

---

# The Ichthyogram

*Newsletter of the Fisheries Experiment Station*

---

Volume 1, Number 2

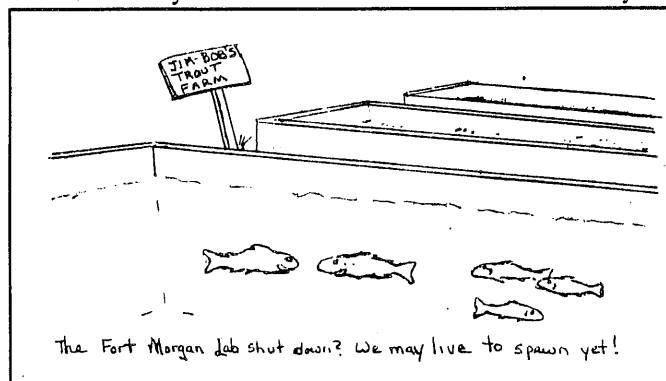
Fall 1990

---

## BUDGET PROBLEMS DELAY PRIVATE HATCHERY INSPECTIONS

The failure of the President and Congress to agree on a budget to reduce the federal deficit has caused shock waves which are being felt all the way down to the low water mark. Beginning October 1, the USFWS laboratory at Ft. Morgan Colorado has been unable to accept laboratory submissions due to shortages of laboratory supplies and an embargo on any new purchases of supplies.

As a result, 6 private aquaculture facilities in Utah were unable to be inspected as scheduled the first week of October. One additional facility is scheduled in late October. At this time, there are no rescheduling plans for these inspections according to Dennis Anderson, director of the USFWS laboratory, due to the uncertain nature of the federal budget. Even when a budget compromise is reached, it will take additional time to order supplies and resume operations. In the meantime, Anderson explained that ongoing inspection samples will be processed as laboratory supplies will allow. Autumn inspections are important to private growers since ovarian fluids from brood fish are only available at this time and growers shipping to California need a second annual inspection in order to qualify for sales. This delay further complicates scheduling for Technical Services staff at the Fisheries Expt. Station who are dealing with an already full schedule for the remainder of the year.



## KUDOS TO RON

Ron Goede, director of the Fisheries Experiment Station was recently singled out for a special award. The Western Division of the American Fisheries Society bestowed Ron with their most prestigious recognition - the Award of Excellence.

This award, which is made very rarely, was given to Ron to recognize both his pioneering efforts in fish disease control and the development of the Fish Health/Condition Assessment System. Because of many years of effort by Ron, we all are enjoying the benefits of a fish culture system which is almost devoid of infectious disease, both in state and private facilities. The Health/Condition Assessment system was developed by Ron at his own initiative and expense. It is being widely used in Utah to monitor the health of fish populations both in culture and in the wild. This system has been widely accepted and used by agencies across the country including the Environmental Protection Agency and the Tennessee Valley Authority. Because of its wide appeal, Ron has been called on to teach this system to many groups across the country, which he has done on his own personal time and for no monetary gain. Congratulations, Ron!!

---

## NEW FACES AT FES

We're pleased to announce the acquisition of several new faces at the Experiment Station in several different positions, both temporary and permanent. Working this fall with Eric Wagner on his Federal Aid research projects are **Diane Driscoll** and **Scott Hawxhurst**. Both are wildlife/fisheries students at Utah State University and are working part-time. Diane comes to us from California where she was involved in the care and management of race horses. Scott is a native of Vermont and came to Utah by way of Arizona. He had been working with us during the summer as an assistant in fish culture.

## New Faces, cont

**Russell Lee** is another new face who will be involved in Technical Services this fall as part of the Federal Aid project involving wild broodstock inspection. Russ is a veterinarian from Idaho who is expanding his horizons into fish health. His wife Kris has just accepted a position as a fisheries biologist with the Forest Service at Ogden.

Last, but not least, **Todd Graham** has filled the FTE position vacated earlier this year by Dennis Cox. Todd is a native of Laramie Wyoming and had worked previously with the Division at the Lake Powell Wahweap installation. We wish all the new employees a warm welcome to Utah and the FES!

