The Ichthyogram

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UDWR Aquatic Section Sets New Direction for Whirling Disease Management

On October 14, UDWR aquatic managers, biologists, culturists and pathologists met in Springville to iron out a new plan for whirling disease management and control. This meeting was called to map out specific plans to implement changes in the state whirling disease management plan, first written in March 1993 after whirling disease was discovered in northern Utah. After the discovery of the parasite in new areas of the state, **control** of the parasite and prevention of its spread became the primary goal, rather than eradication.

Initially, it appeared there was a strong divergence of opinion on what species would be use to restock and/or manage waters contaminated with the parasite. The controversy revolved over ways to provide acceptable fishing opportunities for the public while controlling whirling disease. The merits of rainbow trout versus brown trout in terms of catchability, availability and cost to produce and resistance to whirling disease were discussed. Rainbow trout are considered cheaper to produce, are available year round and enjoy a good return to the creel. Brown trout are very adaptable to environmental conditions and have demonstrated a much greater resistance to whirling disease in Utah.

The group prioritized goals of protecting fish hatcheries near infected waters, providing economic and acceptable fisheries in infected waters, and preventing the spread of whirling disease to other wild salmonid populations. These goals were examined in the context of the rationale of the existing whirling disease management plan.

The group decided to focus on short term (2 year) stocking plans and concensus was quickly reached. In the southern region, infected streams such as the Fremont River, Spring Creek, Otter Creek (*stream*) and lower UM Creek will be managed in the immediate future with fingerlings or catchable brown trout. Contaminated reservoirs such as Mill Meadow or Forsyth will be stocked with resistant hybrid trout in 1996. Reservoirs and lakes free of infected fish such as Koosharem, , Johnson, Otter Creek reservoir and Fish Lake will continue

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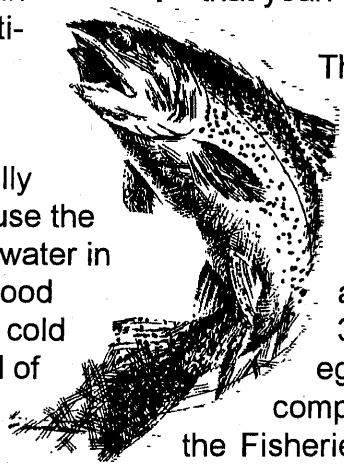
Utah Brood Stock History: Shepherd of the Hills Rainbow Trout

The Shepherd of the Hills strain of rainbow trout (RTSH) originated from Missouri. Like most rainbow trout brood stocks, it originated from Mc-Cloud River in California in the late 1800's. Missouri's first recorded introduction of rainbow trout was in 1882. The Neosho Federal Hatchery in Missouri played a major role in distributing fish in the early part of this century. It received fish from the Wytheville Hatchery in Virginia. In 1921, the Sequoita Spring Hatchery in Springfield, MO began. It received fish from Neosho that were to become the future Shepherd of the Hills strain. The burgeoning growth of Springfield forced closure of the Sequoita Spring Hatchery in 1958 and fish and personnel were transferred to the newly constructed Shepherd of the Hills Hatchery below Table Rock Reservoir. During this time the fish was not outbred with any wild fish, so the strain has essentially been domesticated for about 80 to 100 years.



The RTSH strain was originally chosen for use in Utah because the strain performed well in cold water in Missouri and Utah's future brood facility--Egan Hatchery-- had cold water as well. The Shepherd of the Hills moniker comes from the picturesque region of the same name in southern Missouri. The strain is still widely used in Missouri, although it is called the Missouri strain there. The current stock in Missouri is infected with the *Renibacterium salmoninarum* (bacterial kidney disease), but the state is still using the stock and is working around the problem.

