Trapping and Spawning Colorado River Cutthroat Trout at Dougherty Basin Lake, 1999, an Initial Effort.

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INTRODUCTION

Colorado River cutthroat trout *Oncorhynchus clarki pleuriticus* were first documented in the Escalante River drainage in 1990 (Behnke 1992). By the year 2000 they had been found in 5 tributary streams in the Escalante River drainage and were considered native to this drainage (Hepworth et al. In Press). These trout represent the only known remnant populations of Colorado River cutthroat trout from southern Utah. A multi-agency Conservation Agreement and Strategy for Utah was developed and signed into agreement to conserve, protect, and expand the abundance and range of these fish (Lentsch and Converse 1997). Part of the Conservation Strategy included development of wild brood stocks of Colorado River cutthroat trout by the Utah Division of Wildlife Resources (UDWR) to allow both expanded conservation and sport fish use of this subspecies. The intent of the Conservation Agreement was to promote multi-agency conservation actions, improve the status of this subspecies, and avoid federal listing under the Endangered Species Act (ESA). Any change from the subspecies current unlisted status to threatened or endangered could preclude implementation of management actions for Colorado River cutthroat trout until new decisions and plans are completed under listed status, as determined by the ESA.

Remnant populations of Colorado River cutthroat trout from East and West Boulder Creek were tested annually from 1992 through 1999 for diseases, according to Utah Department of Agriculture and UDWR protocols. These tests were required prior to development of a brood stock by transplanting wild fish. In 1996, Dougherty Basin Lake and Tall Four Lake (interconnected by a short section of canal, Figure 1) were selected as a sites to establish a wild brood stock. The first transplant of native trout into Dougherty Basin Lake from Boulder Creek

was made in 1997. We anticipated that trout in the lake would reach larger average size compared to streams, thus increasing their potential egg production. Fish produced from this brood stock will be used for (1) restocking and maintaining the brood stock at Dougherty Basin and Tall Four lakes, (2) research studies on Colorado River cutthroat trout, (3) replacement of nonnative cutthroat trout currently stocked for sport fishing in the Escalante and Fremont River drainages, (4) replacement, in part, of stunted brook trout *Salvelinus fontinalis* populations (UDWR 2000), (5) stocking to maintain sportfishing and eliminate situations where continued use of nonnative fishes may threaten remnant native populations (Hepworth et al. In Press), and (6) expansions and re-introductions of native Colorado River cutthroat trout (Table 2). This report covers activities associated with the first egg take from the Dougherty Basin Lake brood stock conducted in June, 1999.

STUDY SITE

Dougherty Basin is a 3.7 acre lake (9,720 ft elevation) near the headwaters of North Creek, a tributary to the Escalante River (Figure 1). Access is by a 0.5 mile trail from Barker Reservoir at the end of the North Creek road. There is one tributary (about 1.5 cfs) to Dougherty Basin which originates from a spring located 0.25 mile from the lake. Water temperature of the tributary does not exceed 45 F during any time of the year. The outlet from Dougherty Basin flows for about 0.25 mile before entering Tall Four Lake (0.67 acres) and then from Tall Four Lake into a lava sink hole. Springs on the hillside below Tall Four Lake (presumably from water entering the sink hole) flow into other headwater lakes and eventually into North Creek. Dougherty Basin Lake and Tall Four Lake are, thus, interconnected by a short section of stream but isolated upstream and downstream from other systems containing wild trout. Prior to 1996,

brook trout were stocked to maintain sport fisheries at Dougherty Basin and Tall Four lakes. Plans include entirely replacing brook trout at these lakes with Colorado River cutthroat trout.

METHODS

A total of 250 Colorado River cutthroat trout were transplanted into Dougherty Basin Lake (105 from East Boulder Creek in 1997, 100 from East Boulder Creek in 1998, and 45 from West Boulder Creek in 1999). Transplanted fish ranged in size from 4.0 to 11.0 inches, with at least half of the total number being immature at the time of transplant. Genetic evaluations utilizing mDNA indicated that Colorado River cutthroat trout from East and West Boulder creeks were identical (Shiozawa et al. 1993 and 1994). Use of native trout from other Escalante River tributaries were not considered for brood stock because of evidence of some minor introgression with rainbow trout (0.4%) in the West Branch Pine Creek and incomplete genetic testing at White Creek (only meristics at present) and Water Canyon (small sample size, Toline et al. 1999a and 1999b).

