The Ichthyogram

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Myxobolus cerebralis Found at Second State Hatchery!

Fish health specialists and technicians at the Fisheries Experiment Station have detected spores from the causative agent of whirling disease, *Myxobolus cerebralis*, in trout collected from the Mammoth Creek State Fish Hatchery. The Mammoth Creek facility is the second state-operated hatchery found to be infected with the parasitic disease (see *Ichthyogram*, Volume 11 Issue 1-2). An emergency response team comprised of fish health experts, culturists, biologists, managers and aquatic section supervisors are working on an action plan to deal with the outbreak.

During the hatchery's annual inspection in May 2002, one of the sixty rainbow trout tested had a single spore found using pepsin-digest techniques. The finding was further supported by positive polymerase chain reaction (PCR) tests on the sample. Hatchery officials were notified of the preliminary results, and no more fish were stocked out from the suspected facility. Soon thereafter, another lot of trout was collected from Mammoth Creek Hatchery in order to confirm the findings. The prevalence of spores found by digest methods was greater (10%) in the second sampling. Histopathology confirmed the infection. Two of the suspected fish had cartilaginous lesions that were consistent with *Myxobolus cerebralis* infection. Generative stages of the parasite were also noted. Laboratory results indicate that the infection is in the early stages of the of the disease, and no mortalities have been attributed to the disease.

The Mammoth Creek facility (formerly known at the Panguitch Hatchery) is near the town of Hatch in Garfield County, and has been producing rainbow trout and splake for the southern region of Utah for over thirty years. The hatchery is fed by a protected spring just above the facility. The facility has been tested annually since 1988 and was free of the parasite when tested again in 2001. What makes this finding even more surprising is that the raceways are steel, no live fish are transported into the hatchery and all the eggs are supplied from the J. Perry Egan state hatchery, which has a clean bill of health.

In order to help determine the source of the infection, fish were sampled from waters in proximity to the hatchery. Above the hatchery in Mammoth Creek, rainbow trout and brown trout were found to have a high prevalence of infection with >90% (x/60) of the fish demonstrating spores. Only one brook trout (n=22) electrofished upstream at Mammoth Springs had suspected *M. cerebralis* spores. Rainbow and brown trout sampled from the

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View of Mammoth Creek Hatchery looking upstream

waters immediately below the hatchery (47 brown trout, 13 rainbow trout) likewise had a high prevalence of infection (77%). Fin erosion observations made by hatchery personnel collecting the fish indicate that the fish below are presumably hatchery fish and may have escaped from the hatchery. Fish from above the hatchery did not have any erosive lesions and are suspected to be wild/feral stocks. DWR officials are in the process of planning dye studies to determine if the infective stage of the parasite (triactinomyxons) might have entered the spring fed hatchery from a higher elevation canal that may leach into the aquifer or flood intermittently into the spring. Curiously, young (3 month) rainbow trout in the hatchery building have all tested negative by PCR.

The emergency response team met after the findings were confirmed, and decided to sacrifice the remaining fish in order to prevent any spread of the hardy parasite. Several options for disposal of the carcasses were explored, including rendering, incineration, or burial; and it was determined that the most practical method was burial at a nearby county landfill. Over 17 tons of fish were destroyed on July 23 and transported to the landfill. Quicklime (calcium oxide) was used to cover the fish at the burial site in order to minimize the risk of infecting any nearby waters.

The next order of business for the response team will be to come up with a plan for cleaning up the hatchery. One option will be to utilize the sand filtration methods that are being investigated by researchers at the Fisheries Experiment Station. If all goes well, the Mammoth Creek Hatchery could be back on-line, and disease free within the next couple of years.

The Technical Services portion of the Fisheries Experiment Station will be working with regional biologists and others to test other bodies of water near Mammoth Creek to determine how widespread the infection is in the region. Stocking reports from the last year will help determine high-risk waters that might have been stocked with lightly infected fish from the hatchery in 2002 prior to the inspection. Previous surveys indicate that many of the waters stocked with fish from the Mammoth Creek hatchery have no history of the parasite.

