PROGRESS REPORT

COLORADO SQUAWFISH STUDIES ON THE WHITE RIVER 1982

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INTRODUCTION

This progress report complies with provisions of a Memorandum of Understanding between the State of Utah (acting through the Utah Board of Water Resources), the U. S. Fish and Wildlife Service (FWS), and the U. S. Bureau of Land Management (BLM) to perform studies on the Colorado squawfish (Ptychocheilus lucius) in the White River during 1982. A discussion of work accomplished and data collected between 1 July and 30 September 1982 is presented with previous study results reported for the 10 May to 30 June 1982 period (Radant et al. 1982 [July]).

DESCRIPTION OF THE STUDY AREA

The White River is a major tributary of the Green River in the Upper Colorado River Basin (Figure 1). Originating in the Flat Top Mountains of western Colorado, the White River drains over 5,019 mi^2 (13,000 km^2) and flows approximately 250 mi (402 km) through northwestern Colorado and eastern Utah (Miller et al. 1982).

The river segment addressed by this study is the 71.7 mi (115 km) area between the Utah-Colorado state line and confluence of the White with the Green River (Figure 2). Land use in the upper reaches is predominately livestock grazing while the lower 24 mi (39 km) of the river flows through irrigated farmland within the Uintah and Ouray Indian reservation. Lands above the Indian reservation are managed by the BLM or are privately owned.

Within the 71.7 mi (115 km) river segment three relatively homogenous strata (habitats) were described by Miller et al. (1982). The uppermost stratum within the study area (Stratum X) was originally delineated as the area between Rangely, Colorado, river mile (RM) 94.5 (151.2 km) and the Ignacio Bridge, RM 59.3 (95.4 km) in Utah (Miller et al. 1982). For the purpose of our investigations that portion of Stratum X within the study boundary (Utah-Colorado state line to the Ignacio Bridge) was designated Stratum X_2. This 12.7 mi (20.4 km) section contains the most diverse habitat. The river flows through steep canyons, has a higher gradient than adjacent strata and has riffles with cobble/rubble and rubble/cobble substrate (Miller et al. 1982).

