973004	1F7B4C6337	1 MAY 97	250	155	28.4	
	2973005	1F7B4C7C1E	1 MAY 97	350	191	62.0	M
	2973006	1F78056C78	4 MAY 97	380	185	43.0	
	2973010	1F7828053C	2 MAY 97	435	178	49.1	
	2973020	1F7A3A220A	30 APR 97	1115	249	162.0	F
	2973020	1F78393779	3 MAY 97	1115	151	26.6	
<u>Flannelmouth Sucker</u>							
	2973001	1F7A2B2418	30 APR 97	100	443	761.0	
	2973002	1F78165102	3 MAY 97	119	198	64.0	
	2973002	1F7B6B3F3C	4 MAY 97	119	462	898.0	
	2973002	1F7A761061	4 MAY 97	119	489	1012.0	
	2973005	1F7834082D	6 MAY 97	350	180	52.2	
	2973006	1F783C0825	3 MAY 97	380	444	783.0	
	2973007	1F783B5B53	2 MAY 97	410	189	48.5	
	2973008	1F78342411	29 APR 97	420	329	293.0	
	2973008	1F7B093528	1 MAY 97	420	292	197.0	
	2973009	1F78272D15	1 MAY 97	430	169	42.5	
	2973009	1F7B5C6327	1 MAY 97	430	282	180.0	
	2973009	1F78392B05	3 MAY 97	430	304	216.0	
	2973009	1F783D5656	3 MAY 97	430	419	955.0	
	2973009	1F78383B76	6 MAY 97	430	403	563.0	
	2973014	1F7A1D1139	5 MAY 97	535	200	59.4	
	2973020	1F782B5E60	28 APR 97	1115	182	53.0	
	2973020	1F79014A1D	28 APR 97	1115	319	303.0	
	2973020	1F7A36131E	29 APR 97	1115	291	219.0	
	2973020	1F7A35674B	29 APR 97	1115	459	926.0	
	2973020	1F777A6709	30 APR 97	1115	167	38.0	

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Table 97-3-5 (continued).

Species/Study	PIT-tag Number	Date	Location	Total Length (mm)	Weight (g)	Sex
<u>Flannelmouth Sucker (continued)</u>						
	2973020	1F7A35141E	29 APR 97	1115	248	129.0
	2973020	1F7A36131E	29 APR 97	1115	291	219.0
	2973020	1F7A35674B	29 APR 97	1115	459	926.0
	2973020	1F777A6709	30 APR 97	1115	167	38.0
	2973020	1F78710573	3 MAY 97	1115	165	34.5
	2973020	1F777F7B5B	6 MAY 97	1115	202	67.3
<u>Humpback Chub</u>						
	2973001	1F7B0B1645	3 MAY 97	100	209	74.0
	2973002	1F7A296F4F	27 APR 97	119	391	
	2973003	1F7B187559	20 APR 97	137	154	30.7
	2973007	1F7B4B7922	1 MAY 97	410	150	30.0
	2973008	1F7A202614	28 APR 97	420	204	81.0 M
	2973014	1F78403475	3 MAY 97	535	206	51.5

Lernaea cyprinacea Infections

The external parasitic copepod *Lernaea cyprinacea* most commonly infected humpback chub (Table 97-3-7). Of 54 humpback chub captured, 15 were infected. The mean infection rate was 4.1 *Lernaea* per infected chub and ranged from 1 - 20. Based on this data, the mean population infection rate was 1.1 *Lernaea* per humpback chub in the LCR. Five other species were infected with this parasite, including all three other native species, fathead minnow and plains killifish. However, infection rates on these fishes were low with only one *Lernaea* infecting each infected fish.

Table 97-3-6. Date, location (meters upstream from mouth of LCR), total length, weight and sex of all recaptured fish and the date, location, total length and weight at each of their previous captures (if known) during AGFD Fish Monitoring Trip 97-3 in the Little Colorado River, Grand Canyon, Arizona, 28 April - 8 May 1997.

