THE ICHTHYOGRAM

Newsletter of the Fisheries Experiment Station, Utah Division of Wildlife Resources
Volume 1 No. 1 Summer 1990

What's An Ichthyogram?

I doubt that anyone will find the word *Ichthyogram* anywhere in the dictionary, actually its a coined word which Eric Wagner and I dreamed up while bouncing along the interstate with a load of Strawberry cutthroat. We wanted to come up with a catchy title to a newsletter to inform other state and private fish culturists on events and items of interest relating to fish health. It seems that many folks are unsure what takes place at the Fisheries Experiment Station (contrary to rumor, we are not the northern outpost to repel the "huns from the northlands" of Idaho). In this and subsequent issues, we hope to inform you of some of the research and news relating to fish health taking place here and at other facilities. We hope to publish a new edition every 3 - 4 months as time will allow. If you have a contribution, a suggestion about a topic of interest or comment, we would like to hear from you. Please address all correspondence to:

The Ichthyogram
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WESTERN FISH DISEASE MEETING

The Western Fish Disease Meeting was held at McCall, Idaho on June 29 and 30. Presentations were made on several current items of interest to all those involved in fish culture. It is always interesting to see how few fish health problems occur in Utah relative to other Western states.

VHS

The virus associated with viral hemorrhagic septicemia has now been isolated at 4 locations on the West coast. In all cases, the virus was discovered upon inspection of seemingly healthy fish. However, research has shown that while the virus is definitely related to the virus which has caused so many problems in Europe, the isolates from North America are far less virulent. Mortalities were very low in a wide variety of salmonid species which were bath exposed to the virus. Evidence so far suggests that the incidence of the disease is very low in wild populations and there is a expressed need for more sensitive tests to detect the virus.

SALMONID RICKETTSIAL SEPTICEMIA

An apparently new disease of salmonids has been diagnosed in salmon raised in Chile. This disease has reported caused the loss of 1.5 million salmon and it is further estimated that 30 - 40% of the cultured fish there will die or be harvested prematurely due to this disease. Research shows that a rickettsial organism is responsible for the disease. Affected fish often show signs of anemia, swollen abdomen (ascites) and hemorrhages on the skin. This disease has been seen primarily in fish kept in saltwater, but research has shown that it can occur in freshwater and can be passed from fish to fish. Investigators in Chile and the U.S. are working hard to find a treatment for this disease and some antibiotics tested in the lab show some promise.

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1989-90 FEDERAL AID RESEARCH RESULTS

HEALTH CONDITION PROFILE RESEARCH RESULTS

Ron Goede, director of the Fisheries Experiment Station, developed a methodology to visually assess the health and condition of fish through an autopsy. This Health Condition Profile (HCP) is the synthesis of many years of experience and is being incorporated into monitoring programs throughout the country. Further research into the Health Condition Profile (HCP) was conducted this past year, looking particularly at sources of variation. Observer bias in the HCP was evaluated using two methods: (1) having 14 observers look at the same 20 fish, and (2) having 4 observers look at 60 fish each. There was considerable variation among observers with both methods, with some parameters varying more than others. Using the first method, the summary of percent normal of the thymus ranged from 0 to 65%, and the mean fat index ranged from 1.5 to 3.1, indicating a wide range of interpretations. The mean bile index ranged from 1.4 to 2.4, and the determination of sex was extremely variable in the immature rainbow trout used in the study. Using the second method there were significant differences among the observations of the 4 observers in hematocrit, leucocrit, eye, gill, liver, gut index, kidney, fat index, bile index, sex, and fins. Clearly, if any comparison of parameters among different autopsies is to be made, observer bias should be considered and avoided if possible by having one observer conduct the autopsies.

In another experiment, variances of each parameter were estimated by sampling a large number (240) of juvenile rainbow trout. These data were used to generate tables which show the confidence interval of each parameter for a 20 fish sample, and show the sample size required for a given level of precision.

The thymus and pseudobranch parameters of the HCP are perhaps the least understood of the parameters. The effect of a 30 to 60 sec handling stress and anesthetic upon the thymus and psuedobranch parameters of the HCP was evaluated. The condition of both parameters was observed before placement into anesthetic or being stressed and after one hour. There was no effect upon either parameter due to anesthetic or handling stress within 1 h.

An additional experiment answered the question, "do the autopsy parameters change with time as the fish are left out at room temperature?" Five lake trout were observed using the HCP guidelines, then re-examined after 3 h. There was no change in the parameters within this time. Hematology parameters obviously could not be re-examined.

