

**Summary of Bonneville Cutthroat Trout Spawning
at Manning Meadow Reservoir, 1992-1999.**

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INTRODUCTION

In 1988, the Utah Division of Wildlife Resources (UDWR) purchased water rights to Manning Meadow Reservoir and obtained responsibility for operation and maintenance of the dam by special use permit from the Fishlake National Forest. This acquisition was completed with the intent of developing a wild brood stock of locally native Bonneville cutthroat trout *Oncorhynchus clarki utah* for fisheries conservation purposes, particularly within southern Utah. A water management plan was written and implemented to meet these goals in 1988 (UDWR unpublished file report). The reservoir was chemically treated with rotenone during 1989 and then drained to ensure complete removal of nonnative trout (primarily *O. c. bouvieri*) and redbreasted shiners *Richardsonius balteatus* (Ottenbacher and Hepworth 1989).

Behnke (1976) was the first to suggest that cutthroat trout from three isolated streams in southern Utah (Water Canyon, Reservoir Canyon, and Birch Creek) be considered for transplant and brood stock development. However, only limited numbers of fish were found in these streams, which total less than 5 miles of trout habitat (Hepworth et al. 1997a). As a result, a total of 245 Bonneville cutthroat trout from these three remnant sources were moved into Pine Creek (which had been renovated) in Beaver County, Utah in 1980 to expand overall numbers of Bonneville cutthroat trout and eventually create a brood stock (Hepworth et al. 1997b). Bonneville cutthroat trout were transplanted into Manning Meadow Reservoir from Pine Creek in 1990 and 1991 following the 1989 chemical treatment of the reservoir.

Various sport fishing regulations were applied at Manning Meadow after the first Bonneville cutthroat trout introduction in 1990. Rules were intended to protect transplanted fish and promote the development of a spawning population. The reservoir was closed to all angling

in 1990. Since then, sport fishing was restricted to artificial flies and lures only, with seasonal closures through the spawning period each year. From 1991 to 1994, catch and release rules were imposed for all cutthroat trout. From 1995 through 1998, a creel limit of 2 Bonneville cutthroat trout was allowed, and in 1999, catch and release rules for all trout were again instituted.

Trout were trapped and spawned at Manning Meadow Reservoir for the first time in 1992. Fish produced from this brood stock were used for: (1) restocking and maintaining Bonneville cutthroat trout in Manning Meadow Reservoir; (2) maintaining a sport fish population in Barney Reservoir (Figure 1), also in the same drainage; (3) re-introduction of native trout into Manning Creek and other tributaries within this drainage; (4) replacement of nonnative cutthroat trout stocked for sport fishing purposes throughout southern Utah; (5) various studies involving Bonneville cutthroat trout.

Other Bonneville cutthroat trout conservation actions associated with the Manning Creek drainage include (1) an approved UDWR water right granted in 1991 for an instream flow of 7 cfs in Manning Creek downstream from the reservoir, (2) UDWR acquisition of water storage rights for reconstruction of Barney Reservoir in 1990, and (3) renovation of the entire Manning Creek drainage in 1995-1996 to remove nonnative trout and reintroduce Bonneville cutthroat trout (Ottenbacher and Hepworth 1996).

Management of Bonneville cutthroat trout has recently been guided by a multi-agency plan for Utah to conserve, protect, and expand the abundance and range of these fish (Conservation Agreement and Strategy for Bonneville Cutthroat Trout in the State of Utah, Lentsch and Converse 1997). 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 further management actions involving Bonneville cutthroat trout until decisions and plans are developed under listed status, as determined by the ESA. Bonneville cutthroat trout are managed as a conservation species by UDWR and as a sensitive species by the U.S. Forest Service. This report summarizes results of annual spawning projects conducted through 1999.

STUDY SITE

Manning Meadow Reservoir is a 57-acre impoundment at 9,745 ft elevation on the headwaters of Manning Creek, a tributary to the Sevier River that flows off the west side of the Monroe Mountain (Figure 1). The reservoir and most of Manning Creek are located on the Fishlake National Forest, although the lower 2 miles of stream are on lands administered by the Bureau of Land Management (BLM). The stream is seasonally de-watered for irrigation just downstream from BLM lands. Surface flows only reach the Sevier River during periods of high water such as spring runoff.

Most inflow to Manning Meadow Reservoir is from small springs and seeps, but one tributary (Timber Creek) has sufficient early summer flows to attract spawning trout. Low stream flow during the remainder of the year, however, prevents natural reproduction, and Bonneville cutthroat trout in the reservoir must be maintained by stocking. Bonneville cutthroat trout are self-sustaining in Manning Creek and several other tributaries downstream from the reservoir.

