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Baskets for fish capture displayed at the WAS Asian Pacific regional conference; see page 2 (photo by Ann Shriver)

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Training Fish Farmers in Tanzania

From a report by Kwamena Quagraine, Purdue University, USA

Private subsistence fish ponds dominate freshwater fish culture systems in Tanzania, and many new ponds continue to be constructed each year. While fish ponds provide many important and practical benefits such as erosion control, fire control, livestock watering, irrigation, swimming, picnicking, and wildlife enhancement, fish produced in ponds provide animal protein and income to households. Good fish farming is the result of intensive extension delivery and formal and informal farmer training resulting in appropriate pond site selection, good pond engineering practices, quality fingerling supplies, and proper management of ponds and fish.

With support from the Aquaculture CRSP, the Fisheries Division of Tanzania has been organizing on-site pond training for farmers with the aim of imparting information on fish farm development and technology application. Objectives of the training sessions include providing training on pond management, fish feed and fish health management, teaching farmers principles and benefits of record keeping, and teaching farmers simple methods for assessing and evaluating costs and benefits.

A summer training workshop from 18 to 22 June 2007 at Sokoine University of Agriculture in Morogoro, Tanzania involved 24 men and women fish farmers from three Morogoro region districts and one farmer



Fish farmers learn catfish induced spawning techniques (photo by Charles Ngugi).

WAS Asian-Pacific Conference Brings Together Aquaculturists from 50 Countries

by Ann Shriver, International Institute of Fisheries Economics & Trade

The World Aquaculture Society's Asian-Pacific regional group met in Hanoi, Vietnam on 5-8 August 2007. Over 1100 participants made this the largest aquaculture meeting ever held in Vietnam and a very gratifying turnout for the organization.

Some 250 oral presentations and 125 posters covered topics including marine finfish, shrimp, catfish, genetics, crabs and lobsters, coastal zone management, aquatic animal health, freshwater fish culture, markets and trade, mollusk culture, proteins in aquafeeds, seaweeds and algae, fish larval development and growth, as well as some more narrowly focused on topics such as post-tsunami recovery of aquaculture, managing dynamic growth, and development of a Vietnamese aquaculture researchers' network.

Several very well attended sessions on markets and trade were held. Standing-room only crowds in some of these rooms attested to the popularity of the subjects, and to the overwhelming success of the conference in attracting participation. Even aquaponics—a method of growing fish and vegetable crops in an integrated system in which the plants clean and filter the water—was not neglected, covered in a session chaired by ACRSP investigator James Rakocy (University of the Virgin Islands).

Many current and former ACRSP and AquaFish network researchers contributed to the success of the conference. It would be impossible to capture all of the useful and interesting research results and information presented at the conference, but a few highlights will demonstrate the impact of CRSP supported researchers and their research on some of the key issues.

Remedios Bolivar's (Central Luzon State



Van Mieu Temple (photo by Ann Shriver)

Goings-on in the Pond...



The AquaFish CRSP welcomes its new student employees Aaron Zurcher (graphic design) and Sarah Ing (administrative support). Their contributions are already helping to optimize AquaFish CRSP Management Office publications.

Carl Bond, Oregon State University (OSU) Professor Emeritus of Fisheries, passed away on 12 November 2007. He was involved in the start up of the first Pond Dynamics/Aquaculture CRSP at OSU in 1979. Dr. Bond was one of the world's leading authorities on *Sculpin cottidae* and was involved in several international fisheries research projects.

The AquaFish CRSP HCPI Exchange Project on Tilapia and Cichlid Culture began its Phase II workshop series in South Africa and Ghana (20 October to 3 November 2007). The project brought together Host Country PIs from the AquaFish CRSP and the former Aquaculture CRSP to share information and experiences on tilapia/cichlid culture in different countries, focusing on successful techniques and practices.

A recent study demonstrated that Nile tilapia introduced into ponds containing malaria-carrying mosquito larvae can reduce the number of larvae by 94 percent. This highly cultured food fish may soon be incorporated into an integrated approach to control pesticide-resistant mosquito populations in Kenya. For more on the study, see the full paper in [BioMed Central Public Health](#).

