

Hatchery Reared Burbot Released for the First Time in British Columbia, Canada and Idaho, USA

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Burbot (*Lota lota maculosa*) are freshwater cod native to the Kootenai River in Idaho, Montana, and British Columbia. Burbot are culturally significant to the Kootenai Tribe of Idaho (KTOI) and Idaho's Kootenai River burbot population once supported tribal sustenance harvests and popular sport and commercial fisheries. Drastic population declines have occurred over the last half-century, primarily due to habitat alteration and loss, now this population is considered functionally extinct within Idaho borders. According to Idaho Department of Fish and Game (IDFG), most recent abundance estimates for Kootenai River burbot were approximately 50 fish.

To re-establish a burbot population in the Kootenai River, the Kootenai Valley Resource Initiative (KVRI) convened a burbot sub-committee to help develop a coordinated burbot conservation strategy. Development of burbot culture is one component of a larger multifaceted, international conservation approach that includes habitat restoration. Beginning in 2003, the KTOI, the University of Idaho's Aquaculture Research Institute (UI-ARI) and the British Columbia Ministry of Environment (BCMoE) initiated a research program to assess the feasibility of conservation aquaculture as an interim burbot restoration measure.



Nathan Jensen, Research Technician and UI-ARI hatchery manager Scott Williams spawning the first captive burbot in the winter of 2004. Photo credit, Jorge Slim-Lopez.

Spawning and semen cryopreservation methods were developed first, followed by incubation methods and larval and juvenile rearing strategies involving intensive, semi-intensive, and extensive culture methods. Additional research to characterize burbot disease susceptibility and to establish burbot cell lines for diagnostic purposes was recently completed. With these fundamental methods in place, aided by the knowledge gained through recent disease susceptibility studies conducted at the UI-ARI, the experimental program enabled the first experimental release of cultured burbot in British Columbia and Idaho.

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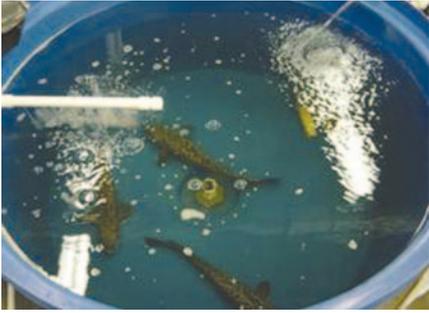


Photo credit: James Hearshey

Adult burbot broodstock in a rearing tank at the UI-ARI aquaculture laboratory



Burbot cultured at the UI-ARI ready for release.



Photo credit: James Barron

Burbot surgically implanted with an ultrasonic transmitter and Passive Integrated Transponder (PIT) tag prior to release.



Photo Credit: Matt Neufeld

KTOI Hatchery Manager Jack Siple releasing ultrasonic tagged burbot into the lower portion of Goat River, a tributary of the Kootenai River in British Columbia.

During October and November of 2009, 247 burbot cultured at the UI-ARI were released into the Kootenai River system in four different locations in BC and Idaho. The experimental release component of this project provides the foundation for studying post-release survival, growth, and condition of hatchery produced burbot. Thirty of the 247 released fish were two years old and implanted with ultrasonic transmitters. These fish are expected to provide valuable information concerning habitat use, movement and migration patterns, spawning habitat selection, and reproductive behavior.

These releases represent a historical milestone for the program, the species, and the Subbasin, as this is the first time burbot have been artificially propagated and subsequently released jointly into U.S. and Canadian waters for conservation purposes. The success of this experimental project paves the way for ongoing burbot conservation aquaculture research, and facilitates needed post-release in-river burbot studies. Ongoing burbot aquaculture research is focused on optimizing techniques for intensive rearing, semi-intensive and extensive culture methods, and determining temperature related growth performance.

As part of this collaborative international project, numerous reports and peer reviewed papers have been published on various aspects of burbot aquaculture, pathology, and management since 2005. This body of literature has contributed substantially to this developing field and would not have been possible without the support and cooperation of the Bonneville Power Administration, the Northwest Power and Conservation Council, KVRI, the KTOI fisheries program, the BCMoE, the U.S. Fish and Wildlife Service, the IDFG, Cramer Fish

Sciences, and the UI-ARI. University of Idaho researchers continue to communicate with European burbot researchers and culturists, further contributing to the success of the Idaho program, and to burbot conservation and restoration in Europe and North America.

