WATERLINES

NEWSLETTER OF THE WESTERN REGIONAL AQUACULTURE CENTER • AUTUMN 2006

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Inside

From the Director

Graham Young, WRAC Director, School of Aquatic & Fishery Sciences, University of Washington

In this issue of *Waterlines,* we continue to highlight WRAC-supported research by focusing on two projects that started last year.

John Colt (Research Fisheries Biologist, National Marine Fisheries Service) is leading a large team of researchers whose aim is to assess current live-haul practices and recommend improvements for systems and protocols (page 6).

A project headed by Vaughn Ostland (Director of Aquatic Pathology, Kent SeaTech Corp.) and Jim Bowker (Fishery Biologist and Director of Research, US Fish & Wildlife Service) focuses on Aquaflor®, one of the few approved therapeutants available for the treatment of infectious diseases in hybrid striped bass. The investigators will assess the optimal dosages, efficacy, economics, and safety of Aquaflor® in combating mortality due to *Streptococcus iniae* (page 8).

Also in this issue is an article on the change of ownership at Troutlodge, Inc. (page 12). This Washington-based company is the world's leading supplier of rainbow trout eggs.

One of the first sessions I attended as WRAC director was the US Trout Farmers meeting in Twin Falls, Idaho, in fall 2004, which coincided with Troutlodge's 50th anniversary. At the anniversary dinner, I had the privilege to sit next to Ed

Graham Young

Penny Swanson

McLeary, Troutlodge's founder, and to learn about the origin and history of the company—and to hear some amazing and occasionally hair-raising stories from those pioneering days. There is no doubt that the innovation that has characterized Troutlodge from its inception will continue under the new owners.

Bill Dewey has been heavily involved in WRAC for many years as a member of the Industry Advisory Council. We take pleasure in reporting that Bill's efforts on behalf of the shellfish industry have been recognized by the National Shellfish Association (NSA). Bill was awarded the NSA David H. Wallace Award—Congratulations, Bill! (page 18)

With the exception of a few years, Ken Chew was director of WRAC more or less continually from the start of the RAC system until 2004. Many of you who know Ken (and who doesn't?) might be

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Funding provided by the US Department of Agriculture, Cooperative State Research, Education & Extension Service

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wondering what he has been up to since his "retirement."

It might come as no surprise to learn that Ken is as busy as ever (perhaps even busier, if that's possible), serving as a commissioner on Washington State's Fish & Wildlife Commission and in a number of other endeavors. Somehow, Ken continues to find the time to promote aquaculture in the western region and to write articles for *Waterlines* and other publications. It is rumored that he even manages to dust the cobwebs off his fishing rods occasionally (see interview, page 3.)

The National Offshore Aquaculture Act of 2005 was introduced to the US Senate last year. The events that led to the Act are summarized on pages 14–16. An appropriate preface to that article is a recent quote from President George W. Bush who said, "Congress needs to move forward with my administration's plan to build a well-managed system of offshore aquaculture, and when we get this right, these farmed fish can provide a healthy source of food and reduce pressure on the ocean ecosystems."

Within the western region, we have the industrial savvy and scientific talent to support the development of offshore aquaculture, and many in the region are anxious to see how President Bush's comments will be translated into action.

This is the first opportunity that I have had, two years after assuming the directorship of WRAC, to thank, in print, all in the WRAC community for their welcome, support, and encouragement. I hesitate to name names in case I forget someone, but a number of people have helped make this busy period of transition enjoyable and relatively painless.

Ken Chew continues to share his vast experience in his "retirement" and Carla Norwood and Sarah Merlino in the WRAC Administrative Office have done a great job educating me in all things WRAC—their patience and wisdom is greatly appreciated.

I thank all on the Board of Directors and on the Industrial Advisory Council and Technical Committee for their welcome and support. WRAC's committees have had increasing demands placed on them as we develop or amend policies in several areas, and I especially thank committee members for the time and energy they have given. Finally, one of the most gratifying aspects has been getting to know people in industry and in WRAC's research community—thanks to all of you for answering my endless questions and for your patience during this transition period. ■

Value of aquaculture as percent of total market value of agricultural products sold in 2002

A map showing the value of aquaculture as percent of total market value of agricultural products sold in 2002 is available through the following link: *http://www.nass.usda.gov/research/atlas02/pdf/02-M032-RGBChor-largetext.pdf*. In many areas in the western region, this percentage exceeds 10%.

2002 Census of Agriculture.: 02-M032
US Department of Agriculture
National Agricultural Statistics Service

Ken Chew—Life After Retirement

Carla Norwood, School of Aquatic and Fishery Sciences, University of Washington

Ken Chew retired from the School of Aquatic and Fishery Sciences and the WRAC directorship in 2004. Since then his professional life has gotten, if anything, busier. Ken is serving on the Washington State Fish & Wildlife Commission, writing articles for *Aquaculture Magazine* and *Waterlines*, staying in touch with former students, and spending time with his ten grandchildren.

Tell us about the state Fish & Wildlife Commission. It's a big part of your post-retirement professional life, and you really seem to enjoy it despite the challenges.

The commission consists of nine members who are appointed by the governor. We work closely with the Washington Department of Fish & Wildlife to protect, restore, and enhance fish and wildlife and their habitats, while providing sustainable and wildlife-related recreational and commercial opportunities.

There are many directives, policies, and regulations that come to us via emails, reports, and meetings. They can take considerable time to study and review. Nonetheless, it is exciting to be involved with the commission and to learn about the many wildlife and fishery issues.

Increasing human population in the state of Washington over the years has meant increasing outdoor and recreational demands and requirements. Attempting to balance these with tribal and commercial harvesting is challenging. It's a good feeling to be in a position to help in a small way to protect and sustain our fish and wildlife resources.

What kind of ties or activities do you still maintain with the School of Aquatic and Fishery Sciences (SAFS) and the College of Ocean and Fishery Sciences (COFS) at the University of Washington?

The commission keeps me hopping, but I still work with Linda Maxson in the Development Office of COFS to reach former students. Because I was involved with SAFS for over 40 years, the school is like a second home; I swing by whenever I have the opportunity. I bump into fewer senior faculty or staff in the hallways or offices now, which is to be expected—signs of time passing!

I still maintain contact with some of my former graduate students, dating back to the 1960s when I first started teaching shellfisheries and aquaculture at the UW. Several of them retired even before I took the plunge into the retirement scene. Thinking back, I realize I've been blessed to have had the chance to teach and interact with so many students.

Being involved with the development of WRAC and its operation has been most gratifying, and an important part of my life at the UW. This program is almost 20 years old—Congress designated the UW as the Administrative Center for WRAC in 1987.

Although not often, I try to drop by the WRAC office to chat with Graham Young, the new Director, and Carla Norwood, Program Manager, to hear of the latest activities. Carla is the WRAC historian, as she has been with the program since its inception.

It's a good feeling to be in a position to help in a small way to protect and sustain our fish and wildlife resources

Is Maegan [Ken's wife] ready to kill you for not slowing down your professional activities now that you are retired?

She finds it disturbing that I plop down on a chair and all I read is material related to commission work or fisheries articles just as I did before I retired. Trouble is, I find this the most interesting reading—a habit I guess. However, I do know there are other good things to be read to round out my thinking and behavior, so I need to be aware of her concern in this area.

When I'm not around the house reading, I'm more often than not at a meeting connected to the commission. I've been writing a shellfish column in *Aquaculture Magazine* for the past 12 years, which occupies more time. I know I should probably back away from this and let someone else do it, but I enjoy it immensely.

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—Ken Chew, Life after Retirement, continued from page 3

It seems I'm busier now than when I was Director of WRAC and Associate Dean of COFS.

Since I promised Maegan to find more time to travel together and extend ourselves to do mission work in areas of need, I have to seriously consider how and when I will reduce my continuing professional activities. Also, ten grandchildren and one more coming through adoption should have priority too!!