Congratulations to Carl Schreck (USGS Fishery Biologist, Oregon State University Professor of Fisheries, and ACRSP PI) for his recent Meritorious Presidential Rank Award, granted through the US Department of the Interior. The Meritorious Executive Rank is awarded to leaders for sustained accomplishments and is awarded through a rigorous selection process to only five percent of Senior Level or Scientific Professionals.

A *New Guide to Fish Farming in Kenya* by Charles Ngugi, James Bowman, and Bethuel Omolo was recently published by the Aquaculture CRSP. Upcoming publications also include *Salud, Ambiente, y Acuicultura en la Costa Pacifica de Mexico*, edited by Maria Haws et al., and *Best Management Practices for Responsible Aquaculture* by Claude Boyd et al. To download or order these and other CRSP publications, visit [our publications page](#).



Chris Brown (ACRSP PI) was recently appointed Division Chief for the US Department of Commerce, running the Aquaculture and Enhancement Division of the National Oceanic and Atmospheric Administration. Dr. Brown has served as a PI for ACRSP research projects in the Philippines from 1998 to 2007.



...TRAINING Continued from Page 1

from the Kilimanjaro region. Three fisheries professionals from each district also attended the training. Teaching modules were developed by the University of Arkansas at Pine Bluff (USA); Fisheries and Aquaculture Development Division (Tanzania), Moi University (Kenya), and the Department of Animal Science at Sokoine University of Agriculture. There were practical hands-on sessions that covered catfish artificial breeding, catfish and tilapia sex identification, and fertilizing ponds using poultry manure. Participants examined microorganisms from pond water under a microscope. Farmers also engaged in open discussions, where many shared their fish farming experience freely. This session was quite lively and brought out technological deficiencies in current farming methods. Study topics were translated into Kiswahili, with a hard copy printed for handout distribution to farmers. Trainees also visited the ponds and hatchery site at nearby Kingolwila Fish Center.

The farmers appreciated this training as it gave them technological knowledge and hands-on practice of techniques that will help them improve their fish operations. Farmers were amazed to learn that keeping good farm records could open doors to financial institutions and government agricultural lending agencies for business loans. Participants shared their experiences on common fish farming problems and what solutions were adopted, and exchanged contact information to continue their information sharing in the future. It is anticipated that when the knowledge acquired from the training is put into use, farmers stand a good chance of improving their livelihoods by moving from subsistence fish farming to commercial fish farming. An economically viable aquaculture industry may also attract additional government resources and services such as extension.



Dr. Charles Ngugi (Moi University) demonstrates injecting catfish with hormones to induce spawning.

Graduate Student Profile: Arkady Uscanga-Martinez



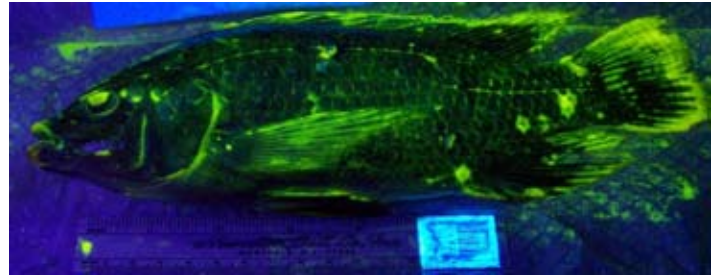
Arkady sorts fish meal in preparation for an experiment.

The AquaFish CRSP, like its predecessor program the Aquaculture CRSP (ACRSP), relies on participating US and Host Country institutions to undertake and present continuing high-quality research in aquaculture and fisheries-related fields. The program provides support for undergraduate and graduate students, who are integral parts of its research teams.

