# The Ichthyogram

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◆ Fish Health in Utah

## Aquaculture Advisory Committee Formed

About one year ago, the Governor's Task Force on Agribusiness Development recommended the formation of a Utah Aquaculture Policy Board. Through a series of meetings involving most interested parties, the decision was made to form the Aquaculture Advisory Committee. The Utah Wildlife Board created this committee on April 15, 1993. This committee's charge is to develop recommendations and advise the Wildlife Board on matters and issues pertaining to private and public aquaculture. The Committee has eight members, four representing various aspects of private aquaculture and four representing public recreation. Those appointed are listed below:

| REPRESENTATION | APPOINTMENT | TERM |
|---|---|---|
| Egg Producer | Bobby Williams | 2 years |
| Live Fish Producer | Bill Jolley | 4 years |
| Farm Bureau | Grant White | 2 years |
| Fish Processor | Mark Leavitt | 4 years |
| Wildlife Federation | Merrill Miller | 2 years |
| Wildlife Leadership Coalition | Al Regenthal | 4 years |
| Utah Trout Foundation | Steve Schmidt | 2 years |
| Stonefly Society | Gerald Nielson | 4 years |

Al Regenthal and Mark Leavitt will be co-chairmen of the Committee. Tim Provan, Director of the Division of Wildlife Resources will serve as the committee's liaison with the Wildlife Board. Ron Goede and Joe Valentine will represent DWR as *ad hoc* members.

The Committee has already held meetings on May 6, May 26, June 16, and July 14, 1993. Their first efforts have been directed toward getting adequate funding for the Fisheries Experiment Station so it can continue to assist in the disease inspections of private fish hatcheries. In the past, this program has been funded by DWR from general fund appropriations (see accompanying story, page 3). Therefore the Committee has brought this dilemma to the attention of the Wildlife Board. Efforts are being made to find the funds to keep this program going for this fiscal year. **Joe Valentine**

### Inside This Issue

◆ Fish Culture Research

# Experimental Use of Cobble Substrates for Improving Fin Condition of Bear Lake Cutthroat

A previous survey of state hatcheries in Utah indicated that better fin condition often occurred in raceways and ponds which contained natural bottom substrates such as gravel or mud. To further test this hypothesis, a controlled study at the Fisheries Experiment Station was conducted using two raceways lined with cobble stone bottoms and two normal raceways with concrete bottoms. The experiment ran for 10 months and HCPs (Health and Condition Profile) were run every two months. Each raceway was stocked with 1,000 Bear Lake cutthroat trout that grew from about 3 to 7-8 inches during the course of the study. The density index at initiation was 0.08 and finished at 0.52-0.73.

. . .natural bottom substrates during rearing can significantly improve fin condition.

The results showed that fin condition remained fairly good in both groups until the last autopsy (at 10 mo.) where there was a significant difference in the fin index ($p = 0.009$), indicating greater fin erosion in the control group (1.1 versus 0.3 in the cobble group). Unfortunately, a major side effect of the cobble treatment was that length (-9.8%) and weight (-26.4%) were significantly reduced compared to fish from control raceways ($p = 0.02$ and 0.04). Fat levels from cobble treatment (mean fat index = 1.1) were also significantly lower than control treatment (mean = 2.0, $p = 0.014$). The reason for this dramatic difference in growth and fat levels was apparently due to the fact that food pellets quickly sunk through the 11" water column and were lost between the stones in the cobble treatment, whereas in control raceways, fish were apparently feeding on the bottom. Water quality was assayed bimonthly and no significant differences were noted between the two types of raceways.

The results demonstrated that natural bottom substrates during rearing can significantly improve fin condition. To avoid the loss in growth and fat levels with cobble treatments, smaller "pea" gravel and greater water depths are recommended to alleviate the problem of pellets sinking quickly between the crevices of the cobble stones. The use of demand feeders *ad libitum* or floating pellets would help eliminate the problem regardless of cobble size or water depth.