Do you still go fishing a lot? If so, talk a bit about where, what you catch, and any fishing techniques you may wish to share.

Fishing! What's that??? From the 1960s through the 1980s, I was out in Puget Sound fishing for salmon from May through September almost every other week. Sometimes I'd go several times in a given week when the kings, cohos, or pinks were in. But since the 1990s, my schedule of responsibilities at work has prevented me from fishing as much as I've wanted. Since 2000, I've hardly gone at all.

One reason is that salmon fishing is not the same as it used to be, with decreasing populations of king, rockfish, ling cod, true cod, and others. Maybe I got spoiled in the earlier years. I often think of the great fishing times I used to have with my sons in Puget Sound in those years between the 1960s and 1980s.

However, for Father's Day this year, I received a surprise from my sons—an invitation to join them at one of the top fishing camps, Alaska King Salmon Adventure, along the Nushagak River near Dillingham in Bristol Bay at the end of June. What a trip!!

My son Gerald and I went to Anchorage a day early to fish for sockeye salmon where the Russian River flows into the famous Kenai River. There was a huge run returning to the Russian River, where it took us less than one hour to hook and land our limits of four each. It was fishing in a "combat zone"—scores of people fishing side-by-side, four to five feet apart. We elbowed our way in for our limits.

My other son Curtis joined us at the Anchorage airport for our flight to Dillingham and subsequent flight by float plane up river to the camp. A dream trip for me, with abundant catch and release. We could only keep one fish per day so we attempted to keep fish

Courtesy of K Chew

Ken Chew and his sons, Curtis (left) and Gerald, fishing in Alaska.

close to 20 lbs and over. We ended up in four days of fishing with 12 kings, ranging from 16 to 36 lbs.

How would you compare aquaculture research when you were just starting out with current research?

The orientation of research in the 1960s and 1970s when I started at the UW was toward increased prospects for production, and how best to farm shellfish. Generally, as I remember, that was true for salmon and trout production as well.

At that time, there was a growing concern in the United States and many other countries for habitat and environmental issues and the need for conservation of natural resources and innovative science in farming aquatic animals and plants. This concern was especially true in the molecular sciences and technology arena, where there was a need to foster better understanding of growth, nutrition, and production of aquaculture products.

As I reflect on the diversity of research work of our graduate students, I remember that several had a major part in studying the ecology and biology of shellfish and improving techniques for shellfish production in Washington State and elsewhere.

Their research efforts elevated the interest in and accelerated the production of Pacific oysters, Manila clams, mussels, and to some degree the geoduck clam. Developing initial techniques to establish the triploid Pacific oyster for the summer market was a major accomplishment made possible by some of our key graduate students.

I can say without hesitation that Washington Sea Grant funding supported almost all of these shellfish culture studies, which resulted in several manuals on prospects and methodologies for developing the triploid oyster and farming the Manila clam and mussel.

The issues raised on pollution, aesthetics, and ecosystem impacts, especially on marine aquatic farming, no doubt will continue, as they have not abated much since the 1960s. If anything, these concerns are of higher sociopolitical interest than ever before as people are more tuned in and more aware of potential ecosystem changes.

Mike Ruse

Dr. Colin Nash presents Ken Chew with the "Sustained Contribution Award" at the Third International Symposium on Stock Enhancement and Sea Ranching on September 21, 2006. The award was given in recognition of "leadership and pioneering research in the fields of aquaculture and stock enhancement."

Everyone wants clean water, including the shellfish grower and fish farmer. Regardless of who is raising questions concerning the advent of expanding shellfish and fish farming, they need to be addressed carefully and rationally with good scientific data for the benefit of all.

Further, the public needs to be better educated on how aquatic farming can be environmentally sound, given proper safeguards and siting. Global aquaculture is a necessary means to keep up with the rising demand for seafood. According to FAO records, we've reached the general limits of what can be attained from wild harvest in the past 20 years, so aquatic farming needs to step in.

Shellfish growers are very aware of people's concerns, in part from past experiences. Thus, the Pacific Shellfish Growers Association and Pacific Shellfish Institute have developed an organizational and operational manual for Best Management Practices for Shellfish Growers to help them better address farming practices. This document was prepared with input from local, state, and tribal groups and is presently being updated. ■

Physiological Changes Associated with Live Haul

John Colt, Research Fisheries Biologist, Northwest Fisheries Science Center

In certain markets, live fish can be sold for substantially higher prices than fresh, dressed fish

In certain markets, live fish can be sold for substantially higher prices than fresh, dressed fish. In the United States, a significant live-haul industry has developed, and fish are commonly hauled 1,500 to 2,000 miles (25 to 30 hours) to market. The most common species hauled are tilapia, channel catfish, and rainbow trout, with smaller amounts of marine rockfish, hybrid striped bass, and carp. Transportation systems for hauling have been adapted largely from those used by state and federal fish and game agencies.

Commercial live haulers operate in an extremely competitive business and tend to push the envelope for both system and operational protocols. Direct mortalities during transport are typically low, but post-haul mortalities can be significant. Because of the economic importance of the live-fish market, improved systems and protocols are needed to allow this industry to expand and prosper.

WRAC-funded Project

WRAC has funded a four-year project to improve the survival, health, and product quality of transported finfish in the western United States. The project team comprises staff from the National Marine Fisheries Service (John Colt, Michael Rust, and Ron Johnson), Oregon State University (Carl Schreck, Grant Feist, Rob Chitwood, and Tracey Momoda), University of Idaho (Gary Fornshell), Clemson University (Joseph Tomasso), and Technical Advisor Dallas Weaver (Scientific Hatcheries). Industrial and institutional cooperators include: Leo Ray (Fish Breeders of Idaho), Ken Beer (The Fisheries), and Jim Parsons (Troutlodge). The project will concentrate on the hauling of tilapia in years 1–3 and the hauling of trout in years 3–4.

Hauling Systems

The most common type of fish-hauling tanks are produced commercially and constructed from fiberglass or aluminum. The most common form of aeration is pure oxygen, but many hauling systems use surface agitators in combination with oxygen. Only a very small number of systems are fitted with refrigeration units. The use of chemical additives such as salt, antifoam, anesthetics, or antibiotics has been common in the past.

The most significant advance in hauling technology in the last 20 years has been the use of bottled oxygen gas or liquid oxygen to maintain adequate dissolved oxygen (DO) levels. These types of systems can maintain significantly higher DO levels than those using air. This reduces the problems associated with localized, low-DO levels in corners and other areas with limited circulation, as mortality may occur in these sites even when the bulk DO is adequate.

Impacts of Hauling

Direct-transport mortality or the delivery of fish in poor condition may be the result of one severe stressor (a physical or chemical agent), several mild stressors, or infectious diseases (usually occurring one or two weeks after transport) induced by transport techniques. Some common stressors include harvest and

Alan Trimble

Unloading tilapia at a retail store in Richmond, British Columbia.

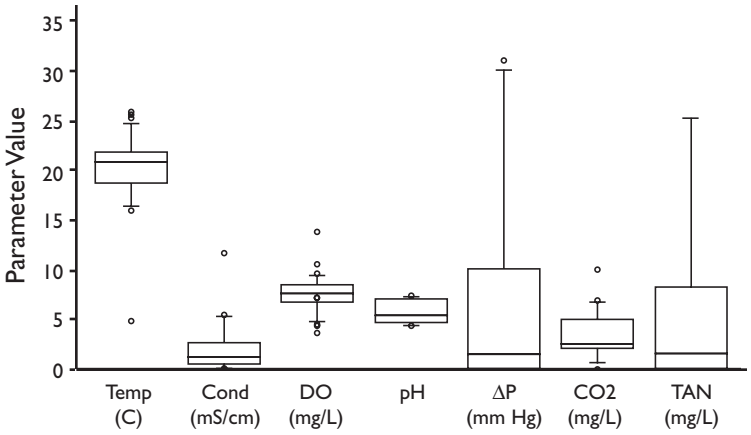

Figure 1
Variability of water quality in retail holding stores in the greater Vancouver, British Columbia area

loading procedures (pumping of water at transfer), shaking of the transport vehicle, low frequency sound from the vehicle and water treatment systems, crowding, poor water quality (high ammonia and carbon dioxide levels, low DO), high light levels, and extreme water temperature.