Eggs were shipped to the Fisheries Experiment Station (FES) December 15, 1970 from the Shepherd of the Hills Hatchery in Branson, MO. Mantua Hatchery received 4678 fish (3.5 fish/lb) from the FES on November 10, 1971. The first eggs were shipped to Egan November 10, 1972. Mantua later shipped eggs to Egan Hatchery on 22 Jan 1973 (15,328 eyed eggs), Nov 29, 1973 (341,348 green eggs), December 7, 1973 (167,200 green), December 19, 1973 (105,792 green), and December 28, 1973 (37,842 green). From these eggs, the strain has been perpetuated at the Egan Hatchery with no further crossing with other wild stocks of the same strain or from outside the state. By 1978, Egan Hatchery had 22927 brood stock from four lots and produced 3,168,000 eggs that year.

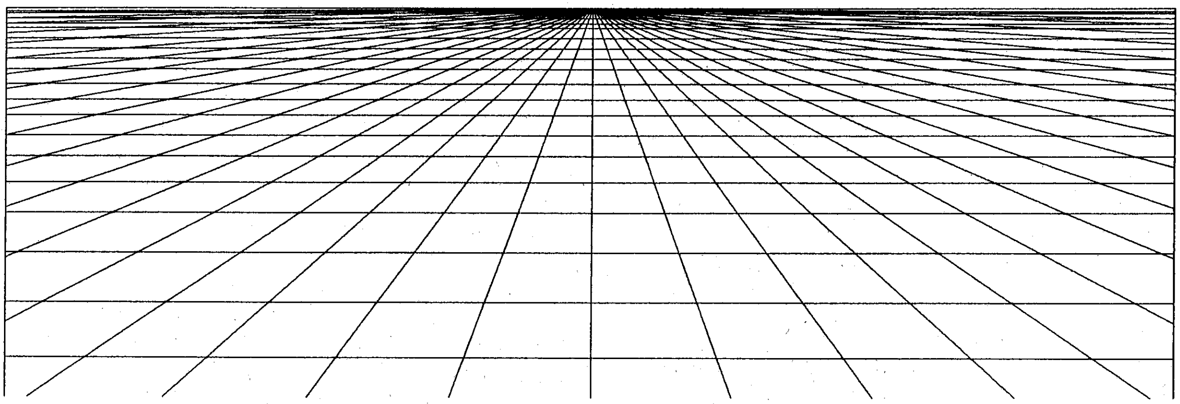
The RTSH typically spawns from about November 1 to January 1. In March 1974, the performance was characterized for several strains in use at the time, and the RTSH averaged 327 eggs per oz. and 1600 eggs per female. In a strain comparison test conducted at the Fisheries Experiment Station from 1973 to 1976, the RTSH ranked second of seven strains in feed conversion (1.26) and condition factor (second lowest at 1.15×10^{-5}). RTSH also had the lowest variation in weight, and the longest average length at 13 weeks (fingerling) and 38 weeks (catchable).

Eric Wagner

Hauling Seminar at FES

A seminar is planned for January 25 - 26, 1995 at the Fisheries Experiment Station concerning hauling fish. The meeting will begin with a review of the literature concerning hauling. Next, the culturists will share their experiences. The goal is to develop mutually agreed upon guidelines for hauling and to pinpoint areas for future research. In addition to the above topics, pH measurement and standardization will be discussed in a hands-on session. FES research concerning post-stocking survival in high-pH waters will also be discussed.

Surfin' the Net



The Fisheries Experiment Station now has a street address on the Information Superhighway. Effective August 1994, FES has modem access to the Internet via Utah State University . The service has already proved useful to transfer messages and information with other fisheries professionals. The E-mail address is **FESDWR@cc.usu.edu.** Drop us a line, we look forward to hearing from you.

(Whirling Disease - continued from page 1)

to be managed with rainbow trout. In the northern region, Porcupine Reservoir is scheduled to receive brake trout in lieu of rainbow trout, while Causey reservoir will continue to be managed with rainbows. Streams such as the Little Bear River and Blacksmith Fork will be managed with existing wild brown trout. Public meetings are being planned to allow anglers to ask questions and make comments.

