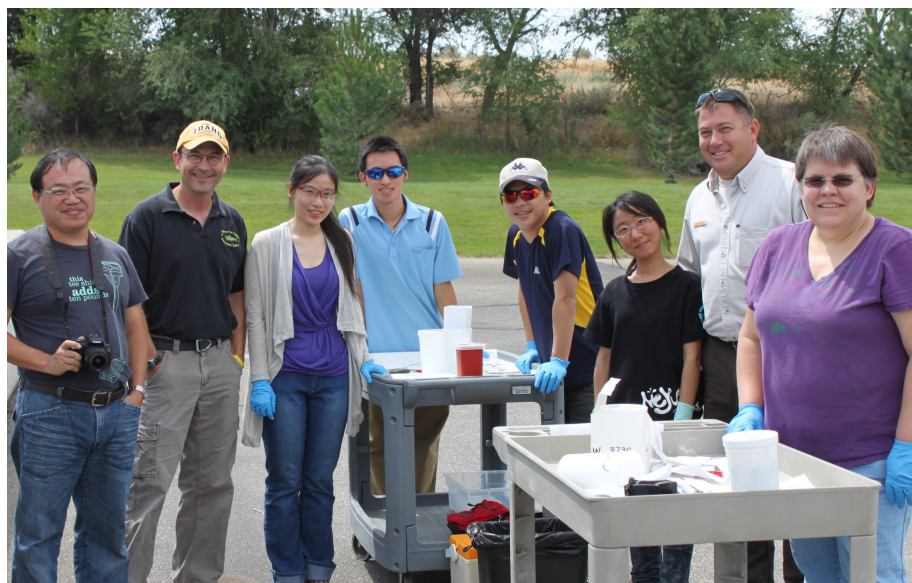


IDAHO TAIWAN CONNECTION

Yearly Exchange Between Two Universities Since 2007

Dr. Chein-Hsein Kuo (far left) a visiting scholar from National Chiayi University in Taiwan samples steelhead trout at the Hagerman National Fish Hatchery with his crew of students during yearly summer collaborations with HFCES and National Fish Hatchery Staff.

Every year since 2007, visiting scholars and students from the National Chiayi University (NCYU) in Chiayi, Taiwan spend 10 weeks studying fish genetics and aquaculture techniques with Dr. Matt Powell in Hagerman. The annual visits are led by Dr. Chein-Hsein Kuo, associate professor in the Aquatic Biosciences Department at NCYU. Dr. Kuo is interested in the genetic diversity of tilapine species and he has worked extensively throughout Asia and the Middle East. Typically, Dr. Kuo brings with him 2-4 graduate students from his department to learn everything from drawing blood samples to quantitative PCR to microarrays.

Undergraduate students from the College of Agriculture and Life Sciences at the University of Idaho, in turn, visit NCYU during

Spring Break every year and tour agriculture and aquaculture facilities throughout Taiwan.

This past spring Dr. Kuo and his students took a road trip to visit the University campus in Moscow for the first time. The group toured the wet laboratories in the College of Natural Resources and both ARI campus facilities. In addition, Dr. Kuo and his group visited with faculty in the Fish and Wildlife Department and Animal and Veterinary Science Department about their research. The group also spoke to Drs. John Foltz and Bob Haggerty who originally set up the yearly NCYU exchanges and visited with the Director of International Programs, Tammi Johnson and the University of Idaho Provost, Dr. Kathy Aiken.

INSIDE

Alternative Protein Diets For
Rainbow Trout: Performance on
a Commercial Trout Farm..... 2

A Cool Idea: Salmon Incubator Hatches
from Old Refrigerators..... 5

Idaho Inbre Student Looks At Fish Blood
For Answers To Diabetes..... 6

Aquaculture Researchers Study Soy Solu-
tion to Feed Shortage 7

Schedule of Events..... 8

Aquaculture Research Institute

The ARI newsletter will be produced semi-annually and available online in Adobe Acrobat format through www.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 Culture 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:

Dr. Ken Cain, Editor
Aquaculture Research Institute
University of Idaho
875 Perimeter Drive MS 2260
Moscow, ID 83844-2260

