The Ichthyogram

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Preliminary Evaluation of the Impact of Whirling Disease in the Beaver River, Beaver County, Utah

In Utah, the impact of whirling disease *Myxobolus cerebralis* on wild populations has not been adequately documented. This study was conducted to collect some recent information about salmonid populations in infected areas and compare it to historical data.

The Beaver River flows through a picturesque canyon directly east of the town of Beaver in southern Utah. "Section 4" of the river runs from the Mammoth Canal diversion at the mouth of the canyon upstream to the confluence with the East Fork 14.9 km (9.25 mi; Fig. 1). This section of the Beaver River supports populations of wild brown and rainbow trout and is supplemented annually with 6500-7000 catchable rainbow trout. Section 4 is a popular fishery and recently tested positive for *M. cerebralis* (October 1996); of eleven 5-fish pools of rainbow trout, all were positive, with an average of 47 spores/100 fields/pool. Significant pathology was also noted in histological slides of the head. Samples from the upstream tributaries (Merchant Creek and Lake Stream) were tested in the summer of 1997 and were negative. Because the river is now infected with *M. cerebralis*, a survey was conducted to assess any changes in the populations of wild trout in the river that may be correlated with the infection.

Three 100 m reaches were sampled by 2-pass electroshocking within Section 4 of the river on September 11 and 12, 1997 and the data compared to stream surveys conducted in 1981 and 1988. Only brown and rainbow trout were captured in sufficient numbers to estimate total population size. Young-of-the-year trout (<85 mm) were not included in these estimates due to difficulty in identification between species. Data for hatchery and wild rainbow trout were pooled for population estimates due to insufficient numbers of hatchery fish in some of the stations and passes. However, hatchery fish (identified by fin erosion) were separated for comparison of relative abundance (percent of sample) between 1988 and 1987. Also, hatchery fish were excluded from the length histograms in which fish from all stations for Section 4 were pooled.

Composition of the salmonid population from surveys conducted in 1981, 1988, and 1997 is shown in Fig. 1. Brown trout and rainbow trout dominated the samples, but an occasional cutthroat trout or brook trout was also captured. The percentage of brown trout was higher than previously

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Table 1. Summary of relative abundance, average size, and biomass (mean ± SD) of rainbow trout and brown trout of the Beaver River between the Mammoth Canal diversion and the East Fork Beaver River (Section 4) in September 1988 and October 1997. An asterisk indicates significant differences between years for a specie. Rainbow trout values include fish of both wild and hatchery origin.

	Rainbow trout		Brown trout	
	1988	1997	1988	1997
Number of fish per km	418 ± 53.8*	217 ± 123.4	292 ± 216.0	810 ± 682.9
Biomass (kg/ha)	58.8 ± 13.8*	31.3 ± 15.5	32.2 ± 24.7*	107.1 ± 45.8
Average total length (mm)	185 ± 43.2	187 ± 39.8	180 ± 39.7	189 ± 53.2

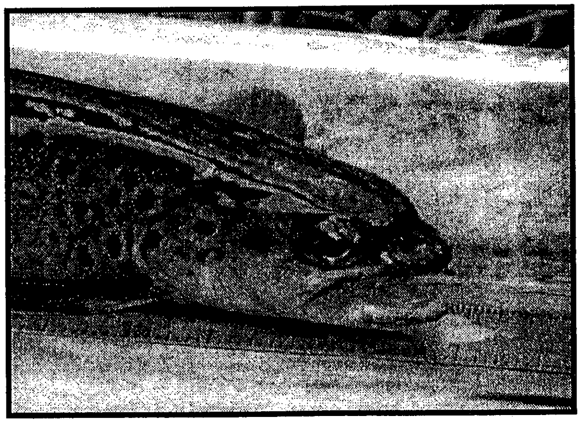
recorded (95.6%) in the sample from the middle of Section 4, but the composition of other samples taken in 1997 was similar to previous years. There were no significant differences in the percentage of either wild rainbow trout or brown trout between 1988 and 1997. The upper stations of the section appeared to have the greatest change in composition, with brown trout outnumbering the rainbows in 1997, while the reverse was true in 1988.