To avoid stress and mortality, some general guidelines for harvest and transport should be followed: reduce the number, severity, and duration of stressors, and minimize plasma ion disturbances. The physical shape and construction of the hauling unit may have an important impact on localized low DO, physical damage to the fish, and survival. Much of this information is not published; however, individual live haulers have modified or custom built tanks based on their experience.

Induced stress from live transport may also negatively affect flesh texture and flavor. Fish subjected to stressful conditions have depleted glycogen reserves in the flesh and accumulate lactic acid. This causes a decrease in flesh pH and, when slaughtered, these fish often experience an accelerated and intensified period of *rigor mortis*.

Objectives

The overall objective of this research project is to improve the health and survival of transported fish. Some specific objectives for tilapia include the following:

- Document the current holding and long-haul protocols and transport systems
- Identify critical locations and parameters that impact health and survival and reduce quality
- Develop computer models to predict water quality, fish quality, and survival in hauling systems
- Determine the impact of chemical addition, surface tension, temperature modification, high DO levels, and tank geometries on fish quality and post-haul survival
- Evaluate the impact of hauling conditions on fish appearance, tissue quality, and overall customer acceptance
- Develop hauling criteria and protocols
- Develop outreach products that can be used by live-haulers to make informed decisions

Results

Initial work in 2005–2006 was concentrated on water-quality sampling in hauling and retail holding systems. Preliminary sampling in Vancouver, BC, has shown wide variability in water quality at the retail holding stores (Figure 1). Problems with temperature, DO, pH, gas supersaturation, and total ammonia nitrogen were observed. Additional sampling will be conducted to confirm these observations and determine the variability during the year. ■

Evaluating the Effectiveness of Various Dosages of Aquaflor®

Jim Bowker, Research Program Manager, Aquatic Animal Drug Approval Partnership Program, US Fish & Wildlife Service,

A major goal of fish culturists is to rear healthy fish using cost-saving measures to manage issues that can negatively impact fish health. One way to do this is to minimize the incidence and severity of fish disease outbreaks and the resultant need for therapeutants. However, the reality is that the maintenance and propagation of fish is dependent upon the use of drugs to maintain fish health and product quality.

Currently, only four therapeutants (Terramycin™, Romet TC™, Aquaflor®, and formalin) are approved for aquaculture use in the United States, and use of these compounds is severely restricted by species, life stage, and the causative agent. Several avenues do exist for using drugs that have yet to be approved for aquaculture (i.e., compassionate Investigational New Animal Drug [INAD], or extra-label use after a valid veterinarian/client/patient relationship has been established). However, additional approved drugs are needed to help sustain increased production to meet sport fisheries, restoration/recovery, commercial, and business goals.

Courtesy of Vaughn Ostland

Hybrid striped bass health studies following oral antibiotic therapy at Kent SeaTech's production facility near Mecca, California

Approval of drugs for use in aquaculture species, as in all food animals, is regulated by the US Food and Drug Administration's (FDA) Center for Veterinary Medicine (CVM). As one might expect, gaining approval through such a regulatory agency is costly and time-consuming. Drug sponsors (i.e., pharmaceutical or drug companies) must demonstrate, following strict CVM guidelines, that a drug is effective for the proposed claim; safe to target animals, humans, and the environment; and can be manufactured consistently. Conservatively, it has been estimated that it requires 10 years and $10–20 million to take a prospective animal drug from the laboratory to final FDA approval.

Fortunately, cooperative efforts between aquaculture drug sponsors and federal, state, and university researchers, as well as researchers affiliated with commercial fish farms, have resulted in substantial progress toward gaining approval of a number of new aquatic animal drugs. One such drug, Aquaflor®, recently gained FDA-approval for use in controlling catfish mortality caused by enteric septicemia.

Aquaflor® is an oral antibiotic formulation in a feed premix; it contains 50% of the broad-spectrum antibacterial agent florfenicol and is manufactured by Schering Plough Animal Health (SPAH) Corporation in Union, New Jersey. Florfenicol has great potential for treatment of infectious diseases, and efforts are underway to expand its approved label to include use in other fish species for other

to Control Mortality in Hybrid Striped Bass

and Vaughn Ostland, Director of Aquatic Pathology, Kent SeaTech Corporation

disease claims. Because of existing data on florfenicol on human food safety and its high potency against veterinary bacterial pathogens, it is anticipated that Aquaflor® will be a major drug in veterinary medicine, with special value in food animals.

Currently, the standard Aquaflor® dosage that can be administered to fish as either an approved compound (or under the Fish & Wildlife Service's INAD #10-697) is 10 mg florfenicol per kg fish per day for 10 consecutive days. In addition, the sponsor is seeking to broaden this initial claim to allow use of Aquaflor® to control mortality in all freshwater-reared salmonids caused by coldwater disease, furunculosis, and columnaris, and to control mortality in tilapia and hybrid striped bass (HSB) caused by *Streptococcus iniae*.

As exciting as this news is, there is some concern that the standard dosage may be inadequate in some cases. Dr. Pat Gaunt (Mississippi State University, personal communication) has shown that 15 mg florfenicol per kg fish per day administered for 10 days is more effective in controlling mortality in tilapia infected with *S. iniae* than the standard dosage.

In addition, there is concern that salmonids with deep-seated diseases such as coldwater disease may not respond to the standard dosage as well as they may at higher dosages. As a result, testing of efficacy and safety at higher dosages is needed to potentially expand the proposed initial label claims beyond the standard dosage to allow more flexibility in dosage regimens.

Therefore, we proposed a project to identify the most effective Aquaflor® treatment dosage to reduce mortality in HSB in laboratory studies, and to confirm these findings with field-based efficacy studies. This research is critical to identify the most efficacious treatment regimen to combat mortality caused by *S. iniae*, a devastating pathogen of warmwater finfish throughout US aquaculture.

In addition, results from this research will take into account the inherent cost of treating this and other florfenicol-sensitive bacterial fish diseases. For example, increasing the dose from 10 mg per kg fish per day for 10 days to 15 mg per kg fish per day for 10 days should dramatically improve the overall performance of the treatment but will yield a 50% increase in the cost of any one treatment. Conversely, extending the length of a 10 mg per kg fish from 10 to 20 days, for example, will also result in a net increase of the overall cost of medication.

To maximize cost-effective measures in US aquaculture, this research must identify the optimal dose and treatment duration to effectively and economically control mortality in HSB caused by *S. iniae*. Both the laboratory and field-based aspects of this research are anticipated to be of relevance to treat florfenicol-sensitive bacterial pathogens of both warmwater and coolwater fish species.

Experimental Design and Methods

Laboratory Trials

The test animals used in all laboratory trials conducted at the Kent SeaTech (KST) experimental research facility in Mecca, California, will be healthy, naive HSB considered to be specific pathogen free (i.e., *S. iniae* has not been cultured from the brain or head kidney of healthy fish during routine health monitoring). Prior to the start of each trial, florfenicol sensitivity of the challenge isolate will be determined using a standardized disk diffusion assay with florfenicol susceptibility discs provided by SPAH.

The first lab trial will consist of a dose-response study to compare the route of infection (immersion vs. intraperitoneal injection) of HSB that will consistently yield a mean cumulative mortality of 50% in the exposed group with the least statistical variation among replicates,

This trial will also serve to identify important dose-dependent variables relevant to this study, including time to onset of first morbidity, time to first mortality, and total cumulative mortality. These variables will enable us to standardize the initiation of administration of florfenicol-

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The reality is that the maintenance and propagation of fish is dependent upon the use of drugs to maintain fish health and product quality

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medicated feed following experimental infection to enable comparisons between trials.