Email: aqua@uidaho.edu

Phone: (208) 885-5830

Fax: (208) 885-5968

Website: <http://www.uidaho.edu/aquaculture>

Alternative Protein Diets For Rainbow Trout: Performance on a Commercial Trout Farm

Gary Fornshell, Extension Educator, University of Idaho

With the costs of feed ingredients likely to remain high for the foreseeable future and the finite global supplies of fish meal, alternative aquafeed ingredients are a necessity in fish feed formulations. However, a lack of information regarding suitable alternative protein blends and questions regarding the ability of alternative protein diets to support optimal growth, health and product quality was identified by industry partners as a hurdle to adoption. Therefore, the Western Regional Aquaculture Center funded the following project, "Cost-effective, alternative protein diets for rainbow trout that support optimal growth, health and product quality," to address these issues.

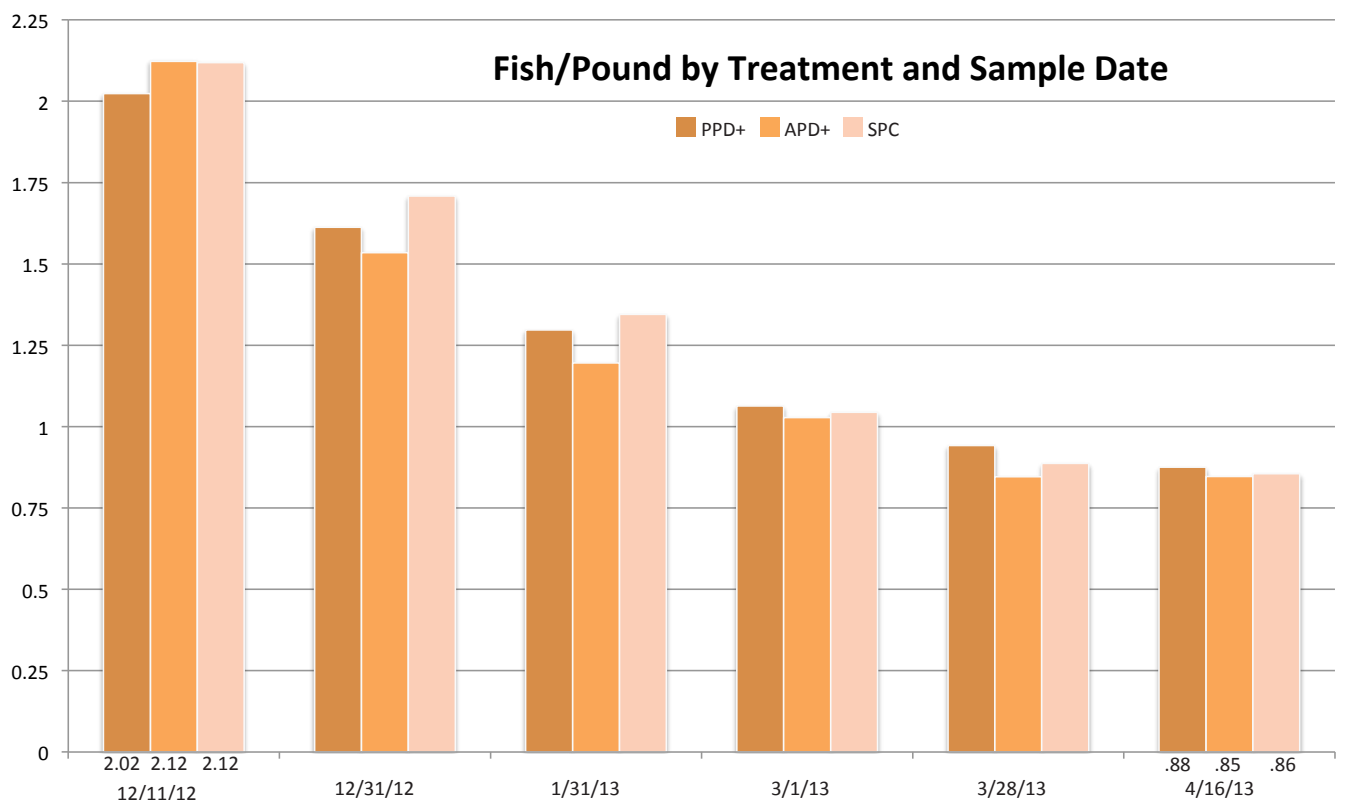
A key component of the project was to determine whether the results found in the lab held true on the farm. On December 11, 2012, nine third-use raceways were stocked with approximately 3,100 trout each. The trout averaged 2.09 fish/lb (217 g). Three replicate raceways for each diet were randomly assigned.