---

## THYMUS INDEX

The thymus index still remains as one of the least understood parameters of the Health and Condition Profile. The index is a categorical observation of the degree of hemorrhaging observed, ranging from 0 (no hemorrhaging) to 2 (severe hemorrhaging). The cause of the hemorrhaging has been observed to be stress-related by a fishery scientist from the northwest. Research conducted by Bruce Barton during his tenure at the Station showed that chronic crowding stress did not cause an increase in the thymus index. In fact, the reverse appeared to be true, despite the lower growth in crowded fish versus uncrowded controls.

In a different experiment, fish were stressed by handling and returned to the raceway for an hour. The thymus index was observed before and after, but the thymus index did not change within that time. It is possible that one hour was not enough time to observe a response. Further experiments are needed to determine the kinetics of the hemorrhaging response and its significance. A French scientist, S. Chilmonczyk, has observed that injection of hormones typically generated during stress caused tiny areas of necrosis in the thymus. These may be related to the hemorrhaging observed with the thymus index.


What is the function of the thymus? The thymus plays a key role in the immune system. The thymus produces T-lymphocytes (T for thymus), the white blood cells that regulate the immune system. Much of the knowledge of immune system function is adapted from human research, which has made great strides in immunology recently, due in part to the AIDS problem. In humans, there are a variety of T-cells, including "helper" and "suppressor" cells, which modulate the immune response, and "killer" cells which can kill abnormal cells directly. Each T-cell has receptors for only a single antigen (foreign bodies that cause an immune response). It is in the thymus that each of these cells become specialized to bind to a single antigen. Investigations

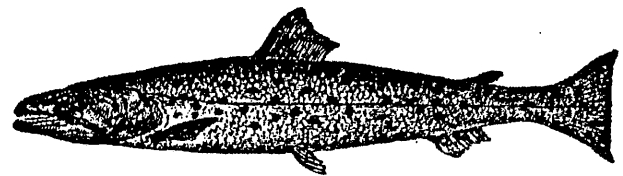
into the thymus of fish began as far back as 1850. In 1984, J. Beard of the University of Edinburgh studied the embryonic development of the organ, yet remained puzzled as to its function. Since that time several authors have published histological investigations, including some recent electron microscopy, yet many aspects of the thymus remain a mystery. Evidence to date suggests that the thymus of fish plays a role similar to that in mammals.

It is interesting to note that the thymus is found in all fish except the jawless fishes such as the lamprey. These primitive fishes must rely on the kidney and spleen, the other sites of white blood cell formation. In fish the spleen is slow to develop, and during early larval life the thymus and the kidney are the only major lymphoid organs. Later in life the thymus appears to become less important, shrinking considerably in size. In addition to age, the size of the thymus is also influenced by stress (inhibitory), seasonal changes, and spawning.

---

## MATTER OF FAX

Keeping right up there with the cutting edge of modern technology, the Experiment Station is pleased to announce our latest gadget, a FAX machine.  This should really help us out with instant reception/transmission of letters, inspection requests, inspection reports etc. Our FAX number is 752-6977. As with most newfangled electronic timesavers, we've spent several frustrating days trying to get the bugs out and it seems we've got the upper hand at last. In the meantime, I'm trying to figure out a way to FAX some excess zucchini to willing (or unwilling) recipients. We'll keep you posted on how it's working out.




---

### The Ichthyogram

Newsletter of the Fisheries Experiment Station

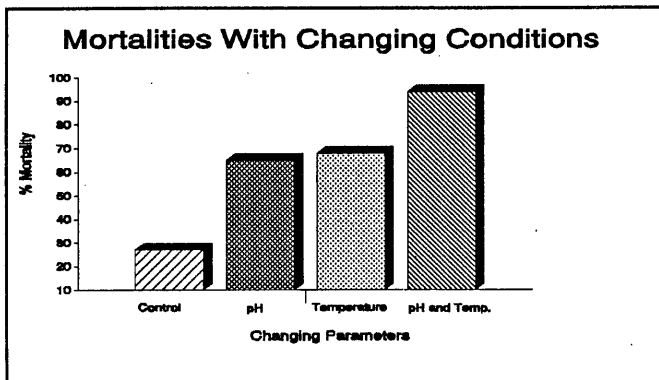
Editor: Chris Wilson

Contributors: Eric Wagner  
Russell Lee  
Ron Goede

The Ichthyogram 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.