Species/ PIT-tag Number	Date	Location	Total Length (mm)	Weight (g)	Sex	Date	Location	Total Length (mm)	Weight (g)	Mark/ Recapture
<u>Flannelmouth Sucker</u>										
7F7F296362	3 MAY 97	430	531	1321.0						
7F7B1A0540	6 MAY 97	430	397	541.0						
1F7B493568	28 APR 97	1115	321	305.0						
1F780F7367	30 APR 97	1115	246	128.0						
<u>Humpback Chub</u>										
1F782A2D12	2 MAY 97	100	196	58.1						
1F78032541	1 MAY 97	119	279	183.0	F					
7F7E431D0D	1 MAY 97	119	416	539.0	F	21 APR 92	LCR	393	542	M
1F7B572768	3 MAY 97	119	219	82.0	M					
1F7779343D	4 MAY 97	430	343	310.0						
1F20462655	5 MAY 97	430	236	100.1	M	10 AUG 93	LCR	164	24	M
7F7D075E55	27 APR 97	435	360		F	12 MAR 92	63.	337	438	R
7F7D076138	27 APR 97	1115	385		F	12 JUN 91	60.	376	453	R

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Table 97-3-7. Number and percent of fish of each species infected with *Lernaea cyprinacea*, mean, minimum and maximum number of *Lernaea* per infected fish and mean number of *Lernaea* per sampled fish during AGFD Fish Monitoring Trip 97-3 in the Little Colorado River, Grand Canyon, Arizona, 28 April - 8 May 1997.

Species	Total Sample	Number Infected	Percent Infected	Number of <i>Lernaea</i> / Infected Fish			Mean Number of <i>Lernaea</i> / Fish Captured
				Mean	Min.	Max.	
<u>Native Species</u>							
Bluehead Sucker	25	1	4.0	1.0	1	1	0.040
Flannelmouth Sucker	45	1	2.2	1.0	1	1	0.022
Humpback Chub	54	15	27.8	4.1	1	20	1.130
Speckled Dace	254	1	0.4	1.0	1	1	0.004
<u>Exotic Species</u>							
Channel Catfish	1	0	0.0				0
Common Carp	17	0	0.0				0
Fathead Minnow	645	1	0.2	1.0	1	1	0.002
Plains Killifish	239	2	0.8	1.0	1	1	0.008
Red Shiner	89	0	0.0				0

Trip 97-4: 8 - 16 May 1997

Report Prepared by: David W. Speas

Personnel

Dave Speas; AGFD, Research Branch, Flagstaff

Dennis Stone; U. S. Fish and Wildlife Service, Flagstaff

General Observations

The fourth and final Little Colorado River (LCR) monitoring crew entered the LCR on 8 May and left on 16 May 1997. The LCR was at base flow (~235 cfs) and the water was clear. Catch of native fish was low compared to that of exotic fish. We observed male fathead minnows guarding nests beneath cobbles near Boulder Camp (approximately 2.2 km above the mouth of the LCR), and common carp of several size classes were abundant throughout the lower 4-5 km of the LCR.

Results

Water Quality

Mean water temperature was 21.5° C and ranged from 19.0 - 24.0° C (Figure 97-4-1). Mean daily water temperature varied little throughout the trip (21 - 22° C).

Turbidity was highest on the first day of the trip (10.4 NTU) but decreased and stabilized at approximately 4.0 NTU from 10 - 15 May 1997 (Figure 97-4-1). Mean turbidity throughout the trip was 5.0 NTU and daily means ranged from 2.5 to 10.3 NTU.

Catch Information

A total of 717 fish representing nine species was caught over a period of eight days. A total of 422 fish was captured during daytime sets, while 295 were captured during overnight sets. Total effort expended was 2175.57 hours (h) for 12 hoop nets, 545.70 h for three mini-hoop nets, and 1091.61 h for six minnow traps (Table 97-4-1). Native species comprised 18.1% of the catch and exotic species comprised the remaining 81.9%.

