The Ichthyogram

March 1995 Volume 6 Issue 1

Experimental Use of Cobble Substrates in Concrete Raceways for Improving Fin Condition of Albino Rainbow Trout (*Oncorhynchus mykiss*)

A recent survey of all ten Utah state fish hatcheries indicated that better fin condition often occurred in trout that were reared in raceways and ponds which contained natural bottom substrates such as gravel or mud. This phenomenon was corroborated in a subsequent study in which cutthroat (*Oncorhynchus clarki* utah) and rainbow trout (*O. mykiss*) in cobblestone bottom raceways had significantly better fin condition than fish in concrete bottom raceways. In the Utah hatchery survey, albino rainbow trout (*O. mykiss*) had better fin condition when compared to normally pigmented rainbow trout of the Fish Lake-DeSmet strain.

In this study conducted in 1994, albino rainbow trout fingerlings were reared for 200 days in concrete raceways with or without (controls) cobblestone bottoms. On four different occasions, health/condition profiles (HCPs) were performed on 20 fish per treatment and fin lengths were measured. There was a significant reduction in fin erosion in cobble bottom raceways using either fin indices (ranked from 0 to 2) applied to the fish as a whole or relative fin lengths (% of body length) of individual fins. Significant shortening of fins of control fish occurred on caudal, dorsal, anal, both pectoral fins, and both ventral fins. These differences were detected by fin length measurements before they became visually noticeable in the fin index.

In addition to fin erosion, other differences were noted between treatments. In the last two samples, fat index and condition factor values were greater in control fish than fish in cobbled raceways. Mean lengths derived from the HCP were also greater for control fish (196 mm) than cobble raceway fish (177 mm) in the last sample. Final mean weight was greater in controls (91.6 ± 25.4 g) than in cobbled raceways (67.3 ± 0.8 g), but the difference was not statistically significant. There were sporadic significant differences in the thymus index (1.4 and 0.7 in control and cobbled raceways respectively; p=0.003, day 192),

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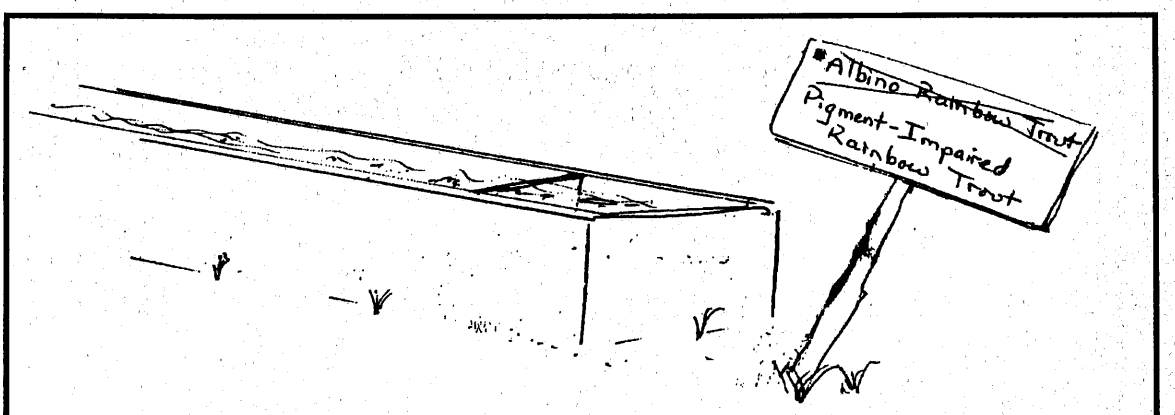
bile index (control 0.55 and cobble 1.15; p=0.032, day 108), and the eye (fish from cobbled raceways had a greater incidence of exopthalmia in the last sample, p=0.050). The eye pathology difference is probably related to the relatively high nitrogen gas saturation in the incoming water.

The results with the albinos differed somewhat from previous results in the same raceways with normally pigmented trout. The albino rainbow trout in cobbled raceways had perfect fins (0 fin index) at the end of the experiment, but normally pigmented rainbows had increasingly worse fin erosion as time progressed, although reduced in cobbled raceways. Behavioral differences may account for the difference, since environmental conditions and rearing variables such as density were identical for the studies. Fin nipping of the dorsal and pectoral fins has been documented for juvenile steelhead trout, *O. mykiss*. G. Kindschi and his coworkers at the Fish Technology Center in Bozeman, MT observed that steelhead fingerlings reared in isolation did not develop dorsal fin erosion, compared to counterparts reared in production nursery tanks.