For more information contact Sue Ireland (Ireland@kootenai.org) at the KTOI or Ken Cain / Nathan Jensen at the UI-ARI (kcain@uidaho.edu/njensen@uidaho.edu).



Photo Credit: Matt Neufeld

Hatchery reared ultrasonic tagged burbot seeking natural cover following release.

Thermal-unit Growth Coefficient – A BETTER PREDICTOR OF FISH GROWTH?

Submitted by: Gary Fornshell, Extension Educator

As accurate a prediction as possible of fish growth is required to estimate feed requirement and for production planning. One common formula used is the specific growth rate (SGR) that is based on the natural logarithm of body weight:

$$\text{SGR} = (\ln \text{FBW (final body weight)} - \ln \text{IBW (initial body weight)}) / D \text{ (number of days)}$$

The SGR is limited in that it does not account for environmental variances, such as temperature. Because growth rates can differ at different sizes of fish, the SGR may not be accurate over long periods of time. It is also limited in making comparisons between different groups of fish.

An alternative formula for fish growth prediction is the thermal-unit growth coefficient (TGC), which is based on the exponent 1/3 power of body weight and takes water temperature into consideration:

$$\text{TGC} = (W_F^{1/3}) - (W_I^{1/3}) / \Sigma [(T)(\text{days})] \times 100; \text{ where } W_F \text{ and } W_I \text{ are final and initial weights in grams, } T \text{ is water temperature in } ^\circ\text{C}, \text{ and days represents the number of days between initial and final weight.}$$

One TGC is determined to predict final body weight over a specific period using the following:

$$[W_I^{1/3} + \Sigma (\text{TGC}/100 \times T \times D)]^3$$

As an example, using production records from “Big Trout” farm, where beginning weight was 36.4 g, ending weight was 445.5 g, water temperature was 14.8 °C, and the growth interval was 140 days:

$$\text{TGC} = (445.5)^{1/3} - (36.4)^{1/3} \div (14.8 \times 140) \times 100 = 0.2087$$

To predict growth, let’s say we begin with fish at 5.88 g each or 77.16 fish/pound and grow them for 180 days. What will be the predicted final weight?

$$\text{Final weight} = [5.88^{1/3} + (0.2087/100) \times 14.8 \times 180]^3 = 399.5 \text{ g or } 1.14 \text{ fish/pound.}$$

Using TGC allows comparison between facilities operating at different temperatures, when other factors are the same. TGC is also sensitive to strain, nutrition, and other factors. Once TGC is determined for a hatchery based on previous production records, growth can be predicted using the formula above for any time period. The metric units can easily be converted to fish/pound and plotted on a graph, such as the one below.

Aquaculture Research Institute

The ARI newsletter will be produced semi-annually and available online in Adobe Acrobat format through www.webs.uidaho.edu/aquaculture/. If you would like to be notified via email when the latest edition is available on our web page, please notify the editor at aqua@uidaho.edu.

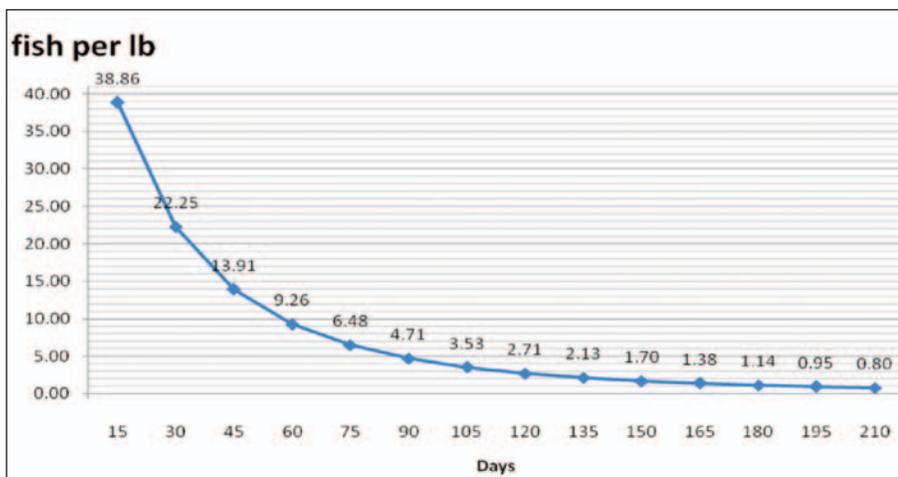
We would be happy to include appropriate contributions from those of you working in the field! Feedback and suggestions on how to improve this newsletter would also be appreciated.