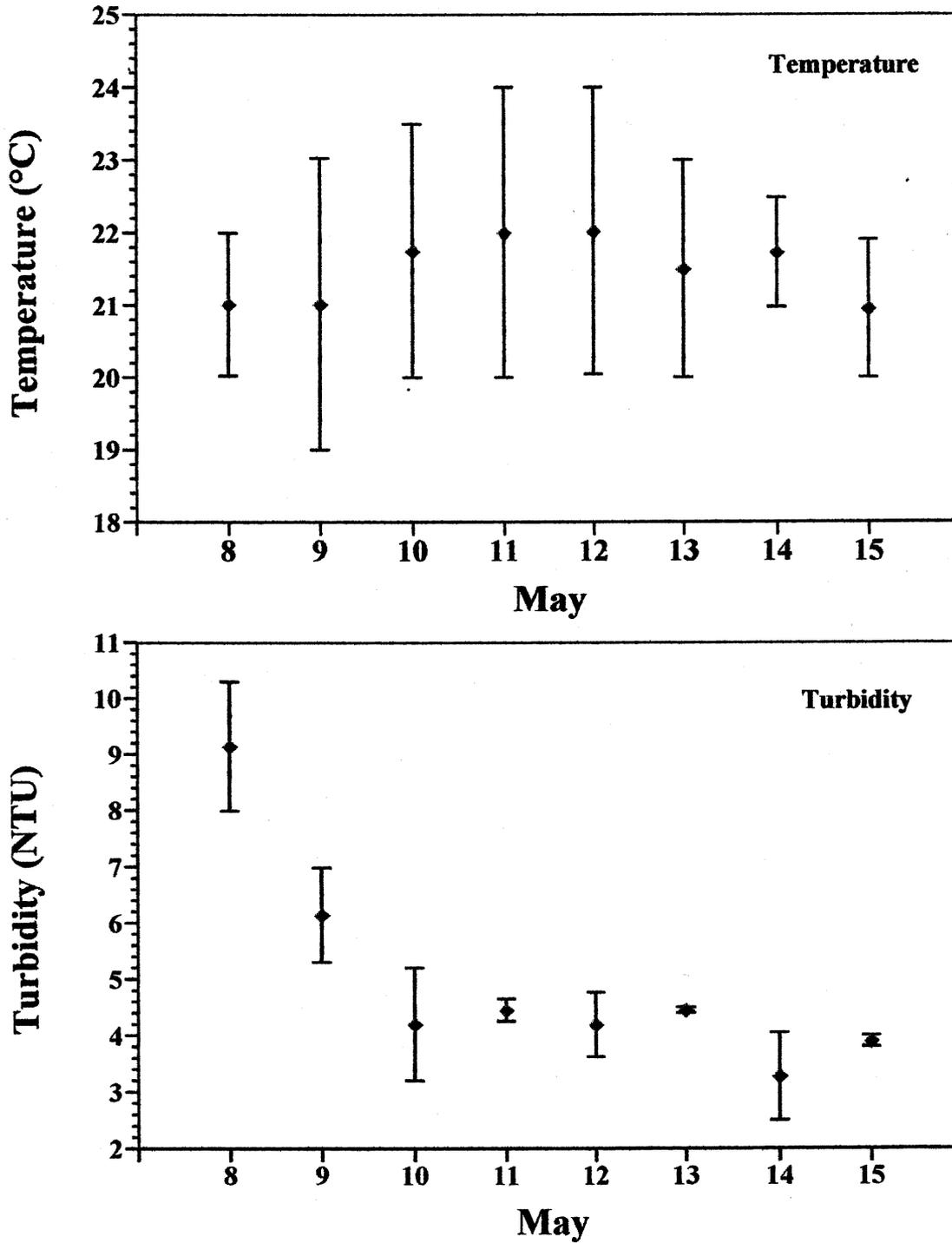


Figure 97-4-1. Mean and range of temperature and turbidity during AGFD Fish Monitoring Trip 97-4 in the Little Colorado River, Grand Canyon, Arizona, 8-15 May 1997.

Table 97-4-1. Total effort and number of sites for each type of fish collection gear used during AGFD Fish Monitoring Trip 97-4 in the Little Colorado River, Grand Canyon, Arizona, 8-15 May 1997.

Gear Type	Total Effort (hours)	Number of Sites
Hoop Net	2175.57	12
Mini-hoop Net	545.70	3
Minnow Trap	1091.61	6

Speckled dace was the most abundant native fish and the third most common fish captured overall, comprising 12.7% of the total catch (Table 97-4-2). Speckled dace was also the second most frequently captured fish in hoop nets. Other native fish species were relatively uncommon. Of the total catch, humpback chub comprised 2.1%, flannelmouth sucker 2.2% and bluehead sucker 1.1%.

Plains killifish was the most frequently captured exotic species, comprising 41.7% of the total catch, and was most the most frequently captured species in minnow traps (Table 97-4-2). Fathead minnows comprised 32.2 % of the total catch and were the most common exotic species captured in hoop nets and mini-hoop nets. Percentages of common carp, red shiner and channel catfish in the total catch were 4.6%, 3.2% and 0.1%, respectively.

