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INSIDE THIS ISSUE:

TRAPPING, SPAWNING, AND TREND SURVEYS OF BONNEVILLE CUTTHROAT TROUT CONDUCTED AT MANNING MEADOW RESERVOIR, 2003

Bonneville cutthroat trout were introduced into Manning Meadow Reservoir, Monroe Mountains, UT, with transplants from Pine Creek in 1990 and 1991. Eggs were collected from spawning trout for the first time in 1992. Eggs were taken manually from wild trout and incubated, hatched, and reared at state facilities. Year 2003 is the 12th consecutive year Bonneville cutthroat trout were trapped and spawned at Manning Meadow Reservoir. This article summarizes 2003 data and makes comparisons among all years for spawning, trapping, and trend-netting activities.

Methods

The inlet trap was set on 13 June and operated until 25 June, 2003. The reservoir spilled for several weeks during early June and some fish were also trapped at the outlet. The inlet trap included compartmentalized pens where fish could be collected, sorted, and held until spawning. Personnel were at the reservoir for 24 h/day while the inflow trap was in operation.

Spawning was conducted on June 18 and 25. The overall project and schedule was supervised by Glenwood Fish Hatchery personnel. Spawning was conducted by personnel from Egan Fish Hatchery. All fish were sorted and ripe fish were spawned using standard state methods. Females were spawned 10 fish at a time, with enough fish spawned to easily exceed 20 paired matings. Females and males were spawned at a ratio of about 2:1. Eggs were water hardened for at least an hour, then transported to the Fish Lake isolation station for incubation. Loa Hatchery personnel were responsible for egg care during incubation, until the eggs were fully eyed and then moved to the Glenwood Fish Hatchery for further rearing. Disease certification was completed as required by standard protocols. Gill-net surveys were used to compare population trend data and condition of fish among years.

Data was recorded and tabulated to keep records on spawning times, number of trout trapped, number of fish spawned, size of trout, and number of eggs taken. In addition, data was recorded on relative fish densities and condition (K_{TL}) of fish in the reservoir to allow adjustments in reservoir stocking rates and management of the brood stock.

Results and Discussion

Spawning during 2003 occurred during mid-June, about mid-range for all years that spawning was conducted at Manning Meadow Reservoir (Table 1). Total number of eggs taken was the third highest for all years, but less than the last two years (Tables 2 and 3). The project was completed by spawning on two days, scheduled a week apart, compared to some years when eggs were collected over 3 weeks. Total number of trout trapped peaked in 2001 at 1,809 and decreased to 753 in 2003. Size of trout and number of eggs per female continued to increase through 2003, reaching the highest values since 1994-1995. Reservoir stocking since 1998 was adjusted to reduce overall fish density, increase mean age and size of trout, and maximize egg-taking potential. Since trend netting data was first conducted in 2000, mean fish length increased from 296 to 359 mm and mean weight more than doubled from 280 to 596 g (Table 4). Also, condition improved from 1.05 to 1.29.

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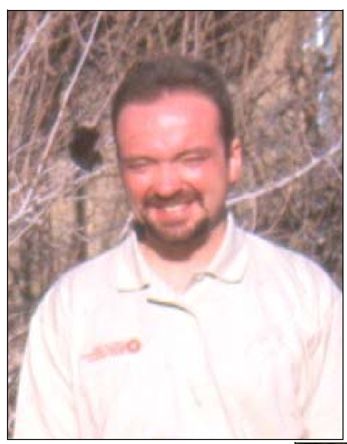
Bigger and better things

FES personnel were saddened to say goodbye recently to Office Technician **Kari Higbee**, who left to start a new career as a law student at the University of Idaho. Best wishes to Kari! Shortly afterward, however, the position was filled within UDWR by **Cathryn Smith**, formerly the director of the Lee Kay Center in Salt Lake City. Cathryn brings a wealth of experience, good humor (she's married to Kirk Smith of the Cache Valley Hunter Education Center) and savvy in dealing with state bureaucracy.

The Technical Services and Research sections of the Fisheries Experiment Station are also currently suffering from empty nest syndrome, as technicians from each section have moved on to bigger and better things. Earlier this summer, **David Latremouille,** research technician for the last year and a half, departed his position in order to further his education at Oregon State University. David was involved in research dealing with methods to prevent and control the spread of whirling disease. At OSU, David will be continuing his studies with myxozoan parasites under the guidance of Dr. Jerri Bartholomew. He is optimistic about finishing his Master's work in a couple of years, and hopes to stay in the west (or at least south of the Canadian border).