METHODS

Bonneville cutthroat trout were trapped and spawned for the first time in 1992 and annually thereafter through 1999 (Figure 2). Fish were trapped at both the mouth of Timber Creek and at the reservoir spillway.

The trap set in Timber Creek was initially installed by excavating a channel in the mouth of the stream that was sufficiently wide and deep enough to hold high numbers of fish and allow installation of a portable trap. Aluminum frames with removable rods spaced 0.5 inches apart were used to funnel trout into the excavated channel and retain fish in holding compartments. Redwood planks held in place with steel fence posts were later added to keep stream banks from sloughing and make the trap more permanent. In 1997, a concrete trap was constructed. It allowed easy placement and removal of screens and provided a level working area to facilitate spawning and handling of fish.

Trout were trapped at the spillway in years when the reservoir had substantial water flowing over the dam during June and July. Overflows were sometimes of minor duration because reservoir water levels were drawn down 6 to 8 feet below the high water line during late summer to prevent excessive overflows the following spring. The spillway consists of a concrete raceway that channels water across the top of the dam. Water drops into the spillway channel from a 4-ft concrete lip that establishes the reservoir high water level and prevents fish that move downstream from moving back into the reservoir. A screen placed at the downstream end of the spillway channel traps spawning trout and prevents escapement of trout into Manning Creek. Operation of the spillway trap was discontinued when the reservoir water level dropped below the spillway or when the reservoir outlet was opened to prevent spilling. A permanent screen

and weir board were installed in 1997 to control water levels in the spillway channel. A chain link fence was constructed around the spillway in 1998 for public safety and to discourage vandalism and poaching.

Fish traps were operated annually for 2-3 weeks during June and early July from 1992 through 1999. UDWR personnel were stationed at the reservoir 24 hours per day while the trap on Timber Creek was operated. If the reservoir was over-flowing into the spillway, the spillway trap collected some fish before personnel were stationed full time at the reservoir. 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 and colder in the inlet) to either promote or delay spawning.

From 1992 to 1995, trapping operations were scheduled and conducted by UDWR regional biological staff. Since 1996, the project was supervised by personnel from the Glenwood Fish Hatchery. All trout were spawned using standard state methods and conducted by personnel from the Egan Fish Hatchery. Prior to 1995, eggs and sperm were taken from 2-10 fish at a time and kept separate in dry containers. The actual number of fish pooled and fertilized at a single time depended on the overall number of fish available for spawning on a given year, but was always conducted to guarantee at least 20 paired matings per year. After 1994, sufficient fish were available that spawning was generally conducted 5-10 fish at a time. 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. Eggs were water hardened for at least an hour before transporting to the Fish Lake isolation facility for incubation, where personnel from the Loa Fish Hatchery supervised the process.

performance in a large river dominated with wild brown trout (C. Thompson, UDWR, personal communication). In 1999, a study was initiated at Panguitch Lake to compare performance in a larger lake among rainbow trout, Bonneville cutthroat trout from Manning Meadow Reservoir, and Bonneville cutthroat trout from Bear Lake.

Although most future Bonneville cutthroat trout restoration projects will likely use transplanted fish from remnant populations, the brood stock at Manning Meadow Reservoir allows for expanded management options. Some restoration projects have not been feasible because of the length of time it would take to restore trout populations by transplanting small numbers of wild fish. Some areas have not been considered for restoration because lakes and reservoirs that required annual stocking to maintain sport fisheries were associated with wild trout streams. Bonneville cutthroat trout produced from Manning Meadow Reservoir are a resource that can now be used in such situations. Also, Bonneville cutthroat trout can be considered for introductions in areas with marginal habitat that were not options in the past because of limited numbers of fish.

Bonneville cutthroat trout from three remnant populations were mixed at Manning Meadow Reservoir to provide the number of fish necessary to establish a brood stock in a reasonable amount of time. The three stocks used were all within the southern historic distribution of Bonneville cutthroat trout and were considered representative of the subspecies as determined from the best information available at the time. Even if greater numbers of fish from a single stock had been available, the use of a single source for the brood stock would have been a debatable issue. Additional local populations of Bonneville cutthroat trout were not considered for brood stock because genetic evaluations were not complete at that time.