The difference between albino and normally pigmented rainbow trout raises some interesting questions: If fins are perfect in cobbled raceways for albinos, does this indicate that aggressive behavioral interactions are nil? Does this apply to concrete bottomed raceways as well? If so, does this mean that the erosion observed is entirely from abrasion and bacterial infection? Does the difference between albino and pigmented rainbow trout in concrete bottomed raceways represent the contribution of agonistic behavior to fin erosion (i.e., pigmented rainbow trout display environment + behavior effects, and albino rainbow trout display only the environmental effects)? If aggressive behavior is still present in albino rainbow trout, is the clear color of the fins a factor?

Overall, cobble substrates markedly reduced fin erosion, suggesting that natural bottoms are especially suitable for albino rainbow trout rearing.

Eric Wagner



Politically Correct Fish Culture in the 90's

Ornamental Goldfish (*Carassius auratus*) Infected with Amoebas: a Case Report

Two ornamental goldfish were presented to the Utah Fish Disease Diagnostic Laboratory by a private aquarist with a concern over the fish's erratic swimming and abnormal orientation in the water. The condition was described as being chronic and progressive. Several affected individuals had previously been euthanized. The fish had been obtained from various pet store and were housed in various containers which utilized undergravel filtration and dechlorinated tap water. Previous treatment for the fish consisted of over the counter commercial preparations to remove external parasites.

A physical examination showed two active individuals that were head down or upside down in the water. The fish were slightly emaciated, although the owner reported the fish showed good appetite for a commercial koi ration. Gross appearance of the external surface and viscera showed no abnormalities. Microscopic examination of the gill filaments from the euthanized fish showed moderate number of monogenetic trematodes on the secondary lamellae. Turbid cerebrospinal fluid examined on a wet mount showed numerous active amoeboid organisms (see figure 1). Based on the morphology, a tentative identification of *Naeglleria* or *Acanthamoeba* sp. was made. Due to the potential for zoonosis, the owner was advised to eliminate the remaining fish. They were referred to the Fish Parasitology lab at Brigham Young University for further study.

At that location, eight goldfish were housed for further observation and study. From this group, two swam erratically and became lethargic. These were removed from the tanks, euthanized and examined for parasites. When an incision was made into the cranium, a grey to yellow purulent exudate appeared. A wet mount of the exudate examined microscopically showed the presence of both amoeboid and flagellated amoeba moving actively throughout the slide preparation. The two protozoa observed were consistent with *Naegleria* and *Acanthamoeba. Naegleria* has both an amoeboid and biflagellated phase in its life cycle, while *Acanthamoeba* has pseudopodia only. Both organisms are facultative parasites with prominent free living forms. These are common soil and aquatic protozoa. From our literature search, this is the first recorded natural intracranial infection of these species of amoeba for fish.

Species of *Naegleria* and *Acanthamoeba* are capable of facultative parasitism in humans; becoming highly pathogenic in intracranial areas.

Naegleria fowleri causes primary amoebic meningoencephalitis (PAM) in humans. Species of *Acanthamoeba* have also caused encephalitis and corneal ulceration in humans. Thus further work is warranted on the intracranial forms in fish.

Four of the eight ornamental goldfish housed at the University lab have died

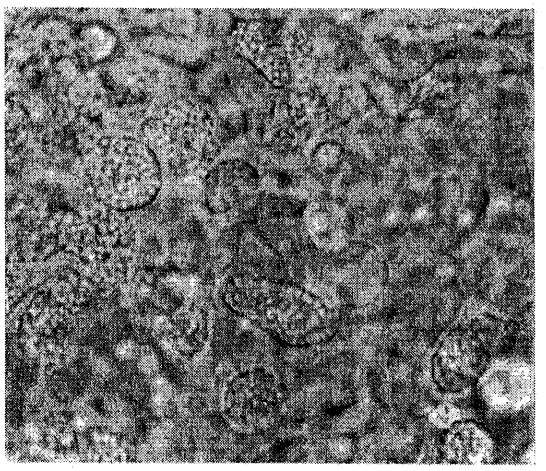


Figure 1. Wet mount of amoeboid organisms from cerebrospinal fluid of goldfish.

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and all have had amoeba in the intracranial area. No success has been made in culturing the amoeba or infecting laboratory mammals. Measurements and observations of the wet and stained slide preparations of the protozoa are consistent with *Acanthamoeba* and *Naegleria* . All the examined goldfish had monogenetic trematodes and *Ichthyopthirius multifiliis* on the gill surface. The gill surface may be an entry point for the intracranial amoeba. The histopathology of the infected fish is under investigation.

Chris Wilson, Fisheries Experiment Station and Richard Heckman, Brigham Young University

(Editors note: This article is revised and abridged from an earlier version that appeared in the AFS Fish Health Section Newsletter.)

Recent Publications from FES

Bosakowski, T., and E.J. Wagner. 1994. Assessment of fin erosion by comparison of relative fin length in hatchery and wild trout in Utah. Canadian J. Fisheries and Aquatic Sciences 51:636-641.