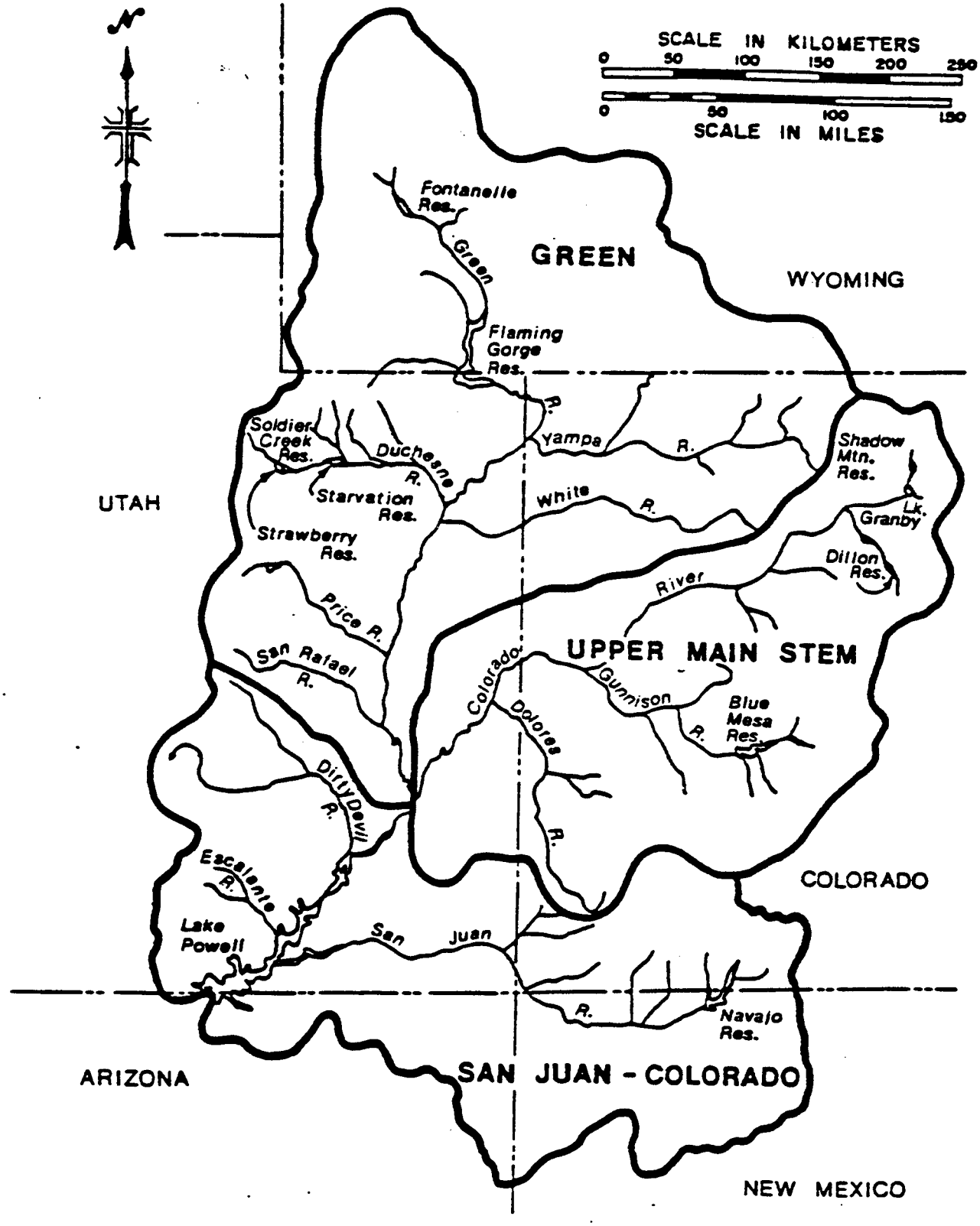

Figure 1. The hydrologic subregions of The upper Colorado River basin (After Iorns et al. 1965) (Miller et al. 1982)