## FEDERAL AID RESEARCH UPDATE

So far this fiscal year, one federal aid experiment has been conducted. This experiment evaluated the effects of both a 10°F temperature increase and an increase in pH to about 9.5. The treatments evaluated each effect individually as well as combined, plus a control. The plasma samples are still being assayed, but there is some preliminary data concerning mortality 24 h after stocking 20 fish into the plastic tanks. Using data from both replicates for each treatment (n=17 to 22), mortality was greatest when both pH and temperature were elevated (94%), intermediate when either pH was high (65%) or temperature (68%), and lowest in the control (27%; no change in temperature or pH). The mortality data indicates a "double whammy" effect of combining high pH and high temperature. This condition is not too uncommon in the summer months where warm lakes with high phytoplankton numbers drive the pH up by consuming carbon dioxide.



A repeat of the loading experiment is slated for later this year with cutthroat trout. This will be conducted in conjunction with the Strawberry Reservoir restocking. The high pH experiment will also be repeated with cutthroat trout, but the fish we are raising on station won't be big enough until next year. Meanwhile, progress is being made on construction of the chiller building. I am planning to move a large chiller unit from Glenwood Hatchery to the Experiment Station, hopefully in December. The chiller will be hooked up to both the wetlab and the hatchery to provide us with colder water for temperature-controlled experiments as well as to meet the rearing needs of coldwater species such as the lake trout. Construction of the metal building should start within a week or two. Speaking of construction, the histology lab is in the process of having a laboratory hood installed. This is a long overdue project, necessary to keep nasty chemical fumes out of the lab.

### OTHER RESEARCH

In addition to Federal Aid experiments, I have been busy on other projects. One experiment currently underway is designed to discover more about the seasonal changes in the thymus index of the Health and Condition Profile (HCP). By

observing the thymus index values in individual fish over time under laboratory conditions, I hope to determine if the fluctuation is based on some internal clock or due to different environmental conditions. The results of the Green River studies indicated a seasonal fluctuation in the index. For this experiment, each fish was tagged and the thymus index for each fish recorded. After examining rainbow trout one month later, I have already discovered that hemorrhaging is a transient phenomenon, i.e., fish with hemorrhaging in the thymus at the start of the experiment did not have the same condition one month later. These fish will be examined monthly to determine the thymus index value.

Also nearing completion is the summary of the feed comparison tests that Tim Miles conducted from October 1989 to July 1990. The statistical analysis is completed but the report has yet to be written. More details next issue...

Scott Hauxhurst is investigating the possible benefit of baffles for managing solid waste within raceways (see Boersen and Westers 1986, Prog. Fish Culturist 48:151). We are modifying the design slightly from that in use in Michigan to make it easier to crowd the fish for transport, grading, etc. This innovation will hopefully flush out solid wastes as they are generated, rather than after they have accumulated in all the slow flow corners of the raceway. This will also address the problem of the fish being bombarded by wastes during cleaning, which can cause gill problems.

Another new technology to be investigated here is the low-head oxygen injection system. A federal aid proposal is being developed to evaluate the physical performance of the system as well as the physiological effects of supersaturation.

Joey Comp and the staff at Mammoth Creek are initiating an experiment to evaluate the effects of demand feeders vs. hand feeding upon fin condition. I applaud their initiative and hope that other similar research within Utah's hatchery system can contribute to the production of better fish.  
ERIC WAGNER

---

## BACTERIAL GILL DISEASE

Bacterial gill disease is a common condition of cultured trout and salmon. It is an excellent example of a disease which arises when environmental stressors weaken the fish's natural defense mechanisms. The early stage of the condition, before bacterial invasion, is more accurately termed "environmental gill disease" because factors in the environment cause irritation to the gill tissue. This results in swelling and fusing of lamellae and filaments which in turn decreases the fish's ability to exchange oxygen and eliminate waste products across the gills. This damaged tissue then provides an ideal location for bacteria and fungi to invade.

**Bacterial Gill Disease - continued**

The bacteria usually associated with this condition are the *Myxobacteria* group. They are common soil and water inhabitants and become pathogenic when damaged tissue is encountered. Their ability to produce disease depends on the numbers present in the water and the health of the fish. The numbers of bacteria will increase as water temperatures rise, making the disease more common during the summer months (May-October). This is also the time of year when more fish are concentrated at culture facilities. Mortality rates vary considerably and may range from 5-90+ %.