Arkady Uscanga-Martinez was supported by the ACRSP for his Master's degree from the Universidad Juárez Autónoma de Tabasco (UJAT), graduating in December 2006. After completing an undergraduate degree in Biology at UJAT, Arkady went on to study Environmental Sciences under Drs. Wilfrido Miguel Contreras Sánchez (now an AquaFish Host Country PI) and Roberto Civera Cerecedo, totaling four years of ACRSP-sponsored work. Arkady was impressed with

Researchers Examine Effects of Live Haul on Tilapia

During typical live-haul of tilapia from farms in Idaho to Oregon, Washington, British Columbia, and California markets, fish undergo loading, transport (often up to 18 hours), and unloading before distribution to markets, which in turn may involve repeating these three steps. Stressors exist in each phase of the live-haul process, generating a physiological response that may negatively impact the health and survival of affected fish, and ultimately the quality of product. With funding from the Western Regional Aquaculture Center of the US Department of Agriculture (Cooperative State Research, Education and Extension Service), researchers at Oregon State University (OSU: Carl Schreck, Grant Feist, Rob Chitwood, and Tracey Momoda), the National Marine Fisheries Service (NMFS: John Colt, Michael Rust, and Ron Johnson), and the University of Idaho (Gary Fornshell), in collaboration with scientific and industrial advisors are investigating the physiological and physical effects that live-haul procedures have on tilapia in the Pacific Northwestern United States.



Tilapia stained with fluorescein dye to visualize surface damage to scales and fins as a result of haul processes (photo courtesy of Tracey Momoda)

designed to optimize fish physiological response and flesh quality, and outreach products designed to inform and assist live-haulers. The research team has currently fulfilled several goals, having identified common loading and transport practices and associated risks to fish health and survival, with cooperation from transport companies and retailers. Vibrations, poor water quality, parasites and infectious pathogens, chemicals, and temperature fluctuations are all stressors that may result in negative physiological responses in transported tilapia. Crowding is a large concern during live-haul, when fish are at risk of physically damaging themselves and others as they are netted or contained prior to and during transport processes.

Carl Schreck (an Aquaculture CRSP PI) and his team at OSU have conducted experiments examining the physical effects of netting on tilapia at their CRSP-supported fish research facility. Their hypothesis is that fish are punctured and abraded during netting (exacerbated by concurrent crowding), resulting in physical damage (lost scales and hemorrhaging) and increased susceptibility to disease. Histological analysis appears to confirm punctures in skin and deeper tissues, tears in connective tissue, and edema and bacterial infections within muscle tissue. Aesthetically unpleasing or deceased fish are filleted, although fillets fetch a much lower market price than whole, healthy fish.

Schreck has also worked with members of the project team to demonstrate the ability of a pre-haul Instant Ocean® salt dip to give the fish anti-parasitic and osmotic advantages, delaying mortalities up to two days when compared to



Tilapia crowded during the netting stage of hauling (photo courtesy of Schreck lab)

The four-year project began in 2005 with project leaders outlining objectives centered on identification of current holding and long-haul procedures, in addition to critical steps and factors affecting fish health and survival. Further objectives included the development of computer models predicting water quality and fish response in hauling systems, hauling criteria and protocols

Notices of Publication

Notices of Publication announce recently published work carried out under Aquaculture CRSP sponsorship. To receive a full copy of a report, please contact the author(s) directly.

HAEMATOLOGICAL CHARACTERIZATION OF LOACH *MISGURNUS ANGUILLICAUDATUS*: A COMPARISON AMONG DIPLOID, TRIPLOID AND TETRAPLOID SPECIMENS

Zexia Gao, Weimin Wang, Khalid Abbas, Xiaoyun Zhou, Huanling Wang, Yang Li, Yuhua Sun
Huazhong Agricultural University, Wuhan, Hubei, P.R. China

Yi Yang
Asian Institute of Technology
Klong Luang, Pathum Thani Thailand

James S. Diana
University of Michigan
Ann Arbor, MI USA

07-222

The purpose of this study was to determine whether diploid, triploid and tetraploid loach (*Misgurnus anguillicaudatus*) differed in terms of their main haematological and physiological characteristics. Diploid and tetraploid fish were produced by crossing of natural diploids ($2n \times 2n$) and natural tetraploids ($4n \times 4n$), respectively. Triploid fish were produced by hybridization between diploid males and tetraploid females. The blood cells were significantly larger in polyploids, and the volumetric ratios of erythrocytes and leucocytes (thrombocyte and neutrophil) in tetraploids, triploids and diploids were consistent with the ploidy level ratio of 4:3:2. No significant differences were observed in haematocrit among polyploids. The erythrocyte count decreased with increased ploidy level, while total haemoglobin, mean cell volume, mean cellular haemoglobin content, and mean cell haemoglobin concentration all increased with increase in ploidy level. Erythrocyte osmotic brittleness declined in polyploids so that polyploid erythrocytes were more resistant to osmotic stress than diploid ones. Overall, loach with higher ploidy levels showed evidence of some advantages in haematological characteristics.