**Thomas Bosakowski**

◆ Fish Health in Utah

# Budget Axe Descends - Where Will the Chips Fall?

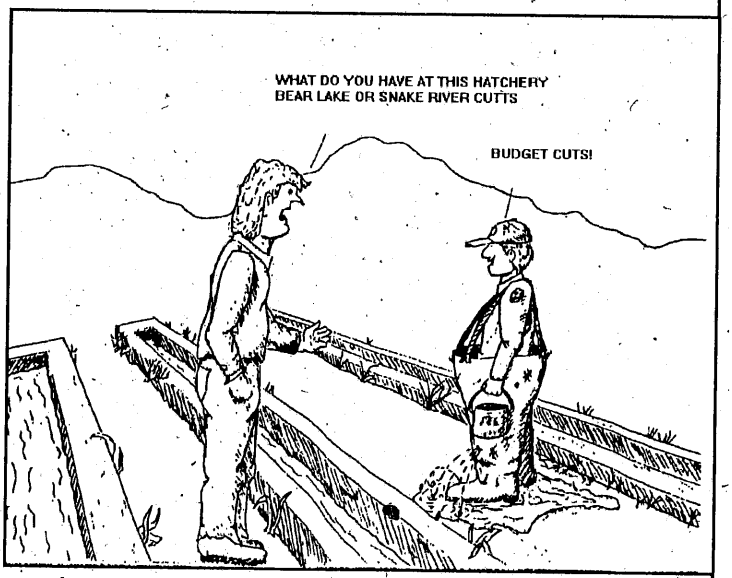
During the spring 1993 session, the Utah Legislature cut $650,000 from the budget of the Division of Wildlife Resources budget. This cut included money earmarked for private aquaculture facilities inspection by Fisheries Experiment Station (FES) biologists. In response, FES Director Ron Goede announced at the spring meeting of the Utah Aquaculture Association that collection services for private aquaculture inspections would cease at the end of the new fiscal year (July 1, 1993). According to Goede, "Since the legislature cut all general fund money, we are forced to remove service, unless funds can be restored." As a means to save money, the contract with Dr. Russell Lee who has been working for UDWR on fish health inspections is scheduled for early termination.

"we are forced to remove service, unless funds can be restored."

In anticipation of financial problems, most of the inspections for private aquaculture were performed in April. However, a few growers who spawn fish in the fall and those requesting a second annual inspection to meet California import requirements are likely to be affected. Those inspections are currently scheduled with the U.S.F.W.S. laboratory in Ft. Morgan, Colorado.

Efforts are underway to obtain replacement funds by direct legislative action or by support by other state agencies, such as the Department of Agriculture. The newly created Aquaculture Advisory committee has been informed of the situation and will consider it at their next meeting. The long-term roles of UDWR in administering a state fish health program and providing inspection and diagnostic services to aquaculture have not been determined at this time.

**Chris Wilson**



◆ Fish Culture Research

# Evaluation of Low Head Oxygen Systems

The "Low Head Oxygenation System" or LHO is a device recently patented for injection of oxygen or other gases into liquids, relying on serial reuse of oxygen through a series of chambers or stages (Figure 1). The LHO is in use currently at Glenwood and Springville hatcheries in Utah, where supersaturation of water with oxygen has permitted increased production of fish. In a study conducted at the Fisheries Experiment Station, the absorption efficiency of the LHO an nitrogen gas supersaturation concentrations were evaluated at five different oxygen flows ranging from 0.40 to 3.20 g/min (about 0.3 to 2.4 L/min).

"loss of DO to the atmosphere as it flowed down the raceway was negligible"

Absorption efficiency (AE) was calculated using the formula (Watten and Boyd 1990),

$$AE = Q_L (DO_{OUT} - DO_i) 10^{-3} / Mo_2$$

where:
- $DO_{out}$ is the mean dissolved oxygen of water exiting the eight LHO chambers in mg/l,
- $DO_i$ is the dissolved oxygen of the water entering the LHO,
- $Q_L$ is the water flow in liters/minute,
- $10^{-3}$ is the conversion from mg to g,
- $M_{O2}$ is the mass flow of oxygen to the unit in g/minute.

The mean absorption efficiency of the LHO units ranged from 67.3 to 90.6%, peaking at 0.79 g $O_2$ /min. (Table 1, page 5.) Absorption efficiency decreased as oxygen flow increased. Nitrogen gas saturation was inversely proportional to oxygen flow, and did not fall below 100% saturation until oxygen flows exceeded 2.5 g/min.

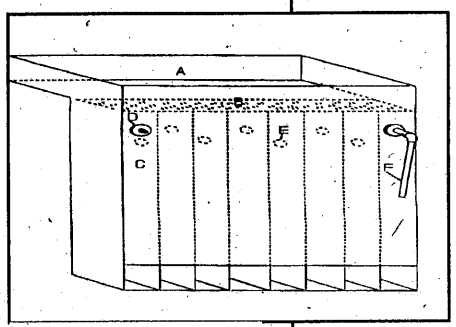



Figure 1. LHO Unit

Measurement of dissolved oxygen concentrations (DO) at the tail end of a fishless raceway did not differ from the mean DO of water exiting the LHO at the head end. This was an indication that loss of DO to the atmosphere as it flowed down the raceway was negligible and that the mean of the eight chambers was an accurate measure of DO leaving the LHO.

Results of the study indicated that if oxygen flows are high enough, LHO units can be used to successfully increase oxygen concentrations for greater fish production, as well as decrease the nitrogen gas supersaturation to benign levels.