An Anomaly Index that ranges from 0 to 120 was developed to augment the HCP with a numeric value that would represent the health and condition of the fish. The Anomaly Index is generated as part of the output of the AUSUM computer program. Also included in the output is the standard deviation of the observations. Marshall Adams, of Oak Ridge National Laboratory in Tennessee, has also proposed an index which will be developed in collaboration with Al Brown of the Tennessee Valley Authority and Ron Goede. He proposes an individual index for external parameters, blood parameters, condition indices (Ktl, fat, parasites, LSI, VSI), organs, and nutritional parameters (bile, liver, fullness of stomach). These 5 categories would then be weighted and ranked to create a Health Index for each fish.

STRESS RESEARCH RESULTS

When fish are stocked from the hatchery to various waters in the state, pH is measured, but its effects upon the ultimate survival of the fish are unknown within the lethal limits defined by previous research. A survey by the Utah Department of Health of 127 lakes and reservoirs showed that pH ranged from 5.8 to 9.5, indicating that high pH is more of a problem in the state than low pH. Some questions that arise concerning the fate of stocked fish are:
(1) What are the lethal limits of pH? (2) What effect does sublethal changes in pH have on the fish? (3) Can acclimation at an intermediate pH help reduce post-stocking mortality?

Lethal limits of pH vary depending upon factors such as species, presence of heavy metal ions, acclimation pH, and age. A pH below 4 or above 10 is generally considered lethal, though pH values within this range can also be lethal depending upon the circumstances.

The experiment conducted here at the station evaluated the effect of transfer from pH 7.6 to high pH (9.0 - 9.1) on juvenile rainbow trout, using cortisol, glucose, chloride, and osmolality. These parameters have been used extensively to measure the effects of stressors (conditions which cause a stress response) which can decrease a fish's ability to escape predation and fight off disease. No effect was observed upon transfer to high pH, suggesting that stocking of rainbow trout into high pH waters common in Utah is no more stressful than the act of stocking itself into water of moderate pH. Research conducted by the staff of the Arizona Coop. Fishery Research Unit in Tucson showed that if pH increased from 7.2 to 9.3 in 6 h, rainbow trout experienced only a temporary loss of appetite. When pH was increased to 9.5 in 6 h, 50% mortality occurred. In Tucson, in direct transfer tests from pH 7.2 to high pH, survival of rainbow trout was 88% at pH 9.0, 68% at pH 9.5, and 0% at pH 10.0.

The effect of four transport truck loading methods on the stress response of rainbow trout was evaluated using the same stress indicators used in the pH experiment. Trout sampled from tanks after loading by each method all showed increases in cortisol above baseline levels indicating that loading was stressful. However, there were no significant differences in any of the stress indicators among the four methods: dip net, Sartorius conveyor, Nielson fish pump, and the Aqualife Harvester fish pump.

OTHER RESEARCH RESULTS FOR FY89-90

To test the relative benefit of night stocking versus day stocking of rainbow trout fingerlings, 100 prey were stocked into concrete ponds containing brown trout predators during the day and night. Autopsies of the predators indicated that no fish from either treatment had been consumed. Although the six-year old brood stock used for predators were trained to eat live prey over a period of several months, the relatively large size of the prey used and the hatchery origin of the predators may have been factors influencing successful predation. No statement can be made regarding the relative benefits of night stocking based upon this data.

Loss of half of the adult brown trout transported to the Fishery Experiment Station prompted a study to assess the effects of buffering salts in transport upon survival. It was hypothesized that the relatively soft water of Egan Hatchery may be a factor in poor survival after stocking. Post-stocking mortality of trout from buffered tanks (KCl, CaCl, and $NaHCO_3$) and unbuffered tanks was about equal, indicating that buffering the transport tank water did not improve the ultimate survival of stocked adult brown trout. A temperature difference of 10^0 F may have been responsible.

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RESEARCH PROPOSED IN FY90-91

The Federal Aid proposal for stress managment for FY 1991 has been approved. The pH experiment and the loading experiment will be repeated with cutthroat trout raised on station to see if this species differs from rainbow trout in its response. Hopefully there will be enough cutthroat eggs to go around this year. A series of temperature acclimation experiments are planned, to determine the minimum acclimation time needed to adapt a fish to temperatures that were lethal when directly transferred. For control of cold temperatures, the chiller from Glenwood Hatchery is to be moved to the Experiment Station. Test of acclimation to higher temperatures by adult trout of various species is also proposed, and will be conducted at Egan Hatchery. The last test proposed is one assessing the synergistic effects of temperature and pH upon rainbow trout.