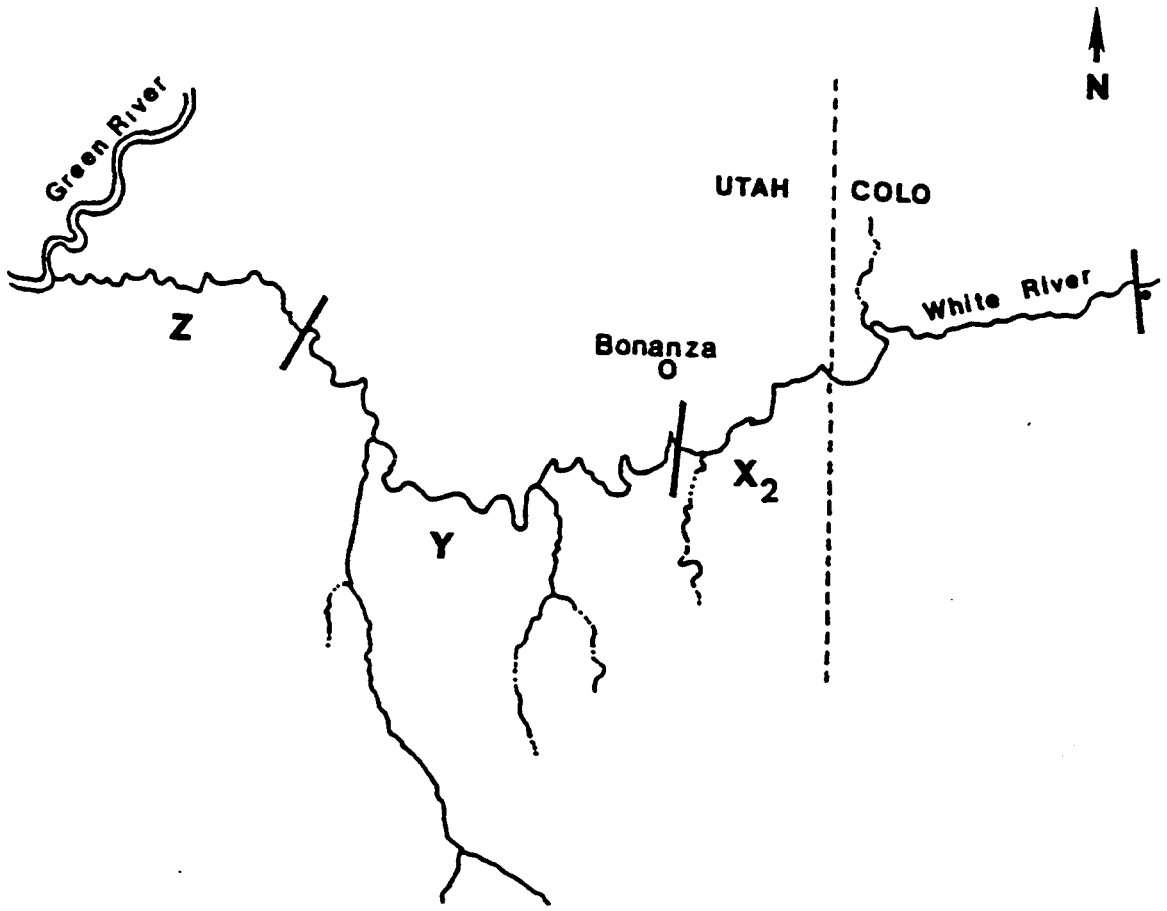

Figure 2. White River study area, Utah.

The middle Stratum (Y) begins at the Ignacio Bridge, RM 59.3 (95.4 km) and ends 38 mi (61.1 km) downstream at the Mountain Fuel Bridge, RM 21.3 (34.3 km). In this section the river flows through more open canyons and has a substrate mixture of sand/silt where water velocities are low and cobble/rubble or rubble/boulder in high gradient, high velocity reaches (Miller et al. 1982).

The lowest Stratum (Z) begins at the Mountain Fuel Bridge, RM 21.3 (34.3 km) and extends 21.3 mi (33.8 km) downstream to the confluence of the White with the Green River. In this stratum the river flows through a wide flood plain and is characterized by its lower gradient, lower velocities and smaller substrate material than is found in upstream strata.

STUDY OBJECTIVES

Four separate but interrelated objectives were established for the 1982 study. These objectives were to: (1) implant radio transmitters in adult Colorado squawfish and follow their movements until 30 November; (2) systematically sample all river habitats with electrofishing equipment, trammel nets and seines above and below the proposed dam site, focusing on capturing all sizes of Colorado squawfish; (3) intensively sample for larval and young-of-the-year Colorado squawfish with seines and small hand nets; and (4) conduct detailed physical measurements (PHABSIM) of the suspected spawning site using standard IFG4 techniques.

MATERIALS AND METHODS

Equipment Description

A boom equipped 18 ft (5.5 m) flatbottom boat was used to electrofish the river reaches. Power was supplied by a Honda ES4500 generator producing 220 volts and 4.0 kilowatts. A Coffelt Model 15 variable voltage pulsator (VVP) was used to produce a pulsating direct current.

Trammel nets 150 ft (45.8 m) long and 6 ft (1.8 m) deep were used to fish eddies and low velocity runs. The nets were composed of 1 in (2.5 cm) and 1.5 in (3.8 cm) square mesh with a wall of 10 to 12 in (25.4 to 30.4 cm) square mesh.

A seine 30 ft (9.1 m) long by 4 ft (1.2 m) deep, and having 0.25 in (6.4 mm) mesh was used to sample shallow water areas. Double weighted lead lines were used for sampling in areas of high water velocities.