This issue of the newsletter highlights various projects being conducted on the Moscow campus, the Hagerman Fish Experiment Station and includes various extension activities.

The Aquaculture Research Institute Newsletter provides information about aquaculture-related activities at the University of Idaho. It is intended to complement rather than duplicate the Idaho Aquaculture Association Newsletter, although some articles may overlap. Articles in this newsletter may be reproduced without permission, provided they are properly cited. Please feel free to submit comments or material you would like us to consider for publication to:

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FEATURED STUDENT

David Burbank is originally from Meridian, Idaho and entered the U.S. Army upon graduating from high school. After serving for four years, David enrolled at the University of Idaho (UI) and continued serving in the Idaho Army National Guard. David was activated with his guard unit during his sophomore year deploying to Iraq. Upon his return, he completed a B.S. in Fisheries, and immediately started work on a M.S. in Fish Health under the direction of Dr. Ken Cain. In addition to his ongoing research, David is also enrolled in the Student Career Experience Program (SCEP) with the U.S. Fish and Wildlife Service.

David's research project is focused on the development of probiotics to control *Flavobacterium psychrophilum* in rainbow trout (*Oncorhynchus mykiss*).

F. psychrophilum is the causative agent of coldwater disease and has a major economic impact on aquaculture operations regionally and worldwide. Facilities rearing rainbow trout are particularly impacted, but all salmonids are considered susceptible to this disease. No known effective vaccine exists for *F. psychrophilum*; however, new antibiotic treatments (Aquaflor) have recently been approved for control of coldwater disease. Although promising, there is concern about increasing reliance on antibiotics resulting in long-term bacterial resistance. The development of a probiotic with the ability to control or prevent *F. psychrophilum* infections not only has the potential to provide an alternative to antibiotic therapy but to provide another treatment strategy altogether.

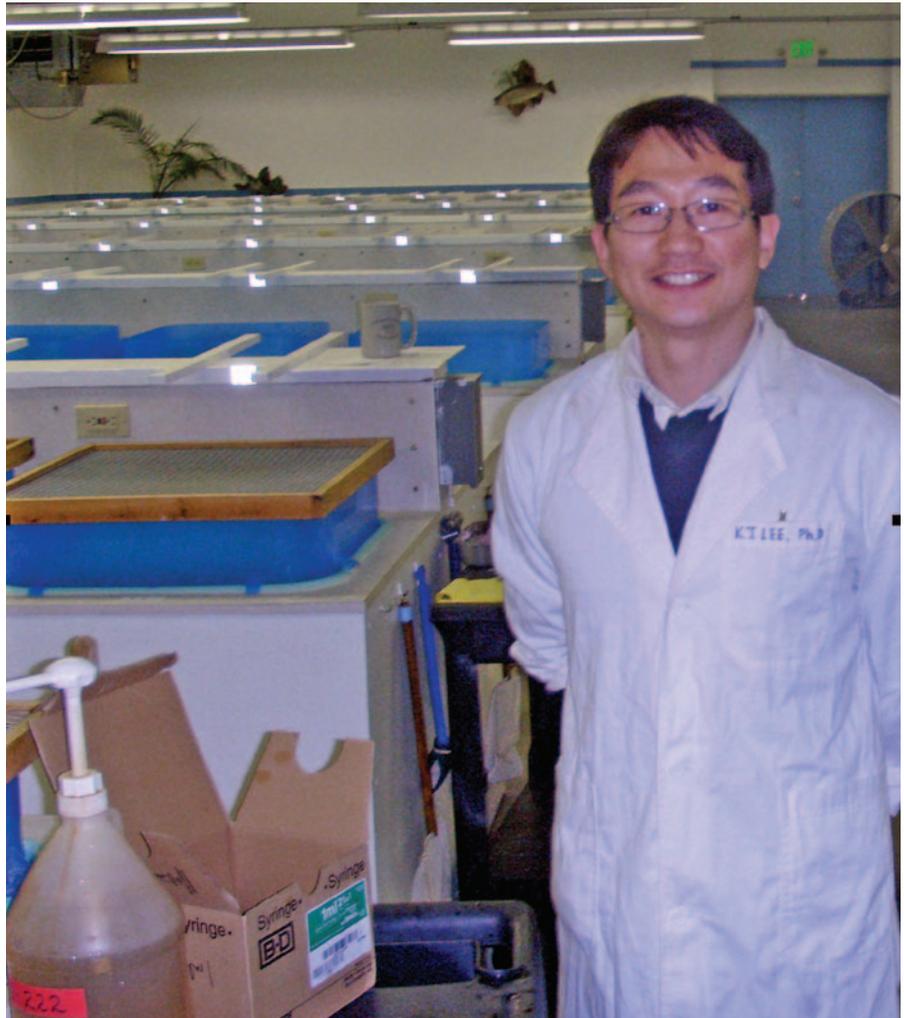
Currently, David has been screening numerous autochthonous bacteria in an effort to identify one or more which may be able to control or prevent disease outbreaks due to *F. psychrophilum*. While initial results have been promising, there is much more work to be completed. David recently presented some of his initial results and was awarded the best student paper at the 50th Western Fish Disease Workshop and AFS Fish Health Section Annual Meeting in Park City, Utah.



