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Dr. Le Xuan Sinh in Tanzania July 2012

USAID BREATHES NEW LIFE INTO AQUAFISH...



Fish cages in Phewa Lake, Nepal. (Photo by Stephanie Ichien)

After about a year and a half of operating in limbo, in March 2013 AquaFish got the green light to continue on when USAID awarded Dr. Hillary Egna and Oregon State University a 5-year extension. Significant changes within USAID along with the two external reviews in 2012 prompted many changes. No longer operating under the Collaborative Research Support Program (CRSP) name, AquaFish is now called the **Feed the Future Innovation Lab for Collaborative Research on Aquaculture & Fisheries**, or AquaFish Innovation Lab for short. AquaFish was also asked to consolidate projects and focus more intentionally on fewer countries and fewer species. The program maintains its primary mission to improve livelihoods and promote health through collaborative research in aquaculture and fisheries through four interrelated themes:

- A. Improved Human Health and Nutrition, Food Quality, and Food Safety
- B. Income Generation for Small-Scale Fish Farmers
- C. Environmental Management for Sustainable Aquatic Resources Use
- D. Enhanced Trade and Investment for Global Fishery Markets

Monday 1 April 2013 officially marked the start of Phase II of AquaFish. Five restructured continuing projects in Asia and Africa responded to a restricted RFP. The continuing projects submitted proposals in early May and have progressed through an NSF-style external peer-review along with a programmatic review involving USAID, the Nutrition Innovation Lab, and the Program Management Office (PMO).

In Phase II of AquaFish, the program will build on successes of the previous CRSP efforts, strengthening longstanding collaborative partnerships and forging new ones. Phase II research will focus on improving the sustainable productivity of

– SUCCESS STORY – SEAWEED FARMING IN ACEH, INDONESIA

By Kevin Fitzsimmons (University of Arizona) and Russell Borski (North Carolina State University)

The production of seaweeds became an important aspect of a CRSP sponsored project to assist with restoration of aquaculture in the tsunami impacted zones of Aceh province in Indonesia. While it was initially a minor component of the project, it took on increasing prominence as the families in Aceh began to appreciate the ecological, economic, and nutritional value of the seaweeds being grown in the ponds. Families began to consume seaweed as a vegetable, process it for agar as a cooking ingredient, and dry it for commercial agar production. We feel that this is an especially successful aspect of our work. It has also been documented in a video featured on a YouTube channel for sustainable development, <http://www.youtube.com/watch?v=5nRR202IEMg>.

The 9.0 magnitude earthquake that struck the Aceh Province of Indonesia in 2004 impacted 30,000 households who had registered aquaculture as being the primary source for household income. The vast majority of these families had small tambaks (ponds of less than one hectare) that were used for the monoculture of penaeid shrimp. The survivors wanted to return to aquaculture, but recognized that the removal of mangroves for shrimp culture may have contributed to the scope of the disaster. Even before the tsunami they were impacted by degradation of water quality, diseases in shrimp, and low prices due to over-production.

Researchers at the Southeast Asian Fisheries Development Center (SEAFDEC) have pioneered mangrove friendly shrimp farming technologies and have been active in publication and dissemination of these methods (Primavera 2000; Tadokoro et al. 2000). These include



Drying fresh *Gracilaria* on a newly constructed drying table. (photo courtesy of the authors)

use of mangroves, seaweeds, and bivalves as biofilters. Early in the project, scientists from Southeast Asian Fisheries Development Center / Aquaculture Department (SEAFDEC/AQD), North Carolina State University, and University of Arizona held workshops on seaweed farming as a method of diversification and pond sustainability. The University of Arizona had developed red algae (*Gracilaria*) farming techniques that are especially useful to integrate with shrimp and/or tilapia production to remove nutrients from effluents (Nelson et al. 2001). Similar work in China (Yang et al. 2005), Colombia (Gautier 2002), and Thailand (Menasveta 2002) provided additional examples of seaweed polyculture from several distinct environments. We began our workshops by explaining the life cycle of the seaweeds, their ecological role, and by providing copies of a hatchery manual we had prepared under an earlier project.

In the following year, the AquaFish team expanded upon the earlier research and workshops on seaweed polyculture in ponds by holding a series of training workshops with a focus on post-harvest seaweed processing techniques. These included how to make edible products from seaweeds grown in shrimp ponds and how to process the seaweed for commercial sale to a seaweed broker for production into agar. The team worked closely with colleagues from the Ujung Batee

Seaweed continued on page 3...