Fish traps were installed on the inlet and outlet at Dougherty Basin Lake on 15 June, 1999 and operated until 23 June, 1999. Traps consisted of portable aluminum frames and removable rods spaced 0.5 inches apart that could be adjusted to various stream widths and set to funnel trout into holding compartments. Division personnel were stationed at the lake or trail head leading to the lake for 24 hours per day during the 9 days that traps were operated. Cutthroat trout were held in traps or live cages placed in the lake until they were ready to spawn or until the project ended. Fish were held at various water temperatures (warmer in the lake or colder in the inlet) to either promote or delay spawning. All of the cutthroat trout collected were from the 1997 and 1998 transplants because the 1999 transplant occurred in July after fish were spawned.

Spawning was conducted on June 17, two days after traps were set, and again 6 days later on June 23. Spawning was overseen by personnel from the UDWR Egan Fish Hatchery. All fish were sorted and ripe fish were spawned using standard state methods. Eggs and sperm were taken from fish spawned one at a time and initially kept separate in dry containers. Eggs from a single female were paired with 1-2 males to insure the maximum number of paired matings. Due to a shortage of males on June 23, some males from the June 17 spawning were used a second time. Males which were re-used were always paired with a male which had not yet been spawned. Fertilization was completed by adding diluent (a saline solution) to the sperm, then mixing this with the eggs. Eggs were rinsed with clean water after setting in the diluent and sperm mixture for 10 minutes. On the second spawning date, plain spring water was used instead of sperm diluent. Eggs were water hardened for an hour before transporting to the Fish Lake isolation facility for incubation. During incubation, disease samples taken at the time of spawning were processed by the UDWR Fisheries Experiment Station in Logan, Utah and the parent stock for the eggs were approved as disease certified. Once the eggs were fully eyed, they were moved to the Fisheries Experiment Station for hatching and culture.

Disease certification was completed as required by standard protocol (Colorado River Wildlife Council 1995), including tests on samples of ovarian fluids from all spawned females and additional testing which required a 60-fish lethal sample. Because of the limited number of female Colorado River cutthroat trout which were spawned, additional samples of ovarian fluids were obtained from 7 spent females that were not spawned and from 17 brook trout during fall spawning. The lethal sample was comprised of brook trout taken by electrofishing from the interconnecting stream between Dougherty Basin and Tall Four lakes. This was the third

consecutive year of disease certification. Brook trout also were used as a surrogate species for disease certification in 1997 and 1998.

RESULTS

A total of 42 Colorado River cutthroat trout were trapped at Dougherty Basin Lake, of which 31 were taken from the inlet and 11 from the outlet (Figure 2). Eggs were taken from 16 females (Table 1). Seven females were spent by the time the first egg take was conducted. Ovarian fluid for disease certification was collected from 23 Colorado River cutthroat trout, including spawned females and females already spent at the time of the egg take. Two females were still green and not ready to spawn when the project was discontinued on June 23. Seventeen males were spawned, some of which were spawned on both June 17 and 23. A total of 7,734 eggs were collected, of which 4,350 were taken on the first spawning date. Spawned females averaged 11.1 inches total length and ranged from 9.0 to 13.2 inches. Males averaged 11.2 inches total length and ranged from 9.4 to 13.6 inches. An average of 483 eggs were collected per female at a size of 387 eggs per fluid ounce.

Eggs and fry from the second spawning date (June 23) suffered high mortality and eventual total loss. It is uncertain if this was a result of failure to use sperm diluent, the lack of ripe males for the second spawn, poor quality eggs, or some other factor. Eggs taken on the second spawning date were smaller than eggs taken the previous week (Table 1) and did not appear to be high quality. Survival of eggs taken on the first spawning date was generally good. All fish produced from the egg take were held and cultured at the Fisheries Experiment Station for stocking in spring of 2000. By January, 2000 there were about 2,500 fish on-hand averaging 3.3 inches total length.