The potential number of eggs that can be regularly taken at Manning Meadow Reservoir was probably not achieved. Although spawning was conducted for 8 years, various factors impacted egg production. Angling regulations and annual stocking quotas were changed several times to adjust numbers, ages, and size of Bonneville cutthroat trout in attempt to increase the number of eggs taken. Management changes were made to balance brood stock management with sport fishing objectives. We tried to maximize the numbers of adult fish that were age 3 and older, yet prevent over-stocking, slow growth, and fish in poor condition. Vandalism and poaching of fish held in traps and live cages was a problem on some years. Fencing, improved traps, and more experience in scheduling personnel stationed at the reservoir reduced these problems.

A number of measures were taken to insure genetic diversity was maintained in the brood stock. Initial transplants of Bonneville cutthroat trout into the reservoir consisted of 714 trout from Pine Creek, which, in turn, was developed from three remnant populations. Annual spawning was conducted to insure at least 20 paired matings each year. Brood stock were replaced in the reservoir by stocking fish from each year-class of eggs taken since 1992 with plans to restrict stocking, for the most part, to fry. Bias in artificially selecting spawning times was avoided by trapping almost all of the spawning run each year. Eggs were taken from most females including early and late spawning individuals by spawning fish over a 2-3 week period.

As a result of the Manning Meadow brood stock program, both conservation and sport fish use of Bonneville cutthroat trout have increased. Nonnative trouts have been eliminated from the Manning Creek drainage and replaced with locally native fish. Bonneville cutthroat trout produced from Manning Meadow Reservoir were used to replace stockings of nonnative

cutthroat trout throughout southwest Utah. Bonneville cutthroat trout were incorporated into other sport fish programs, either supplementing or replacing other nonnative trouts, and used in a number of evaluations and research projects throughout Utah.

ACKNOWLEDGMENTS

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Table 1. Bonneville cutthroat trout spawning times at Manning Meadow Reservoir, Utah, 1992 - 1999.

Year	Trap operation dates		Dates spawned		Number days spawned	Lake water temperature (Fahrenheit)	
	Begin	End	First	Last		First spawn	Last spawn
1992	2 June	30 June	16 June	30 June	3	55	62
1993	21 June	6 July	22 June	6 July	3	62	62
1994	14 June	22 June	16 June	22 June	2	56	60
1995	3 July	11 July	5 July	11 July	2	60	62
1996	24 June	2 July	26 June	2 July	2	58	60
1997	23 June	1 July	25 June	8 July	3	59	62
1998	29 June	13 July	1 July	13 July	3	58	63
1999	18 June	6 July	22 June	6 July	3	58	62

Table 2. Bonneville cutthroat trout spawning totals at Manning Meadow Reservoir for 1992 - 1999.

Year	Number of females spawned	Mean length (inches)		Total eggs	Eggs per fluid ounce	Mean number of eggs per female	Total number of trout in trap
		Female	Male				
1992	27	13.4	--	19,218	361	712	--
1993	61	15.2	--	61,148	328	1002	--
1994	45	15.8	--	57,000	345	1267	--
1995	218	13.5	14.4	176,896	383	811	--
1996	198	13.5	14.2	136,980	283	691	485
1997	141	14.4	14.8	92,603	368	657	271
1998	116	14.3	12.7	80,514	359	694	330
1999	296	12.4	13.1	198,895	420	672	744

Table 3. Bonneville cutthroat trout introduced and stocked into Manning Meadow Reservoir, 1990 -1999.

Year	Month stocked	Number stocked	Source or age*	Size (number per pound)
1990	June and August	469	Transplant	20.0
1991	June and July	245	Transplant	20.0
1993	July	1,995	Age 1	13.2
1994	June	1,999	Age 1	14.0
	October	4,648	Fry, age 0	584
1995	September	6,024	Fry, age 0	394
1996	October	5,060	Fry, age 0	872
1997	July	1,499	Age 1	4.5
	October	8,202	Fry, age 0	269
1998	July	2,008	Age 1	9.2
	October	9,506	Fry, age 0	415
1999	October	12,428	Fry, age 0	296

* Transplant = initial introductions from Pine Creek used to establish the Manning Meadow brood stock. Age 1 = a cohort spawned the year prior to stocking. Fry = fish spawned and stocked the same year (age 0).

Table 4. Total number and size of Bonneville cutthroat trout produced from Manning Meadow Reservoir and stocked in Utah waters, 1992-1999.

Year	Age and size of fish stocked (number per pound) *	Number stocked	Number of waters and stream sections stocked
1993	Age 1 (10.3)	5,523	3
	Fry (302)	13,973	2
1994	Age 1 (18.3)	18,499	4
	Fry (380)	16,498	3
1995	Age 1 (8.8)	14,328	4
	Fry (332)	22,719	10
1996	Fry (582)	63,601	18
1997	Age 1 (5.4)	11,227	3
	Fry (269)	17,211	3
1998	Age 1 (9.4)	17,101	7
	Fry (522)	31,204	13
1999	Age 1 (7.5)	10,688	7
	Fry (468)	47,501	13
Total	Age 1 (10.6)	77,366	10
	Fry (462)	212,707	26
Combined total	All sizes (342)	290,073	31

* Age 1 = a cohort spawned the year prior to stocking. Fry = fish spawned and stocked the same year (age 0).