In the second lab trial (B), using the optimal dose and exposure route described previously, groups of naive HSB will be experimentally infected as described. Florfenicol-medicated feed will be administered at a predetermined time post-infection (at least one day), and replicate groups of HSB will be fed either 0, 10, 15, or 20 mg florfenicol per kg fish per day for 10 days. The resulting data will identify the lowest treatment dose that results in the least cumulative mortality during the 10-day trial.

In the third and last lab trial (C), the lowest treatment dose that resulted in the least cumulative mortality (identified in Trial B) will be used to examine the effect of treatment duration on cumulative mortality of HSB experimentally infected with *S. iniae*. Groups of HSB will be fed medicated feed (at least one day post infection) for either 0, 10, 15 or 20 days.

Field-Based Trials

At least one field-based trial will be conducted to confirm that the treatment regimen(s) identified during the laboratory-based trials are indeed efficacious under simulated production conditions. All field-based trials will be conducted at KST's intensive HSB production facility. The most efficacious dose determined in Trial B of the laboratory studies will be administered to fish in the treated group for the most efficacious duration determined in Trial C; fish in the untreated group will receive non-medicated feed for the same duration. All field-based studies will be conducted using a portable experimental tank unit that has been mounted on a steel platform, thus enabling the unit to be easily relocated to a production tank that has been identified as containing HSB infected with *S. iniae*.

At the culmination of this project, we anticipate that we will have demonstrated whether a dosage other than the standard dosage is more effective in controlling mortality in HSB caused by *S. iniae*.

Project Outreach

The principal investigators of this study are considered "experts" with respect to conducting effectiveness studies in support of new animal drug approvals. As such, and as per CVM requirement, results from the field effectiveness studies will be drafted into Final Study Reports and submitted to CVM for formal review. In addition, results from the study will be shared with (1) the SPAH to provide information that can be used by the sponsor's decision makers on whether to pursue a claim to allow use of Aquaflor® at a dosage other than the standard dosage, (2) holders of the Aquaflor® INAD (USFWS's Aquatic Animal Drug Approval Partnership Program) with a request to amend the compassionate protocol to allow use at different dosages, and (3) fish health biologists and fish culturists, via scientific literature and professional conferences and proceedings, to alert them to the effectiveness of dosages other than the standard dosage. ■

Courtesy of Vaughn Ostland

Kent SeaTech's experimental research facility where laboratory-based trials will be conducted

Bob Fridley Remembered

Ken Chew, Professor Emeritus, School of Aquatic and Fishery Sciences, former Director of WRAC

Bob Fridley, an expert on mechanized fruit harvesting and fish farming

Many of us were saddened by news of the passing of Robert (Bob) Fridley in March 2006.

I became acquainted with Bob during his early involvement with the Weyerhaeuser Company in the late 1970s. At that time, his openness about fish culture and the prospects of ocean ranching of salmon led to his involvement in the beginning of the silver salmon ocean ranching project for Weyerhaeuser in Oregon.

Bob's thoughts on the potential of aquaculture were in concert with those of us who were attempting to show its importance in the 1970s and 1980s. He realized that in order to meet the growing demand for seafood from our escalating national and global populations, aquatic farming was needed and should be encouraged to supplement wild catches.

My more personal interactions with Bob began when I was an External Evaluator for the USAID/Pond Dynamics Program in several foreign countries, and they continued when he was on the Board of Directors (BOD) during the early years of the WRAC program (1987–1988).

Bob was a principal part of the Pond Dynamics Program and I spent many hours with him while visiting international AID projects to review their progress. This gave me an opportunity to discuss many issues with him. I also noted how well he worked with a wide range of people with different talents and responsibilities.

Given Bob's knowledge and experience as a scientist and administrator, his role on the BOD was most helpful in WRAC's early development and operations.

Bob was a highly regarded member of the University of California, Davis community, where his academic career started as an assistant specialist in the College of Biological and Agricultural Engineering (BAE) in 1956. He was appointed assistant professor in 1961, professor in 1969, and chair of BAE in 1975. He was most recognized for his studies of the mechanized harvesting of tree fruit.

Bob held several patents and, in 1983, co-authored *Principles and Practices for Harvesting Fruits and Vegetables*, with BAE's Mike O'Brien and Michigan State's Burt Cargill.

After an eight-year stint with Weyerhaeuser Company (1977–1985), where he focused on forest engineering and aquaculture operations, Bob returned to UC Davis to direct the Aquaculture and Fisheries Program, which he expanded and strengthened. In 1989, he was appointed Executive Assistant Dean for the College of Agriculture and Environmental Sciences.

In 1989, he headed a national committee to assess technology for aquaculture. The committee's recommendations were published by the National Academies Press in *Marine Aquaculture, Opportunities for Growth*.

Bob officially retired in 1994. Never one to be inactive, as Professor Emeritus, he served as a special assistant through 2000 at UC Davis.

Bob received numerous honors throughout his career and he was elected to the National Academy of Engineering in 1985. He received the UC Davis College of Agriculture and Engineering's Award of Distinction in 2005 for Outstanding Faculty.

Bob will be missed by many of us who knew him, but his legacy will live on. ■

Sale of Troutlodge, Inc—The World's Leading Supplier of

Kenneth K. Chew, former Director, WRAC, Professor Emeritus, School of Aquatic and Fishery Sciences, University of Washington

Pioneering of new products

Dedication to the family line-breeding program

Search for new facilities and partnerships

In November 2005, Troutlodge, Inc., a well-known company in the salmonid arena and the world's leading supplier of rainbow trout eggs, was sold to an investor group headed by its present top management. Troutlodge's operation is headquartered near Tacoma, Washington. The sale includes Elm International, Inc., Troutlodge's parent company, and Troutlodge's sister company, Quetro SA, a Chilean supplier of eyed salmonid eggs, breeding services, and fry.

Russ McLeary, retiring President of Elm International, Inc., said, "We are pleased to announce the sale of Elm International and its operating companies, Troutlodge and Querto, to a management and private-investor group that has nearly forty years collective experience working in the aquaculture industry and with the Troutlodge family businesses."

The New Owners

Jim Barfoot has had a diverse career in the management of large enterprises; he was hired originally as Troutlodge's president in 1996 and will continue as president of the organization.

Jim Parsons has worked as Troutlodge's Vice President of Technical Services since 1998 and is also a member of the WRAC Industry Advisory Council. Prior to joining Troutlodge, he had 20 years of aquaculture experience with Blue Lakes/Pisces Investments and Clear Springs in Idaho and Weyerhaeuser in Oregon. He has degrees in Fisheries Biology and Genetics and Cell Biology. Mr. Parsons remains Senior Vice President of Technical Services and will continue to head Troutlodge's fish health and genetics program, including the extensive line-breeding program.

Steve Brown has served as corporate counsel for Troutlodge since 1982 and has been on Troutlodge's Advisory Board for many years. He will now serve as Chairman of the Board and General Counsel.

Ken Gohrick has owned and run Ken Gohrick Construction since 1980. He will be a member of Troutlodge's Board of Directors and will assist with ongoing construction projects.

John Hodder has been a practicing certified public account for the past 33 years. He will be

Makoto Kusakabe

Troutlodge's Soap Lake (#1) facility

Rainbow Trout Eggs

a special advisor to the company on financial matters and a member of the Board of Directors.

Greg Pelland has owned and operated Pelland Enterprises, a Washington construction firm which specialized in site development for many years. Mr. Pelland has joined Troutlodge's Board of Directors and will assist with various aspects of the firm's construction projects.

David Radcliffe has more than 25 years of experience in marketing and sales with Emerald Home Furnishings, LLC, a multinational furniture wholesaler and manufacturer, and the Old Canner Furniture Warehouse. He joined Troutlodge's Board of Directors and will assist with marketing issues.