Mean catch-per-unit-effort (CPUE) varied by species, gear type and site (Table 97-4-2). Mean CPUE in minnow traps was 3.480 fish/12 hour set and varied by site from 0.461 to 8.344 fish/12 hour set. Minnow traps consistently captured large numbers of plains killifish and fathead minnow from pool habitats. Mean CPUE of hoop nets was 2.029 fish/12 hour set and varied by site from 0 to 6.538 fish/12 hour set. Total native fish catch rates were greatest at 1115 m, a vegetated run (3.236 fish/12 hour set), and generally decreased toward the mouth of the LCR. Mean CPUE of mini-hoop nets was 0.725 fish/12 hour set and varied by site from 0.066 to 1.450. Catch rates of exotic fish were greatest for plains killifish in minnow traps (2.711 fish/12 hour set). Among native fish, speckled dace were captured at a rate of 0.430 fish/12 hour set in hoop nets.

Table 97-4-2. Total number of each species captured (N), the composition of the catch (%) and mean catch-per-unit-effort (CPUE) in each gear type and in all gears combined during AGFD Fish Monitoring Trip 97-4 in the Little Colorado River, Grand Canyon, Arizona, 8-15 May 1997.

Species	Hoop Nets		Mini-hoop Nets		Minnow Traps		Total	
	N	CPUE %	N	CPUE %	N	CPUE %	N	%
Native Species								
Bluehead Sucker	6	0.033	1	0.022	1	0.011	8	1.1
Flannelmouth Sucker	15	0.083	1	0.022	0	0.000	16	2.2
Humpback Chub	14	0.077	1	0.022	0	0.000	15	2.1
Speckled Dace	<u>78</u>	<u>0.430</u>	<u>4</u>	<u>0.088</u>	<u>9</u>	<u>0.099</u>	<u>91</u>	<u>12.7</u>
Total Natives	113	0.623	7	0.154	10	0.110	130	18.1
Exotic Species								
Channel Catfish	1	0.006	0	0.000	0	0.000	1	0.1
Common Carp	31	0.171	2	0.044	0	0.000	33	4.6
Fathead Minnow	158	0.870	17	0.374	56	0.615	231	32.2
Plains Killifish	47	0.259	6	0.132	246	2.711	299	41.7
Red Shiner	<u>18</u>	<u>0.100</u>	<u>1</u>	<u>0.022</u>	<u>4</u>	<u>0.044</u>	<u>23</u>	<u>3.2</u>
Total Exotics	<u>255</u>	<u>1.406</u>	<u>26</u>	<u>0.571</u>	<u>306</u>	<u>3.370</u>	<u>587</u>	<u>81.9</u>
Total	368	2.029	33	0.725	316	3.480	717	

Size Distribution of Fishes

Bluehead sucker ranged in size from 89-170 mm TL and were probably one to three years of age: no size class was particularly abundant (Figure 97-4-2; Table 97-4-3). While it is notable that two age 0 humpback chub (22-23 mm TL) and a one age 0 (25 mm TL) flannelmouth sucker were captured, the few older fish that were captured varied widely in size. Speckled dace were mostly age-1 (50-90 mm TL), although those fish > 90 mm TL may have been two years of age. At least two and probably three year classes of common carp were present (Figure 97-4-3), while fathead minnow, plains killifish and red shiner were predominantly age 1.

Maturity of Fishes

Most adult humpback chub (71.4%) showed evidence of spawning activity (Table 97-4-4), however these fish were either spent (two males, one female) or ripe males. No gravid female humpback chub were captured. No bluehead or flannelmouth sucker showed evidence of spawning activity. Male fathead minnow were observed guarding nests under rocks near Boulder Camp, and 16.2% of fathead minnows captured were in spawning condition. One captured channel catfish was gravid, and its eggs ranged from approximately 1-3 mm in diameter.

Mark/Recapture of Native Fishes

Twenty native fish ≥ 150 mm were captured and checked for PIT-tags. Four of seven humpback chub were recaptured, while only two of ten flannelmouth sucker were recaptured and no bluehead sucker were recaptured (Tables 97-4-5 and 97-4-6). Original data for the two recaptured flannelmouth sucker are currently unavailable. Three humpback chub, eight flannelmouth sucker and three bluehead sucker ≥ 150 mm TL were implanted with PIT-tags during Trip 97-4.