Anglers can help contain the disease by following a few simple procedures, outlined in the Division of Wildlife Resources ***Whirling Disease and Utah Trout: What Utah Anglers Need To Know*** brochure.

Patrick Goddard and Chris Wilson

Effect of Heat Shock Temperature on Triploidy Induction Rates in Brook Trout

Heat shock of salmonid eggs shortly after fertilization has been reported to induce triploidy. This condition means that three sets of chromosomes are found within the egg, caused by the suppression of the second polar body during meiosis. Triploids are sterile and are useful for fisheries management for better control of reproduction and interaction with native species. Brook trout are notorious for overpopulating and stunting in small streams, so population control would be desirable. Anglers could potentially catch larger fish.
The success of the rainbow trout heat shocking program for the past few years has encouraged the consideration of other non-native species such as lake and brook trout. Previous research has indicated that the heat shock recipes used for rainbow trout are not necessarily applicable to brook trout. Dubé et al. (1991) found that brook trout had the highest triploidy rates using 28 C for 10 min at 15 min after fertilization. At a preshock temperature of 11-12 C, optimal triploidy rates (79-99%) were induced by thermal shocks at 28 C for 10 min, 10-16 min after fertilization (Galbreath and Samples 2000). Further testing by these authors resulted in 98-100% triploid brook trout using 28 C for 10 min at 10 min after fertilization.

Methods
Eggs from a total of 20 brook trout females were 'dry' fertilized by a pool of milt from 5 males for each of three lots (one lot used for each replicate). Sodium chloride diluent was used to enhance the duration of sperm motility. A few minutes after fertilization the eggs were rinsed with hatchery well water and left in the water (9 C) until time for the heat shocks. The heat shocks were conducted in coolers equipped with recirculating heat pumps. Within the coolers, perforated aluminum trays with short legs were used to hold the eggs. These trays were lined with mosquito netting to ease the transfer of eggs from the cooler to egg incubation trays. Temperatures were recorded just before the eggs were immersed and at the end of the heat shock period.
For the heat shocks, four treatments were evaluated in triplicate in addition to an untreated control (9 C):

1. 27 C at 10 min post-fertilization (p.f.) for 10 min
2. 28 C at 10 min p.f. for 10 min
3. 29 C at 10 min p.f. for 10 min
4. 29.4 C at 18 min p.f. for 7 min

After the heat shocks, the eggs were transferred to a tray for incubation at 8 to 9 C. The eggs were mechanically shocked (bumped) after 37 d to kill infertile eggs. The eggs were sorted with the aid of a mechanical picker the following day (17 Jan 02), removing the dead eggs. The live and dead egg numbers were estimated from sample counts using a Von-Bayer trough. The eyed eggs were transferred from the Egan Hatchery to the Fisheries Experiment Station and hatched there. Additional egg picking enumerated the subsequent mortality between eyeup and hatch (30 Jan 02). After hatching, the fry with obvious deformities were removed and the number of these cripples expressed as percentage of the surviving eggs at eyeup. The fry were reared in separate trough compartments until they were sampled for triploidy. The blood samples were collected directly from the caudal vein of lethally anesthetized fish. The blood was diluted in Alsevere's anticoagulant solution in microcentrifuge tubes kept on an ice water bath. These samples were shipped fresh to Paul Wheeler at Washington State University where the ploidy status was determined by flow cytometry.

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Results and Discussion

The survival of the eggs and the ploidy assay results are shown in Table 1. The data indicated that the higher the temperature of the heat shock, the higher the triploidy induction rate. The highest rate achieved was 96.7% triploidy, using a recipe refined and recommended by Tim Yesaki, a British Columbia researcher. Heat shock had a detrimental effect on egg survival, with a general increase in mortality as temperatures climbed from 27 to 29 C. Reducing the duration to 7 min in the 29.4 C treatment significantly improved eyeup rates over that for the 29 C for 10 min treatment. However, mortality was still significantly above that for controls. This survival reduction effect is generally greater than we experienced with the rainbow trout heat shocks and what has been reported for brook trout (Galbreath et al. 2000). Hatching rates were significantly better in controls than the treatments (P <0.001, ANOVA). The 27 and 28 C treatments had significantly poorer hatching rates than the 29.0 and 29.4 C treatments. Crippling rates were similar among treatments ranging from 1.0 to 3.3%, although the 29.0 and 29.4 C treatments had significantly higher rates than controls (P = 0.049).