This abstract was excerpted from the original paper, which was published in *Comparative Biochemistry and Physiology - Part A*, Vol. 147(4): 1001-1008 in August 2007.

MORPHOLOGICAL STUDIES OF PERIPHERAL BLOOD CELLS OF THE CHINESE STURGEON, *ACIPENSER SINENSIS*

Gao Zexia, Wang Weimin, Khalid Abbas, Li Dapeng
Huazong Agricultural University
Wuhan, Hubei P.R. China

Yi Yang
Asian Institute of Technology
Klong Luang, Pathum Thani Thailand

Zou Guiwei
Yangtze River Fisheries Research Institute of the Chinese Academy of
Fishery Sciences
Jingzhou, Hubei, P.R. China

James S. Diana
University of Michigan
Ann Arbor, MI USA

07-223

The peripheral blood cells of one-year-old Chinese sturgeon (*Acipenser sinensis*) have been studied by light microscopy and transmission electron microscopy. The erythrocyte count was 84.86×10^4 cell mm^{-3} in the peripheral blood of the fish and that of leucocytes was 2.24×10^4 cell mm^{-3} . The erythrocytes and four main types of leucocyte—thrombocytes, lymphocytes, granulocytes (including neutrophils and eosinophils), and monocytes, were identified in the peripheral blood. In addition to normal erythrocytes, reticulocytes and division of erythrocytes were observed. Thrombocytes were the most numerous among the leucocytes, and the number of neutrophils with lobated nuclei was larger than for other fish. The structures of the erythrocytes, lymphocytes, monocytes, granulocytes, and thrombocytes of the fish were studied. The erythrocytes were almost completely devoid of organelles, except for some mitochondria and granules. A large number of vacuoles and a few organelles were observed in cytoplasm of the monocytes. There were many microvilli on the membrane and pseudopodia-like cytoplasm bulge in the lymphocytes. The neutrophils were round or oval in shape with bilobed, trilobed, or multilobed nuclei whereas the eosinophils had big special granules, dark stained. There were many vesicles in some thrombocytes, which were related to its phagocytosis; some thrombocytes had almost no cytoplasm or organelles.

This abstract was excerpted from the original paper, which was published in *Fish Physiology and Biochemistry*, Vol. 33(3): 213-222 in September 2007.

...NOPs Continued on Page 6

Notices of Publication, continued

TILAPIA FINGERLING PRODUCTION IN HONDURAS

Suyapa A. Triminio Meyer, Daniel E. Meyer
Panamerican Agricultural School
Tegucigalpa, Honduras

Joseph J. Molnar,
Auburn University
Auburn, AL USA

William E. Tollner
University of Georgia
Athens, GA USA

07-224

This study was supported by Aquaculture Collaborative Research Support Program (ACRSP) of the United States Agency for International Development (USAID) and conducted in Honduras by the Panamerican Agriculture School (PAS) from September 2003 and July 2004. The objective of the study was to evaluate tilapia fingerling production and examine the factors that influence the way farmers produce and distribute fingerlings and to provide recommendations to improve the quality and availability of fingerlings in Honduras. The study describes the socioeconomic characteristics of tilapia fingerling producers, their production techniques, as well as their needs for training and technical assistance in Honduras. Sixteen farmers were identified, visited, and interviewed. A sample from each farm of the 13 producing and distributing fingerlings was taken to the Aquaculture Station at the PAS to determine their count and evaluate their quality based on uniformity of size, color, and male gender. Seven of the fingerling farms are family owned, four are private companies, one is a cooperative, one is operated by a nonprofit organization (NGO), another is run by a university, and two by the government. In aggregate, they produce approximately 15.3 million fingerlings a year. Most (75%) of the fingerling producers interviewed also produce marketing size tilapia, produce other aquaculture species, and have other farm enterprises. Results show that fingerling sex reversal with hormone-treated feed is practiced by 13 of the 16 farmers. Tilapia fingerling producers have between 4 and 6 years of formal education and an average of 6.7 years of experience (range

of 0-25 years). The results of the study suggest that a farmer's experience growing tilapia food fish is positively correlated to production of quality fingerlings. Analysis of the fingerling samples shows that there is variability on the quality of the fingerlings from one farm to another.