Lernaea cyprinacea Infections

The parasitic copepod *Lernaea* sp. was found only on humpback chub during Trip 97-4 (Table 97-4-7). Two of 15 (13.3%) humpback chub were infected by *Lernaea*. Mean infection rate was 1.5 *Lernaea* / infected humpback chub.

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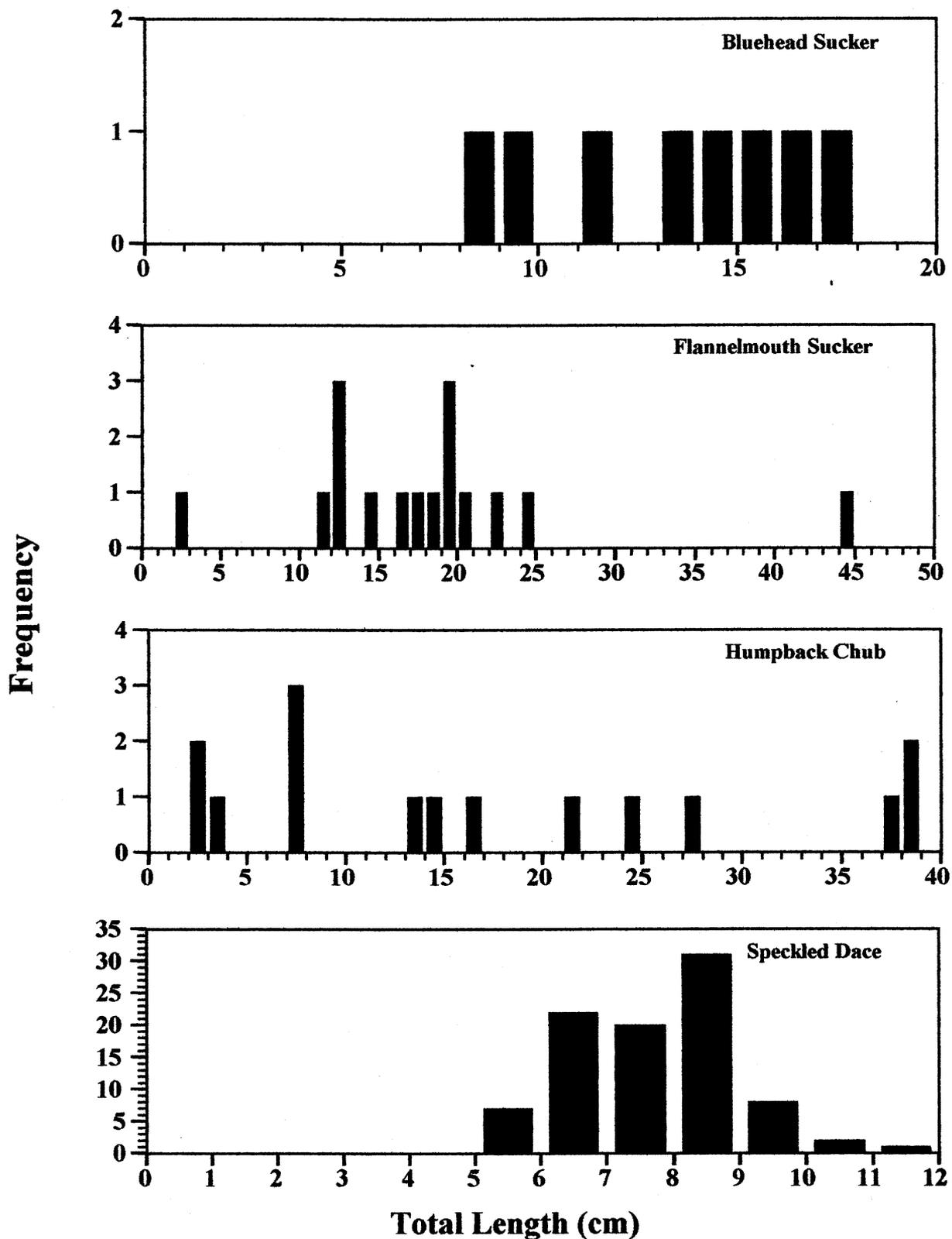


Figure 97-4-2. Length frequencies of native fish captured during AGFD monitoring Trip 97-4 in the Little Colorado River, Grand Canyon, AZ, 8-15 April 1997.