Ed McLeary was the founder of Troutlodge and has been active in it ever since. He will remain a shareholder in Quetro, SA, Troutlodge's operation in Chili, and has graciously agreed to continue as a consultant to the overall operation. Troutlodge was driven by Ed, who pioneered the trout-egg business in 1945. He made possible, with help from key staff, the supply of the first disease-free eggs, in quantity, on a year-round basis.

Mr. McLeary expanded the company's pioneering technological efforts to produce triploid trout. From its small beginning in eastern Washington, the company has grown to include seven hatcheries in Washington State, one in Oregon, and a major facility in Chile. It now supplies certified eggs to more than 300 customers in 40 countries.

Rededication to Innovation

The new management rededicated the company to a spirit of innovation. Initiatives include the following:

- ***Continued dedication to the family line-breeding program.*** Under the direction of Jim Parsons, this program will continue to improve Troutlodge stocks in ways that will benefits its customers.

Ikumi Nakamura

Sean Nepper, Troutlodge's Director of Research and Development, holding a mature female rainbow trout at Troutlodge's Sumner facility

- ***Pioneering of new products,*** including new strains of salmonids and other species, to supply the global need for fish protein.
- ***Continued search for new facilities and partnerships*** to leverage Troutlodge's 60 years of experience and a world-class group of employees.

The new owners, along with Troutlodge's 90-plus employees worldwide, remain committed to supplying live trout for stocking and enhancement. This includes work with the Cooperative Trout Enhancement Program, a nonprofit organization dedicated to stocking lakes and streams for the benefit of the fishermen of Washington.

Uniformly, the new management expressed great appreciation for the McLeary's and their 60 years of effort and innovation at Troutlodge, and their enthusiasm for continued growth and innovation for the next half century. ■

Events Leading to the National Offshore Aquaculture Act

On April 6, 2006, the National Ocean Policy Study Subcommittee of the Senate Commerce Committee held a hearing to examine current proposals to regulate offshore aquaculture operations, discuss research being conducted off the coasts of New England and Hawaii, and explore the impacts that expanded aquaculture operations would have on fishermen, seafood processors, and consumers. Chaired by US Senator John E. Sununu of New Hampshire, the hearing drew participation from US Senators Barbara Boxer (California), Ted Stevens (Alaska), Daniel K. Inouye (Hawaii), and Olympia Snowe (Maine). This was the first hearing on the *National Offshore Aquaculture Act of 2005* (S. 1195), which was introduced in the Senate last June.

At the hearing, the Subcommittee heard from six invited panelists: William Hogarth, Director, NOAA's National Marine Fisheries Service; Richard Langan, University of New Hampshire's Open Ocean Aquaculture Program; Randy Cates, Cates International, Inc., Hawaii; Mark Vinsel, United Fishermen of Alaska; Rebecca Goldburg, Environmental Defense; and Sebastian Belle, Maine Aquaculture Association.

Dr. Hogarth represented the Department of Commerce. His testimony focused on the compelling case to be made for the development of the domestic marine aquaculture industry in the United States to meet the growing demand for seafood, and NOAA's commitment to ensure this happens in a predictable, environmentally compatible and sustainable manner. All of the written testimony is posted on the Senate Commerce Committee's website at: *http://commerce.senate.gov/hearings/witnesslist.cfm?id=1810*.

Statements for the record, from US research institutions, industry, non-government organizations, private citizens, and businesses, were also submitted to the Subcommittee for consideration as part of the hearing process.

The History

1878. The US Commissioner of Fish and Fisheries begins an artificial propagation program in response to decreased marine fish landings off the Atlantic Coast. Sport fishermen advocate for hatchery operations for freshwater fish.

1939. The US Fish & Wildlife Service in the Department of the Interior assumes responsibility for artificial propagation programs for commercial and sport fisheries.

1966. Congress passes the national Sea Grant College Program Act, recognizing that aquaculture can substantially benefit the United States, and setting in motion Sea Grant College Program activities to teach, conduct research, and provide extension services on a range of topics, including aquaculture.

1968. The Stratton Commission report recognizes marine aquaculture as a coastal use that should be included in a national ocean policy.

1970. Executive Reorganization Plan No. 4 creates the National Oceanic and Atmospheric Administration (NOAA). As part of the reorganization, all marine fishery programs are transferred from the Department of the Interior to the Department of Commerce, and the Bureau of Commercial Fisheries is reorganized into NOAA's National Marine Fisheries Service.

1978. The National Research Council (NRC) issues a report, "Aquaculture in the United States: Constraints and Opportunities." In the report, the NRC observes that "constraints on orderly development of aquaculture tend to be political and administrative, rather than scientific and technological."

1980. Congress passes the National Aquaculture Act, stating that aquaculture is in the national interest. The Act establishes the interagency Joint Subcommittee on Aquaculture and instructs Federal agencies to conduct studies and report on "regulatory restrictions" to aquaculture development [Section 9(a)]; prepare and submit to Congress a Regulatory Constraints Study with steps

to remove unnecessarily burdensome regulatory barriers to the initiation and operation of commercial aquaculture ventures [Section 9(b)]; and develop a National Aquaculture Development Plan to identify aquatic species with significant potential for culturing on a commercial or other basis (e.g., stock enhancement) and to recommend actions to be taken by public and private sectors to achieve that potential.

1983. The first National Aquaculture Development Plan is completed by the Joint Subcommittee on Aquaculture, providing the first comprehensive federal identification of priorities in US aquaculture.

1992. A second National Research Council Report, *Marine Aquaculture: Opportunities for Growth* calls for "a framework…to provide an orderly process for the leasing and conduct of marine aquaculture operations to reduce the uncertainty that industry now faces…."

1993–1994. Five legislative bills dealing with aquaculture are introduced in the 103rd Congress, but none is enacted.

1995. A bill (S.1192) is introduced to strengthen the Commerce Department's marine aquaculture responsibilities, but it is not reported out of the Senate Commerce Committee.

1996. A revised National Aquaculture Development Plan identifies regulatory problems and focuses on solutions:

4.4.8 Federal Regulatory Framework.
Challenges. The complex, fragmented, and uncertain regulatory environment affecting aquaculture is a deterrent to the development of a profitable and competitive US aquaculture industry. Because aquaculture involves land and water use as well as the production, processing, and distribution of food for human consumption, a number of Federal, State, and local government agencies are involved in regulating the industry. As a result, aquatic farmers may either be required to comply with a daunting and expensive array of regulations or, as exemplified by offshore marine aquaculture initiatives, be forced to operate in a highly uncertain regulatory framework.

Opportunities. The Federal government has a responsibility and opportunity to develop alternative, rational approaches to the Federal permitting, licensing, and regulatory requirements now in place. This can include clarification, streamlining, and consolidation, wherever possible, of the regulatory process, while simultaneously ensuring protection of the health and well-being of the population and environment.

5.8 Federal Regulatory Framework.
The Federal government will:

5.8.1 ***Recommend Improvements to the Federal Regulatory Framework:*** Review and recommend improvements to the Federal regulations, permits, and monitoring; fish health inspection; transport and export of live aquaculture products; depredation control; research on and commercial culture of genetically altered aquatic organisms; seafood inspection and safety; cultivation of "non-indigenous" species; testing and approvals of new animal drugs and vaccines; permits and regulations

—continued on page 16

Christopher Bridger

Offshore research net pen in the Gulf of Mexico

—continued from page 15

for commercial aquaculture operations in public waters, including Federal marine water (emphasis added); and other issues as appropriate.

5.8.2 ***Implement Recommendations to Improve Regulatory Framework:*** With direct cabinet-level leadership, evaluate and implement recommendations to improve the Federal regulatory framework for aquaculture.

5.8.3 ***Evaluate Discharge Standards and Discharge Impacts:*** Support efforts to evaluate existing water quality standards for discharge from aquaculture facilities and the impact of other discharges on aquaculture operations.

5.8.4. ***Develop Improved Compliance Standards for Public Waters:*** Develop simplified and uniform standards for review procedures, uniform siting standards, baseline surveys, monitoring protocols, and reporting requirements for aquaculture in public waters.