This abstract was excerpted from the original paper, which was published in Journal of Applied Aquaculture, Vol. 19(2): 1-27 in June 2007.



Poetry Corner

Fugu Soup Blues

by Aimee Nezhukumatathil

Nothing good can come out of eating
something named porcupine fish. It's like
playing Russian Roulette when you cook it—
the pulse of toxin in its sweet little body
can kill thirty men. But this is the most delicious
of all fishes, the sweet meat almost sugared
and the salty broth mix—it's worth any death.
Can you taste the pure poison hidden
in the skin folds? Can you forget what you eat
may kill you even as you wipe your mouth
with the back of your hand? Consider the way
the porcupine fish dies: it is the only fish
that can close its eyes. When a cleaver comes
near its head, it even winces. Sushi chefs
complain of the noise it makes on the chopping
block—
like crying—even though fishermen always
stitch its small mouth shut. And the blinking.
Don't we expect fish eyes to be dead-black
and dumb? You cannot stop this hunger. When
something this good can kill you, every pin prick
of white pain just adds more flavor. When
the waiter with the curvy smile asks if you want
seconds, set down your spoon. Say *yes*, but also
please.

Printed with permission by the author from the book *At the Drive-In Volcano*, Tupelo Press 2007. To listen to Aimee Nezhukumatathil read this poem, visit www.fishhousepoems.org



...ARKADY Continued from Page 3

UJAT's aquaculture facilities and camaraderie that allowed him to pursue his interests in the fields of aquaculture and aquatic nutrition.

The cichlid *Petenia splendida* is an important native species cultured in Tabasco, Arkady's home state in southeastern Mexico. This fish fetches high prices in local markets, and Arkady's research focused on the challenges of improvement of *Petenia* broodstock management, larval culture, and nutrition. His thesis project, entitled "Determination of Protein Requirements in Masculinized and Non-masculinized Juveniles of the Native Cichlid *Petenia splendida*," involved filtration systems that incorporated ultraviolet light, bacterial filtration and sunlight. Arkady's experiments related to the elimination of methyltestosterone residues from intensive masculinization systems, to reduce harmful substances in aquaculture and improve the culture of native species in the southeast region of Mexico.

Arkady is proud that his ACRSP-funded research at the aquaculture laboratory at UJAT contributed to the development of optimal *Petenia* culture technology. He has enjoyed working with researchers in Mexico and the United States, and traveling to international meetings to present his work and learn about similar research in his field of interest. Arkady would like to continue his training in aquaculture and is currently pursuing a PhD at the Universidad de las Palmas de Gran Canaria in Spain to improve his knowledge of fish nutrition and the digestive physiology of cichlids. He looks forward to a career in academia in Mexico, teaching undergraduate and graduate students about the culture and nutrition of fish.

Perhaps one day Arkady himself will serve as an AquaFish CRSP Host Country PI. He appreciates the ACRSP's contributions to the study of native species, and the "support that [the] ACRSP has provided to undergraduate and graduate students in Mexico, making the difference for many of us that otherwise wouldn't receive economic support for ourselves and our investigations." The AquaFish CRSP appreciates his hard work and looks forward to future collaborations with this accomplished student.

Upcoming Meetings and Events...

The CRSP is proud to support workshops and meetings designed to facilitate increased knowledge and communication in aquaculture. Meetings and workshops coming up in 2007-08 include...