Deformities related to hooking injury were common in the 1997 samples, but there were also some clinical signs of whirling disease. The rainbow trout population had a greater percentage of deformities (10-12%) than brown trout (1.5%) in the section, which is consistent with susceptibility differences reported among salmonids. In the gauging station sample, 2 of 19 (10.5%) rainbow trout had the high, sloped forehead type of deformity. Further upstream, 2 of 130 (1.5%) brown trout had head deformities as well (**see photo**). Above the Kent's Lake turnoff, 2 of 16 (12.5%) rainbows had head deformities. The deformities were primarily in the head, such as highly sloped foreheads and malformed opercles.

The total trout biomass ranged from 22 to 100 kg/ha in 1988 and from 90 to 165 kg/ha in 1997. Rainbow trout biomass was significantly lower in 1997 than in 1988, but total biomass was not significantly different. The decline in rainbow trout biomass was compensated by the significant rise in brown trout biomass.

The number of rainbow trout per river km in 1988 varied from 350 to 481 among the four reaches sampled, compared to 80 to 320 per river km in 1997. Numbers of brown trout ranged from 142 to 612 per river km in 1988, and from 320 to 1590 per river km in 1997. Rainbow trout were significantly less abundant in 1997 than 1988 (Table 1). Brown trout numbers were higher in 1997, but the difference was not significant.

Is the decline in rainbow trout due to whirling disease? That cannot be determined for certain with the data at hand. Since no



whirling disease testing of the river was conducted prior to Oct. 1996, the time when whirling disease first infected the stream will never be known. Hence, comparisons with

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previous years are compromised. Comparisons in this evaluation are based on the assumption that whirling disease was a recent invader of the Beaver River system, a hypothesis supported by the fact that the tributary streams were still *M.c.* free in 1997. Recent surveys of wild populations throughout the state also indicated that the disease is not widespread and that the infection is relative recent.

The decline in rainbow trout may reflect greater fishing pressure in more recent years. Due to differences in catchability, anglers could selectively harvest more rainbow trout than brown trout. This hypothesis is supported by the histograms of rainbow trout which appear to indicate healthy populations, with adequate recruitment of wild fish in both 1988 and 1997. In both 1988 and 1997, brown trout appear to have the size distribution of a healthy population, with more small or juvenile individuals and a gradual decline in the number of individuals as size increases.

If whirling disease is killing rainbows, it is not affecting the size distribution. However, this may indicate that the disease has been present for several years, reducing numbers of fish in all size classes. Unfortunately, there was no previous disease sampling nor creel survey data to more accurately quantify fishing pressure or the time of infection.

In summary, the rainbow trout population has declined to about half that observed in 1988. Solid evidence to pinpoint the cause is not available, although whirling disease and fishing pressure are primary suspects. Brown trout populations are healthy and expanding and the increase in total biomass of this species indicates that adverse environmental factors are not causing overall declines in salmonid abundance. It is interesting to note that brown trout abundance currently does not appear to be compromised by the presence of the infected rainbow trout population. In fact, brown trout appear to be more abundant upriver than in 1988. Further population monitoring in conjuction with creel surveys is recommended to track rainbow trout abundance over time.

