# Fish Disease Risk Assessment Study: Whirling Disease and Ceratomyxosis

# Summary of 2002 Research Results

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## COMPLETED VIRULENCE STUDIES

To model disease and evaluate risk in a population, it is important not only to know if the fish are susceptible to infection, but to know how many spores they will introduce back into the system after exposure to different infection levels. This study year we repeated challenges with Deschutes Basin strains of bull trout and steelhead. Challenges of chinook salmon were completed using upriver bright and Willamette River strains at a younger age and under different exposure conditions than in previous challenges of the Deschutes Basin strain. Results for each species are summarized below.

- Bull trout: Evaluation of the susceptibility of bull trout fry to *Myxobolus cerebralis* infection using two different laboratory challenge models demonstrated that the method for administering the exposure dose affected infection prevalence. Administration of a low parasite dose (500 per fish) in a single exposure did not establish infection, but when the same cumulative dose was administered over 21 d, the prevalence of infection was 45%. Results of challenges at a high exposure dose (5,000 per fish) were similar, with infections detected in 24% of the fish receiving a single dose and in 40% of the fish administered the same dose in multiple exposures. Clinical disease was not detected in fish exposed using either challenge method. Susceptibility of yearling bull trout was tested using a single high dose of 10,000 per fish, and infection was detected in only 5% of those fish.

- Chinook salmon: Laboratory challenges with *M. cerebralis* demonstrate that rainbow trout have a greater susceptibility to infection and development of whirling disease compared to chinook salmon. In age-dependent challenges, triplicate groups of each species were exposed at 1, 3, 5, 7, and 9 weeks posthatch to 1,000 triactinomyxons per fish, and juvenile chinook salmon were exposed to a high dose of 10,000 triactinomyxons per fish. Assessment of infection at 5 months postchallenge showed that chinook salmon acquire resistance to clinical disease after 3 weeks posthatch, as compared to 7 weeks posthatch for rainbow trout. Furthermore, all measures of infection severity, including myxospore burden and lesion score, were lower in chinook salmon. To model a natural exposure and evaluate the ability of the fish to retain resistance following repeated challenge, replicate groups of chinook salmon and rainbow trout were exposed daily to low parasite doses (5–200 triactinomyxons per fish) for 4 weeks. A low prevalence of infection and no clinical disease signs were recorded in the sustained challenges. These challenges indicate an overall greater susceptibility to *M. cerebralis* for rainbow trout.

- Steelhead trout: Results of challenges with steelhead in this study contrast with other reports where this species was found highly susceptible. When compared with simultaneously exposed rainbow trout of approximately the same size, the Deschutes River steelhead appear to be more resistant to *M. cerebralis*. Results from the 2002 challenge, where steelhead were exposed to 50 and 500 triactinomyxons eight times over 3 wk, supported earlier findings. Clinical disease signs (whirling, exopthalmia, blacktail, and skeletal and cranial deformations) were present in all exposure groups, but prevalence of spinal deformities, exopthalmia and blacktail were higher among rainbow trout than steelhead. Assessment of challenge data for steelhead is continuing.

## DISTRIBUTION OF THE ALTERNATE WORM HOST

Above the Pelton Round Butte Project (Project), *Tubifex tubifex* was identified from five sites on the Crooked River [RM 5 (above Cove Palisades), RM 30 (Lone Pine bridge), RM 46 (McKay Creek), RM 47 (Ochoco Creek) and RM 60 (Sterns Dam)]; six sites on the Metolius River [RM 5 (Chinook Island), RM 7 (Box Canyon), RM 10 (Street Creek), RM 11, 12 (2 samples around Rattlesnake Point), and RM 6.1 (Suttle Lake Outlet into Lake Creek)]; and from two sites on the

upper Deschutes River [RM 116 (Delta area) and RM 133.5 (Lower Bridge)]. In Lake Simtustus, *T. tubifex* was identified from a sample collected at RM 108.5.

Below the Project, *T. tubifex* has been identified from samples collected in the mainstem of the Deschutes River at RM 47 (Oak Springs Hatchery), RM 51 (Bakeoven Creek) and RM 87 (Trout Creek) and in the Warm Springs River at RM 10 (Warm Springs Hatchery). Many of these sites were sampled several times, and samples from many sites yielded only juvenile tubificids, and their identity as *T. tubifex* could not be confirmed. See Figure 1 for locations of sites where *T. tubifex* was detected.

## BIOASSAYS FOR INFECTIOUS *M. CEREBRALIS* IN THE LOWER DESCHUTES RIVER BASIN

The following is an overview of sites where sentinel fish were exposed between 1999 and 2002 (Figure 1):

- 1999 – Rainbow trout and steelhead were exposed at a site just above Oak Springs Hatchery (RM 47.2) for 2 weeks in June and July.
- 2000 – Steelhead were exposed at Oak Springs, the Reregulating Dam, and in the Warm Springs River near the Warm Springs Hatchery for 2 weeks beginning July 24th.
- 2001 – Rainbow trout were held at Moody Rapids, Oak Springs, in the Warm Springs River near Warm Springs Hatchery and Trout Creek for 2 weeks in July/Aug.
- 2002 – Rainbow trout were exposed in the Warm Springs River at Warm Springs Hatchery and in Shitike Creek for 2 weeks in late August and early September. In October, test fish were exposed to the lower Deschutes River at Oak Springs Fish Hatchery, and in lower Buck Hollow and Trout creeks.

*Myxobolus cerebralis* infections have not been confirmed in any sentinel fish exposed at sites in the lower Deschutes River Basin. Testing of fish exposed in 2002 is not complete; however, to date there have been no detections of *M. cerebralis*.

## GENETIC VARIATION OF WORMS / SUSCEPTIBILITY TO *M. CEREBRALIS*

Genetic analysis of *T. tubifex* collected from the Deschutes River at Oak Springs was done by Dr. Rassmussen at the National Fisheries Research Center in Seattle. This analysis utilizes two different sets of molecular markers that amplify either a specific region of the ribosomal RNA gene sequence (ITS1) or random DNA sequences (RAPDs) to analyze this population and other geographic isolates of *T. tubifex*.

Analysis of *T. tubifex* collected from the Deschutes River at Oak Springs Hatchery demonstrated that the most abundant *T. tubifex* genotype grouped with strains that show a decreased susceptibility to infection. However, it is not known if this is the predominant genotype present throughout the river, and there is limited data on the relationship between genetic strain and ability to support the parasite life cycle.

## *CERATOMYXA SHASTA* STUDIES

Studies were conducted to determine if exposure in the Pelton Fish Ladder could be predicted and the source of infection identified. Sentinel fish were held in the ladder weekly for 6 wks prior to transfer of chinook salmon to the raceway. Samples of 25 fish were removed after a 1 d and 6 d exposure, and after 1 wk each group was transferred to holding facilities at the OSU-SDL. Infection was not detected by PCR from any of the exposure groups, and none of the fish retained for 3 mo developed Ceratomyxosis.