The Ichthyogram

Newsletter of the Fisheries Experiment Station

Utah Division of Wildlife Resources

STATE OF UTAH NATURAL RESOURCES Wildlife Resources

Volume 3, No. 2 Summer 1992

Range of Whirling Disease Expands

As the snowpack melts from the upper Fremont River Drainage, UDWR biologists from the southern region electroshocked and gillnetted streams and reservoirs in the area to further investigate the extent to which whirling disease has spread since its discovery in June of 1991.

Thousands of fish have been tested at the Fisheries Experiment Station so far this spring. The results have been both a surprise and disappointment to fish pathologists at the station. Fish testing positive for *Myxobolus cerebralis* spores have been found in Short Creek and 2 locations on UM Creek, both tributaries of Forsyth Reservoir. Both locations were considered suspect, since Forsyth Reservoir was discovered positive in 1991. However, it was hoped that diseased fish would not be found on the upper UM Creek. In addition, infected fish were also found on the upper Fremont River between Mill Meadow and Johnson Reservoirs.

On the positive side, no further sites tested to date have shown positive fish in 1991. Some of the critical suspect areas tested included Johnson Reservoir, Seven Mile Creek, Fish Lake and Tasha Creek. The dam at Johnson Reservoir appeared to have blocked upstream movement of infected fish In addition, several other sites in the Colorado and Great Basin drainages were also found negative.

A final (fourth) testing of sentinel fish from Loa State Hatchery was performed in April and also found negative. As a result, the quarantine placed on stockings from the hatchery was lifted. The partial quarantine was placed after a flood in August 1991 passed through the hatchery.

These findings increase the likelihood that previously untreated waters in the upper drainage will be subjected to rotenone treatment in the fall to eliminate salmonid hosts for an extended period of time. The discovery of whirling disease in upper UM Creek (a largely roadless area) is expected to complicate the treatment.

In order to provide recreational fishing opportunities in the absence of trout, biologists have considered several alternatives. One suggestion being contemplated would be to place cool water species such as yellow perch and striped bass/white bass hybrids in the contaminated reservoirs. These fish should provide a side benefit of consuming any remnant trout as well as providing good fishing during this period.

Last of the Lahontans?

Bryce Nielsen holds a Lahontan cutthroat, one of a small population "rediscovered" in the Pilot Mountains. Plans were underway to enhance the population onsite and later introduce them to new watersheds. A disease sample collected from 1 spawning female in April, however, has tested positive for *Renibacterium salmoninarum*, the pathogen causing bacterial kidney disease. Plans are now being formed to obtain further samples and determine the extent of infection in these wild fish.

A Survey of Water Quality at Utah's Ten Hatcheries

As part of a recent study of trout fin erosion in the Utah state hatchery system, I also analyzed water quality. To our knowledge, this is the first comparative water quality analysis at all ten state hatcheries done during the same season.

The study was conducted in March and April when fish loads were at their maximum just prior to spring stocking. A total of 8 water quality parameters were taken from raceways or ponds. Dissolved oxygen was measured with YSI probes. Total alkalinity, total hardness, carbon dioxide, and ammonia-nitrogen were measured with a Hach Fish Farmer's Kit. Total gas supersaturation (ΔP) was taken with a Weiss saturometer at the head end of raceways. Water temperature and all other readings were taken at the tail end of raceways.

Water temperatures vary considerably throughout the state, with lowest readings found at Mantua, Egan, Kamas, and Whiterocks hatcheries (Table 1). These lower temperatures are preferable for raising cutthroats and kokanee, but could be a bit on the cool side for maximizing rainbow growth. Klontz (1) reports the standard environmental temperature (SET) for rainbow is 15.0 C which produces maximum growth rates of 1.10 to 1.27 mm per day. Below the SET point, an 8.25% decrease in growth rate per degree centigrade occurs.

Moderately correlated with temperature was dissolved oxygen (Table 2), but due to differing fish densities and water re-use systems, DO was variable. Brannon (2) gives a range of 7.0 to saturation for best growth of rainbows, but a range of 5.0 to 7.0 for limited growth. Piper et al. (3) also note that a DO should be above 5.0 for trout. In our hatchery system, several facilities already using low-head oxygen units or aeration units with water re-use were pushing the lower limits on DO. In these cases, a reduction in fish density or improvement in oxygen injection will improve growth rates and reduce stress.

Hardness refers to the concentration of cations (Ca,Mg,Na,Fe) in water. Carbonate rocks, calcite and dolomite, are also responsible for most of the carbonates (anions) which contribute to alkalinity (1). Thus, it was not surprising that a high correlation was noted between alkalinity and hardness (Table 2). The hardest waters were at Midway and Springville hatcheries and softest waters were at Egan, Loa, and Glenwood hatcheries. Waters with higher alkalinity have a better buffering capacity against pH shifts and certain water pollutants (including acid mine drainage).