More recently, **Jared Zierenberg**, technician with the Fish Health services left his position for a more permanent position with the Federal Government. He will be working for APHIS as a wildlife biologist surveying and controlling turkey vulture populations in beautiful Gila Bend, Arizona. Jared worked at FES for only a year, but was instrumental in helping the Technical Service team keep up with inspection and survey demands during a time when personnel was limited.

All of us at FES wish all of these folks the best of luck in their new pursuits.

Myxobolus cognati Discovered in Mottled Sculpin in the Logan River, Utah

The advent of whirling disease and the discovery of *Myxobolus cerebralis* in the Logan River system has prompted a research effort that has proceeded on a few different fronts. One has been by Dr. Phaedra Budy and her staff in the College of Natural Resources at Utah State University, looking into the effects of whirling disease on the trout populations in the river and movement of fish within the system. The other effort has been to develop monoclonal antibodies against the parasite that could be used to develop diagnostic assays. This effort has been spearheaded by Dr. Nabil Yousef in the Biology Department. The specificity of the antibodies created is of special concern, since a cross reaction with a similar species of *Myxobolus* would be undesirable for an assay. *Myxobolus neurobius* is one such myxozoan species that could potentially be found in the same head with *M. cerebralis*, causing a cross reaction. Efforts to collect *M. neurobius* from the Logan River at the confluence of Temple Fork have been unsuccessful, despite previous surveys indicating its presence. However, aquatic worms from the area produced actinospores of a few different varieties. These included a triactinomyxon that was probably *M. cerebralis* and two different rabeia forms, one with a longer style. Since the work of Markiw and Wolf (1983), it is known that myxosporeans may require two hosts to complete its life cycle. The aquatic worm host is the one that releases the actinospore stage that attaches to the fish.

The unknown actinospores in the Logan River indicated that there were more myxozoans in the system that we were unaware of, so we started looking around for the other pieces of the puzzle. Ron Goede, former director of the Fisheries Experiment Station and fish pathologist, had found *Henneguya* sp. in cysts in whitefish, so that was one of the pieces. Subsequent study of cysts from mountain whitefish from the river have been reported in the 2002 Ichythyogram, vol. 13(1). Examination of mottled sculpin (*Cottus bairdi*) from the river have also turned up some myxosporeans, including a *Henneguya* sp. in the gills that is different from the muscle-infecting species in the whitefish. An unknown *Myxobolus* species was also found, the examination of which is summarized in this article.

Mottled sculpin were collected from the Logan River on 28 June 2001, 6 and 8 August 2002, and 30 July 2003. On 28 October 2002, 5 mottled sculpin were also examined from the Beaver River, at a site near the gauging station upstream of the town of Beaver, Utah. Of the 5 fish, one (127 mm TL) had a stomach cyst with an unknown *Myxobolus* species in it. By the time the fish were examined, they were starting to putrify, so no measurements were made. In addition, two mottled sculpin from the East Fork of the Little Bear River upstream of Porcupine Reservoir, were necropsied on 5 October 2001. In this small sample, a whitish cyst was discovered between the fin rays of the pelvic fin of one fish, and the other fish had cysts between the rays of the pectoral fin. These were preserved in alcohol for future use, but were not examined. On 28 June 2001, 18 fish were necropsied, 7 of which (39.9%) had cysts (2 to 8 per fish) on the stomach wall; one fish had a cyst on the tongue, and another had cysts on the gills. The stomach cysts were somewhat spherical, measuring 142 to 760 um (n = 10) on the longest axis. A total of 13 spores were measured from one of the cysts, using an ocular micrometer at 1000x using the measurement guidelines of Lom and Dykova (1992). For the 2002 sampling, 17 fish from the dugway section of Logan River were necropsied, one of which had a whitish cyst in the peritoneum which was fixed in formalin for later analysis. An additional 18 fish from the lower Logan River (near 10th W.) were necropsied, 1 of which (76 mm TL) had a peritoneal cyst. There were 11 mottled sculpin necropsied in 2003, one of which (80 mm TL) had a cyst (about 0.5 mm) in the gonad tissue (immature). Another fish (95 mm TL) had a cyst in the dermis of the upper bucchal cavity. Both cysts were excised and 14 spores from each were measured from fresh preparations.

The results of the spore measurements are summarized in Table 1. The measurements are similar among the various tissues sampled, indicating that one species is likely capable of

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Of concern, however, the overall gill-net catch dropped to 8 fish per net-night in 2003 (Table 4). Catches of 20-30 trout per net-night are considered good with higher values thought to be excessive enough to impair growth and condition of trout. Fish density at Manning Meadow Reservoir during the years from 2000 to 2002 was higher than desired but then suddenly dropped to a lower than desired level in 2003. Netting data may have been influenced by poor conditions for catching fish, resulting in sampling error, but trends in trout numbers collected in the spawning trap, overall increases in average fish size, and increased mean condition seem to verify a substantial reduction in reservoir fish density.