In response to this plan, the hatchery system has already significantly expanded the production of brown trout. Future meetings are being planned to formulate long term goals and plans. Results of sentinel fish studies as well as susceptibility studies on hybrids such as brake trout, splake and tiger trout will help provide direction on ways to reduce spread of the disease while still providing for acceptable angling opportunities.
Chris Wilson

Evaluation of Depressurization Duration During Pressure Treatment of Rainbow Trout Eggs to Induce Tetraploidy

Introduction

Sterile fish can be a useful tool for fisheries managers and aquaculturists. Sterile grass carp, *Ctenopharyngodon idella*, have been used for aquatic weed control in areas where natural reproduction of the grass carp is undesirable. The potential superior growth of sterile fish and higher dress-out weights are also desirable attributes. Here in Utah, sterile fish are needed to maintain the genetic integrity of wild cutthroat in fisheries where the fishing pressure is too great to maintain the fishery solely with cutthroat trout.

Sterile fish are produced by inter-specie cross breeding or by manipulating the number of chromosomes to create triploid individuals, i.e., individuals with three sets of chromosomes instead of two as in normal diploid fish. Triploidy can be induced by shocking the fish eggs shortly after fertilization (during meiosis). Alternatively, triploids may be created by an interploid cross, i.e., crossing tetraploids and normal diploids. In waters where reproduction is undesirable, 100% sterility or triploidy is required. The percentage of triploidy in rainbow trout (*Oncorhynchus mykiss*) has varied considerably, ranging from 43 to 100%, depending upon the post-fertilization time, shock duration, type of shock, and other related factors. The percentage of triploidy in rainbow trout derived from an interploid cross was more consistent: 93 to 100% in three different studies. Relative to heat-shock derived triploids, interploid triploids had better survival to the fry stage.

To produce the tetraploid brood stock necessary for interploid crosses, shocking the embryos prior to the first cleavage stage has proven to be a reliable technique. Researchers from the University of Washington in Seattle identified 55 to 75% of the first cleavage interval as the optimum time to apply the pressure shock. The technique was further refined by identifying the pressures and duration of pressure treatment required to optimize the percent tetraploidy. Research at the Fisheries Experiment Station evaluated fluids in the pressure chamber and found that water was superior to glycerol and sperm diluent.

This study was designed to continue improving the methodology established for creating tetraploids while developing a tetraploid brood stock for production of sterile rainbow trout. This investigation evaluated the survival and percent tetraploidy of rainbow trout eggs subjected to three depressurization durations during the pressurization process.

Methods

The time to first cleavage was determined in a previous study. Pressure treatments were conducted at approximately 65% of the time to first cleavage (6:12 to 7:00 h post fertilization, p.f.). Three separate pools of Sand Creek strain rainbow trout eggs from 5 year old females (fifteen females/pool) were fertilized with 4 year old males (fifteen males/pool) at 15 min intervals to allow enough time for pressure treatment. The pressure in the chamber was brought up to 6.2×10^7 Pa (9000 psi) over a 30 sec interval by means of an 18 metric ton hydraulic press. The pressure of the chamber was maintained for 4 min, then depressurized over 10, 30, or 60 sec interval. All treatments were applied to each of the three pools, resulting in three replicates per treatment. For each replicate, about 1,100 eggs were carefully poured into a hydrostatic pressure chamber (Aquatic Ecosystems, Apopka, Florida) with hatchery spring water already in it. The water had a total hardness of 86 mg/l, total alkalinity of 103 mg/l, pH of 8.1, and temperature of 9C. Dead eggs (<5%) were removed by a suction bulb prior to pouring. Control eggs were poured into water in the chamber and left for 5 min, but no pressure was applied. The treated and control eggs were carefully poured into twelve incubation trays, one tray randomly assigned for each replicate.

Counts of dead eggs were made after 24 h. The crippling rate (percent of deformed fry

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culled) was calculated as a percent of total eggs used in each replicate. After hatching, fry from each of the twelve replicates were randomly assigned to twelve separate compartments of four fiberglass troughs. As the fish grew larger, space limitations forced pooling of the replicates of a treatment into a single circular tank until they were tagged a year after hatching. Each of the pressure-treated fish was tagged with a visual implant tag and a non-lethal blood sample was taken from the caudal vein. The blood was analyzed by flow cytometry to determine how successful the tetraploid induction process was.