The diets (Table 1.) were an all plant-based feed supplemented with amino acids (PPD+), a fishmeal-free animal protein feed supplemented with amino acids (APD+), and a commercial feed (SPC) used by the farm that served as the control (Figure 3.).

Table 1. Composition of the three diets (g/100 g, as-fed)

	PPD+	APD+	SPC
Poultry by-product meal		24.28	
Blood meal		2.97	
Feather meal		2.95	
Soy protein isolate	16.88		
Corn gluten meal	21.61	8.80	
Soybean meal	15.96	12.39	
Whole wheat	15.76	20.62	
Poultry fat	10.34	7.56	
Fish oil	7.49	7.45	
L-Lysine HCL	2.94	2.67	
DL methionine	0.67	0.67	
Threonine	0.81	0.85	
Astaxanthin pink	0.043	0.040	
Crude protein	38.70	40.00	45.60
Fat	20.50	14.20	16.90
Energy kJ/kg	21.80	21.45	21.87

Figure 1



Fish were cultured and sampled monthly from December through April 16, 2013 (125 days). Monthly and at the conclusion of the trial, fish were sampled for length weight frequencies (60 fish/raceway); five fish were sampled for proximate composition and five fish were sampled for hepatosomatic index (HSI), viscerosomatic index (VSI), and fillet yield.

Before getting into the results, a couple of things need pointing out. One, not only were the experimental diets fishmeal free, but they were also lower in crude protein than the commercial control diet. Two, due to the nature of the raceways used for the trial; third-use water, ponds above swept regularly and diminishing water flows over the course of the

trial, higher than normal mortalities and feed conversion ratios occurred relative to the farm. Fortunately, death didn't discriminate and was equally destructive across treatments.

There were no statistical significant differences for growth (figure 1.) and FCR by treatment. No significant effects of alternative proteins on VSI, HSI or fillet yield were observed. However, diet did alter fillet color in that fish fed the PPD+ had Salmo fan scores ranging from 22 to 24 while fish fed APD+ or SPC diets had Salmo fan scores ranging from 28 to 31. The flesh color of the fish fed the plant protein feed was more orange colored than red (Figure 2.).

An economic spreadsheet matrix was used to estimate returns over feed costs based on estimated feed

costs of the three diets, FCRs from the production trial and a range of farm-gate trout prices (low, medium and high). Due to high mortality and FCRs all returns for the trial were negative. However, when FCRs are corrected for mortality (assuming 1.2 FCR for all diets and medium farm-gate), economic analysis demonstrates similar cost per gain for all treatments (Table 2.). In addition, the ingredients used for the experimental diets are commercially available for feed manufacturers.

In the laboratory trial conducted concurrently at the Fish Technology Center in Bozeman, MT the same results regarding growth efficiency were observed. During the 112 day trial trout grew from 3.60, 3.65 and 3.56 fish/lb to 0.62, 0.59 and 0.55 fish/lb fed with PPD+, APD+ and SPC, respectively (overall, from about 126 g to 769 g). Survival was much higher at Bozeman and water temperature was slightly warmer too.

Following the production trial, the effect of diet on sensory properties of trout fed two alternate protein diets and a commercial control were evaluated by untrained consumers recruited

Table 2. Based on treatment FCR, cost of diet and a range of trout prices received

Returns Over Feed Costs (\$) on a per Pound Basis				
Diet	Low	Medium	High	1.2 FCR & medium trout price
PPD+	-0.44	-0.39	-0.34	0.425
APD+	-0.31	-0.26	-0.21	0.463
SPC	-0.15	-0.10	-0.05	0.462

Panelists were able to distinguish between diets. The SPC was preferred over the PPD+ and the preference for APD+ was between.