Dried seaweed (*Gracilaria*) in a bailing bag. (photo courtesy of the authors)

...Seaweed continued from page 2.

Aquaculture Center (UBAC) in Aceh, and also recruited Maria Luhan and Evelyn De Jesus-Ayson of SEAFDEC-AQD in the Philippines to assist with the trainings. Sidrotun Naim, a female graduate student from Indonesia also assisted with the workshops. The target audience for the workshops was women, and it was a valuable opportunity to have Maria, Evelyn, and Sidrotun as experts to lead and interact with the workshop attendees.

The two-day training was set in the town of Sigli, one of the more severely devastated areas struck by the 2004 tsunami, about 112 kilometers east of the city of Banda Aceh. AquaFish HC-CoPI Hassan Hasanuddin from UBAC purchased and delivered bamboo and ropes for building the demonstration seaweed-drying table and worked with Mr. Muhammed, a community leader to start construction of the drying table.

The first day of the workshop consisted of presentations by Maria and Evelyn on the reasons for seaweed processing, proper drying technique for avoiding contamination, and how to construct sturdy tables from local materials for drying large quantities of seaweed. Primarily attended by shrimp pond owners and managers, the workshop also involved officers from the local Department of Fisheries, who attended in order to extend these new techniques to other towns and villages.

Each of the participating local shrimp farmers operates a tambak (a less than one-acre pond) that serves as the main source of family income and most had adopted the polyculture of *Gracilaria* seaweed in the ponds as recommended on earlier AquaFish visits. Many of the participants had seen improved shrimp survival and growth with luxuriant seaweed growth; however, their initial attempts to sell the seaweed to professional buyers had failed. The farmers had pulled the seaweed from the ponds and were dried it on the pond bank. This method contaminated their seaweed with sand and snail shells and the bottoms of their piles decomposed rather than drying properly. The techniques and tools

discussed in the workshop provided farmers with the tools and knowledge to prevent contamination and even how additional processing could yield pharmaceutical grade agar.

On the second day of the workshop, Maria and Evelyn focused on home uses of *Gracilaria* and other seaweeds. They provided several recipes and prepared a few of the products in groups. The first group took finely chopped fresh *Gracilaria* and mixed it with wheat-based flour, seasonings, and a little water to form a small ball of dough that was then flattened through a tortilla-type press. The resulting chip was then deep fried in oil to make a seaweed-flavored chip. The second group lightly cooked the seaweed (blanched) and then prepared a casserole style meal with onions, carrots, potatoes, tomatoes, and some local vegetables. The third group boiled their seaweed and then strained it through tightly twisted cheesecloth and collected the raw agar. The agar was then frozen and thawed and allowed to separate to create a partly processed agar, commonly used as a thickener for cooking or as the main ingredient in several kinds of candy.

In another activity, the AquaFish team traveled to Jakarta at the invitation of the CP Prima Group, a global shrimp producer in Indonesia. They met with 23 senior managers from CP Prima to give a formal presentation and discussed options for polyculture of shrimp with fish and seaweeds. As the biggest shrimp farming company in Indonesia, their ability to produce large quantities of seaweed for commercial agar markets would be considerable. CP Prima has begun trials with seaweeds, but has not moved to a commercial scale yet.

The AquaFish team and several of the farmers in Aceh also met with Mr. Zarkasyi Bin Ismail, a seaweed buyer in Medan, Sumatra. The meeting was focused on negotiations over both price and contributions from the buyer. The final agreement was that the buyer would lend money to the farmers to build four additional drying tables, in addition to the two tables AquaFish had

Seaweed continued on page 5...



Workshop participants with USPI Dr. Kevin Fitzsimmons preparing a few of the new seaweed dishes. (Merged photos courtesy of the authors)

AQUAFISH DIRECTOR HILLARY EGNA HONORED FOR HER CONTRIBUTIONS TO AQUACULTURE



Photo from crsps.net/2013/

In recognition of her impact on the field of aquaculture, Dr. Hillary Egna was presented the Honorary Life Award by the World Aquaculture Society (WAS) during their triennial meeting in Nashville, Tennessee on 22 February 2013. The first woman to receive the award since its inception in 1963, Hillary was nominated by WAS members for her "longstanding and significant contribution" to the field of aquaculture.