DISCUSSION

A limited egg take was expected in 1999 because of the low number and young age of cutthroat trout transplanted into Dougherty Basin Lake. The number of trout trapped during the spawning run was 39 % of the number transplanted in 1997 and 20 % of the total number transplanted in 1997 and 1998. Considering this was the first attempt to spawn Colorado River cutthroat trout from southern Utah, the total number of fish produced was promising. The number and size of brood fish should increase over the next few years, thereby increasing total egg production.

The small size of Dougherty Basin Lake will eventually limit the number of eggs that can be taken. A number of measures were taken to maximize potential egg production from the Dougherty Basin brood stock. Special catch and release fishing regulations were instituted in 1997 to maintain high numbers of mature cutthroat trout in the lake. Also, stocking of Colorado River cutthroat trout is planned at Tall Four Lake to maintain a source of fish for lethal samples (annual disease certification) and additional fish for spawning. Nevertheless, future management needs for Colorado River cutthroat trout could exceed the maximum production at Dougherty Basin and Tall Four lakes (Table 2). Approximate production capabilities should be determined within 4-5 years. Fish produced from eggs taken during 1999 will be stocked in Dougherty Basin and Tall Four lakes in 2000 and in UM Creek as part of a research study on Colorado River cutthroat trout and whirling disease (Chamberlain and Hepworth 1999). Demand for cultured Colorado River cutthroat trout will increase in 2001 and after as plans are implemented to replace stocking of nonnative cutthroat trout with native fish, as populations of stunted brook are replaced, and as native trout restoration projects are conducted.

Management of the Dougherty Basin Lake brood stock will include measures to insure genetic diversity is maintained. To prevent dominance of the brood stock by fish from a single cohort, stocking of Dougherty Basin and Tall Four lakes in 2000 will be limited to 250 and 150 Colorado River cutthroat trout, respectively. Also to maintain diversity, transplants of Colorado River cutthroat trout were made over a 3-year period and included taking fish from both headwater forks of Boulder Creek. Future spawning should be conducted to guarantee at least 20 paired matings annually. In addition, efforts should be made to trap and spawn native trout throughout the duration of the spawning season to avoid altering natural spawning times by artificially restricting spawning periods. Bias in selecting spawning times can be avoided by trapping the entire spawning run and holding all fish until they become ripe. Fish can be held in varying water temperatures between the lake and inflow to delay or promote spawning, similar to Bonneville cutthroat trout at Manning Meadow Reservoir (Hepworth and Ottenbacher 1996). A few females at Dougherty Basin Lake were already spent when trapping began in 1999 and a few were still green when the project was terminated, but most fish were utilized. Prediction of spawning times and trapping fish at Dougherty Basin Lake should improve with experience.

It is uncertain at present how much, if any, additional stocking of Colorado River cutthroat trout will be needed at Dougherty Basin and Tall Four lakes. In the future, Colorado River cutthroat trout will be able to spawn in the interconnecting stream between the two lakes, with young fish being able to migrate to either lake. However, before the stream can be managed for natural recruitment of Colorado River cutthroat trout, it will need to be treated for several consecutive years with rotenone to eliminate brook trout. In addition, Colorado River cutthroat trout might be able to utilize the upstream tributary to Dougherty Basin Lake for spawning if low

temperatures in the inlet are not a limiting factor. Most spawning cutthroat trout trapped during 1999 were attempting to spawn in the inlet. To allow natural reproduction, trapping of the spawning run would need to be managed to allow some escapement. If spring-spawned cutthroat trout can hatch during summer and migrate into the warmer water in Dougherty Basin lake, growth will likely be sufficient to allow winter survival. Recruitment of young trout from the inlet stream could be somewhat similar to the situation in the upper East Fork of Boulder Creek where Colorado River cutthroat trout spawn in a small tributary that is significantly warmer than the main spring fed stream. In both cases, a nursery area with warmer water is available in association with cold spring water.

The 1999 egg take at Dougherty Basin Lake was the culmination of a number of years of work and preparation. Genetic evaluations were completed to insure proper identification of native fish, multiple years of disease certification were completed at both Boulder Creek and Dougherty Basin Lake, and transplants of wild fish were completed over a 3-year period. Fish produced from this brood stock will allow expanded management opportunities for the subspecies including research, increased sport fish use, and better coordination between sport fish and conservation objectives.

ACKNOWLEDGMENTS

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Table 1. Colorado River Cutthroat trout spawned at Dougherty Basin Lake during 1999.