Figure 2. Fillet color as affected by diet



Wendy M. Sealy, USFWS, Bozeman Fish Technology Center

from the Washington State University (WSU) community. Sensory testing was conducted over two test dates in the WSU School of Food Science Sensory Laboratory. During these tests the color of the fillets from the three diets was indistinguishable because of special lighting used to mask fillet color. Panelists were able to distinguish between diets. The SPC was preferred over the PPD+ and the preference for APD+ was between.

In a subsequent sensory test where the panelists could see the color of the fillets, significant differences were only found for trout appearance. For all the other attributes, including overall acceptance, no significant differences were found between treatments. These results suggest that even though consumers preferred one sample (PPD

+ diet) less than the others based on appearance, this did not translate to a decrease in the overall acceptance of a particular sample.

In summary, the plant protein and animal protein feed without fish meal and lower crude protein levels performed equal to a higher protein fish meal control feed. The animal protein feed can be used by producers raising white or red trout. Additional research is needed to overcome the color issue associated with plant protein feed.

Principal Investigators for the project were Wendy Sealey, Gibson Gaylord, Rick Barrows, Chris Myrick, Carolyn Ross and Gary Fornshell. Chris Nelson was the project monitor and David Brock was the industry advisor. Skretting USA manufactured the feeds.

Figure 3. The three diets used for the production trial



Wendy M. Sealy, USFWS, Bozeman Fish Technology Center



A Cool Idea: Salmon Incubator Hatches from Old Refrigerators *Author: Tara Roberts*

Reprinted with permission by University of Idaho Magazine, Fall 2013

A recycled refrigerator turned in-stream incubator may be the answer to increasing wild salmon populations, a team of University of Idaho engineering students recently discovered. For their senior project, the student team adapted old refrigerators and even coolers that can help increase wild salmon egg survival rates, now roughly 5 percent, to match hatchery levels as high as 90 percent. These incubators use common, inexpensive materials so they can be easily built and used by American Indian communities and others working to boost healthy salmon runs.

The students tested a pilot model in a local stream this spring and presented their work at the annual Engineering Design Expo, where students display their senior projects.

The system is simple: Spring-water flows through a pipe into the incubator, then into the main stream. People put eggs harvested from wild salmon into small plastic-mesh boxes, where they hatch inside the refrigerator. When the fish reach a certain growth stage, they instinctually know to swim through an opening in the incubator into the stream. The design allows the fish to hatch, grow and leave with no human contact

beyond the day the eggs are placed in the incubator. Wild fish are genetically stronger than hatchery fish, leading to an overall healthier population, and they replenish nutrient levels in streams by bringing back nutrients from the ocean. The incubators increase fish populations in their native habitat without the need for a costly facility downstream.

The next step is to help write research and educational grants so communities —academic or otherwise — can put the incubator design into action.

Idaho INBRE Student Looks at Fish Blood for Answers to Diabetes

Submitted by: Dr. Matt Powell

The results of Tracy's work were presented at the annual Idaho INBRE conference in Moscow in August. Each INBRE student intern presented their poster to a group of reviewers and each was asked a series of questions regarding their work. For his hard work and excellent presentation, Tracy was awarded second place out of more than 100 undergraduate poster presentations.



Each year Idaho's IDEa Network of Biomedical Research Excellence or "INBRE" program selects several outstanding undergraduates and graduate students from around the state as fellows or interns to participate in biomedical related research at one of Idaho's universities. Tracy Kennedy, an Oregon State University undergraduate from Rupert, Idaho spent this summer learning molecular genetic techniques in Hagerman as part of the Idaho INBRE program. INBRE is part of the National

Institute of Health's Institutional development Awards (IDEa) program. In 2013, there were active INBRE programs in 23 states and Puerto Rico.

With a passion for the outdoors and fishing, Tracy elected to carry out his 10 week internship at the Hagerman Fish Culture Experiment Station. Tracy is the third Idaho INBRE intern that has chosen Hagerman for their research experience. In 2010, Sterling Jones and Logan Robinson undergraduates from the College of Southern Idaho, also interned in the laboratory of ARI Associate Professor, Matt Powell.