Table 5. Waters stocked with Bonneville cutthroat trout produced from the Manning Meadow Reservoir brood stock, 1993-1999.

Water	County	Year(s)	Number of fish stocked
Manning Meadow Res	Piute	1993-1999	53,369
Barney Reservoir	Piute	1993-1999	35,718
Cottonwood Creek	Piute	1996	2,527
Manning Creek	Piute	1996-1999	7,037
Pine Creek Bullion	Piute	1996,1998	3,022
Minersville Reservoir	Beaver	1994	3,495
Upper Kents Lake	Beaver	1995,1996,1998,1999	19,423
Mumford Reservoir	Beaver	1995,1996,1998,1999	1,609
Senceball Lake	Beaver	1995,1996,1998,1999	2,025
South Creek Reservoir	Beaver	1995	5,025
Wards Cache Pond	Beaver	1999	308
Lower Kents Lake	Beaver	1998,1999	2,008
Middle Kents Lake	Beaver	1998,1999	4,501
East Fk Sevier River	Garfield	1993-1996	41,420
Pacer Lake	Garfield	1995,1996,1998,1999	15,098
Pine Lake	Garfield	1995,1996,1998,1999	20,666
Lower Twin Lake	Garfield	1995,1998	1,545
Upper Twin Lake	Garfield	1995,1998	1,545
Upper Big Hollow Pond	Garfield	1996,1999	1,033
Otter Lake	Garfield	1996,1998	2,022
Porcupine Lake	Iron	1996	519
Summit Creek	Iron	1996	519
Little Creek	Iron	1998,1999	1,014
Upper Abes Pond	Sevier	1996,1999	202
Abes Reservoir	Sevier	1996	5,006
Floating Island Lake	Sevier	1998,1999	8,087
Meeks Lake TLM	Sevier	1999	5,057
Morrell Pond	Sevier	1999	5,057
Provo River	Utah	1993-1995,1997-1999	36,448
South Fk Little Bear River	Cache	1997	2,332
Kolob Reservoir	Washington	1995	2,436