Table 1. Mean (±SD) triploidy induction rate, fry crippling rate, and survival rate of heat-shocked brook trout eggs to the eyed-egg stage (eye-up) and to hatching. Hatching rate and crippling rate are expressed as a percentage of eyed eggs. Means within a column with a common letter following it are not significantly different (P >0.05).

Treatment	Eye-up (%)	Hatching rate (%)	Cripple (%)	Triploid (%)
27 C, 10 min/10 min	57.3 ± 8.2c	57.3 ± 3.7	1.4 ± 0.4	33.3 ± 24.7
28 C, 10 min/10 min	60.9 ± 3.6bc	64.3 ± 5.6	1.6 ± 0.2	71.5 ± 11.3
29 C, 10 min/10 min	42.1 ± 5.3a	73.8 ± 0.8	3.3 ± 1.5	85.0 ± 10.0
29.4 C, 18 min/7 min	53.3 ± 7.5b	76.7 ± 1.6	3.1 ± 1.5	96.7 ± 5.8
Control 9 C, 10 min	87.9 ± 2.0d	91.3 ± 1.3	1.0 ± 0.3	0.0 ± 0.0

The initial tests indicate that high triploidy induction rates are possible for Utah's brook trout. Further testing around the best treatment in this test should help refine our success in the future. The results will hopefully mean larger brook trout for anglers in the future and protection of native cutthroat trout.

Eric Wagner

Literature Cited

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June Sucker Milt Research – Spring 2002

The June sucker *Chasmistes liorus*, indigenous to Utah Lake (Utah County, Utah), is listed as endangered by the state and federal government. Since 1991 the Fisheries Experiment Station (Logan, Utah) has housed various age classes of the fish. Over the past decade, new year classes have been added from field-spawned progeny and light-trapped fry. Several years ago interest was raised in artificial spawning of the adult fish at the station. During the spawning seasons of 1998 and 1999, both females and males of certain age-classes were injected with human chorionic gonadotropin (HCG) to induce gamete maturation and spawning behavior. Variable results were obtained from both year's efforts, but it was evident that captive broodstock could be a valuable tool in reestablishing viable wild populations.

The quality and timing of eggs and sperm available during a spawning season greatly influence the success of a propagation program and may vary from year to year. To improve the success of fertilization, many artificial propagation programs rely on some sort of sperm extender. The purpose of an extender is to maintain the sperm in an inactivated state, under similar pH, chemical composition, and osmotic pressure as in seminal fluid. By diluting the milt with an extender, the milt can be stored for several days under refrigerated and oxygenated conditions. This allows the researcher alternatives such as holding milt until females are ripe, fertilization at alternative, convenient sites, and pooling multiple males collected over time to enhance genetic contributions. Extenders are commonly used on various freshwater and marine species, but have not been investigated with the June sucker.

Beginning in the spring of 2002, several attempts were made at characterizing June sucker sperm, and evaluating various sperm activators and extenders that might benefit the program. During the first attempt at collecting milt (05-06-02) only one male of four available expressed any milt, but the quantity was very limited. A small sample of the milt was placed on a microscope slide and activated with a 0.7% lab-grade NaCl (Mallinckrodt AR® reagent grade) diluent but no sperm activity was noted, so it was assumed the sperm were not viable. During the next attempt of collecting milt (05-14-02), good quantities of milt were collected from three males. Once again samples of the collected milt were activated with 0.7% NaCl, but less than 1% of the sperm observed displayed any movement. Out of frustration a second sample was activated with well water from the June sucker building and the sperm showed good activity. Subsequent samples were taken from each of the three milt samples, and three replicates from each were tested for activity. The average percent of sperm observed to be motile was 86%, and the duration of motility was 43 second. As a comparison, trout sperm may be motile for 1-2 minutes with generally >60% of sperm being motile. For each slide observed, 6.5 FL of milt was activated with 45 FL of diluent.