1997. NOAA completes the first draft of offshore aquaculture legislation as part of a broader effort among Federal agencies to address gaps in statutory authorities with respect to aquaculture. The NOAA bill specifically addresses the regulatory gap that had become evident in the Federal Exclusive Economic Zone (EEZ).

1998. The NOAA Aquaculture Policy is adopted. The policy recognizes the need to deal with emerging issues and encourages marine aquaculture to develop in an environmentally responsible manner.

1998–1999. NOAA distributes the first draft of the offshore aquaculture legislation to constituents at national aquaculture conferences.

1999. The Department of Commerce Aquaculture Policy is adopted. The policy set targets for increasing US aquaculture production and jobs. Like the NOAA policy, the DoC policy emphasizes sustainable aquaculture development.

1999. NOAA begins a five-year Marine Aquaculture Initiative, funding numerous projects in areas identified in consultation with the Joint Subcommittee on Aquaculture and NOAA constituents. Top priorities include research in regulatory reform, siting of facilities, environmental standards, regional cooperation, and demonstration projects for offshore (also known as open-ocean) aquaculture.

2000. NOAA submits a draft National Offshore Aquaculture Act to the Office of Management and Budget (OMB) for Federal interagency review. Clearance process is interrupted by a change in Administrations in January 2001.

2003. NOAA shares a revised version of offshore aquaculture legislation for discussion with other federal agencies on the Joint Subcommittee on Aquaculture.

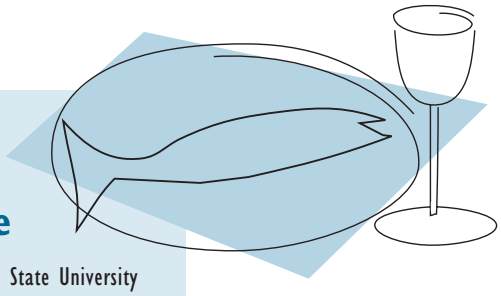
2003. The PEW Oceans Commission report recommends that "Congress should require the development of a comprehensive and environmentally oriented permitting system for offshore aquaculture."

2004. NOAA submits the National Offshore Aquaculture Act to OMB for interagency clearance.

2004. The US Commission on Ocean Policy makes four recommendations regarding marine aquaculture, one of which is for NOAA to be responsible for developing a comprehensive, environmentally sound permitting, leasing, and regulatory program for marine aquaculture.

2004. The Bush Administration responds to the US Commission on Ocean Policy by issuing the US Ocean Action Plan, which includes a commitment to submit national offshore aquaculture legislation to the 109th Congress.

2005. In June, the Administration clears the National Offshore Aquaculture Act of 2005 and transmits the proposed legislation to Congress for action. ■



South Asian Spice Grilled Rainbow Trout with Lime-Ginger Dipping Sauce

Malley Sisson, RD, LD, Kansas State University
Grand Prize Winner of the Clear Springs Foods "Create a Classic" competition

Rainbow Trout boasts its versatility in this inspired dish with the perfectly balanced textures and flavors of the East. It works as a starter or as passed hors d'oeuvres—not to mention as an entree with a whole rainbow trout fillet and more rice. Exactly the mouth-watering item to excite jaded palates.

1/4 cup	plain yogurt
1 1/2 oz (1/4 cup)	finely chopped ginger root
1 Tbsp + 1 tsp	ground turmeric
1 Tbsp + 1 tsp	sugar
1 Tbsp + 1 tsp	rice vinegar
1 Tbsp	finely chopped lime zest
2 tsp	coarse salt
6	natural fillets, 4 oz each, each cut lengthwise into 4 strips of Clear Springs Clear Cuts® Rainbow Trout
24 leaves	lettuce, torn into small, ruffled pieces
1 1/2 cups	cooked, warm jasmine rice

lime–ginger dipping sauce (recipe follows)
torn lemon balm leaves as needed for garnish

Just before service, thoroughly mix yogurt and next 6 ingredients; toss rainbow trout strips with mixture. Marinate 30 minutes.

Grill 2 pieces of trout flesh-side down for 1 minute. **Turn; grill** until just firm, about 30 seconds.

To assemble, make 2 nests of 3 pieces lettuce each.

Put 1 tablespoon rice into each nest.

Drizzle each with 1 teaspoon dipping sauce.

Add 1 piece trout to each, cut to fit.

Drizzle each with 1 teaspoon dipping sauce, then **garnish** with torn lemon balm leaves.

Serve 3 tablespoons dipping sauce on the side.

Lime-Ginger Dipping Sauce: Puree 1 1/2 cups fish sauce, 1 cup sugar, 1 cup water, 3/4 fresh lime juice, 2/3 cup chopped ginger root, 1/3 cup fresh cilantro leaves, 4 cloves chopped garlic, and about 6 chopped Thai bird chiles. Reserve.

Aquaculture Working Group

The Winter 2006 Interim final report of the Aquaculture Working Group of the US Department of Agriculture National Organic Program is available at:

http://www.ams.usda.gov/nop/TaskForces/AATFInterimFinalReport.pdf

Ron Hardy, Director of the University of Idaho's Aquaculture Research Institute and Chair of WRAC's Board of Directors, is a member of the group.

Bill Dewey Receives the NSA David H. Wallace Award

Ken Chew, Professor Emeritus, School of Aquatic and Fishery Sciences, University of Washington

Bill has taken an active role in shaping public policy as it affects the shellfish culture industry

During the National Shellfisheries Association (NSA) annual meeting in Monterey, California, March 26–30, 2006, Bill Dewey was selected by its Executive Committee to receive the NSA David H. Wallace Award.

Since graduating from the UW's School of Fisheries (now the School of Aquatic and Fishery Sciences) in 1981, Bill has spent 20-plus years as a shellfish farmer in Washington State, and has taken an active role in shaping public policy as it affects the shellfish culture industry.

He was featured in the Spring/Summer 1997 issue of *Waterlines*—when he was first on WRAC's Industry Advisory Council and Division Manager of Taylor Shellfish, serving the needs of the company and the whole industry. As we stated in that issue, "In all aspects of his involvement with aquaculture in the state of Washington, Bill has served the industry with integrity, and with an eye toward the future.

His training, experience, and expertise in the shellfish industry have put him in high demand, and we are fortunate that he has been willing to further expand his efforts on behalf of the WRAC program."

Courtesy of Ken Chew

l to r: Ken Chew, Bill Dewey, and Lou D'Abramo (President, NSA) at the annual meeting in Monterey, California in March 2006

Bill has been a highly recognized advocate in the aquaculture arena. From his start at Rock Point Oyster Co., and through his years at Taylor Shellfish, Bill's keen interest in promoting the well-being of the shellfish industry on the West Coast was apparent. He started his own shellfish farm (Chuckanut Shellfish Farm) in 1991. Over the years, Bill has had an exceptional record of effectively bringing together research scientists and industry groups and producers so that the products of research are applied for the benefit of the shellfish industry.

Bill has tirelessly made it his personal charge to be aware of any legislative and political matter of potential concern for the industry, and has shared his concern with industry members for action. Bill's expertise, accomplishments, and commitment led to his appointment to the National Aquaculture Association (NAA) Board of Directors as well as other task force committees and councils—both locally and nationally. He is a true "watch dog" for the shellfish industry.

Bill works closely with the Pacific Coast Shellfish Growers Association (PCSGA) and has served as its president. He was also instrumental in helping to organize the Pacific Shellfish Institute (PSI), which develops and disseminates scientific and technical information about shellfish-related environmental and animal/human health and safety issues to the general public, shellfish farmers, and public officials.

Bill's efforts as a major organizer and synthesizer in the preparation of user documents is well known. One example, *North America West Coast Shellfish Industry's Research and Initiatives Priorities 2010,* was first published in 1999, and revised in 2003. Through PSI, he was instrumental in getting cooperation from many members of the PCSGA and the Pacific Coast Section of NSA to develop and revise this document, which is important not only to the West Coast, but as a reference throughout other coastal areas of the United States. Presently, Bill

Courtesy of Bill Dewey

Bill clamming

Courtesy of Bill Dewey

Joyce and Bill Dewey

is working with key scientists and growers in updating this important user document to 2015 priorities.