Water velocity measurements were taken with a direct reading Marsh-McBirney (Model 201) portable electro-magnetic current meter. Corresponding water depths were measured with a calibrated wading rod.

Specific conductance of the water was measured with a Beckman Solu Bridge RB3 meter. Dissolved oxygen and pH levels were measured with a Hach field chemistry kit.

Radio transmitters implanted in selected Colorado squawfish were AVM fish modules (AVM 1979) weighing approximately 11 g and Smith-Root modules weighing approximately 15 g. Transmitters were powered by a mercury battery having a theoretical life of 180 days for the AVM modules and 150 days for the Smith-Root modules. The units transmitted in a

frequency range from 40.660 to 40.700 MHz. A Smith-Root SR-40 "search" receiver was used to scan for all emitted frequencies, then a Smith-Root RF-40 receiver was used to identify the specific frequency transmitted. A Larson-Kulrod whip antenna was used to search for implanted fish and a directional loop antenna to triangulate fish location.

A 16 ft (4.9 m) flatbottom boat powered by an 18 hp outboard motor was used in radiotelemetry and intensive sampling efforts.

Drift nets used to collect larval fishes were constructed with 1/32 in (0.8 mm) bar mesh netting and had an 18 in (46 cm) by 12 in (30 cm) rectangular opening. The nets were 43 in (109 cm) long with a removable PVC bucket attached to the cod end.

Hand seines measured 3.3 ft (1 m) by 2.5 ft (0.8 m) and were made with 1/32 in (0.8 mm) bar mesh netting.

Study Procedures

Between 25 May and 2 July extensive electrofishing was conducted throughout the study area to collect adult Colorado squawfish for radio transmitter implantation. Only fish larger than 450 mm total length (TL) were considered for transmitter implantation. Each Colorado squawfish captured was weighed, measured and a numbered Carlin tag attached. Water depth, velocity, substrate type and habitat type were recorded where the fish was first observed. Fish selected for radiotelemetry monitoring were anesthetized with MS-222, and radio transmitters surgically implanted following procedures similar to Bidgood (1980) and incorporating modifications described by Miller et al. (1982).

A standardized program was followed to systematically sample each of the three river strata during spring runoff and autumn post-runoff periods. Sampling procedures corresponded to those presented by Archer et al. (1980). One stratum was randomly selected as the starting point. Sampling then progressed sequentially downstream to the last stratum, then shifted back to the top stratum to complete the series. Within each stratum one 5.0 mi (8.0 km) station was randomly selected. The upper and lower 0.5 mi (0.8 km) reaches within the station were intensively sampled. Intensive sampling of the various habitats within the 0.5 mi (0.8 km) reaches was conducted using seine and trammel nets. Trammel nets were checked every three hours until they were removed at 2400 h. Physical measurements for depth, substrate, habitat type, and water velocity were recorded for each trammel net set and at each seining location. Total fish numbers by species and catch per unit effort were recorded. The following morning the 5 mi (8.0 km) station was electrofished downstream and intensive sampling initiated at the lower 0.5 mi (0.8 mi) reach.

Drift nets were fished 1 hour out of every 2 or 4 hour intervals within a 24 hour sampling period. Samples were collected during alternating 24 hour periods. Three nets were simultaneously fished across the river at each station. Two 0.5 in (1.3 cm) diameter rebar were anchored into the river substrate to hold and position each drift net in the current. The depth each net fished was adjusted so combined they sampled the entire water column.

STUDY PROGRESS

Radio Tagging and Tracking of Adult Colorado Squawfish

Eight Colorado squawfish were implanted with radio transmitters between 25 May and 2 July and their subsequent movement monitored (Table 1). The largest fish implanted with a transmitter was 711 mm long and the smallest 453 mm. Seven of the eight radiotelemetered squawfish were equal to or greater than 540 mm long and were thought to be mature.