Alkalinity is also a function of carbon dioxide. Although fish and other biota produce CO_2 through respiration, it is dissolved in equilibrium with carbonates already present. Thus, a strong correlation of carbon dioxide content and alkalinity was apparent (Table 2). Most fish culture references recommend that CO_2 levels should be lower than 10 mg/L (1), although natural lakes often contain about 9-10 mg/L (4). All hatcheries were at or above this level, probably due to high fish densities and/or high natural alkalinity. Levels of 20-40 mg/L can inhibit oxygen transport and produce calcareous deposits in the kidney (nephrocalcinosis) (5).

The pH of water is a measure of the hydrogen ion concentration or acidity. However, a number of already mentioned variables can control (buffer) the equilibrium of these ions, including alkalinity, carbon dioxide, and hardness. These variables showed strong inverse correlations with pH (Table 2). Overall, the pH ranged from 7.3 to 8.2 at Utah hatcheries which falls well within the recommended range of 6.7-8.5 for fish culture (2). The pH tended to be slightly lower at hard water stations (Midway and Springville) and higher at soft water stations (Egan).

Gas saturation is of interest to fish culturists mainly because of the possibility of "gas bubble disease" from nitrogen supersaturated waters. There are a wide variety of devices which have been specifically developed to reduce nitrogen gas supersaturation (6). Low-head oxygen injection units have only recently been installed at several hatcheries. At FES, we have found that the units significantly reduce nitrogen gas levels. This finding has also been documented by other studies using LHO units, aeration towers, plunges, screens, and packed columns (6,7). In short, there is no excuse for any hatchery to subject trout to gas super-saturation. The mean threshold concentration, based on time to 50% death (TM50), was 123% for cutthroats (8).

Ammonia has been extensively studied in recent years with regard to fish culture (9). Once ammonia (NH_4+) is excreted by fish, a small percent is converted to the un-ionized form (NH_3) under the influence of temperature and pH. The chronic tolerance limit (TLMc) for salmonids is about 0.03 mg/L for NH_3 (1). Highest NH_3 estimates came from Fountain Green, Springville, and Loa Hatcheries. If high ammonia conditions are detected, the first thing to do is to stop feeding and then reduce the fish density within 24 to 48 hours (1).

Table 1. Summary of Water Quality at State Hatcheries - Spring 1992

Hatchery	Location	Water Temp °C	pH	DO mg/L	Total Hard mg/L	Tota Alka mg/L	Ammo Nitr mg/L	un-ion NH3 mg/L	Gas sat mm-Hg	CO2 mg/L
Midway	R 1AB	13.5	7.3	6.9	616	325	0.8	.0019	30	25
	R 5AB	13.5	7.3	6.9	"	"	1.3	.0063	33	30
	Ctr Crk#2	14.8	7.5	7.2	684	342	0.4	.0034	5	30
	Cabin Pd	14.3	7.3	10.9	"	"	1.0	.0050	45	25
Mantua	R 1A	8.4	7.7	9.0	171	154	0.4	.0033	24	10
	R 4	8.4	7.7	6.7	"	"	0.5	.0041	-9	20
Kamas	Dirt Pd#4	9.7	7.8	5.8	239	222	0.4	.0046	-7	15
	R 3B	11.1	7.7	8.6	"	205	0.1	.0010	45	15
	R 4B	11.0	7.7	8.6	"	205	0.5	.0050	17	15
	Dirt Pd#3	9.0	8.0	7.3	"	222	0.25	.0042	-19	15
Whiterocks	LrPd 3&4	10.1	7.8	6.8	325	257	0.2	.0034	-5	14
	LrPd 1AB	10.1	7.7	7.0	"	"	0.2	.0019	-5	17
Springville	Westside#2	17.2	7.5	5.2	513	257	1.0	.0100	-6	25
	Eastside#1	16.2	7.5	8.5	"	"	0.5	.0046	32	20
	Westside#5	17.2	7.5	4.4	"	"	1.3	.0125	-13	26
Glenwood	R C4	14.1	7.7	7.0	103	120	0.6	.0045	-3	15
	R B2	15.0	7.9	7.3	"	"	0.2	.0043	2	10
	R B3	14.4	8.0	7.3	"	"	0.1	.0026	1	10
Fountain Gr	Pd 3A	14.5	7.9	7.2	257	222	0.3	.0062	6	20
	Pd 4C	15.0	7.9	7.7	"	"	0.9	.0192	0	10
	Pd 6	14.6	7.9	7.7	"	"	0.2	.0026	7	20
Mammoth Crk	R 1A	13.0	7.8	5.0	171	171	0.6	.0088	5	15
	R 6B	13.5	7.6	4.3	"	"	0.9	.0087	7	15
Loa	R E4	15.8	7.8	5.7	103	120	0.4	.0073	-4	15
	R E9	16.0	7.9	5.0	"	"	0.5	.0114	7	10
	R C5	15.8	7.7	4.3	"	"	0.4	.0058	3	15
Egan	R 3A	9.0	8.1	7.8	86	103	0.2	.0042	13	15
	R 8D	10.0	8.1	7.8	"	"	0.2	.0046	7	15
	R 9C	10.0	8.2	8.5	"	"	0.4	.0115	12	15
	R 10B	9.5	8.1	8.5	"	"	0.2	.0044	13	10