**Eric Wagner**

Low Head Oxygen - continued

Table 1. Oxygen absorption efficiency and gas saturation levels from LHO units under different oxygen flow rates. AE = absorption efficiency, TG = total gas. Initial D.O. of water supply was 7.0 ± 0.1 mg/L.

| LHO Unit | 02 Flow (g/min) | AE (%) | TG (%) | N (%) | Ratio 02/N2 | Final D.O. (mg/L) |
|---|---|---|---|---|---|---|
| 1 | 0.40 | 85.98 | 109.56 | 115.13 | 0.78 | 8.09 |
| | 0.79 | 91.70 | 109.37 | 110.92 | 0.94 | 9.51 |
| | 1.48 | 72.58 | 109.53 | 107.56 | 1.09 | 10.75 |
| | 2.32 | 66.65 | 110.29 | 103.69 | 1.31 | 12.39 |
| | 3.20 | 60.63 | 110.33 | 99.52 | 1.53 | 13.89 |
| 2 | 0.40 | 77.28 | 109.15 | 114.84 | 0.77 | 8.01 |
| | 0.79 | 87.50 | 110.24 | 112.32 | 0.92 | 9.42 |
| | 1.48 | 77.01 | 108.55 | 105.74 | 1.13 | 10.95 |
| | 2.32 | 61.75 | 108.89 | 103.19 | 1.27 | 11.94 |
| | 3.20 | 71.45 | 109.17 | 94.63 | 1.74 | 15.06 |
| 3 | 0.40 | 59.16 | 109.50 | 115.86 | 0.74 | 7.81 |
| | 0.79 | 71.22 | 109.34 | 112.47 | 0.87 | 8.96 |
| | 1.48 | 61.63 | 109.27 | 108.88 | 1.02 | 10.18 |
| | 2.32 | 56.60 | 110.21 | 105.82 | 1.21 | 11.62 |
| | 3.20 | 60.70 | 109.56 | 98.64 | 1.54 | 13.84 |
| 4 | 0.40 | 81.54 | 108.90 | 114.17 | 0.79 | 8.13 |
| | 0.79 | 92.53 | 108.90 | 110.13 | 0.95 | 9.58 |
| | 1.48 | 80.56 | 108.45 | 104.87 | 1.17 | 11.20 |
| | 2.32 | 73.39 | 109.04 | 100.34 | 1.42 | 12.99 |
| | 3.20 | 71.17 | 108.78 | 94.22 | 1.74 | 15.02 |

## PASSAGES

Shirley Devenport, the office manager at the Fisheries Experiment Station will be officially leaving us effective July 30. Shirley will be leaving the Division of Wildlife Resources to pursue work in medical transcription at Logan Regional hospital and to spend more time with her family. Shirley will be remembered for her cheerful voice, her ability to cut through bureaucratic red tape and her love of chocolate Symphony bars. Interviews for her replacement are currently underway. Good luck and best wishes,

◆ Fish Health Regulations

# Regulations, Quality and "Fish Dangling"

During the 1950's and 60's, improved methods of transportation and shipment of fish aided the expansion of fish markets. Development of culture techniques facilitated production of fish and fish products. It became increasingly possible and profitable to move live fish to distant areas. Culture served as an amplifier of a variety of pathogens while improved means of distribution provided a means of "sharing" them with other parts of the world. What had been a group of isolated problems grew to international scale. The development of sensitive detection methods and an increase in numbers of trained scientists and technicians resulted in the ability to track some of these proliferations and to focus attention on problems which had been present in some instances but until that point not identified. State and federal government fish culture and fisheries management programs were being called on to provide more fish in response to a wide variety of demands. Private aquaculture was becoming a serious, viable and vital industry. Aquaculture entrepreneurs sought new sources and species of fish.

"We have the fish for you but they have IPN . . . do you want them"?

As the diseases began to take their toll a number of government and private programs ran into trouble. There was a need to develop some sort of regulation which would protect one and all. All efforts at development of national programs failed. Few state programs contained the expertise or programs to deal with fish health problems. It was not uncommon to find agencies with good intentions unable to come to grips with the problem. There were substantial efforts to deal with diseases in hatcheries and improve the quality of fish. However, when it came time to distribute and stock questionable fish the agencies found themselves on the horns of a dilemma. The U.S. Fish and Wildlife Service and some states would get into what became known in fish disease circles as "fish-dangling". They got around the ethical question of whether to plant some of the infected stocks by contacting management programs in desperate need of fish and saying "We have the fish for you but they have IPN . . . do you want them"? Often they were accepted. Many commercial sources of eggs and fish sold and/or purchased contaminated products without knowing it or got into some form of "fish-dangling" themselves.