Eric Wagner

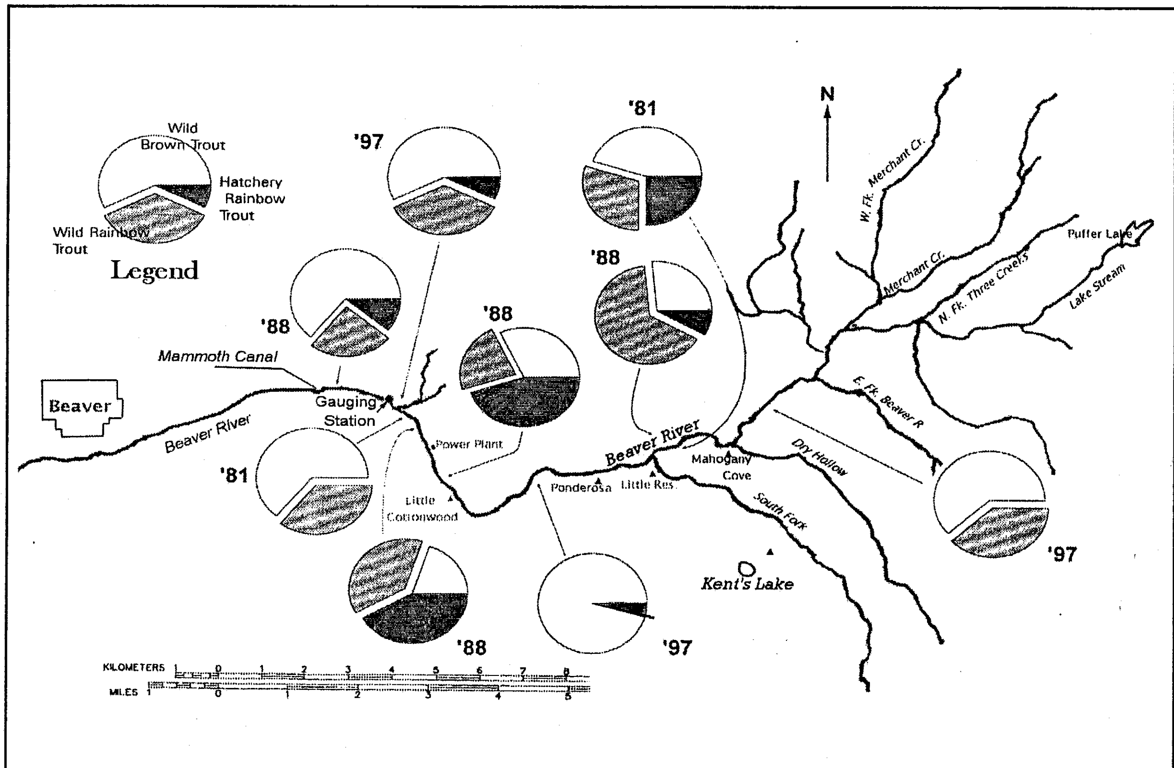


Figure 1. Percent composition of brown trout, wild rainbow trout, and hatchery rainbow trout from electrofished samples from Section 4 of the Beaver River, Beaver County, Utah taken in 1981, 1988 and 1997.

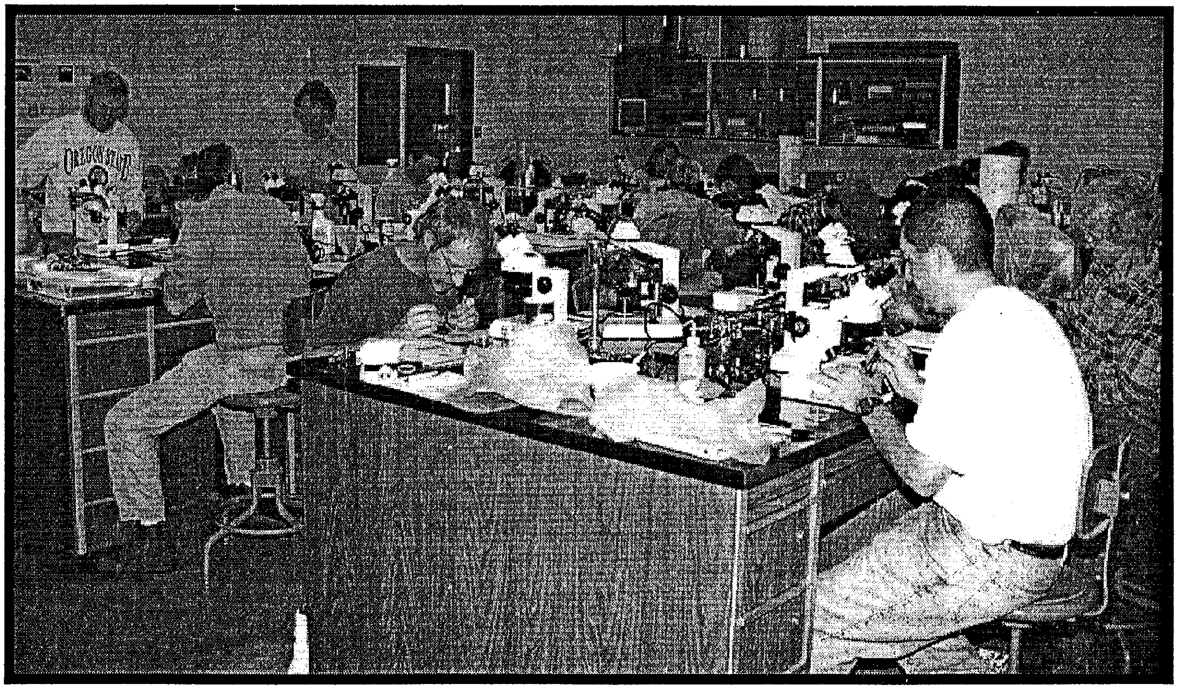
New Faces at Fisheries Experiment Station

1997 has seen a number of comings/goings to the staff at the Fisheries Experiment Station. Office manager **Debbie Kohler** retired to spend more time with her growing family. Replacing her is **Helen Roberson**. Helen is a native of Ogden. She comes to Logan along with her daughter, Jennifer and son David.