When it was established the sperm were viable, we checked to see what effect different diluents (activators) might have. Two types of salt were included: 0.7% lab-grade NaCl and 0.75% rock salt (Western Sun™ Solar Salt), which is the typical trout diluent. A commercial diluent, Diluer 532 (Sanofi Sante Animale), was included, as well deionized water, and well water. During the third hour after the milt was originally collected, each diluent was checked with respect to its ability to activate sperm. See Table 1 for these results as well as pH measurements of each, as high pH tends to keep sperm deactivated. One slide viewed using lab salt as the diluent, which initially showed no

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activity, displayed good activity after a small amount of well water was placed around the margin of the cover slip. The extender, Ca^{++} Free Hanks Balanced Salt Solution (HBSS), was included in this initial analysis to remove it as a possible activator. Rock salt was clearly the best diluent, followed by well and deionized water. It is worth noting that the three diluents with the best activation were also the three formulations with the lowest pH values.

Table 1. Average (N = 3) sperm motility and time of duration of June sucker milt activated with various diluents approximately 4h after collection.

Diluent	Motility (%)	Duration (s)	Diluent pH
Dilueur 532	<1%	-	8.44
Rock salt, 0.75%	95%	103	7.61
Lab salt, 0.7%	<1%	-	7.90
Well water	48%	33	7.32
Deionized water	72%	40	6.08
Ca^{++} free HBSS	0	0	7.25

Once it was established the sperm was viable, each sample was divided into two, with one being diluted on a 1:1 basis with (HBSS). This diluent had been used successfully to store razorback sucker for several days by Tiersch et al. (1997). The second portion of each sample was left untreated. All samples were placed in 50 mL plastic vials and kept at 5E C. These samples were then to be analyzed over time to see if the extender enhanced storage time. After 24h, samples were again analyzed for quality using the above listed diluents. The results from this check are displayed in Table 2. Approximately twice daily each vial was uncapped and gently agitated to allow for gaseous exchange.

Table 2. Average (N = 3) sperm motility and time of duration of extended or un-extended June sucker milt activated with various diluents approximately 24 h after collection. E = extended, U = unextended.

Diluent		Motility (%)	Duration (s)
Dilueur 532	**U**	5*	67*
	E	52	64
Rock salt, 0.7%	**U**	<1*	115*
	E	67	107
Lab salt, 0.75%U		<1*	52*
	E	18	62
Well water	**U**	0	0
	E	58	51
Deionized water	**U**	0	0
	E	80	38

* only one replicate (male #2) was useable, so means were not calculated.

After 24 h, all three unextended milt samples had turned gelatinous, and two of the three extended ones were thickening noticeably. However the extended samples clearly

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exhibited superior sperm quality compared to the unextended milt. The 0.75% rock salt solution also exhibited better storage capabilities than the others. It is also worth noting that in its extended form, the sperm samples were activated to a high degree by lab salt and Dilueur 532, both of which exhibited little activation potential with 4 h unextended samples. Sperm quality samples taken at 48 h resulted in motility of 33% and duration of 56 sec for extended sperm activated with rock salt, and a motility of 27% and duration of 13 sec for extended sperm activated with well water. Unextended sperm was no longer viable at 48 h, and the other diluents were not tested further due to their limited success. Samples were evaluated again at 72 h but motility for extended sperm activated with rock salt or well water averaged <1%. No further viability assays were made beyond 72 h.