A request was made through the Colorado River Wildlife Council to develop a policy on "fish-dangling". A fish disease committee was created in 1969 with the charge to do just that. Over the next two years through some rather stormy but productive deliberations, the Colorado River Wildlife Council fish disease policy was developed and ratified by the seven member states. Thus began the drainage concept of fish disease control. The policy set forth some criteria which fish would have to meet in order to be imported into and be moved within the drainage. This also ushered in the need for inspection and certification of fish stocks. The policy was applied initially to the government programs. Potential importers were inspected pursuant to a set of standard methods and all state and federal government hatcheries in the drainage were required to have annual fish health inspections. All went well at first as the council awaited an anticipated plethora of diseases. It was found that the problems were not as wide spread as was feared and that we were early enough to do some good. The Great Lakes Commission soon followed suit as they developed their model fish health program which also followed the drainage concept. The Eastern Seaboard states were next and finally the Pacific Northwest group which was structured essentially around the Columbia drainage and salmon.

Fish Dangling, continued

These groups have all functioned in the absence of national regulations. They worked relatively well as long as they centered around the agency programs but the growth of commercial aquaculture created some substantial problems. The answers for natural resource oriented programs were not always compatible with commodity-based private industry. Problems grew, factions developed and it has still not been worked out. Numerous serious questions remain. Who regulates? Who pays for regulation? Who inspects and certifies? What constitutes an adequate inspection? What is fairness of application of inspection protocols? How can we arrive at a standard inspection acceptable in all parts of the world. What constitutes a qualified inspector? What is the disposition of contaminated stocks? Who decides the fate of these stocks?

There has arisen a curious situation with respect to regulations. Over the years there have been efforts to delist or downlist pathogens. Bacterial kidney disease (BKD), Whirling Disease, Channel Catfish Virus (CCV) and Proliferative Kidney Disease have been downlisted from prohibited to notifiable pathogens. This means that inspection is required but action is not mandated. This has brought us to the era of "haves" and "have-nots" . Those agencies who do not have the pathogens do not want them. Those who have them try to manage with them. If the regulations are removed all together it still comes down to "haves and have-nots". If there are two comparable sources of fish and one has whirling disease, for example, the buyer will probably go to the source which is free of the parasite. In this instance it is not a matter of regulation but of quality control or assurance.

Those agencies who do not have the pathogens do not want them. . . . If the regulations are removed all together it still comes down to "haves and have-nots".

During the National BKD Workshop in Phoenix in 1991 the question was posed "How many people here would still order destruction of fish stocks with BKD?". There were not many clear declarations, but it was plain that most would probably not do so. The question was then asked "How many people here would accept fish knowing they had BKD if they could obtain BKD-free stocks elsewhere?". Again there were not many clear declarations but it was plain that most would not likely do so. This is where much of the problem lies. It goes beyond regulation and gets into quality control. Whirling disease and bacterial kidney disease are definitely involved in this type of question at present in many areas of the United States.

Buyers will not accept fish from sources known to harbor these organisms when they can obtain them from sources known to be free of them. This applies whether the organisms are prohibited or not. Many potential buyers will not purchase certified "clean" stocks from areas known to have whirling disease. Although this is their option, it can prove disastrous to live trout producers in such an area.

The interesting thing is that we appear to be coming full circle on the old "fish-dangling" problem and it will likely require some broad regulation to deal with it. "Let the buyer beware" is still an important caveat but protection through regulation is usually needed when individual ethics can not be relied upon. Regulation is not the monster it is currently perceived to be. If regulations were removed completely, the question of quality would still be with us and this fact would ultimately generate more regulations.

This growing problem has not been dealt with effectively to date. Serious factions are developing in the "industry". Management agencies, charged to protect the wild, free-ranging stocks are concerned about survivability and aesthetic acceptability of released stocks (see page 8)

and the strong probability of infecting resident stocks. Commercial producers depending on the live fish market must produce fish acceptable to regulating agencies and to the prospective buyers. Whether due to regulations or perception of quality their market could disappear the moment they are known to be "contaminated". Those producers depending on the dressed fish market have somewhat different worries. While they are not as concerned about long term survival of live fish and do not move live fish, they are very susceptible to perceptions of the quality and safety of a product which must satisfy a market based on a premium, aesthetic product for the table. They are concerned about their source of fish and they, as the other elements, must still worry about the effluents from their facilities.

If you include the philosophical differences between the natural resource management and the commodity-based, market driven industry the development of fair and effective regulation philosophies is very difficult. Numerous boards or committees made up of various special interest groups are being formed across the country to attempt resolution of the problems. In Utah the newly appointed Aquaculture Advisory Committee, composed of private aquaculturists and representatives of the angling public will address these problems. They have a difficult task ahead of them. Let's hope they are successful.

It is hoped that this article will provide some "food for thought" and stimulate people to consider the similarities and differences of regulation and quality control. The perception of quality is a powerful factor. **Ron Goede**

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