Table 2. Intercorrelation matrix of 8 water quality variables from 30 raceways and ponds.

	Temp	pH	DO	T.Hard	T.Alk	Ammon	CO2	Gas-Sat
pH	-.41	-						
DO	-.39	.09	-					
T.Hard	.35	-.82	.13	-				
T.Alk	.24	-.77	.13	.95	-			
Ammon	.46	-.69	-.26	.59	.49	-		
CO2	.26	-.72	-.05	.86	.81	.51	-	
Gas-Sat	-.00	-.38	.59	.34	.28	.13	.15	-

References

1. Klontz, G.W. 1992. How to produce a marketable fish. Part II: determining your production potential. Northern Aquaculture. May/June:21-25.

2. Brannon, E.L. 1991. Rainbow Trout culture. pp 21-55 In: Culture of Salmonid Fishes (Ed. R.R. Stickney). CRC Press, Boca Raton, FL.

3. Piper, R.G., et al. 1989. Fish Hatchery Management, Fourth Edition. U.S. Fish Wildl. Serv., Washington, D.C.

4. Reid, G.K. and R.D. Wood. 1976. Ecology of inland waters and estuaries. D. Van Nostrand and Co., New York, N.Y

5. Colt, J., et al. 1991. Water quality considerations and criteria for high-density fish culture with supplemental oxygen. Amer. Fish. Soc. Symp. 10:372-385.

6. Marking, L. 1987. Gas supersaturation in fisheries: causes, problems, concerns, and cures. U.S. Fish Wildl. Serv., Fish Wildl. Leafl. 9, 10 pp.

7. Dwyer, W.P. and J.E. Peterson. 1992. Evaluation of the low head oxygenator at the Giant Springs state fish hatchery, Great Falls, Montana. Development in Fish Culture, Bozeman Information Leaflet, Number 69, 14 pp.

8. Nebeker, A.V., et al. 1980. Comparative responses of Speckled Dace and Cutthroat Trout to air-saturated water. Trans. Amer. Fish. Soc. 109:760-764.

9. Meade, J.W. 1985 Allowable ammonia for fish culture. Prog. Fish-Cult. 47:135-144.

TOM BOSAKOWSKI

Promotions/Awards

Several employees in the Fish Culture Branch were promoted recently. **Kirk Smith** was promoted from Wildlife Technician I to Wildlife Technician II at the Mantua Hatchery. **Pat Lakin** was promoted from Wildlife Technician II to Assistant Superintendent at Whiterocks Hatchery. These positions were reclassified by the Department of Human Resources to recognize the true responsibilities carried in these jobs. **Ramona Widdison** was promoted from Office Technician III to Wildlife Resources Specialist in the Salt Lake Office. This position is new and was created to manage fish culture databases that are being developed as part of the new Fisheries integrated system.

Fish health biologists **Ernie Dean** (virology) and **Kent Thompson** (parasitology) at the Fisheries Experiment Station were promoted to Grade 25. We congratulate our colleagues for their promotions and wish them continued success in their careers.

Awards

Congratulations to **Blaine Hilton,** superintendent of J. Perry Egan hatchery, who was recently awarded the 1992 K.E. Bullock award as outstanding employee for the Division of Wildlife Resources.

Double congratulations to **Ron Goede,** director of the Fisheries Experiment Station, who was awarded the College of Natural Resources ALUMNUS OF THE YEAR award from Utah State University and the Professional Achievement Award from the Utah State University Alumni Association and the College of Natural Resources.

Iodine Compounds Declared Low Regulatory Priority by FDA

In a letter dated May 8, 1992, the National Fisheries Research Center at La Crosse, Wisconsin received notice from the Food & Drug Administration that povidone iodine compounds were low regulatory priority when used *after* water hardening at a level of 100 ppm for 10 minutes as egg disinfectants. This means that these compounds can be used in this manner without obtaining an investigational new animal drug (INAD) permit from FDA. This ruling is not an approval nor a guarantee of efficacy or safety by FDA.