Stressors other than water temperature include overcrowding, stagnant or low water, inadequate oxygen concentration, high pH, and high levels of ammonia and/or solids in the water. These factors, either singly or in combination, can lead to gill tissue damage and resultant bacterial invasion.

Signs of environmental gill disease include loss of appetite, sluggish swimming behavior, and fish that remain near the surface or at the tail of the raceway. The gills appear swollen and can be seen to protrude from beneath the operculum. The posterior portion of the head appears thickened due to incomplete closure of the opercula. Once bacterial gill disease has occurred, white or gray spots appear on the gills. These are areas of gill tissue destruction.

Early recognition of the problem and accurate diagnosis can save considerable expense in manpower, time, cost of chemicals, and loss of production. Chemical treatment without correction of the underlying stressors only leads to repeated episodes. During the early stages (environmental gill disease) treatment should be aimed at correcting those factors which stress the fish. Corrections may be accomplished by reducing densities, reducing or eliminating feeding for a period of time, or increasing water flows. A salt flush of 1-2% will reduce gill tissue swelling, decrease the uptake of ammonia by-products by the gills, increase oxygen exchange, and reduce the bacterial load on the gills. In more advanced cases, the use of other external disinfectants such as Hyamine or Chloramine-T® is often utilized to reduce the bacterial load on the fish as well as in the water. Hyamine 3500 which is a 10% solution is used at a dosage of 20 mg/liter for 1 hour on 3 - 4 consecutive days. It is bactericidal and virucidal and acts as a detergent to disrupt the cell wall of the organism. This detergent action also aids in the removal of excess mucus from the gills. Toxicity to the fish can develop in soft water. In hard water, it is less toxic and less effective. Chloramine-T® is used at 4.5 - 6.5 mg/liter for 1 hour. Few problems have been encountered when used at the recommended levels and it is considered to be more effective than Hyamine. Certain antibiotics have also been used. However, due to the difficulty of administering antibiotics through the feed to fish that are not eating and the small number of FDA approved antibiotics available, this practice is not widely used.

One of the philosophical problems fish health professionals (and fish culturists) face is the treatment of fish with products that are not approved by the FDA. Hyamine and Chloramine-T® are not FDA approved for use on live food fish, however, their usage has become so common that we tend to forget this fact. The U.S. Dept. of Agriculture and aquaculture groups are supporting ongoing work that may eventually lead to approval. It has also been proposed that fingerling fish be exempted from consideration as food fish so they may be legally treated with additional chemotherapeutants. It makes more sense to correct underlying problems rather than relying on chemicals to treat conditions that rightfully should be corrected by changing nutrition, management, or water quality. Bacterial gill disease is one of these conditions. By paying more attention to good management we could reduce the dependence on these chemicals. As with many other diseases, prevention is the most efficient and cost effective way to deal with bacterial/environmental gill disease.

RUSSELL LEE

\*\*\*\*\*

**HEALTH CONDITION PROFILE UPDATE**

The UDWR hatchery system has now been using the health condition profile (HCP) for about three years as a required part of the routine. The data is being entered into "AUSUM" which is a Lotus 123 template programed to store, calculate and to summarize the original observations as well as to print out a standard report format. At present these reports are being forwarded to the Fisheries Experiment Station for review and entry into the broad database set up for that purpose. This is carried in "Paradox" which is a powerful relational database facilitating extensive storage, manipulation and retrieval of all of the information. Evaluation of this information in the context of quality control is achieved in this manner. Periodically the information is queried, printed and sent to the Salt Lake Office. This information is reviewed there and sent out to appropriate people for use at the stations of origin.

It has become apparent that people understand how to conduct the autopsies and how to use "AUSUM" but do not understand the interpretation and application of the information. It is therefore necessary to develop another training course or seminar to be held in the very near future.

This is not unique to the hatchery people. There seems to be similar confusion in other user groups. I have for this reason developed a "post-graduate" session designed to facilitate the interpretation and application of the HCP. This module will be added as an option for further HCP training courses but it is likely going to be most effective and useful to people who have been using the system. The Utah hatchery personnel will be notified soon and other agencies having received the training will be advised of this new training module.

RON GOEDE