- **8th Asian Fisheries Forum**
20-23 November 2007 in Kochi, India
www.8aff2007.org
- **Aquaculture CRSP/AquaFish CRSP Annual Meeting**
18-19 May 2008 in Busan, Korea
- **World Aquaculture Society Meeting**
19-23 May 2008 in Busan, Korea
www.was.org
- **IIFET 2008 - Achieving a Sustainable Future: Managing Aquaculture, Fishing, Trade and Development**
22-25 July 2008 in Nha Trang, Vietnam
<http://www.ntu.edu.vn/iifet2008/>
IIFET organizers are providing one student travel award for best paper on an aquaculture economics topic related to the developing world, and two travel grants for economics professionals. See the conference awards page at <http://www.ntu.edu.vn/iifet2008/index.htm?id=Awards>.
- **8th Annual International Symposium on Tilapia in Aquaculture (ISTA)**
12-14 October 2008 in Cairo, Egypt
Co-sponsored by the World Fish Center and the Central Laboratory for Aquaculture Research in Egypt, the conference will include a trade show, Farmer to Farmer session, farm and lab tours, and several social events in addition to technical presentations.
<http://ag.arizona.edu/azaqua/ista/ISTA8/ISTA8.htm> or
www.ista8-egypt.com



...WAS CONFERENCE Continued from Page 2

University, Philippines) presentation on “Feeding Strategies for Cost-Containment in Tilapia Culture” spotlighted the importance of combining the science of fish response to various diets with a realistic understanding of the economic situation faced by producers, and the requirement that profitability be considered when developing production strategies.

Amrit Bart (Asian Institute of Technology, Thailand) outlined the challenges facing aquaculture farmers and those dependent on the government and the wide variety of aid agencies operating in Aceh, Indonesia and other tsunami-affected areas, in recovering infrastructure lost to the 2004 tsunamis.

Kevin Fitzsimmons (University of Arizona, USA) presented a fascinating overview of the growth of tilapia markets. Most of the 350,000 tons of tilapia consumed last year in the US—\$483 million worth—were imported. In recent years tilapia has risen to the top fifth most popular seafood product. European markets are expanding too; strong demand for new product forms and packaging mean that value-added product forms are a growth market. Health, quality control, environmental considerations, and product safety issues will be foremost in shaping future market trends.

Nguyen Thanh Phuong and his team of researchers from Can Tho University (Vietnam) focused the attention of participants on one of the



Amrit Bart and Nguyen Thanh Phuong at the WAS conference (photo by Ann Shriver)

overarching themes of the conference: what are the appropriate types and levels of proteins to use in fish feeds for optimal growth, profitability, and sustainability? Reduction of fishmeal as a protein source has both costs and benefits that need to be considered. Nguyen Phu Hoa (University of Agriculture and Forestry, Vietnam) contributed to this debate with research on the use of local, wild live-feed sources within intercropped systems.

Asian-Pacific Aquaculture 2007 made significant contributions to the generation and dissemination of knowledge about aquaculture as a source of income, employment, and food security throughout the world.



...TILAPIA RESEARCH Continued from Page 4

control fish. John Colt at NMFS has also developed a hauling medium comprised of a salts mix based on fish osmoregulation that reduced mortality during transport.

As the project begins its third year of funding, researchers continue to investigate the physiological changes in tilapia that may occur during live-haul. The project team is developing hauling criteria and protocols that will protect tilapia health and quality with the assistance of computer models that predict pH, alkalinity, and temperature changes over time during different seasons in the Pacific Northwest. These criteria include alternatives to damaging procedures during live-haul, such as pumping rather than

netting fish during transfers. Ultimately, their research will serve to preserve the health and survival of tilapia during transport processes. The benefits affect not only the fish involved, but also retailers able to sell whole, healthy tilapia.

This research will also be performed with trout in the Pacific Northwest in order to optimize transport of farmed fish in that market. While live-haul transport factors and protocols may vary in geographically diverse areas, the desire for a healthy and valuable end product is universal, and aquaculture farmers and transport companies worldwide may find these types of studies highly valuable within their own regions.