Harry Rea, former AquaFish CRSP USAID Agreement Officer Representative congratulated Hillary on her award: "The AquaFish CRSP

and its predecessors owe much of their success to Hillary's untiring technical and administrative leadership. Perhaps her greatest contribution has been her leadership in forming partnerships with host-country partners that have led to those partners being true partners and leaders in the CRSP" (CRSP Digest March 2013). Harry, who recently retired from USAID, has worked with Hillary for 22 years.

Please see the CRSP Digest webpage for more on Hillary's award: crsps.net/2013/ and page 16 of the June 2013 (Vol.44 No.2) issue of "World Aquaculture," the WAS magazine.

Additionally, Hillary was recongized by the Asian Fisheries Society (AFS) at the 10th Asian Fisheries and Aquaculture Forum (10AFAF) with the Merit Award for Service to the Society in recognition of her scientific achievements and her contributions to development in AFS. In attendance at 10AFAF, Hillary received the award on Tuesday 30 April 2013 at the opening ceremony in Yeosu, Korea.



Photo by Stephanie Ichien

Goings-on in the Pond...



KUDOS to Harry Rea, our esteemed Agreement Officer Representative (AOR) at USAID who retired at the end of 2012 after many years of dedicated work. Harry will be missed as we move forward into this next phase of AquaFish, and we wish him the best of luck in all his future endeavors. We extend a hearty congratulations to Harry on his retirement.*

*Even in his retirement, Harry continues to work as needed a few days per week at USAID and remains a valube asset to the AquaFish community.

Congratulations to AquaFish HCPI Dr. Chalres Ngugi, who was honored with the award for the Elder of the Order of the Burning Spear. The award was presented to Charles on 12 December 2012 by the President and Commander-in-Chief of the Defense Forces of Kenya in recognition of outstanding services rendered to the nation in various capacities and responsibilities.

The first ISTA conference was held in Nazareth, Israel in 1983, and now, 30 years later it is returning to Israel on 6-10 October 2013. This will be the 10th of a highly successful series of symposia that will draw together researchers, farmers, business persons, and policy makers from all over the world to review the latest discoveries in tilapia nutrition, physiology, reproductive biology, genetics, ecology, improvements in production systems, and other fields related to tilapia. Co-sponsored by Aquafish, ISTA10 will provide the opportunity to reflect on 30 years of research and development of the tilapia industry as well as highlight recent innovations and future prospects. The ISTA10 website can be viewed at: www.ista10.com

The AquaFish Management Team is pleased to welcome new additions to the Project Management Office at Oregon State University as we gear up for Phase II. Paris Edwards and Caleb Price join the team as our Training, Gender, & Capacity Building Coordinators. Jenna Borberg and Kat Goetting join us as our new Communicaton and Outreach Maangers. We are excited to involve our new team members in working towards the AquaFish mission.

The Walimi Fish Farmers Cooperative Society (WAFICOS) held a succesful Sixth Fish Farmers Symposium and Trade Fair on 23-25 January 2013 in Kampala, Uganda. Involving many AquaFish partners as presenters, the symposium and trade fair attracted fish farmers, researchers, and technical advisors from the whole region. Please see the AquaFish website for the Agenda and pictures of this year's event: <http://aquafishcrsp.oregonstate.edu/events.php>

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aquaculture through the development and transfer of innovative technologies that address a few key elements:

- The health and nutrition needs of our target communities, particularly women and children;
- Natural resource management, climate change, and biodiversity issues with targeted activities that protect native fisheries and the integrity of local and regional water systems; and
- Market development by linking small producers to markets and training rural stakeholders in food safety and food quality standards.

As part of the new Feed the Future Food Security Innovation Center, AquaFish moves forward under the Program for Research on Nutritious and Safe Foods, which "addresses undernutrition, especially in women and children, by increasing the availability and access to nutrient dense foods through research on horticulture crops, livestock, fish and dairy, food safety threats such as mycotoxins and other contaminants and on household nutrition and food utilization" (R. Bertram 12/07/12).

Moving forward AquaFish forges new beginnings, building on a long history of fruitful work. Already there is an established foundation for the AquaFish Innovation Lab to build upon. Since inception in 2006, the AquaFish CRSP core and associate award research projects have operated in 20 countries with 33 Host Country and 17 US partners. Over 100 investigations have been successfully completed. Scholarly output has been significant through

the publication of over 150 peer-reviewed journal articles. AquaFish CRSP research and outreach activities have resulted in 9,983 hectares under improved technologies or management practices. AquaFish CRSP has leveraged nearly 7 dollars of extramural support for every dollar committed by USAID. A capacity building effort has to date supported 344 degree-students, of whom 48% are women and are all part of an international network of aquaculture scientists and professionals ensuring the long-term success of in-country accomplishments. Over 7,100 individuals have benefitted from 224 short-term training events on a variety of topics offered by the AquaFish CRSP around the World.