Table 97-4-3. Mean, minimum and maximum length (mm) and weight (g) of each species of fish captured during AGFD Fish Monitoring Trip 97-4 in the Little Colorado River, Grand Canyon, Arizona, 8-15 May 1997.

Species	Total Length (mm)			Weight (g)		
	Mean	Minimum	Maximum	Mean	Minimum	Maximum
<u>Native Species</u>						
Bluehead Sucker	132.8	89	170	22.80	5.7	53.0
Flannelmouth Sucker	181.8	25	448	101.21	12.6	881.0
Humpback Chub	175.2	22	387	141.44	3.0	535.0
Speckled Dace	76.6	52	116	4.36	1.3	12.7
<u>Exotic Species</u>						
Channel Catfish	359.0	359	359	500.00	500.00	500.00
Common Carp	161.5	85	266	68.51	8.1	244.0
Fathead Minnow	54.4	39	71	1.86	0.5	3.9
Plains Killifish	44.5	32	63	1.00	0.1	3.0
Red Shiner	47.9	35	65	1.24	0.3	2.9

Table 97-4-4. Number of adult fish not in obvious spawning condition and the number and percentage of adult fish in obvious spawning condition during AGFD Fish Monitoring Trip 97-4 in the Little Colorado River, Grand Canyon, Arizona, 8-15 May 1997.

Species	Spawn			Spawning Condition				
	No	Yes	% Yes	Gravid(♀)	Ripe (♂)	Spent(♀)	Spent (♂)	Tuberculat
Bluehead Sucker	3	0	0.0	0	0	0	0	0
Flannelmouth Sucker	1	0	0.0	0	0	0	0	0
Humpback Chub	2	5	71.4	0	2	1	2	0
Fathead Minnow	191	37	16.2	16	0	0	0	21
Plains Killifish	207	7	3.3	6	1	0	0	0
Channel Catfish	0	1	100.0	1	0	0	0	0

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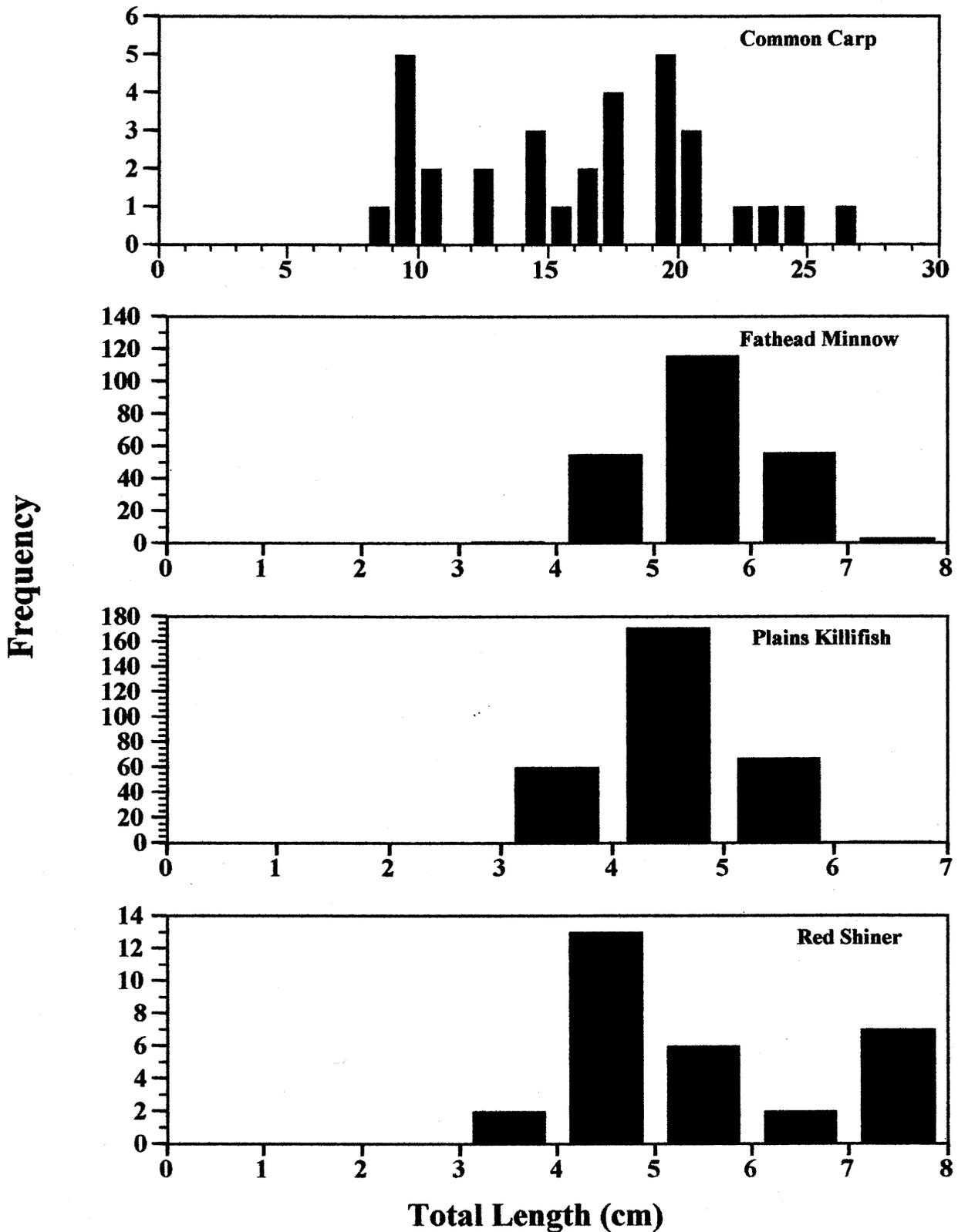