Povidone iodine compounds are commonly used during the water hardening process to prevent vertical transmission of viral diseases and certain bacterial diseases. An extension of this ruling to include use *during* water hardening is being sought.

New Fish Culturists Complete Training

Six new fish culturists completed the cold-water fish culture training at the Fisheries Experiment Station in Logan in April. The information presented in this course is required to work and advance in the UDWR fish culture system. The culturists participating in the 2 week session were Rick Hartman, Dale Liechty and Gary Ogborn of the Springville hatchery; Matt Briggs of the Glenwood hatchery, Mark Fuller of the Midway hatchery and Bart Burningham of the Fisheries Experiment Station. Tom Bosakowski, the new research biologist at the FES also participated in the training in order to understand the standards and methods utilized in the Utah culture system. It was a good group and a productive session. We are happy to have these people on board. There were several others who attended specific parts of the training. This type of interest is always welcome.

This intensive 2 week training has been presented since 1983 and has played a major role in the development of our fine fish culture system. All hatchery personnel have received it. It has facilitated standard methods and provided the common vocabulary so important in communication. It is now also easier for personnel to transfer between facilities. They understand the records and procedures in use at the new site and are better able to fit in or take over.

The Ichthyogram
Newsletter of the Fisheries Experiment Station
Editor: Chris Wilson
Contributors: Eric Wagner
Tom Bosakowski
Ron Goede
Joe Valentine
Chris Wilson

The Icthhyogram is the newsletter of the Fisheries Experiment Station, Division of Wildlife Resources. Comments and suggestions are welcome. Please address to: The Ichthyogram, 1465 W 200 N, Logan UT 84321.

Printed on Recycled Paper

Fungus Control Experiments Comparing Diquat and Formalin

Control of fungus during the incubation of fish eggs is a constant battle. Currently the staff at the J. Perry Egan Hatchery is using formalin, the only FDA approved chemotherapeutant for fungus control, but health concerns about formalin fumes in the incubation room and concerns about its efficacy have prompted a search for alternatives. Diquat (1,1-ethylene-2'2-dipyridylium dibromide), a common herbicide, was evaluated in a series of trials conducted by assistant superintendent Richard Jensen and the staff of the Egan Hatchery over a period of 3 years.

Eggs were obtained from 3-year-old rainbow trout of three strains: Fish Lake-DeSmet (RTFD), Ten Sleep (RTTS), and Sand Creek (RTSC). Formalin was added at a concentration of 1667 ppm for 15 min duration by means of a peristaltic pump, except during the first trial in which there was a flush treatment of 88.8 ml formalin/liter. Diquat was added as a flush treatment (130 ml of 18.3 ml/l stock solution) or during 15 or 60 min drips at 400 or 100 ppm, respectively. The percent eye-up is summarized in the table below for each trial.

TRIAL	TROUT STRAIN	Total egg wt. per jar (g)	Treatment method	Percent eye-up DIQUAT 15 min	DIQUAT 60 min	FORMALIN
1	RTFD	1049 to 2410	FLUSH	-	80	65
2	RTFD	10,461	DRIP	-	83	82
3	RTTS	1531 to 1644	DRIP	-	70	70
			FLUSH	69		-
4	RTTS	1446 to 1871	DRIP	31	84	80
			FLUSH	0		-
5	RTSC	6577 to 6747	DRIP	83	84	82

The results indicate that diquat is similar in effectiveness to formalin in controlling fungus. Eggs treated with diquat were stained brown (probably due to the bromide), but diquat did not adversely effect the eye-up or the ability to mechanically pick dead eggs. It was also noted that the diquat-treated eggs were slightly sticky or adhesive. Observations were made in trial 3 and 5 on the crippling rate, prevalence of blue sac, and fry mortality, but no great difference between the treatments was observed.

So, based on the results of these trials, diquat appears to be viable alternative to formalin.

Researchers at Oregon State have reported successful control of fungal growth with finpropidin, fenpropimorph, melaleuca, and salt. Questions remain about the environmental impacts of diquat on the aquatic community downstream from the hatchery. Diquat also requires some safety precautions for handling, but has a lower rate of dermal absorption than many pesticides. The process for FDA approval of any new chemotherapeutant for fungus control will likely take several years due to lengthy and costly research necessary and the lack of corporate sponsors.

The Ichthyogram
Fisheries Experiment Station
1465 W. 200 N.
Logan, UT 84321