Radio contact with four fish was lost by 6 July. Failure to maintain contact with these fish was thought to be due to radio transmitter failure. Fish number 3075 was located the day after radio implantation, then no further contact was made. Consequently, no movement data were obtained for this fish. Six observations were recorded for fish numbers 3024 and 3060 and five for fish number 3026. All three fish exhibited downstream movement during this time.

Fish number 3036 traveled rapidly from its original capture site at RM 50 downstream and into the Green River. Once in the Green River it maintained a stationary position at the confluence of the Green and White rivers through July. No further contact was made with the fish until 28 September when it was located at RM 95.8 of the Green River, 30.5 river miles below the White River confluence.

The most extensive movement data were obtained for the three largest squawfish captured. Contact with these fish has been maintained throughout the reporting period. Each fish displayed divergent movement.

Table 1. Movement of radiotelemetered Colorado squawfish in the White River, May through September 1982.

Tag No. / TL (MM)	3024 / 453		3036 / 576		3060 / 550		3026 / 592		3051 / 694		3093 / 711		3057 / 645		3075 / 540	
	Date Observed	Location (RM)	Date Observed	Location (RM)	Date Observed	Location (RM)	Date Observed	Location (RM)	Date Observed	Location (RM)	Date Observed	Location (RM)	Date Observed	Location (RM)	Date Observed	Location (RM)
	5/26	12.5	6/11	50.0	6/11	59.1	6/17	68.9	6/17	64.3	6/23	33.2	6/24	17.2	7/1	14.8
	5/27	12.6	6/23	7.7	6/14	53.4	6/21	67.0	6/21	54.9	6/25	32.8	6/25	3.3	7/2	14.7
	6/10	11.6	6/24	126.3[a] (GR)[b]	6/17	53.4	6/29	53.2	6/23	13.6	6/29	33.0	7/1	128.1 (GR)		
	6/23	7.7	6/25	126.3 (GR)	6/25	24.8	7/2	48.4	6/24	126.3 (GR)	7/2	28.7	7/3	128.0 (GR)		
	6/25	7.7	6/29	126.2 (GR)	7/1	16.0	7/6	48.2	7/5	79.0 (GR)	7/6	36.8	7/5	128.4 (GR)		
	6/29	0.8	7/1	126.2 (GR)	7/2	10.4			7/13	35.8 (GR)	7/9	35.7	7/6	138,0 (GR)		
			7/3	126.3 (GR)					7/14	35.8 (GR)	7/12	39.5	7/9	181.5 (GR)		
			7/5	126.3 (GR)					7/15	34.2 (GR)	7/14	38.8	7/16	191.0 (GR)		
			7/8	126.2 (GR)					8/12	34.0 (GR)	7/26	24.3	7/21	5.1 (YR)[c]		
			7/27	126.3 (GR)					8/19	34.3 (GR)	7/29[d]	23.0	7/21	4.5 (YR)		
			9/28	95.8 (GR)					9/14	85.3 (GR)	7/30	164.0 (GR)	8/12	224.3 (GR)[e]		
									9/20	91.9 (GR)	8/2	132.0	8/17	224.9 (GR)		
									9/24	87.0 (GR)	8/6	133.0 (GR)	8/19	0.5 (YR)		
											8/12	134.0 (GR)	8/27	0.3 (YR)		
											8/19	134.0 (GR)	9/2	229.0 (GR)		
											8/23	133.7 (GR)				
											9/10	133.5 (GR)				
											9/16	133.0 (GR)				
											9/20	133.0 (GR)				

[a] RM 126.3 is confluence of White and Green rivers.
[b] Green River
[c] Yampa River
[d] An unsuccessful attempt was made to capture fish by electrofishing.
[e] RM 225 is confluence of Yampa and Green rivers.

Between 17 June and 13 July fish number 3051 moved from RM 64.3 of the White River, downstream, out of the White River, to RM 35.8 in the Green River. From 13 July through 19 August it remained in this general area. Work conducted by FWS personnel showed that ripe males and other radiotelemetered squawfish were present in this same area during July (pers. comm., Harold Tyus 1980, U. S. Fish and Wildlife Service). It appeared that squawfish spawning occurred at this site in 1982. By mid-September fish number 3051 had traveled back up the Green River to RM 85.3 and remained in this vicinity for at least 10 days.