Another document which Bill was instrumental in getting published is *Environmental Codes of Practice for the Pacific Coast Shellfish Industry* (2002), a useful tool for orienting shellfish growers toward the need to stay on top of environmental issues and impacts.

In many ways, Bill has demonstrated similar attributes to David H. Wallace through his accomplishments in assisting the shellfish industry.

Heartiest congratulations to Bill for this honor! ■

David H. Wallace

This award was developed by NSA in 1981 to honor David H. Wallace "In recognition of his long and dedicated service in promoting research, understanding, and cooperation among shellfish scientists, culturists, managers, producers, and regulators." The first award was given in 1982.

Wallace was very active in New York's Long Island Sound and coastal politics wherever shellfish were produced in the United States. He encouraged interaction and cooperation among industry, academic, and scientific communities for the benefit and future of all shellfish.

Wallace moved among all levels of governmental agencies, and served on various task forces and councils concerned with environmental and habitat issues— which, in many cases, directly affected the industry. He was the go-to person for help in addressing legislative and political issues impacting the development of aquaculture—especially the oyster industry in the 1950s and 1960s. Wallace was an asset to the shellfish industry on the east, west, and Gulf coasts.

University of Maryland Laboratory Director Claims to Have

Dennis O'Brien, The Baltimore Sun Company

The beauty of the system is that the tanks can be installed in warehouses and placed anywhere

In a basement lab at the Inner Harbor in Baltimore, one of the world's most intensely studied fish is swimming in a computer-monitored tank—a journey designed to end on a dinner plate. For years, the gilthead seabream, a Mediterranean delicacy fished nearly to extinction, has been the focus of research at the University of Maryland Biotechnology Institute's (UMBI) Columbus Center.

To try to mass produce saltwater fish indoors —away from the ocean—scientists have been probing what they eat, how they mate, their growth rate, the water temperatures they prefer, and techniques for ridding the massive tanks of their waste.

Now they believe they've figured out how to do it—and make money. "The beauty of the system is that the tanks can be installed in warehouses and placed anywhere—in the Midwest, near an airport or railway, in an inner-city neighborhood where jobs are scarce," said Yonathan Zohar, director of UMBI's Center of Marine Biotechnology and godfather of the decade-long project.

Zohar and colleagues have also performed the ultimate experiment on their seabream—arranging taste tests in Baltimore restaurants. "It always sells well. People think it's great," said Kevin Bonner, executive general manager of McCormick & Schmick's Seafood Restaurant.

The "closed loop" system is the first of its kind, a recirculating tank farm that loses almost no water and produces a saltwater fish, Zohar says. Other tank systems produce freshwater fish, but Zohar says a saltwater system ensures higher-quality fish with a wider range of health benefits.

Fish farming is hardly new. The Chinese have raised them for thousands of years. US biologists have raised trout since the 1880s and catfish and tilapia since the 1970s. With sturgeon, Atlantic salmon, hybrid striped bass, and a variety of shellfish thrown in, US fish farming is a $1 billion a year business, federal officials say.

The problem: Many of these fish farms are based in oceans, ponds, estuaries, and streams where they're subject to the vagaries of weather and where the waste creates environmental headaches.

With the latest government dietary guidelines promoting the health benefits of seafood, America's fish consumption is expected to increase from 11 million tons last year to 14 million tons by 2025, according to the National Oceanographic and Atmospheric Administration (NOAA).

Meanwhile, the US already imports 70% of its seafood, and demand is increasing, one reason Zohar thinks the time is right for UMBI's project. "Obviously we're running out of fish—that's the main concern," he said. "The oceans cannot give us any more."

Environmentalists prefer tank systems like UMBI's because they don't pollute waterways with densely accumulated fish waste. Tank systems also avoid the possibility of farm-raised fish escaping and mating with wild fish, creating a hybrid species, said Rebecca J. Goldburg, a senior scientist with the Environmental Defense Fund. "As long as the energy costs are kept in line, it's considered the preferable way," she said.

Federal officials diplomatically say there's need for all types of fish farming. "All of these technologies are a step in the right direction because we need seafood," said Michael Rabino, who runs NOAA's sea-farming efforts.

But experts warn would-be fish farmers to tread carefully. Like raising cattle, hogs, and other animals, it's more complicated than novices expect—and more than a few entrepreneurs have gone belly-up. "I'm a little concerned people underestimate the difficulty involved in trying to operate these closed-loop systems" said Jim Carlberg, president of Kent SeaTech Corp., which produces hybrid striped bass in San Diego.

Scott Lee, who operates Deale Aquaculture, a wholesale fish operation, started a tilapia farm in the 1990s, using tanks and filters he set up

Developed a Viable Closed Loop Sea Bream System

in a 10,000-square-foot concrete warehouse. The system, based on technology different from UMBI's, never worked as promised. "Instead of raising 200,000 pounds a year, we were lucky to produce 30,000 pounds," he recalled. "The system looked good, but there were flaws that people coming into the business for the first time couldn't have seen."

At one time, there were 10 to 12 tilapia operations in Maryland, hoping to cash in on a fish promoted for its health and market potential, he said. But they're all history now.

Lee survives as a wholesaler, selling fish to markets in the Washington area and using his 32 tanks to store fish instead of raising them.

UMBI is looking at an entirely different fish. The gilthead seabream (*Sparus aurata*) is pricier than tilapia and should be more successful, according to Zohar and Karl Roscher, a spokesman for Maryland's Aquaculture Coordinating Council.

Roscher said tilapia dealers were hit hard when the price dropped because so many people began raising it—including competitors in Ecuador and Costa Rica. "They couldn't really go head-to-head with the import market," he said.

Farmers now get about $1.50 per pound for tilapia, while seabream sells for about $5. Zohar says he chose seabream because there's a market for it and because the fish can only live and be raised in saltwater. That results in a better-quality product than freshwater fish produced in tanks elsewhere.

But not everyone is convinced: Seabream are now farm-raised in open-water European sytems—if the fish hits it big here, skeptics say, Zohar will eventually face the same foreign competition as tilapia producers.

"I'd say he has a three-year window before other people get into the game and bring the price down,' said Ewen McLean, director of the Virginia Tech Aquaculture Center.

Zohar said the strength of his system is its versatility. It can produce a variety of saltwater fish: If the market drops for seabream, a farmer can switch to grouper, cod, or bronzini.

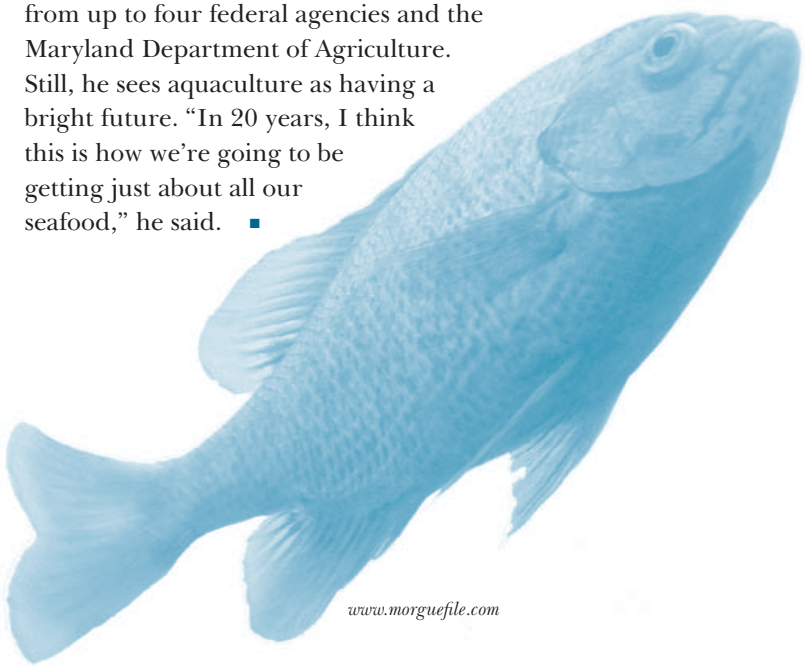
UMBI's prototype fish farm is also designed so that an operator can start small and scale up gradually.