FIN EROSION

Fin erosion is common in salmonid fish raised in hatcheries and is often used in the field as an indicator of domestic origin. I recently began searching the literature to find out what might potentially cause fin erosion and what steps might be taken to ameliorate the problem. The following is a brief synopsis of that search.

At first, I thought that fin erosion might be caused in part by the rough concrete of the raceways. This cause has yet to be ruled out, but fin erosion has also been observed in floating net pens and in polluted coastal waters.

Research into the effects of crowding have been mixed. Atlantic salmon held at densities of 2.59 to 20.95 kg/m^2 (0.53 to 4.29 lb/ft^2) of rearing container bottom area did not differ in fin condition, growth, and survival. Densities of 27, 54, 111, and 221 kg/m^3 (1.68, 3.37, 6.93, 13.80 lb/ft^3) did not affect fin condition of lake trout that were 17.5 cm (6.9 in) long. Final rearing densities ranging from 10.0 to 28.2 kg/m^3 (0.62 to 1.76 lb/ft^3) did not correlate with fin erosion. However, other authors have found an increase in fin erosion as densities of Atlantic salmon approached 2.49 kg/m^2 (0.51 lb/ft^2) to 5.93 kg/m^3 (0.37 lb/ft^3).

Fin erosion or fin rot has also been attributed to bacterial infections (Flexibacter species, Psuedomonas, Vibrio, and Aeromonas), but these infections are secondary to contributing factors such as poor nutrition, presence of other disease organisms, or injury.

Nutritional deficiencies have been related to fin erosion. Wound repair is delayed or inhibited in fish on low vitamin C diets. Deficiencies in the amino acid lysine and/or vitamin B complex vitamins (inositol and folic acid) can cause degenerate fins.

Another predisposing factor for fin erosion may be aggressive behavior. Two authors noted that fin erosion in trout could be ameliorated by overfeeding by 50% or feeding to satiation. Feeding extra rations can be expensive, so further experimentation showed that addition of 30% non-digestible bulk helped satisfy hunger and improved fin quality at little extra cost.

If any of you have made observations or make observations in the future regarding fin erosion I would be glad to hear about them. A list of references of this review is available upon request.

Eric J. Wagner

USE OF MEDICATED FEED FOR FISH

Although a rare problem in Utah fish culture, bacterial diseases can wreak havoc when they occur. When bacterial infections occur, however they are often treated by the use of medicated feeds. Traditionally medicated feed refers to the addition of an antibiotic, but sometimes other compounds are added such as hormones (testosterone) or nutritional supplements such as extra vitamin C.

In general, antibiotics should only be used for the treatment of specific diagnosed bacterial diseases. Diagnosis involves both bacterial culture of affected fish and sensitivity testing to ensure the antibiotic is effective against any bacterial pathogens that may be found. The Fish Disease Diagnostic Laboratory at the Fisheries Experiment Station is equipped to perform such testing. It is very important that diagnosis and treatment be initiated early in course of the disease.

Currently, there are only two antibiotics which are registered as approved for use in food fish with the FDA. Oxytetracycline (Terramycin, Pfizer Inc.) is a bacteriostatic drug, meaning that it inhibits the growth and division of bacteria, rather than killing them. It is dosed at 2.5 - 3.75 g/100 lb of fish per day (55 - 82.5 mg/kg) for 10 days in salmonids and catfish. The withdrawal time is 21 days. It is registered only for the treatment of Aeromonas, Hemophilus, and Pseudomonas infections in fish. The other legal drug is a combination of ormetoprim and sulfadimethoxine (Romet-30, Hoffman-LaRoche). This drug is also bacteriostatic and is dosed at 50 mg/kg for 5 days in salmonids and catfish, with a withdrawal time of 3 days in catfish and 21 days in salmonids. It is registered for the treatment of furunculosis in salmonids and enteric septicemia in catfish. There is a lot of interest now ongoing to develop other drugs for use in fish culture. Some of the more promising include quinilone drugs such as sarafloxacin (Sarafin, Abbott Laboratories) and oxolinic acid as well as florfenicol (Schering).

Comparison of Antibiotics for Use in Fish

	Romet-30	Terramycin
Active Drug	Ormetoprim/ Sulfadimethoxine	Oxytetracycline
Method of Action	Bacteriostatic	Bacteriostatic
Advantages	Floating Feed Low Resistance Short Withdrawal	Inexpensive Palatable
Disadvantages	Higher initial cost Palatability	Widespread Resistant Long Withdrawal Only in Sinking Food

Antibiotics can be highly effective in the treatment of bacterial diseases of fish under certain conditions. Fish that are sick do not eat and consequently will not obtain any medication. Consequently, use of medicated feed may be looked on as a preventative of disease in healthy, feeding fish rather than a treatment of sick ones. It is important to recognize that bacterial diseases are often a secondary problem to an underlying source of stress. In such a case, antibiotics will only treat the symptom, not the primary problem. It is imperative to identify and eliminate the source of stress.