Fish number 3057 was implanted with a radio transmitter on 24 June at RM 17.2 of the White River. By 1 July this fish had reached RM 128.1 of the Green River and on 21 July was 5.1 mi up the Yampa River, immediately below a confirmed spawning site. It was inferred that this fish spawned in the Yampa River during the latter part of July. During August fish number 3057 moved back and forth between the Yampa and Green rivers. It was last observed on 2 September at RM 229 (approximately 4 mi above the Yampa River confluence) of the Green River, indicating it was moving upstream rather than returning downstream.

Fish number 3093 was the only radiotelemetered squawfish that was known to have remained in the White River through July. It remained in the vicinity of its original capture location until 26 July when it was observed traveling slowly downstream toward the confluence. While in the White River fish number 3093 maintained a relatively stationary position in the general area suspected by Miller et al. (1982) to have squawfish spawning. Additional sampling in this area failed to provide evidence of

any spawning concentrations; however, the fish may have attempted or completed spawning in the White River. High water temperatures in the White River and the date when the fish traveled from the White River into the Green River suggests a post-spawning movement rather than a pre-spawning movement. An unsuccessful attempt was made to recapture and examine the condition of fish number 3093 on 29 July.

One squawfish captured in the Green River and implanted with a radio transmitter by the FWS entered the White River and was observed at RM 12.8 on 24 June. It was last observed in the White River at RM 6.5 on 8 July and apparently moved back into the Green River shortly thereafter. It appeared to be a transient movement rather than a preconditioned spawning migration into the White River.

In summary, radiotelemetry of squawfish captured in the White River showed extensive movement of fish from the White River to the Green River in June. This movement appears to be, at least partly, related to spawning. Observations showed independent movement by squawfish from the White River to separate spawning sites on the Green and Yampa rivers. The one squawfish that remained in the White River through July provides further evidence that squawfish may spawn in the White River, but to date spawning has not been confirmed. Identification of larval fish samples will provide additional data. It appears that if spawning is occurring in the White River fish numbers are probably low.

Systematic Sampling of River Habitats Above and Below the Dam Site

Standardized sampling of a 5.0 mi (8.0 km) station in each of the three strata was completed between 15 and 25 June and between 7 and 16

September. Electrofishing was the most effective method for collecting squawfish (Table 2). Only one squawfish was taken during the September systematic sampling effort compared with six captured by the same effort in June. Trammel netting captured only one squawfish; however, the nets were difficult to set and maintain in fishing condition because of water flows and scarcity of suitable habitat in which to fish the nets. No squawfish were collected by seining.

Combined intensive and nonintensive electrofishing efforts and catch rates for Colorado squawfish were: (1) Stratum X_2, 13.55 hr of electrofishing for 0.37 squawfish/hr; (2) Stratum Y, 28.67 hr of electrofishing for 0.31 squawfish/hr; and (3) Stratum Z, 23.60 hr of electrofishing for 0.25 squawfish/hr. Table 3 presents information for all Colorado squawfish captured between 25 May and 1 October.

A squawfish captured in the White River by FWS personnel on 20 August 1981 was recaptured on 3 June 1982 by study personnel. The fish increased in length from 400 to 414 mm, maintained its weight at 480 g, and moved 2.3 mi (3.7 km) from its original capture location at RM 18.6 (29.9 km).

Intensive Sampling for Larval and Young-of-the-Year Colorado Squawfish

Drift netting and hand seining were used to collect larval fish samples. Drift nets were fished for alternating 24 hr periods from 19 July to 1 August. Two sampling stations were selected, one near the

Table 2. Catch/effort[1] of Colorado squawfish during systematic sampling by strata and gear type in the White River, Utah.