The results from the first test indicated that June sucker sperm retained relatively good motility for 1-2 days when diluted 1:1 with Ca^{++} free HBSS and activated with rock salt. However the quickness with which the extended samples gelatinized suggested that the dilution ratio of milt: Ca^{++} free HBSS was probably not high enough. As a result, a second test was conducted (6-12-02) to determine the optimal dilution ratio to maintain viable sperm. For this test milt was collected from three males and each sample was diluted on a 1:1, 1:5, 1:10, and 1:20 basis; milt: Ca^{++} free HBSS. Rock salt was used again as an activator, and at the same time a new activator was tried; rock salt with urea. Urea is commonly used on eggs to help eliminate stickiness. This has been a problem in the past with June suckers where large portions of a lot of eggs might be lost due the adhesion of the eggs forming a mass, and becoming more susceptible to fungus and resultant mortality. The formulation of the rock salt/urea diluent was 3 g urea, 4 g rock salt, and 1.0 L well water. Activation and sperm quality assays were conducted as mentioned previously.

Sperm quality assays taken 1-2 h after the milt was initially collected averaged 87% motile and 85 s for rock salt, 72% and 93 s for the rock salt/urea, and 47% and 38 s for well water. The 24h sample (see Table 3) revealed a rapid drop in sperm viability one day after collection. As a comparison, extended sperm from the first test activated with rock salt were 67% motile for over a minute compared to 34% motile for 57 sec from this test. This might indicate a drop in sperm viability as the spawning season reached its end or simply poorer quality among the males chosen for the second test. Sperm activated with the salt and urea mixture had a higher motility (averaged across dilutions), 43%, compared with 21% for the sperm activated with salt only. A duration of 60 sec was also obtained from the urea mixture compared with 47 sec for the salt only.

Table 3. Average (N = 3) sperm motility and duration time of milt extended at different dilution ratios with Ca^{++} free HBSS extended June Sucker milt activated 24h after collection. For each dilution ratio treatment samples were activated with either rock salt or rock salt with urea.

	Rock Salt		Rock Salt with Urea	
Dilution ratio	**Motility (%)**	**Duration (s)**	**Motility (%)**	**Duration (s)**
1:1	34	57	55	57
1:5	24	39	53	63
1:10	9	41	27	65
1:20	15	49	38	53

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When the milt samples were further assayed for quality at 48h, most viability had been lost (Table 4). Sperm activated by rock salt alone exhibited less than 1% motility, while sperm diluted on a 1:1 basis and activated with salt and urea were 20% motile. The milt that was diluted at 1:1 had begun to gelatinize after 24 h and by 48h the 1:5 samples were gelatinizing also. The 1:10 and 1:20 samples maintained good fluidity, but this did not translate into an increase in sperm viability as indicated by the results. The samples were examined again after 72h, but no viable sperm were found.

Table 4. Average (N = 3) sperm motility and duration time of milt extended at different dilution ratios with Ca^{++} free HBSS extended June sucker milt activated 48h after collection. For each dilution ratio treatment samples were activated with either rock salt or rock salt with urea.

	Rock Salt		Rock Salt with Urea	
Dilution ratio	**Motility (%)**	**Duration (s)**	**Motility (%)**	**Duration (s)**
1:1	<1	15	20	39
1:5	<1	24	2	48
1:10	<1	17	<1	13
1:20	<1	14	8	46

From these two examinations of June sucker milt it appears possible to collect, extend, and store milt samples for 1-2 days and still retain viable sperm. The results from the first test are contradictory, where high quality lab salt inhibited sperm activation, while rock salt, at a similar concentration, proved to be the best diluent. The pH values of the diluents may be a factor although the difference between lab and rock salt was 0.31 units. Diluents of lower pH, less than 7.9, were capable of good activation. These results are opposite of what would be expected with other fish. In general, with trout, a pH of 8.0 or below and > 9.5 can prevent activation. We recommend continued use of a rock salt diluent of 0.75% for hatchery and field fertilization. The calcium free HBSS proved to be adequate as an extender when milt was stored for a day or less. Using dilution ratios of milt to extender of 1:1 or 1:5 appeared to be the best combinations. At higher dilutions the milt seemed nice and fluid after several days, although few or no viable sperm were retained. Some of these results are interesting and conflicting, and lead us to believe that more research is required to develop a good working extender. A extender would allow biologists to collect milt and hold it under oxygenated and refrigerated conditions for a week to ten days, as is possible with other fish species.