VISITING SCHOLAR

Dr. K.J. Lee was born and raised in Busan, the largest coastal city in South Korea. He received his BS (1994) and MS (1996) from Pukyung National University (formerly National Fisheries University of Busan) in Fisheries and Aquatic Sciences. Dr. Lee's master's work involved characterizing dietary requirements of vitamin C and E for Korean rockfish, *Sebastes schlegeli*. He completed his Ph.D. in fish nutrition at Ohio State University under the supervision of Dr. Konrad Dabrowski, a renowned fish nutritionist. His Ph.D. research involved utilization of cottonseed meal in rainbow trout feeds focusing on toxicity and metabolism of gossypol. This toxic polyphenol compound is present in the cottonseed gland, and is the reason for restricted use of cottonseed meal in feeds for monogastric animals including fish.

Dr. Lee's educational journey took him to the Department of Marine Life Sciences, Jeju National University, Jeju, Korea as an assistant professor. Since then, K.J. served as PI in several research projects on fish meal replacement with seaweeds, fermented cottonseed, and soybean meal and amino acid nutrition with dipeptides in marine fish species including olive flounder (*Paralichthys olivaceus*), parrot fish (*Oplegnatus fasciatus*), puffer (*Takifugu rubripes*) and seabream (*Pagrus major*). His recent research includes studies on 1) nonspecific immune responses of fish by feeding possible immune stimulants produced from either natural fermented plants, which may reduce the use of synthetic antibiotics that are being used in large amounts in commercial fish farms, 2) establishment of a dietary model using dipeptides instead of crystalline free amino acids to reevaluate and reestablish the dietary requirements of amino acids with a hypothesis that the previously established amino acid requirements for fish were overestimated, and 3) fish meal replacement by plant or



animal byproducts emphasizing fermentation effects to develop low-cost, highly efficient aquafeeds for the above mentioned marine fishes.

The Hagerman Fish Culture Experiment Station (HFCES) accepted Dr. Lee as a visiting scholar in 2009. Since March he has studied advanced techniques in molecular biology, and has participated in evaluating Alaska fisheries byproducts to replace fish meal or oils. The goal is to eventually establish low-cost, highly efficient diet formulations based on plant protein sources combined with fisheries byproducts for several species including rainbow trout, tilapia and white sturgeon. The byproducts include fish

bone meal, several fish oils and fish hydrolysate fractions produced from Alaskan seafood processing wastes. His research approach is to utilize fisheries byproducts as raw material to develop novel feed ingredients in feeds for the fish species mentioned above.

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UPCOMING EVENTS

May 23-26, 2010, Australasian Aquaculture 2010, Hobart, Tasmania

June 1-4, 2010, Idaho Annual Genetics Meeting of the American Fisheries Society, Boise, Idaho. Title: Genetic Adaptation of Salmonids

June 12, 2010, Idaho Aquaculture Association Annual Meeting, June, Twin Falls, Idaho. Contact Linda Lemmon, Executive Secretary IAA at iaa@northrim.net for registration information.

April 19-23, 2010, Western Division Annual Meeting of the American Fisheries Society, Salt Lake City, Utah. Title: The Future of Aquatic Resources in the West: Science, Management and Politics.

August 20-22, 2010, The 8th International Conference on Recirculating Aquaculture, Roanoke, Virginia.