Bosakowski, T., and E.J. Wagner. 1994. A survey of trout fin erosion, water quality, and rearing conditions at state fish hatcheries in Utah. J. World Aquaculture Society 25(2):308-316.

Wagner, E.J., and T. Bosakowski. 1994. Performance and behavior of rainbow trout reared in covered raceways. Progressive Fish-Culturist 56:123-129.

Wagner, E.J., T. Bosakowski, and S.A. Miller. 1995. Evaluation of the absorption efficiency of the low head oxygenation system. Aquacultural Engineering 14:49-57.

Wagner, E.J. and D. M. Driscoll. 1994. Physiological stress responses of cutthroat trout to loading by fish pump, conveyor, or dip net. J. Applied Aquaculture 4(1):19-27.

Wilson, C., R. Heckman, R. Goede, and V. Inchausty. (1995). Intracranial amoebiasis in ornamental goldfish (*Carassius auratus*): a case report. Fish Health Section Newsletter. Vol. 23 (1) :1 - 3.

New Faces at FES

The Fisheries Experiment Station welcomes Quentin Bradwisch, Wildlife Technician, who replaced Brian Shearer. Quentin graduated from Utah State University with a BS degree in Wildlife and Fisheries Science in 1991. He was earlier employed as a temporary biologist for the Utah Division of Wildlife Resources on the Virgin River. Before being hired as our technician in January 1995, he was a technician raising endangered fishes at the Ouray Federal Hatchery. Welcome aboard!

Further Information on the Brake Trout (*Salmo trutta x Salvelinus namaycush*) and the Reciprocal Cross

In 1993, Utah Division of Wildlife Resources decided to experiment with a hybrid cross, the" brake trout" (see *Ichthyogram*, Volume 5, Issue 1). This is a lake trout male x brown trout female. It was hoped that this hybrid would be resistant to whirling disease and could be stocked in the infected areas to provide a good sport fishery. The lake trout are reported to be resistant to whirling disease and the brown trout have proven to be less susceptible to the disease.

On October 26, 1993, brown trout females from the Egan Hatchery were crossed with the lake trout males taken from Fish Lake and heat shocked to induce triploidy. Researchers from Washington State University have found that inducing triploidy in hybrid crosses increases survival. Eggs were heat shocked 40 minutes after fertilization for 10 minutes at 27-28 C. Eggs were incubated at 5.1 C at the Fish Lake hatchery building until eye-up and then shipped to the Fisheries Experiment Station where eggs were incubated at 12-13 C, hatched, and surviving fish raised to be tested for whirling disease in infected waters. The brake had a 30% hatch and 7.4% went on feed (Table 1).

To continue the study of brake trout resistance to whirling disease, additional eggs were taken at Fish Lake on November 11, 1994. This time eggs were not heat shocked for triploidy. This group of brake trout had only a 3.56% hatch and 0.3% of fish were on feed. A very high percentage of alevins and fry on feed were blind and the head was deformed. This is believed to be a congenital problem.

A reciprocal cross (the lake trout female x brown trout male) was also done on October 19, 1994. . This group was heat shocked. Survival was very poor: 17.39% of eggs hatched and only 0.16% of fish on feed. A very high percentage of the alevins had a clear gelatinous sac around the yolk sac and the yolk sac was coagulated. This is also believed to be a congenital problem, possibly related to water temperature.

Table 1. Summary of survival to hatching and initial feeding of brown & x lake trout % and lake & x brown % crosses.

Lot/Heat Treatment	Eggs Received	Percent Hatched	Percent fish on Feed
1993 Brake Trout Heat Shocked	56,052	30.03%	7.4% (4147)
1994 Brake Trout not Heat Shocked	96,938	3.56%	0.30% (295)
1994 Reciprocal Brake Heat Shocked	74,561	17.39%	0.16% (120)

Although not replicated, our experience with brake trout corroborates the findings of other researchers that have shown that inducing triploidy by the heat shock method

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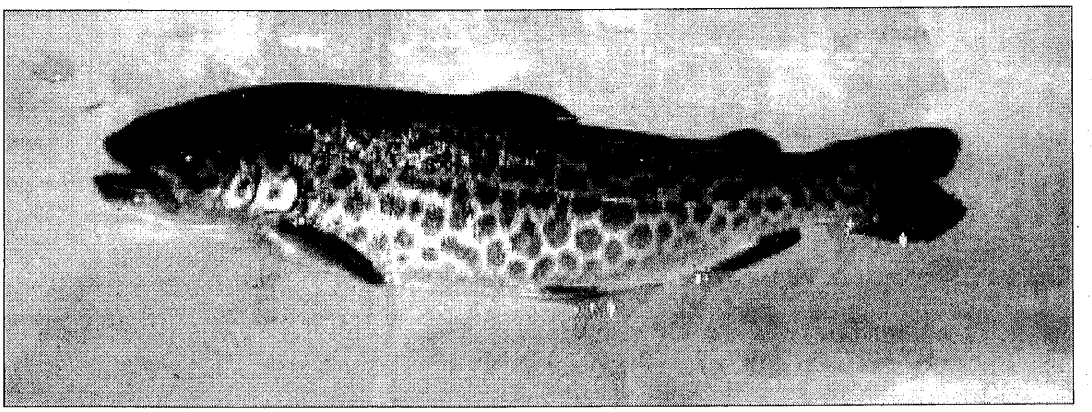
increases survival. Eggs taken in the fall of 1995 will be heat shocked. Further work with the reciprocal brake will not be pursued due to the poor performance of the 1994 lot and the scarcity of lake trout eggs.