Date	Lake water temperature	Number females spawned	Length (inches) females		Length (inches) males		Total eggs	Eggs per ounce	Mean number of eggs per female
			Mean (n)	Range	Mean (n)	Range			
17 Jun	55 F	10	11.1 (10)	9.0-13.2	11.5 (11)	9.4-13.6	4,350	360	435
23 Jun	58 F	6	11.1 (6)	10.2-12.2	10.5 (6)	9.6-11.7	3,384	423	564
Total	--	16	11.1 (16)	9.0-13.2	11.2 (17)	9.4-13.6	7,734	387	483

Table 2. Waters and number of Colorado River cutthroat trout planned for future stocking, Escalante and Fremont River drainage, southern Utah.

Water	Identification number	Drainage	Surface area or stream length (acres or miles)	Cutthroat trout natural reproduction	Stocking frequency	Expected stocking quota
			Brood stock replacement			
Dougherty Basin Lake NCL	I 310	Escalante	3.7	Expected after brook trout removal	Annual 2000-2005	250 holdovers 1st year, 500 fry after
Tall Four Lake NCL	I 360	Fremont	0.7	Expected after brook trout removal	Annual 2000-2005	150 holdovers 1st year, 200 fry after
			Multiple species stocking and/or replacement of nonnative cutthroat trout			
Blind Lake NBS	I 794	Fremont	52.3	None expected	Annual	5,000 fry
Chuck Lake BT	I 301	Fremont	5.1	None expected	Annual	500 fry
Crescent Lake BT	I 304	Escalante	10.4	None expected	Biennial	500 fry
Deer Creek Lake EBS	I 307	Escalante	26.0	Possible with habitat improvement	Annual	11,000 fry
Farrals Pond TLM	I 500	Fremont	0.3	None expected	Biennial	100 fry
Floating Island Lake TLM	I 502	Fremont	2.5	None expected	Annual	4,000 fry
Forsyth Reservoir	I 503	Fremont	158.0	Possible, will need to be evaluated	Annual, 2000-2005	4,000 holdovers
Grass Lake EBS	I 320	Escalante	11.5	None expected	Biennial	2,000 fry
Green Lake EBS	I 321	Escalante	3.7	None expected	Biennial	400 fry

Honeymoon Lake NBS	I 812	Fremont	1.0	None expected	Biennial	1,000 fry
McGath Lake SBS	I 329 A	Escalante	47.4	None expected	Biennial	2,000
Meeks Lake TLM	I 511	Fremont	4.0	None expected	Biennial	5,000
Morrells Pond TLM	I 513	Fremont	4.0	None expected	Biennial	5,000
Moseman Lake EBS	I 331 A	Escalante	3.7	Possible, will need to be evaluated	Biennial, 2000-2005	1,200
North Creek Reservoir	I 333	Escalante	30.0	Possible, will need to be evaluated	Annual, 2000-2005	2,000 fry
Round Lake TLM	I 823 A	Fremont	3.5	None expected	Biennial	1,500 fry
Stone Lake	I 523	Fremont	6.6	None expected	Biennial	1,000 fry
		Replacement of stunted brook trout				
Beaver Dam Reservoir NBS	I 793	Fremont	13.4	Possible, will need to be evaluated	Annual, until reproductio n evaluated	1,500 fry
Blue Lake NCL	I 297	Escalante	1.6	None expected	Biennial	200 fry
Bullberry Lakes NBS	I 798	Fremont	3.0	None expected	Biennial	1,000 fry
Donkey Lake NBS	I 805	Fremont	23.0	None expected	Biennial	5,000 fry
Fish Creek Reservoir NBS	I 807	Fremont	25.6	Possible with habitat improvement	Annual	2,500 fry
Heart Lakes NBS	I 811	Fremont	0.7	None expected	Biennial	100 fry
Long Willow Bottom NCL	I 328 A	Escalante	3.7	Possible, will need to be evaluated	Annual, until reproductio n evaluated	500 fry