Results and Discussion

The percent tetraploidy was significantly greater in the 10 sec treatment (87.8%; $P < 0.013$) than in the 30 and 60 sec treatment (Table 1). Fish from the 60 sec treatment had a significantly higher percentage of tetraploidy than the 30 sec treatment (60.9, 33.9%, respectively; $P = 0.028$). At 24 h, there was no difference in egg survival among the treatments and controls. The percentage of crippled fry was significantly higher ($P = 0.0498$) in the 10 sec treatment than in controls (4.7% and 0.4%, respectively), but did not differ among the depressurization treatments. The percent survival to 50 and 102 d was significantly lower than controls in all pressure-treated groups, but was not affected by the depressurization times tested (Table 2).

Results indicated that the shorter 10 sec depressurization treatment was superior due to the higher percentage of tetraploids produced without any additional mortality relative to the longer (30, 60 sec) depressurization times.

Eric Wagner

Table 1. Number of tetraploid (4N), diploid (2N), and mosaics (2-4N) resulting from pressure treatment and depressurized over three different time periods. Percent tetraploid values with a different letter subscript are significantly different ($P < 0.05$).

Depressurization time (sec)	4N	2N	4N (%)	2-4N
10	36	4	87.8_a	1
30	19	35	33.9_b	2
60	14	8	60.9_c	1

Table 2. Percent cripple and percent survival at 24 h (eggs), 50 d, and 102 d of rainbow trout pressure-treated and depressurized over 10, 30, or 60 sec.

Depressurization time (sec)	Cripple (%)	24 h survival (%)	50 d survival (%)	102 d survival (%)
10	4.7	96.4	5.2	3.7
30	3.4	97.4	5.1	3.8
60	2.6	97.0	2.3	1.5
control	0.4	97.4	50.1	---

Health Condition Profile at Willard Bay

Gizzard Shad were brought in from Nebraska to introduce into Willard Bay (a diked, freshwater bay of the Great Salt Lake) on June 1, 1990. The Health Condition Profile (HCP) was determined for twenty fish off the truck at the time of introduction. Samples also were collected during the March 1991 electroshocking at Willard Bay. At that time we collected gizzard shad and walleye and conducted necropsies to develop the HCP. The results were interesting enough that the sampling was continued each spring after that through March, 1994. This is not a formal study but the results have proven interesting so the more significant portions of those data are presented here.

The various health, normality and condition indices included in the profile were within normal ranges. The most interesting portion centered around the fat index and level of feeding activity in both species. The mesenteric fat is ranked (0 - 4). The mean fat ranking of the population is used to develop the fat index which is the percent of the highest it can be. The level of feeding index is based on observations of the volume and color of bile in the gall bladder. The higher the index the more active the feeding. An index in excess of 67% is considered to indicate relatively active feeding.

As can be seen in the figures 1 and 2, the fat index of the shad sampled from the truck when they arrived from Nebraska was zero (there was no fat). The fat index for the first generation as sampled in Willard Bay in March 1991 was 62.5 %. The shad had grown at a fast rate and laid down a fair amount of fat. This was to be expected in the first year for such a successful and fecund planktivore. The second year the fat level had decreased and it has remained much lower since. The level of feeding index also dropped substantially over the following years down to zero this past spring. The walleye which had been having trouble with growth and energy storage at Willard Bay prior to the shad introduction grew substantially and their fat index in 1991 and 1992 was at or near 100%. The fat index began to drop over the next two years. The feeding activity decreased with them over the sample period also but not as drastically. Review of historic observations on walleye at Willard Bay confirms that pre-shad walleye were small and had low fat levels.

This rather empirical work permits speculation that the shad were very successful their first year while they were "catching up" to the forage base. The subsequent generations did not fare as well. The walleye grew considerably the first two years and laid down a considerable fat depot as this new forage base became available. They have increased in numbers and size and the fat index is decreasing as well as the level of feeding activity.