Currently, 150 brake trout are being held in sentinel cages in Spring Creek and Forsyth Reservoir in Wayne County. In the spring of 1995, the brake trout will be checked for whirling disease as will the rainbow trout being held in these waters as controls. Preliminary trials by Dr. S. LaPatra at Clear Springs Trout Farm indicate these fish have a high innate resistance to infectious hematopoetic necrosis virus (IHNV). In addition to disease susceptibility, the 1993 brake trout will be tested for fertile gametes. A brake x brake trout cross may be conducted to determine If they are fertile.

Doug Routledge



More on Whirling Disease

Whirling disease is, once again, very much in the news as additional information surfaces. The pathogen has shown up in high profile streams for which there was substantial historical data. This data indicated very serious loss of recruitment in the wild rainbow trout since infection with *Myxobolus cerebralis*. The systems of note are the Madison River in Montana and the Upper Colorado River in Colorado. Biologists in those areas are mounting intensive investigations to determine if whirling disease is responsible for the loss. Fish pathologists must determine pathology and pathogenesis, but determination of impact on wild populations must come from efforts of population-oriented field fisheries biologists. Substantial joint efforts are now developing. Trout Unlimited and the national news media have picked up on it and a great deal of concern has been voiced.

The idea, voiced in many quarters, that whirling disease is no problem is looking a little weak right now. It would appear that the strong concern by the Utah Division of Wildlife Resources and the desire to contain this parasite will be vindicated. Our stand from the beginning has been that we would not turn this parasite loose until the impact

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on wild populations was defined and it indicated no significant problem. It is still considered a prohibited pathogen by the newly instituted Fish Health Policy Board which operates now under the Utah Department of Agriculture.

We are initiating research projects in Utah to track impact. Baseline population data will be obtained on the S. Fork Ogden, Little Bear, and Blacksmith Fork rivers. Work will be done in Causey and Porcupine reservoirs to determine dynamics of the disease and impact on the kokanee populations. Hybrids such as the splake, reciprocal splake, brake, and tiger trout will be evaluated for disease resistance and possible sport fish management in infected waters. Standard stress challenges will be conducted with infected and non-infected fish. The biology of the tubificid intermediate host will also be investigated. The next issue of the *Ichthyogram* will deal with this subject in more detail.
Ron Goede

FES Research Direction

On Feb 1, 1995 the Aquatics Section staff provided some input into the research direction at the Fisheries Experiment Station. At that meeting, the following areas were determined to be research priorities:

- **Fish sterilization techniques**
- **Hybrid fish performance**
- **Whirling disease impacts**
- **Feed evaluation studies**
- **Enhancing wild fish production in culture activities (e.g.,fecundity and productivity)**
- **Evaluation of fish culture theraputics**
- **Wild vs. domestic trout studies**

The sterile rainbow trout are needed for Strawberry Reservoir management. To this end, tetraploid brood stock will continue to be evaluated, with diploid crosses being initiated for the first time this fall. Electroporation will also be evaluated as a technique. Hybrid fishes (tiger, brake, splake, and reciprocal splake) are to be evaluated for resistance to whirling disease, survival in the wild, and contribution as a sport fish. These fish may be suitable alternative to rainbow trout in whirling disease waters. The feed evaluations are primarily for floating and low phosphorus feeds which hold promise for reducing waste accumulation and phosphorus pollution in the hatchery outfall. Loa, Mantua, and Midway hatcheries will be involved with the low phosphorus diet experiments beginning in the fall of 1995. Also planned is some additional research with native cutthroat strains, optimizing perfomance in the hatchery and the wild. The primary theraputant to be evaluated is hydrogen peroxide. Recent tests on eggs were ineffectual, so additional tests will evaluate longer durations and higher concentrations. In addition, clinical trials will be started in some hatcheries in coordination with the superintendents and FES Technical Services for treatment of bacterial gill disease and ectoparasites.

There is a lot to do as you can see. With a new person on board March 20th (Ronney Arndt), we are looking forward to an exciting year of research. Eric Wagner

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