Once diagnosis is made and treatment is initiated, it is important to maintain the treatment at the proper dosage and for the full recommended time. Failure to do so may

MEDICATED FEED - cont'd
help to produce resistant strains of bacteria which fail to respond to treatment. Abuse of antibiotics has contributed to the large number of strains of many bacteria which are partially or totally resistant to previously effective drugs.

Chris Wilson

HELLO, GOODBYE

At the Fisheries Experiment Station, we have had the sad duty to say "goodbye" to a couple of old friends and "hello" to a new one. Pat MacDonald is leaving us to move back to her hometown in Connecticut and pursue a new career in real estate. Pat has been with us for 4½ years and has done so much to keep the station running smooth and keep us all out of trouble (for the most part!) In addition, culturist Dennis Cox has left the station to rest and write short stories before traveling out of state for another job. We'll miss both you guys!!!

At the same time, we are proud to announce that Shirley Devenport has taken the position of office manager. Shirley is a longtime resident of Logan along with her husband and 6 children. Shirley has already proved her ability to take over the position of office computer whiz. Welcome, Shirley!

John Leppink has just recently announced that he will be leaving Utah to accept a new position with the state of Oregon. Utah's loss will definitely be Oregon's gain! Good luck, John!

FES PERSPECTIVE by Ron Goede

ICHTHYOGRAM is a long overdue newsletter from the FES. Chris Wilson and Eric Wagner are the latest additions to the technical staff and bring with them a desire to communicate with the field. Chris has undertaken to serve as Editor. It will be up to all of us to contribute to this effort.

The Fisheries Experiment Station is passing into a new level of existence as we enter the decade of the "nineties". The general plan conceptualized during the "ODI" process a few years ago is being realized. We are broken into three major sub-programs. Each of these are becoming more independent but developing within the overall program of the FES.

The Technical Services portion of the program includes all of the disease and fish health management program. This generally includes diagnostic services, inspection and certification services and fish health monitoring services. They will periodically get into special "trouble shooting" modes to look into specific problems. We are monitoring state fish culture facilities, wild brood sources and private aquaculture facilities. Chris Wilson is heading up technical services. He took over the program in January, 1990 and brings new energy and expertise to the job. He has considerable computer skills and these will be useful in setting up the necessary data bases needed to accomplish the job. It is immediately useful in developing and producing "ICHTHYOGRAM". His staff consists of Ernie Dean, Kent Thompson and Nelma Gates. Nelma will also spend some time in research.

Research has been separated into a separate program. This is done to protect it from the rest of the program. It is obvious that the more expedient disease programs will prevail when there are conflicts over people and facility. When fish were "sick", research always had to wait. It is now a separate sub-program within the FES and is funded primarily by Federal Aid funds. It has a specific mandate from the legislature at this time to conduct investigations of ways to improve survivability of fish. With the numbers of fish stocked in this state a small increase in survivability of those fish soon provides the equivalent of a new additional fish culture operation. Eric Wagner is in charge of the "Research" program at the station. He has the responsibility to develop and conduct the program. This includes writing and communicating his results in-house and through peer review processes. It will grow substantially over the coming years. He is developing the scope and content of his research at this time and welcomes input of ideas from the field. Eric also brings considerable computer aptitude to the Station.

Tim Miles is in charge of the fish culture at the station. He supervises maintenance and coordinates use of water, raceways, etc. The FES has been taking care of fish distribution in the Cache Valley area for the Division culture programs. The fish generally come from Midway Hatchery and are held here while they are distributed. We are producing many of Mantua hatchery's rainbow trout this year so that they can produce Bear Lake Cutthroat for Strawberry Reservoir. This has been extra duty for Tim and his staff. Tim and staff also handle culture for Eric's research program.

Shirley Devenport manages the office and Nelma Gates coordinates much of the lab activity. Nelma's skills as a histotech and her emerging skills in some of our specialized surveys place her in both technical service and research.

I supervise and coordinate the entire operation and serve as a staff member of the chief of fisheries, Bruce Schmidt. It is in this role that I attempt to represent the FES point of view in all questions brought before that staff. This role is an important one in that it provides for implementation of the FES program and philosophies.

We'll cover activities of each of these programs in more detail in the coming issues.