Citations

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Ronney Arndt

Preliminary Tests with Lake Trout Triploidization

Lake trout were first stocked into Bear Lake, Utah-Idaho in 1911. Sporadic stockings since then were conducted in the first half of that century. Despite natural reproduction in the lake, a few anglers have been clamoring for more stocking of lake trout. Sterile lake trout would be ideal for this situation so that natural reproduction and total lake trout numbers could be more closely controlled by fisheries managers concerned about other species there that exist nowhere else in the world. Recent successes with rainbow trout triploidization have led to the desire to apply the heat shock methodology to other species, including lake trout.

Three different experiments were conducted. For the first two, lake trout treatments were the same as those for the brook trout: 1) 27EC for 10 min at 10 min post-fertilization (p.f.), 2) 28EC for 10 min at 10 min p.f., 3) 29EC for 10 min at 10 min p.f., 4) 29.4EC for 7 min at 18 min p.f. and 5) controls held at 9EC for 10 min. Three egg lots were used, one for each of the three replicates per treatment. Heat shocks were conducted in coolers fitted with recirculating heat pumps, perforated aluminum trays on short legs, and mosquito netting lining the tray. One test was conducted at the Egan State Fish Hatchery in Bicknell, Utah with the Jenny Lake strain and the other at Saratoga National Fish Hatchery, Saratoga, Wyoming with the Louis Lake strain. The third test was at Egan Hatchery, conducted in an attempt to make up for the losses incurred in the first test. For the third test, the duration was increased to 15 min for the 27, 28, and 29EC treatments. However, survival in the third test was so poor that the eggs were dumped at eye-up.

Survival in the first Egan experiment was poor (Table 1). Survival to hatch ranged from less than a percent to 4.2% among heat shocked groups and from 7.2 to 26.7% among control replicates. Survival to first feeding, relative to controls, ranged from 2.4 to 49.2% among the heat shock treatment replicates. Of the 146,722 eggs shocked, only 140 fish survived to March 5, 2002. Control fish were also not surviving, indicating that there were problems with egg quality unrelated to heat shock. The splake survival was also lower than in past years, averaging 37% eye-up. The lake trout brood replacement lot also had a low eye-up (13%). This indicated that there were general problems with egg quality in the Egan broodstock that were unrelated to a particular take, incubation location (tray vs. jar), or time since the last spawning.

For the Saratoga fish, survival was slightly better, but still not great. Survival from green egg (107,153) to initial feeding among heat shocked groups varied from 0 to 15.4%, resulting in 168 triploid fish by March 5, 2002. The control fish eye-up was much better at Saratoga Hatchery, averaging 66% (Table 1). The broodstock there also appeared to be healthier.

There were problems running the blood samples from Saratoga's lake trout. This may have been a result of insufficient blood due to the size of fry at sampling or the blood was

Idaho Fish & Game biologist Dave Teuscher adds reagents to tubes of lake trout blood

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partially frozen in transit to the lab. During the assay for the Egan blood samples, there were also 14 blood samples that were not testable of a total of 270 samples (20 per replicate for heat shocked groups, 10 per replicate for controls).

Researchers express blood from a lake trout fry for triploidy verification

The triploidy rates were significantly affected by temperature. For the Egan samples, the triploidy rate for the 27EC treatment did not significantly differ from controls, but the 100% triploidy rates achieved in the 28, 29, and 29.4EC treatments were significantly higher than controls or the 27EC treatment (Table 1). When the treatments were duplicated at Saratoga Hatchery, the results differed. Statistical analysis was limited to the 27 and 28EC treatments (mosaic data and non-readable samples not included) which did not differ from each other. Only one replicate of the remaining treatments was testable. Overall the triploidy data were inconclusive, but suggest that high levels of triploidy are possible, albeit with higher mortality levels. We plan to try again this fall and try to reach the goal of producing 50,000 triploid lake trout for stocking into Bear Lake.