Discontinued stocking of “holdovers” (age 1 fish held over-winter in the hatchery) since 1998 was the main means of reducing overall trout abundance. Since then, replacement of the reservoir brood stock was totally dependent on stocking of “fry” (age 0 fish stocked the same year eggs are taken). Fry are deemed a better alternative to stocking holdovers (providing that survival is adequate) because: (1) fry minimize any potential selection on the brood stock due to hatchery rearing; (2) they have an appearance similar to wild trout with little fin damage compared to holdovers; and (3) stocking of fry minimizes the chance of inadvertently stocking other nonnative trout from a hatchery.

The abundance of holdovers (identifiable by fin condition) in gill-net samples and spawning traps declined to 25 % during 2003 (Table 4). Holdovers were at least 6 years old -- the last time they were stocked was 1998. Conversely, 75% of all the fish observed during 2003 resulted from fry stocking. Holdovers have been observed to spawn at ages 2-3, having the advantage of extra growth from being held in a hatchery over-winter. It is expected that trout stocked as fry generally would not mature until age 3 or 4. This being the case, most trout spawned during 2003 that were stocked as fry, were likely introduced into the reservoir in 1999 and 2000 when over 12,000 fry were stocked each year. After that, stocking was reduced to approximately 10,000 fish in 2001 and no stocking at all in 2002.

A review of the stocking history, gill-net results, and spawning totals suggests that further declines in the population of spawning adults might occur over the next year or two. It is recommended that stocking be increased to 15,000 - 20,000 fry per year. Hopefully, this will compensate for holdovers being totally displaced from the population and keep spawning and egg-taking capabilities in the range that has occurred the past 3 years. Prior to 1990, Manning Meadow Reservoir was annually stocked with 20,000 Yellowstone cutthroat trout fry; adult fish had slightly less than desired mean lengths, weights, and condition factors. In recent years, Bonneville cutthroat trout numbers, size and condition have been close to desired levels, but it will likely be necessary to increase stocking of fry to maintain these levels. Achieving balance among reservoir fish density, fish size and condition, and stocking rates will likely require continual adjustments.

submitted by Dale K. Hepworth, Michael J. Ottenbacher, Charles B. Chamberlain, & James E. Whelan, edited by Eric Wagner

Table 1. Bonneville cutthroat trout spawning times at Manning Meadow Reservoir, Utah 1992-2003.

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
2000	5 June	13 June	6 June	13 June	3	58	59
2001	12 June	20 June	14 June	20 June	2	58	61
2002	7 June	18 June	11 June	18 June	2	58	61
2003	13 June	25 June	18 June	25 June	2	55	57

Table 2. Spawning totals at Manning Meadow Reservoir during 2003.

Date	Lake water temperature	Number females spawned	Number males spawned	Total eggs	Eggs per ounce	Mean number of eggs per female
18 June	55	202	100	163,836	369	811
25 June	57	68	49	59,778	369	879
Total	--	270	149	223,614	369	828

Table 3. Bonneville cutthroat trout spawning totals at Manning Meadow Reservoir for 1992-2003.

Year	Number of females spawned	Mean length (inches)		Total eggs	Eggs per fluid ounce	Mean number of eggs per female	Total number of trout trapped
		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
2000	265	12.7	13.2	173,484	377	655	1099
2001	516	12.9	13.5	330,129	375	640	1809
2002	560	13.4	14.1	368,688	327	658	1310
2003	270	14.1	14.5	223,614	369	828	753

Table 4. Annual trend gill-net results at Manning Meadow Reservoir, 2000 - 2003 (CTSB = Southern Bonneville

Year	Number nets set overnight and (total CTSB caught)		Number CTSB caught per net-night	Mean total length (mm) (range)	Mean weight (g) (range)	Mean K_{TL}	Number CTSB from "fry" stocking (%)	Number CTSB from "hold-over" stocking (%)
	Floaters	Divers						
2000	1 (79)	1 (86)	83	296 (187-391)	280 (67-596)	1.05	74 (45%)	91 (55%)
2001	1 (38)	1 (90)	64	310 (213-397)	320 (79-597)	1.07	84 (66%)	44 (34%)
2002	1 (46)	1 (72)	59	332 (220-380)	427 (119-636)	1.15	78 (66%)	40 (34%)
2003	1 (7)	1 (9)	8	359 (288-409)	596 (317-1050)	1.29	12 (75%)	4 (25%)