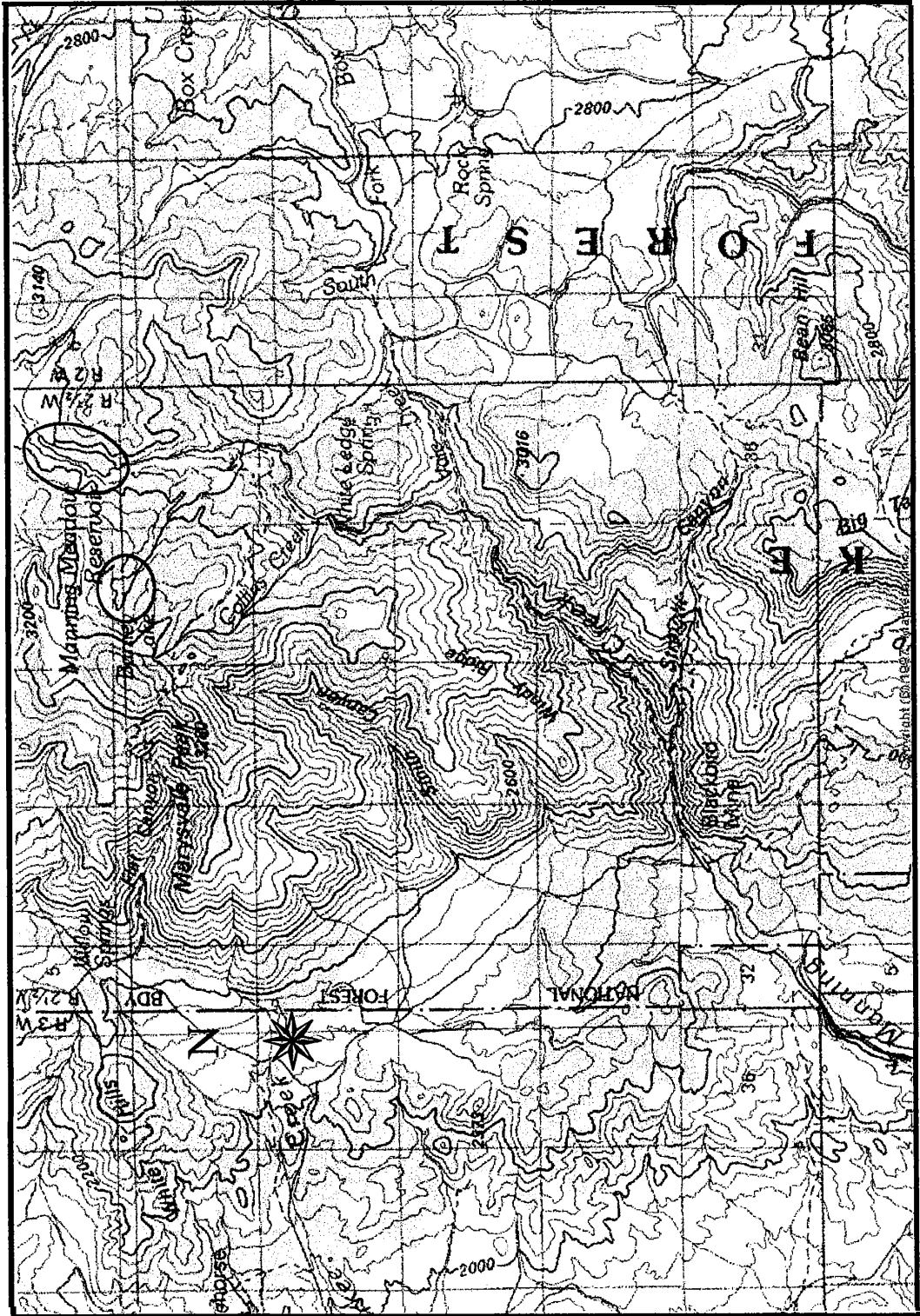


Figure 1. Map of Manning Creek showing Manning Meadow and Barney reservoirs.

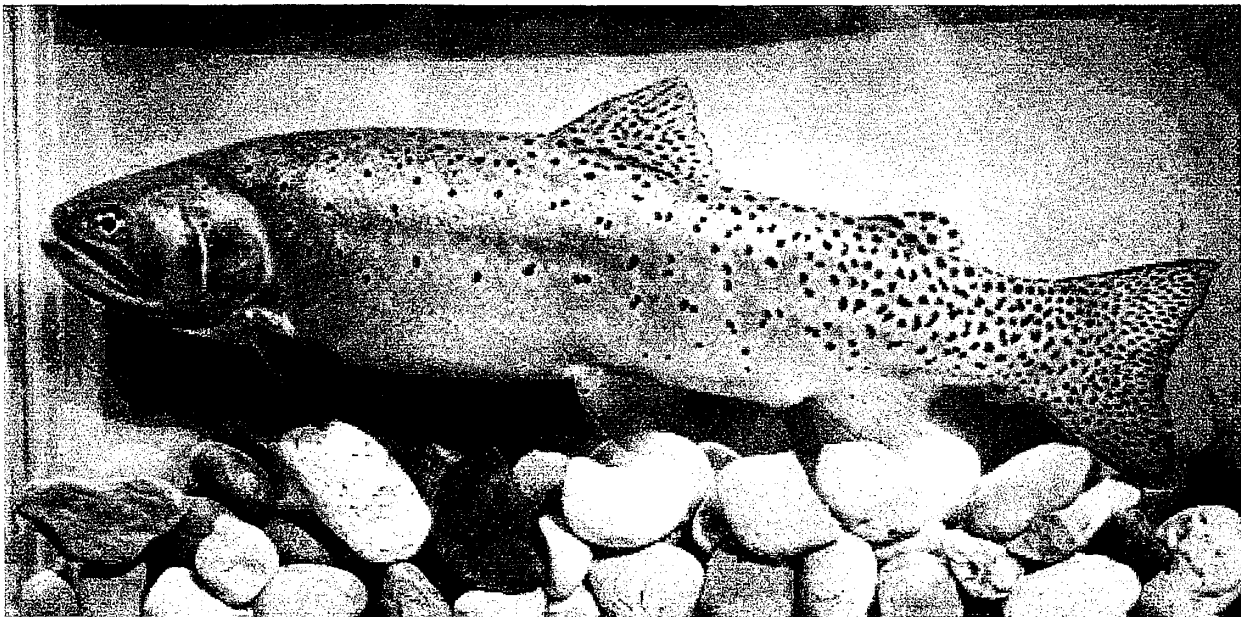


Figure 2. Male (top) and female (bottom) Bonneville cutthroat trout spawned at Manning Meadow Reservoir, 1998.