Tracy continued on with work started by Dr. Karen Plant, A post-doctoral researcher in the lab at Hagerman, who previously developed methods for culturing blood cells in dialysis cassettes that allow for them to be treated with different chemical or metabolic constituents. Tracy's work examined the way red blood cells or erythrocytes in fish are affected by varying levels of prolonged blood sugar. Biomedically, the work is important because most fish are glucose intolerant and experience prolonged, elevated blood glucose (hyperglycemia) after a meal that contains high levels of carbohydrates. So much so, that some species such as rainbow trout, can serve as a model for Type II diabetes in humans. The work is also important in aquaculture because including just the right amount of carbohydrates in commercial feeds may help some fish metabolically spare protein to build muscle rather than breaking down that protein for energy.

Tracy incubated blood cells collected from rainbow trout, Nile tilapia, and white sturgeon in separate culture media that contained glucose at normal levels and at elevated levels. He then examined how those cells changed in appearance over time and also measured the expression of several genes related to stress and glucose metabolism to compare differences among fish with a more omnivorous (i.e. tilapia) diet to those that are more carnivorous (i.e. trout).

The results of Tracy's work were presented at the annual Idaho INBRE conference in Moscow in August. Each INBRE student intern presented their poster to a group of reviewers and each was asked a series of questions regarding their work. For his hard work and excellent presentation, Tracy was awarded second place out of more than 100 undergraduate poster presentations. Part of his work will also be presented at the 12th International symposium on Aquaculture Nutrition in Villahermosa, Mexico in November. For now though, Tracy is back finishing his B.S. in fish ecology from OSU. Next fall he hopes to enroll in graduate school and continue with his interests in fisheries and aquaculture.

Aquaculture Researchers Study Soy Solution to Feed Shortage

Author: Tara Roberts

Reprinted with permission by

University of Idaho Magazine, Fall 2013

The aquaculture industry is booming, and billions of people rely on farmed fish as their primary dietary protein source. As carnivores, most of today's farmed fish feast on fish meal, which is made from other fish. But the world's supply of fish meal can't keep up with demand, said Ron Hardy, director of the University of Idaho's Aquaculture Research Institute, or ARI, in Hagerman.



"Here we are in Idaho and we have this wonderful trout industry that is in a sense a microcosm of a global industry"

ARI researchers are investigating ways to replace fish meal with plant-based ingredients, opening doors for a more sustainable industry. A grant from the national Soy Aquaculture Alliance is supporting ARI research into feeding fish with the meal left over after cooking oil is extracted from soybeans. The research goes beyond traditional "feed 'em and weigh 'em" studies, Hardy said. ARI uses molecular techniques to analyze how high-soybean-meal feed affects fish, down to the genetic level.

The researchers not only investigate the effects of soy-based feed on everyday trout, but also have selectively bred a strain of rainbow trout that fare particularly well on a plant-based diet. The ultimate goal is to raise fish that grow quickly, efficiently and economically while remaining healthy, said ARI-based postdoctoral researcher Biswamitra Patro. ARI's research into fish feed helps Idaho's multimillion-dollar trout industry—No. 1 in the nation—and international farmers alike.

"Here we are in Idaho and we have this wonderful trout industry that is in a sense a microcosm of a global industry," Hardy said. "The issues it faces are the same issues faced by the global aquaculture industry."

New Facility Approved

The UI is planning to replace the ARI facility on Poultry Hill, which has housed aquaculture research for the past 25 years.

This facility was built in the 1930s as a facility for the poultry science program. It contains offices as well as a basement area that was modified to rear fish. At present, the fish rearing facilities are used to spawn and raise a native species of burbot in a partnership with the Kootenai Tribe. The aim of the burbot program is to assist in the recovery of this species in the Kootenai River.

The building is in need of repairs and modernization to bring it up to current code and the cost to do so exceeds the cost of replacing the building. Once final approval is given, the planning process will begin with a target completion date in late summer of 2015.

University of Idaho

Aquaculture Research Institute
PO Box 442260
Moscow, ID 83844-2260



Non-Profit Org
US Postage
PAID
University of Idaho

SCHEDULE OF EVENTS

Annual Meeting, June 7, 2014 - June 11, 2014, World Aquaculture Society
World Aquaculture 2014, Location: Adelaide SOUTH AUSTRALIA

Annual Meeting, August 16-2014 – August 20, 2014,
American Fisheries Society
Location: Portland, Oregon