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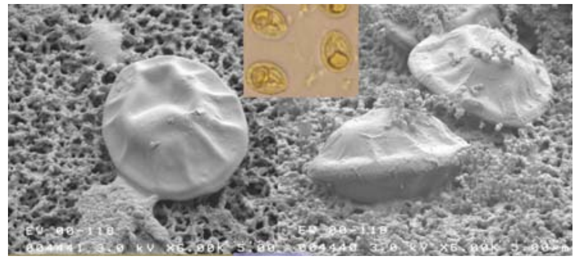
infecting a variety of tissues of the sculpin host. All the spores were oval and had several sutural ridge folds that buttressed between the rim of the shell and the dome of the shell (Fig. 1). Few *Myxobolus* species are described in Cottidae, but existing species known to date include *Myxobolus cognati* in *Cottus cognatus* in Lake Michigan (Cone et al. 1996), *M. spatulatus* in *Paracottus kneri* in Lake Baikal and *M. talievi* in a variety of cottids from Lake Baikal (Shul'man 1966). *M. spatulatus* differs from the spores observed in this study by having a posterior nub, narrower width, and shorter polar capsules. M. *talievi* differs by having shorter polar capsules, a round spore shape (rather than oval), and larger cysts.



The measurements of the spores from the mottled sculpin in the Logan River closely matched those for *Myxobolus cognati* (Table 1; Cone et al. 1996). The oval shape and sutural folds are also the same, as well as the size of the cysts. A mucous envelope was observed around some of the spores in this study. The primary difference between the description by Cone et al. (1996) and the Logan River observations is the tissue tropism. In Cone et al. (1996), the cysts were primarily found in the perioral tissue and the operculum, although two fish had cysts in the pelvic and pectoral fins, and

Table 1. Comparison of measurements (mean, range, and standard deviation) of *Myxobolus cognati* (Cone et al. 1996), *M. spatulatus,* and *M. tulievi* (Shul'man 1966) with measurements made from fresh cysts taken from *Cottus bairdi* from the Logan River. The number of spores examined is indicated for each tissue.

Tissue	Spore length um	Spore width um	Polar capsule length um	Polar capsule width um	Spore depth um
Stomach (n=13) Mean Range SD	 12.8 10.5-14 1.0	 9.6 9-11.2 0.7	 6.1 5.5-7.5 0.6	 3.2 2.5-4 0.4	
Bucchal cavity (n=14) Mean Range SD	 13.4 13-14 0.4	 9.5 8.9-10.4 0.5	 6.5 5.9-6.9 0.4	 3.0 3.0-3.5 0.2	 7.9 (n= 4) 6.9-8.4 0.7
Gonad (n=14) Mean Range SD	 14.0 13-15 0.6	 9.8 9-11 0.6	 6.8 6.4-7.4 0.3	 2.8 2.5-3.5 0.3	 7 (n = 1)
M. cognati (n=15) Mean Range SD	 13.3 12-14 0.8	 10.0 9.5-10.5 0.3	 6.6 5.5-7.5 0.6	 3.0 3.0-3.0 0.0	 8.5 8.0-9.0 0.2
M. spatulatus Mean Range SD	 9.0-12.0	 6.0-7.0	 5.0-6.0		
M. talievi Mean Range SD	 9.3-12.0	 9.0-11.0	 3.9-5.0		

another cyst was found on the flank of the body along the lateral line. In the fish observed in Utah, the site of cyst formation ranged from the fins to the stomach wall, gonads, bucchal cavity, and peritoneal cavity. The preponderance of evidence shows that the myxospores observed in the Logan River mottled sculpin are *Myxobolus cognati*. This represents the first report of this species in Utah and west of the Mississippi River. This is also the first report of *Myxobolus cognati* in *Cottus bairdi*,

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although a *Myxobolus* sp. was previously reported in gills of *C. bairdi* in Ontario, Canada (Dechtiar 1972). Cysts with *Myxobolus* sp. have also been found in the stomach wall of *C. cognatus* in Lake Aishihik, Yukon (Arthur et al. 1976), indicating that the parasite may be widespread in North America.

The impact of the parasite on sculpin populations is unknown, but populations in the rivers sampled in Utah appear to persist just fine in spite of infection.
Eric Wagner

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Out with the Old/In with the New

This past summer, our 70 year old zig-zag series of raceways were demolished and new raceways were built and completed in November, 2003. The new raceways will have approximately 8000 cu ft of rearing space using up to 800 gpm of 57F water. Additional warm water and reuse water from various areas of the facility can also be used to allow for greater flexibility in our water management. Low Head Oxygen Units, manufactured by Water Management Technologies, were installed to add oxygen to the main supply and our reuse water. Our thanks to JUB Engineers and the contractor , Spindler Construction, out of Logan, Utah.

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