Round Willow Bottom NCL	I 347	Escalante	8.3	Possible, will need to be evaluated	Annual, until reproductio n evaluated	1,000 fry
Oak Creek Reservoir EBS	I 333 A	Fremont	37.0	Possible, with habitat improvement	Annual	8,000 fry
Pine Creek Reservoir NBS	I 821	Fremont	3.3	Possible, with habitat improvement	Annual	500 fry
Short Lake SBS	I 355 A	Escalante	1.7	Possible, with habitat improvement	Annual	200 fry
Solitaire Lake NBS	I 825	Fremont	4.7	None expected	Biennial	750 fry
Further protect remnant populations of Colorado River cutthroat trout						
Spectacle Reservoir BT	I 356	Escalante	34.0	None expected	Annual	5,000 fry
Halfmoon Lake BT	I 323	Escalante	9.0	None expected	Annual	1,000 fry
Horseshoe Lake BT	I 325	Escalante	16.1	None expected	Annual	4,000 fry
East Lake BT	I 312	Escalante	6.0	None expected	Annual	1,500 fry
Ledge Lake BT	I 327	Escalante	2.5	None expected	Annual	300 fry
Transplants and re-introductions						
UM Creek	I AZ 130 Z	Fremont	23.0	Expected	2000, then evaluate	2,100 holdovers
Sand Creek	I AZ 130 M 01	Fremont	3.0	Expected	Annual 2000-2001, then evaluate	1,000 fry
Twitchell Creek	I AJ 160 F	Escalante	4.2	Expected	Annual, 2002-2004, then evaluate	1,000 fry
Short Creek	I AZ 130 Z 00	Fremont	1.0	Expected	2000, then evaluate	100 holdovers

Miller Creek	I AZ 130 U 03 A	Fremont	2.0	Expected	Annual 2002-2004, then evaluate	1,000 fry
Lower West Boulder Creek	I AJ 110 D	Escalante	2.0	Expected	Annual 2001-2003, then evaluate	1,000 fry
Pine Creek	I AZ 130 U	Fremont	7.5	Expected	2003-2004, then evaluate	2,000 fry