Figure 97-4-3. Length frequencies of common nonnative fish captured during AGFD monitoring Trip 97-4 in the Little Colorado River, Grand Canyon, AZ, 8-15 May 1997.

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Table 97-4-5. Date, location (meters upstream from mouth of LCR), total length, weight and sex at capture of all fish implanted with a PIT-tag during AGFD Fish Monitoring Trip 97-4 in the Little Colorado River, Grand Canyon, Arizona, 8-15 May 1997.

<u>Species/Study</u>	<u>PIT-tag Number</u>	<u>Date</u>	<u>Location</u>	<u>Total Length (mm)</u>	<u>Weight (g)</u>	<u>Sex</u>
<u>Bluehead Sucker</u>						
2974002	1F78424166	13 MAY 97	119	173	53.0	M
2974007	1F7B09312C	8 MAY 97	410	167	37.4	
2974020	1F7B65631E	13 MAY 97	1115	155	28.0	F
<u>Flannelmouth Sucker</u>						
2974001	1F7B060E52	14 MAY 97	100	187	45.6	
2974001	1F78385859	13 MAY 97	100	166	31.5	F
2974002	1F78022641	12 MAY 97	119	209	90.0	F
2974005	1F78307544	7 MAY 97	350	195	49.6	
2974005	1F7A1C5675	7 MAY 97	350	225	83.6	
2974009	1F7B57533C	9 MAY 97	430	190	52.0	F
2974020	1F78400425	7 MAY 97	1115	249	115.0	
2974020	1F7B653F42	12 MAY 97	1115	174	34.0	F
<u>Humpback Chub</u>						
2974001	1F7B062F31	12 MAY 97	100	249	141.0	M
2974009	1F78334076	9 MAY 97	430	213	80.0	M
2974020	1F7A706A0D	8 MAY 97	1115	163	30.0	

Table 97-4-6. Date, location (meters upstream from mouth of LCR), total length, weight and sex of all recaptured fish and the date, location, total length and weight at each of their previous captures (if known) during AGFD Fish Monitoring Trip 97-4 in the Little Colorado River, Grand Canyon, Arizona, 8-15 May 1997.

Species/ PIT-tag Number	Date	Location	Total Length (mm)	Weight (g)	Sex	Date	Location	Total Length (mm)	Weight (g)	Mark/ Recapture
<u>Flannelmouth Sucker</u>										
1F465E5596	8 MAY 97	119	448	881.0						
1F783B5B53	10 MAY 97	1115	193	50.0						
<u>Humpback Chub</u>										
7F7D287C46	9 MAY 97	100	371	396.0	F	21 APR 92	LCR	363	404	M
7F7F485A3F	9 MAY 97	350	380	417.0	M	21 APR 92	LCR	362	342	M
7F7F48010A	8 MAY 97	1115	387	535.0	M	3 MAR 93	LCR	386	650	M
7F7F484877	13 MAY 97	1115	274	178.0	M	16 JUN 92	LCR	199	60	M

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Table 97-4-7. Number and percent of fish of each species infected with *Lernaea cyprinacea*, mean, minimum and maximum number of *Lernaea* per infected fish and mean number of *Lernaea* per sampled fish during AGFD Fish Monitoring Trip 97-4 in the Little Colorado River, Grand Canyon, Arizona, 8-15 May 1997.