Hybrid striped x white bass (wipers) were introduced last summer and were sampled in October. It will be interesting to follow this over the next few years to

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observe the impact of the wipers on the dynamics at Willard Bay. Ron Goede

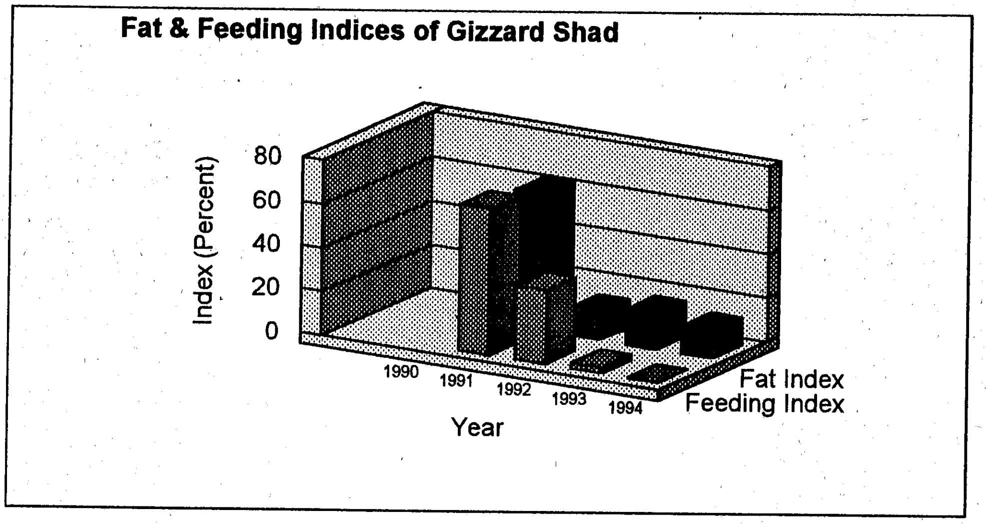

Figure 1. Indices of Gizzard Shad at Willard Bay.

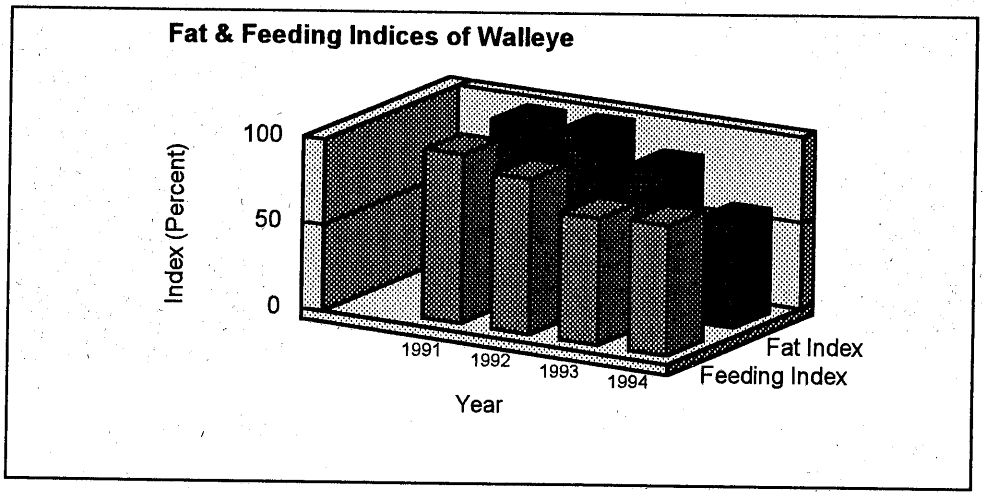

Figure 2. Indices of Walleye at Willard Bay.

New Kid on the Block

The research section of FES has a new face. **Steve Intelmann** has accepted a position as a research assistant for a six month period. Steve comes to Utah from Columbia, Missouri, where he worked for the Missouri Department of Conservation as a fisheries assistant in stream habitat and channel geomorphology. Previously he worked for a private environmental firm performing bioremediation of groundwater. He obtained his B.S. degree in wildlife biology from the University of Missouri in 1992.

Steve will be working with Eric Wagner in various research projects dealing with fish stress physiology. His future plans include possible graduate work in fish physiology. Welcome to Utah, Steve!

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