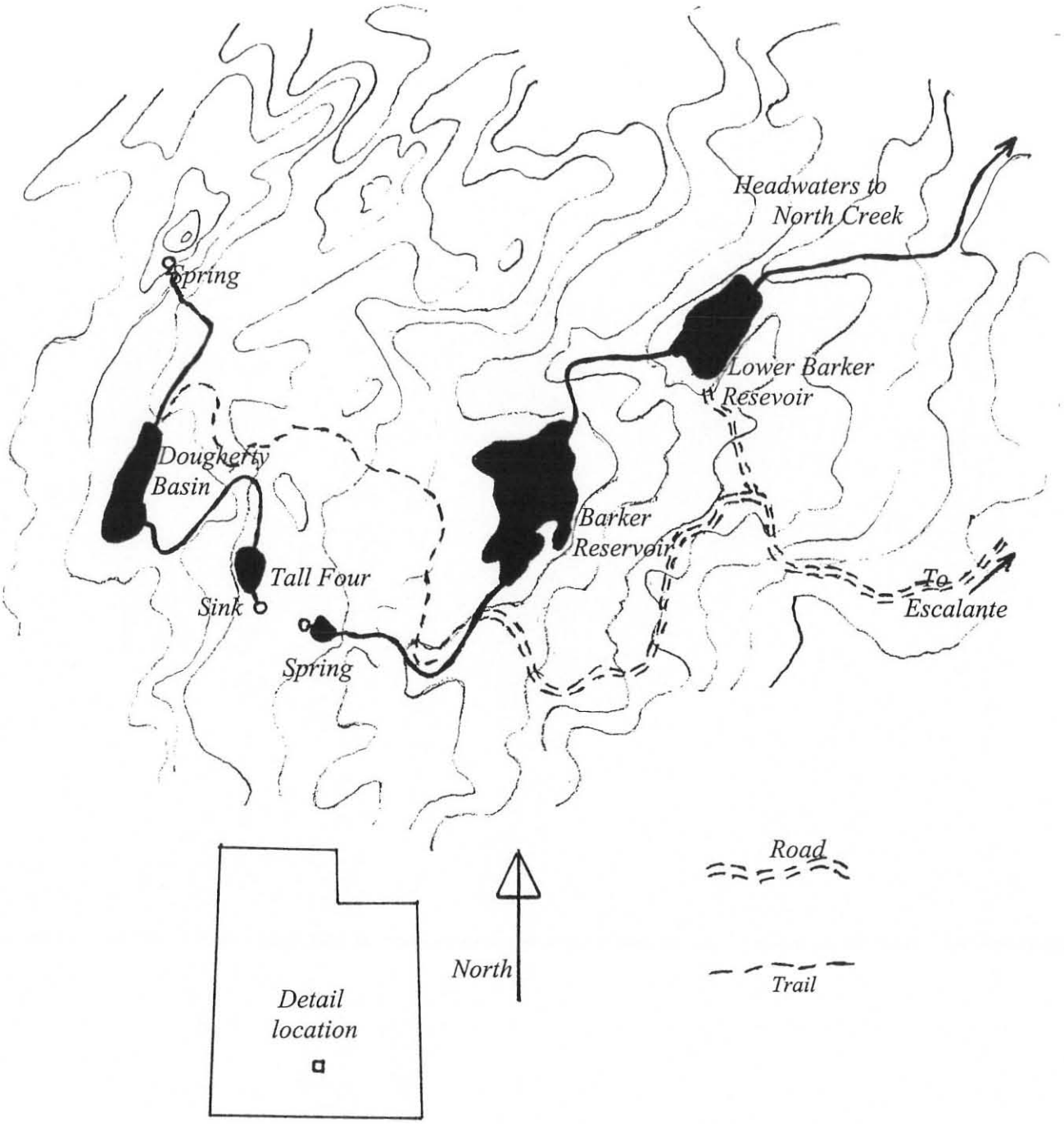

Figure 1. Dougherty Basin Lake, Tall Four Lake, and the headwaters of North Creek, Escalante River drainage, Utah.

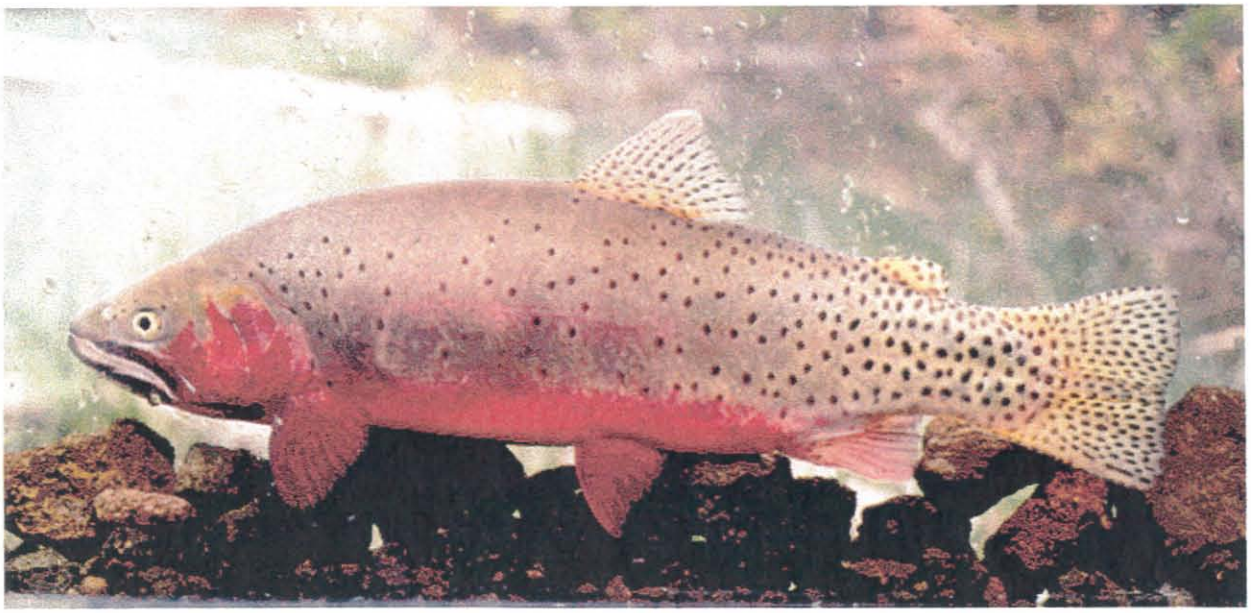

Figure 2. Male (top) and female (bottom) Colorado River cutthroat trout spawned at Dougherty Basin Lake, 1999.