Returning to Logan as Wildlife Technician II in the hatchery is **Roger Mellenthin**, who replaces **Quentin Bradwisch**, who took a position at Lake Powell. Roger previously worked at the Station as caretaker for the June sucker project.

Also returning to work as a short term research biologist is Mark Brough who replaced Mark Smith who returned to college. The current June sucker technician is Dave Gatherum, a student in Wildlife and Fisheries at Utah State University.

National Oligochaete Workshop Held in Logan, Utah



Ronney Arndt and Art Butts from the Fisheries Experiment Station are among students learning all about tubifex worms at a national oligochaete workshop sponsored by the Whirling Disease Foundation and the Utah Division of Wildlife Resources. Students from agencies and universities across the country were among the participants.The meeting was held on October 21-23 at Utah State University in Logan and was conducted by Dr. Deedee Kathman and Dr. Ralph Brinkhurst of the Aquatic Resources Institute in Franklin, Tennessee.

Progression of Whirling Disease in Kokanee Salmon at Porcupine Reservoir from 1996 - 1997

As previously reported, *Myxobolus cerebralis* was first discovered in kokanee salmon from Porcupine Reservoir in northern Utah in 1994 (see *Ichthyogram,* Vol. 5 #2, Vol. 7 #1). Prior to the finding, fish had been tested from 1987 to 1993 and found negative for the parasite (n=150). DWR pathologists have been concerned about the potential impact of the infection on this species because of their reproductive biology, where spawning adults die within the stream each year. It has been feared that large numbers of spores of the parasite would be released annually from the decomposing fish, thus raising the level of infection in the aquatic ecosystem.

Grossly deformed kokanee were first observed in gill nets in 1995. In an attempt to track the levels of infection in spawning fish, biologists electroshocked the major spawning tributary to the reservoir in October of 1996 and 1997. A total of sixty spawning kokanee was collected each year and examined for gross deformities, using the deformity index portion of the Health Condition Profile (see *Ichthyogram*, Vol. 6 #3). This index compiles observable deformities of the cranium, operculum, gill rakers, mandible, spine, fins or elsewhere. In addition, deformities were ranked 1 - 3, depending on severity. The total observed deformities were expressed as a percentage to arrive at the deformity index. Male kokanee commonly show secondary sexual characteristics such as malformed mandibles, although kype formation was not recorded as a deformity for this study. Lengths of individual fish were recorded, then cranial wedges were excised and bagged individually. Wedges were individually processed by the pepsin-trypsin digest method and the residue examined for presence and number of spores resembling *M. cerebralis* (100 fields at 40x magnification).

Both visual observations and laboratory results show a rapid increase in the frequency, levels and severity of infection of these fish by the whirling disease parasite from 1996 to 1997. The overall deformity index increased slightly from 1996 to 1997, but the number of fish with cranial deformities (considered more characteristic for whirling disease) increased dramatically from six to eighteen. In 1996, 100% of fish (6/6) with cranial deformities were infected, and in 1997, 83.3% (15/18) were infected. The percentage of individual fish positive for the parasite increased from 30% (n=18) to 73% (n=44). In addition, the average number of spores/100 fields/fish radically increased from 2.1 to 128.9.

The results of this limited study strongly suggest that the incidence and severity of whirling disease is rapidly increasing in the population of spawning kokanee adults at this reservoir. Population trends of this species have not been determined in the reservoir. Biologists report that redd counts in the stream have not diminished thus far. It is considered likely that increased infection in individual fish will preceed any population effects. Plans are underway to continue testing of the population in 1998.

Chris Wilson

Table 1. Summary of comparison of values between kokanee salmon sampled at Porcupine reservoir between 1996 and 1997.

	No. of Infected fish	Percentage Infected fish	Spore Average/ 100 fields	Deformity Index	Cranial Deformities	Total # of Fish with Deformities
1996	18	30	2.11	14.7	6	21
1997	44	73	128.9	15.75	18	31

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