Table 1. Mean survival to the eyed egg stage (eye-up) and triploidy rates (± SD, *n* = 3) of Egan State Fish Hatchery and Saratoga National Fish Hatchery lake trout heat shocked at various temperatures, durations, and times after fertilization. Means within a column that have a common letter following it are not significantly different (one way ANOVA and Duncan's Post Hoc test, $P < 0.05$).

	Egan Hatchery		Saratoga Hatchery	
Treatment temperature, min after fertilization, and duration	**Eye-up (%)**	**Triploidy rate (%)**	**Eye-up (%)**	**Triploidy rate (%)[1]**
27EC, 10 min/10 min	16.8 ± 8.6 b	63.3 ± 34.0 a	28.0 ± 17.6 b	87.2
28EC, 10 min/10 min	12.9 ± 5.0 b	100.0 ± 0.0 b	27.7 ± 9.4 b	85.7
29EC, 10 min/10 min	8.7 ± 3.9 b	100.0 ± 0.0 b	18.7 ± 13.6 b	87.5
29.4EC, 18 min/7 min	15.8 ± 4.0 b	100.0 ± 0.0 b	33.6 ± 10.6 b	60.0
Control 9EC, 10 min	30.2 ± 6.4 a	0.0 ± 0.0 a	66.3 ± 5.0 a	0.0

[1]Insufficient replication for statistical analysis due to problems with poor fry survival and blood sample shipment.

Eric Wagner

The Latest (and Greatest) Folks at FES

Welcome to the new fish health specialist, **Dr. Patrick Goddard**. Patrick is a native of Durango, Colorado and recently graduated from the College of Veterinary Medicine at the University of Wisconsin. Prior to that he earned a Masters degree in fisheries at the University of Alaska and helped manage a trout farm in Colorado for a couple of years. Patrick brings a lot of talent and enthusiasm to the job and is already making a positive impact to the program.

Patrick will be focusing on the fish health inspections of hatcheries and wild broodstocks as well as the whirling disease survey. He can be reached at 435-752-1066, extension 11.

That friendly and helpful voice on the phone when you call FES belongs to **Kari Higbee**, our new Office Tech III. Kari is a native of Idaho and has a wide variety of work skills and experiences, including working as a page in the Idaho legislature and as a legal secretary. She raises and shows rabbits in her spare time.

Kari has jumped right into the job and has even managed to get folks to fill out their timesheets correctly (with just a little arm-twisting!) She can be reached at 435-752-1066, extension 17. Welcome, Kari!

AL technician Michael Colvin has left the FES to attend graduate school at the University of Idaho. The Technical Services team at the FES has replaced Mike's position with **Anna Marie Miller**. Anna is a native of New Mexico and earned her BS degree in Marine Biology and MS degree in Wildlife and Fisheries Sciences at Texas A&M University. She studied marine mammals in college and examined the effects of tourist activities on dolphin behavior for her masters. She has also worked for the National Marine Fisheries Service and monitored the demolition and removal of offshore structures with explosives and observed the impacts of the removals on wildlife. After promising not to fish with explosives, Anna pledged to use her expertise to monitor fish health in Utah. Welcome aboard Anna! Anna can be reached at 435-752-1066 extension 20.

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Editor:
Chris Wilson (chriswilson@utah.gov)
Contributors for this issue:
Ronney Arndt (ronneyarndt@utah.gov)
Eric Wagner (ericwagner@utah.gov)
Patrick Goddard (patrickgoddard@utah.gov)
This newsletter is distributed electronically at http://www.udwrfes.org/ichthyog.htm .

Send comments or change of address to:
EDITOR, The Ichthyogram
1465 West 200 North, Logan, UT 84321

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Fisheries Experiment Station
1465 West 200 North
Logan, UT 84321
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