Zohar routinely shows visitors through his operation, where 1,100-gallon seabream tanks' circulation system is self-contained, so that less than 1% of the water is wasted. A computer controls temperature, salinity, and pH levels, as well as levels of dissolved oxygen and carbon dioxide used as disinfectants.

The system circulates waste through tanks containing microorganisms that turn it into environmentally friendly nitrogen. Sludge collected from the tanks is turned into methane, a potential fuel source.

The UMBI model envisions a facility of 55,000 to 60,000 square feet that produces 400,000 pounds of seabream a year and requires a $3 million investment in a warehouse and equipment. It would take three to four years before investors saw a return on their investment, according to Dan Grosse, an environmental consultant UMBI hired to conduct a market study.

Zohar acknowledges that a working fish farm could be years away—besides finding a site, a potential fish farmer would need permits from up to four federal agencies and the Maryland Department of Agriculture. Still, he sees aquaculture as having a bright future. "In 20 years, I think this is how we're going to be getting just about all our seafood," he said. ■



www.morguefile.com

New Biotechnology Aquaculture Lab Opens at Hagerman

Graham Young, Director, WRAC, Professor, University of Washington

On September 14, 2006, I had the privilege of representing WRAC at the dedication ceremony of the University of Idaho's new $2.9 million biotechnology aquaculture laboratory and office complex at the Aquaculture Research Institute site in Hagerman.

Ron Hardy, director of the Institute and the Hagerman Fish Culture Experiment Station and current chair of WRAC's Board of Directors, welcomed approximately 200 visitors. The audience included a very large representation from the heart of Idaho's aquaculture industry in the Magic Valley along the Snake River.

After Dr. Hardy's welcome, university, state, tribal, and agency officials—including Tim White, president of the University of Idaho, and Idaho Governor Jim Risch—made speeches to mark the occasion. In his speech, Mark Daily, president of the Idaho Aquaculture Association, emphasized the partnership between Idaho's aquaculture industry and the University of Idaho.

John Halver, Professor Emeritus at the University of Washington, world-renowned fish nutritionist, and member of the National Academy of Sciences, closed the official part of the proceeding. Professor Halver, Dr. Hardy's PhD mentor and founder of the Hagerman Station, spoke about the early days of aquaculture research at this location.

Courtesy of Ron Hardy

Ron Hardy addresses the audience at the dedication of the University of Idaho's new biotechnology aquaculture laboratory at the Aquaculture Research Institute site in Hagerman

Chef Kurt Martin, owner of the Snake River Grill in Hagerman (*http://www.snakeriver-grill.com*) catered a fine lunch featuring cultured fish. Kurt is well known to the local aquaculture community, particularly as he caters the dinner at the Idaho Aquaculture Association's annual meeting.

Constructed in collaboration with tribal partners at the Columbia River Intertribal Fish Commission and with Federal Initiative support and private donations, the 13,000-square-foot building has six well-equipped analytical laboratories, offices, and other workspaces. The Institute is equipped for state-of-the-art work in genomics and proteomics, and a variety of biochemical analyses. There is also a conference room wired for distance learning and video-conferencing with the university's Moscow campus.

In addition to carrying out work of relevance to commercial aquaculture, Institute researchers are involved in conservation biology. The new building has a room dedicated to archiving fish tissue samples from around the Pacific Northwest. These samples will be available for future DNA testing associated with research in the population genetics of salmon, steelhead, trout, sturgeon, lampreys, and burbot, and with other studies.

The lobby features a large aquarium with native species and a smaller aquarium with ornamental species that are candidates for production in Idaho using geothermal resources.

Just prior to the dedication, Blackwell Science Publications at Oxford University reported that the University of Idaho was the 2005 top US university by number of ISI-ranked papers published in the *Journal of Fish Diseases*. Dr. Hardy stated: "We are grateful for this international acknowledgment, which speaks volumes for the quality of our work. This new biotechnology laboratory will allow us to continue producing top-quality research that impacts the state, the nation, and the world."

All at WRAC send our congratulations to Ron and his team—they have done an amazing job of promoting and planning this advanced research facility. ■

Aquaculture Extension Contacts

Alaska

Brian Allee
Alaska Sea Grant-UAF
205 O'Neill Building
Fairbanks, AK 99775-5040
phone: (907) 474-7949
fax: (907) 474-6285
email: *brian.allee@sfos.uaf.edu*

Raymond RaLonde
University of Alaska Fairbanks
2221 E. Northern Lights Blvd, #110
Anchorage, AK 99508-4140
phone: (907) 274-9697
fax: (907) 277-5242
email: *afrlr@uaa.alaska.edu*

Arizona

Kevin Fitzsimmons
Environmental Research Lab
University of Arizona
2601 East Airport Drive
Tucson, AZ 85706-6985
phone: (520) 741-1990
fax: (520) 573-0852
email: *kevfitz@ag.arizona.edu*

California

Fred S. Conte
Department of Animal Science
University of California-Davis
1 Shields Avenue
Davis, CA 95616
phone: (530) 752-7689
fax: (530) 752-0175
email: *fsconte@ucdavis.edu*

Susan C. Schlosser
Humboldt Co. Coop. Ext.
2 Commercial St., #4
Eureka, CA 955016
phone: (707) 443-8369
fax: (707) 445-3901
email: *scschlosser@ucdavis.edu*

Colorado

No Extension Contact

Idaho

Ron Hardy
Hagerman Fish Culture E.S.
3059 National Fish Hatchery Rd.
Hagerman, ID 83332
phone: (208) 837-9096
fax: (208) 837-6047
email: *rhardy@uidaho.edu*

Gary Fornshell
Twin Falls County Extension
University of Idaho
246 3rd Avenue East
Twin Falls, ID 83301
phone: (208) 734-9590
fax: (208) 733-9645
email: *gfornsh@uidaho.edu*

Montana

Martin Frick
Agricultural Education
116 Cheever Hall
Montana State University
Bozeman, MT 59717-0374
phone: (406) 994-3201
fax: (406) 994-6696
email: *uadmf@montana.edu*

Nevada

Michael Collopy
University of Nevada-Reno
Dept. of Env. & Resource Science
1000 Valley Rd.
Reno, NV 89512
phone: (775) 784-4773
fax: (775) 784-4583
email: *mcollopy@cabnr.unr.edu*

New Mexico

Jon Boren
New Mexico State University
Box 30003, Dept. 3AE
Las Cruces, NM 88003-8003
phone: (505) 646-1164
fax: (505) 646-5441
email: *jboren@nmsu.edu*

Oregon

John Faudskar
Sea Grant Program
Oregon State University
2204 Fourth Street
Tillamook, OR 97141
phone: (503) 842-3433
fax: (503) 842-7741
email: *john.faudskar@orst.edu*

Utah

Nancy Mesner
College of Natural Resources
Utah State University
5210 Old Main Hill
Logan, UT 84332-5210
phone: (435) 797-2465
fax: (435) 797-1871
email: *nancym@ext.usu.edu*

Washington

Steve Harbell
Cooperative Extension
Washington State University
PO Box 88
1216 Robert Bush Drive
South Bend, WA 98586
phone: (360) 875-9331 x633
fax: (360) 875-9304
email: *sharbell@u.washington.edu*

Wyoming

Jim Bennage
Sheridan College
3059 Coffeen Avenue
Sheridan, WY 82801
phone: (307) 674-6446 x6164
fax: (307) 674-4874
email: *jbennage@sheridan.edu*

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University of Washington
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