Gear Type	Date	Strata X_2	Strata Y	Strata Z	N
Electrofishing	Jun. 15-25	0.8	0.4	0.5	5
Seine	"	0	0	0	0
Trammel	"	0	0.04	0	1
Electrofishing	Sept. 7-16	0	0.2	0	1
Seine	Sept. 7-16	0	0	0	0
Trammel	Sept. 7-16	0	0	0	0

[1]Electrofishing = fish/h; trammel nets = fish/h; seines = fish/10 m^2.

Table 3. Colorado squawfish captured in the White River, Utah between 25 May and 1 October 1982.

Date	Strata	RM	Total Length (mm)	Weight (g)	River Habitat	Gear Type
5/25	Z	13.5	453	666	Eddy	Electrofishing
6/3	Z	20.8	411	470	Run	"
6/3	Z	20.9	414[a]	480	Run	"
6/4	Y	58.6	332	240	Eddy	"
6/7	X_2	63.1	273	130	Run	"
6/10	Y	58.3	550	1,150	Run	"
6/10	Y	53.4	570	1,560	Run	"
6/16	X_2	68.5	592	1,480	Run	"
6/16	X_2	64.9	483	850	Run	"
6/16	X_2	64.3	694	2,830	Eddy	"
6/22	Y	32.1	364	375	Shoreline	Trammel net
6/22	Y	34.1	711	2,740	Eddy	Electrofishing
6/23	Z	29.5	485	820	Run	"
6/24	Z	17.0	645	2,670	Run	"
7/1	Z	15.1	540	1,080	Run	"
7/1	Z	14.8	378	390	Side channel	"
7/14	Y	38.8	267	130	Riffle	Trammel net
7/22	Y	37.2	390	380	Riffle	Electrofishing
7/22	Y	42.2	480	920	Run	"
9/8	Y	34.1	364	300	Run	"
9/14	X_2	66.3	540	1,150	Run	"

[a]Recapture

proposed White River Reservoir dam site at RM 50.6 and one at RM 22.9. Nets at the upper station were fished on a 2 hr rotation while those at the lower station were fished on a 4 hr rotation. Seventy-two combined net collections were made at RM 50.6 and 49 at RM 22.9 for a total of 121 samples. Considerable debris was present in the samples making it time-consuming to locate and separate larval fishes. All of the samples will be processed by 1 November so larval fish can be delivered to the Larval Fish Laboratory in Fort Collins, Colorado for identification.

Backwater areas in the White River were hand seined in August to obtain qualitative samples of larval fishes. These samples will be sent with drift net collections to the Larval Fish Laboratory for identification by 1 November.

Backwater areas will be systematically seined in October to sample for young-of-the-year Colorado squawfish. An attempt will be made to locate and sample a backwater at five mile intervals from the Utah-Colorado stateline to the confluence of the White and Green rivers. Young-of-the-year squawfish will be large enough for field personnel to identify.

Physical Measurement (PHABSIM) of the Suspected Spawning Site Using Standard IFG4 Techniques

Fish and Wildlife Service personnel have assumed responsibility for meeting this objective. An initial series of data were collected during runoff below the suspected spawning site on 17 and 18 June. A second series of data were collected on 16 July with descending post runoff

water flows. A third, and final, series of data will be collected during the first week of November.

Water flows in the White River in May and June 1982 were substantially greater than 1981 flows during this same period (Table 4). Large snow pack and cool spring temperatures maintained high river flows over an extended period in contrast to the short time and lower peak flows that occurred in 1981. Water flows occurring in the White River during the 1982 field season will be summarized and compared with 1981 flows in the final study report.

Table 4. Discharge in the White River below Asphalt Wash.

1981 Date	Flow (cfs)	1982 Date	Flow (cfs)
May 4	943	May 4	1380
May 12	581	May 13	1353
May 26	526	May 26	2061
June 4	1398	June 4	1909
June 8	1477	June 15	2047
June 17	635	June 22	2018
June 26	276	July 1	2001

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