AquaFish CRSP Cooperative Agreement Awardees

Partner Institutions

Improved Cost Effectiveness and Sustainability of Aquaculture in the Philippines and Indonesia

North Carolina State University (lead US institution)
Philippines Bureau of Fisheries and Aquatic Resources
Central Luzon State University (Philippines)
North Carolina State University (USA)
Southeast Asian Fisheries
Development Center (Philippines)
Ujung Batee Aquaculture Center (Indonesia)
University of Arizona (USA)

Personnel/Host Country PI

Russel Borski (lead US PI)
Nelson Lopez
Remedios Bolivar, Emmanuel Vera Cruz, Wilfred Jamandre
Peter Ferket, Charles Stark, Upton Hatch
Felix Ayson, Evelyn Grace de Jesus-Ayson,
Anicia Hurtado, Nelson Golez
Sugeng Raharjo
Kevin Fitzsimmons

Improving Sustainability and Reducing Environmental Impacts of Aquaculture Systems in China, and South and Southeast Asia

University of Michigan (lead US institution)
Hainan University (China)
Huazhong Agricultural University (China)
Institute of Agriculture and Animal Sciences (Nepal)
Shanghai Fisheries University (China)
University of Agriculture and Forestry (Vietnam)
Wuhan University (China)

James Diana (lead US PI)
Lai Qiuming
Wang Weimin
Madhav K. Shrestha
Yang Yi
Le Thanh Hung
Song Biyu

Developing Sustainable Aquaculture for Coastal and Tilapia Systems in the Americas

University of Arizona (lead US institution)
Guyana Department of Fisheries
Texas Tech University (USA)
Universidad Juárez Autónoma de Tabasco (México)
Universidad Autonoma de Tamaulipas (México)

Kevin Fitzsimmons (lead US PI)
Tejnarine Geer
Reynaldo Patino
Wilfrido Contreras Sánchez
Pablo Gonzalez Alanis

Human Health and Aquaculture: Health Benefits through Aquaculture Sanitation and Best Management Practices

University of Hawai'i at Hilo (lead US institution)
Central American University (Nicaragua)
Center for Research for Research for Food &
Development (México)
Universidad Autónoma de Sinaloa-Culiacán (México)
Universidad Autónoma de Sinaloa-Mazatlán (México)
Louisiana State University (USA)

Maria Haws (lead US PI)
Agnes Saborio Coze
Omar Calvario Martinez
Eladio Gaxiola Camacho
Guillermo Rodriguez Domingo
John Supan

Development of Alternatives to the Use of Freshwater Low Value Fish for Aquaculture in the Lower Mekong Basin of Cambodia and Vietnam: Implications for Livelihoods, Production and Markets

University of Connecticut at
Avery Point (lead US institution)
Cantho University (Vietnam)
Inland Fisheries Research
and Development Institute (Cambodia)
University of Connecticut (USA)
University of Rhode Island (USA)

Robert Pomeroy (lead US PI)
Le Xuan Sinh, Tran Thi Thank Hien
Hap Navy, Prum Somany, So Nam
Sylvain De Guise, Tessa Getchis
David Bengtson

Improving Competitiveness of African Aquaculture through Capacity Building, Improved Technology, and Management of Supply Chain and Natural Resources

Purdue University (lead US institution)
Tanzania Aquaculture Development Division
Kwame Nkrumah University of
Science and Technology (Ghana)
Moi University (Kenya)
Sokoine University of Agriculture (Tanzania)
University of Arkansas at Pine Bluff (USA)
Virginia Tech University (USA)

Kwamena Quagraine (lead US PI)
Kajitanus O. Osewe
Stephen Amisah, Paul Sarfo-Mensah
Charles Ngugi, John Makambo
Sebastian W. Chenyambuga
Carole R. Engle, Aloyce R. Kaliba
Emmanuel A. Frimpong

AquaFish CRSP
Oregon State University
418 Snell Hall
Corvallis OR 97331-1643 USA
<http://pdacrsp.oregonstate.edu>



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AQUAFISH CRSP CONTACT INFORMATION

AquaFish CRSP and Aquaculture CRSP publications can be accessed online at <http://pdacrsp.oregonstate.edu/pubs/publications.html>.

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Your comments, stories, student profiles, and photos are always welcome! Send information to aquafish@oregonstate.edu (please include "Aquanews" in the subject line).

Program Director: Dr. Hillary S. Egna
Aquanews Editor: Dr. Kara Warner
Student Support: Aaron Zurcher

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