Species	Total Sample	Number Infected	Percent Infected	Number of <i>Lernaea</i> / Infected Fish			Mean Number of <i>Lernaea</i> / Fish
				Mean	Min.	Max.	
<u>Native Species</u>							
Bluehead Sucker	8	0	0	0	0	0	0.000
Flannelmouth Sucker	16	0	0	0	0	0	0.000
Humpback Chub	15	2	13.3	1.5	1	2	0.200
Speckled Dace	0	0	0	0	0	0	0.000
<u>Exotic Species</u>							
Channel Catfish	1	0	0	0	0	0	0.000
Common Carp	33	0	0	0	0	0	0.000
Fathead Minnow	231	0	0	0	0	0	0.000
Plains Killifish	299	0	0	0	0	0	0.000
Red Shiner	23	0	0	0	0	0	0.000

Comments and Recommendations

1 - Catches of fish were lower during this trip than previous years for many species. It appears that we missed the spawning run of humpback chub, flannelmouth sucker and bluehead sucker this year. Apparently, we need to reassess the timing and methodology used for this monitoring. Some suggested modifications to the sampling design and methods are:

- A - Adding wings to hoop nets, which would direct fish into the nets. This should increase the efficiency of this gear, if the wings can be set effectively. Other modifications to the hoop nets may also be advisable. Changing the shape and/or dimensions of the mouth may also help. More oblong-shaped mouths or slit-shaped mouths which would reach the bottom of the net may increase catches of benthic fishes such as suckers.
- B - The use of trammel nets should be considered, as they would greatly increase the catch of large fishes. Frequent checking of these nets should reduce or eliminate the danger of mortality to native fishes.
- C - Minnow traps were very effective at catching the small exotic fishes, and their use should be expanded to monitor these fishes which may prey on and/or compete with small native fishes. Also, deploying them in groups of five traps per study number, as is done in the mainstem, would improve our ability to statistically analyze data from minnow traps.
- D - Mini-hoop nets were less effective and the composition of their catch was similar to that of the larger hoop nets. We should consider eliminating the use of mini-hoop nets for future LCR fish monitoring. Effort could be redirected elsewhere, such as towards more large hoop nets.
- E - Modification of the sampling schedule may also be warranted to account for the greatly variable nature of the spawning season of humpback chub. We suspect that chub may generally spawn earlier, but examination of the previous AGFD data and consultation with researchers from ASU and USFWS is warranted. Splitting the sampling period into two sections may work (e.g., two trips in March, before the mainstem trip, and two trips in April/May, after the mainstem trip). The date of the spring mainstem trip is somewhat flexible.

- F - Changing the location of some nets may be warranted. The hoop net at 1115 m above the mouth of the LCR consistently caught native fish and had the highest catch rate of natives. This habitat was a vegetated run (*Phragmites*, *Typha* and others) about a meter in depth. In a similar habitat near Boulder Camp, bluehead sucker and small humpback chub were observed feeding. Vegetated runs may deserve increased effort. Alternatively, the hoop nets set near the mouth of the LCR caught few fish and elimination of some of those sites may be practical.
 - G - The use of larval light traps on the latter trips may be of help in the capture of larval fishes that would aid in the documentation of the time of spawning for each species.
- 2 - Most fish captured during the later trips were small (< 100 mm TL), exotic fish (plains killifish, fathead minnow, red shiner), and many length and weight observations were made on each of these fish. We should reevaluate our need for length/weight information on each exotic fish and consider whether taking these measurements on a subsample of the fish captured would meet those needs within acceptable confidence limits. The time spent measuring these fish could be applied to working additional sampling sites, especially if new gear types such as trammel nets or hoop nets with wings are deployed.
 - 3 - The PIT-tag database needs to be updated to allow checking of recaptures. Currently, original capture data on >50% of the recaptured fish, particularly flannelmouth sucker is unavailable to all researchers.
 - 4 - The new satellite phone was an excellent purchase. The phone worked well and we were confident that it could be used in case of an emergency. The satellite phone is much better than two-way radios of the past.