The AquaFish Innovation Lab will continue to operate in the same manner as the previous CRSP whereby OSU serves as the Lead US Institution and partners with other institutions in the US and internationally. Continuing to build on the interconnected network of researchers worldwide, the Program will collectively work to fulfill the overall AquaFish mission to enrich livelihoods and promote health by cultivating international multidisciplinary partnerships that advance science, research, education, and outreach in aquatic resources. Bringing together resources from US and Host Country institutions, AquaFish strives to strengthen the capacities of its participating institutions, to increase the efficiency of aquaculture and improve fisheries management in environmentally and socially acceptable ways, and to disseminate research results to a broad audience.



(photo by Prum Somany)



(photo by Charles Nguji)



(photo Courtesy of Russell Borski)



(photo by Peg Herring)

...Seaweed continued from page 3.

sponsored. The farmers would repay the loan in quarters taken from their first four shipments, which would consist of 14 MT of dried seaweed with not more than 20% moisture. Mr. Ismail also agreed to deliver two baling machines and baling ties for the farmers to use to compress and tie the seaweed into the 35 kg bales preferred for transportation. The bailers would remain the property of the seaweed buyers firm, Pt. Kruengoo. The intent was to supply 600 MT per month from the Sigli farmers at a price of 3,500 rupiahs per kg.

Overall, the project has been productive and rewarding. The farmers are on the verge of benefitting from a significant new revenue stream that comes entirely from a by-product of improving pond water quality. Evelyn and Maria had a great rapport with the women of Sigli, who have a new highly nutritious aquatic vegetable to prepare in several recipes. They now understand how to process the seaweed to generate agar for use as a thickening agent in cooking or as a base for making candies and desserts.

Students at the elementary school also listened in on the

presentations, and watched the cooking demonstrations. By being exposed to the benefits of growing seaweeds on the farm and to the variety of recipes and preparation methods, we believe they will be more interested in promoting the adoption of seaweed into the family diet and as a profitable side venture of aquatic farming.

Seaweed farming is an important industry across much of Indonesia, but had never been introduced to Northern Sumatra. The Visual Backstory prepared by Vanda Gerhart has received considerable play on YouTube <http://www.youtube.com/watch?v=5nRR202IEMg> and other linked sites. We hope that this exposure will contribute to interest in the project, and spur additional participants to add seaweed to their farming practices and to look for more seaweed products in their markets. We are pleased that our efforts have succeeded in generating new income and improving nutrition for many families in the shrimp farming area and at the same time, contributed to making shrimp farming more sustainable. An impact assessment of activities indicates that almost 400 ha of farms are now producing seaweed in polyculture with shrimp in Aceh, Indonesia.

AQUAFISH STUDENT CORNER

GRADUATE STUDENT PROFILE:

JOHN WALAKIRA

By Paris Edwards

The African Lungfish, a fish native to Uganda, could play a key role in food security and income for fish farmers. This is the focus of AquaFish student researcher, John Walakira, a Ugandan PhD candidate at Auburn University. John has dedicated several years to exploring the prospects of lungfish farming. His dissertation, "Culture of African Lungfish (*Protopterus* spp) in Uganda: Prospects in Aquaculture Development, Growth Performance in Tanks, and Potential Pathogens," will help develop methods and technologies to increase fish productivity and reduce disease—work that is critically important to aquaculturalists and to threatened wild fish populations. Working alongside AquaFish US PI, Dr. Joseph Molnar and the National Fisheries Resources Research Institute in Kampala, John will continue his research and expand his focus on income generation and nutrition for small-scale farmers in Uganda.

John has been involved with AquaFish for the past several years, building on his biological sciences degree from Makerere University in Uganda. His research began with a pilot study on indigenous species, "Prospects and Potential of the African Lungfish (*Protopterus* Spp): An Alternative Source of Fishing and Fish Farming Livelihoods in Uganda and Kenya" with AquaFish researchers, Joe Molnar and Charles Ngugi. Initially, a part of the 2011 AquaFish Air Breathing Fishes Symposium in Shanghai, China, this work explored the aquaculture potential for lungfish while considering indigenous knowledge and practices of fish farming and incorporating the information into technical improvements.



Lungfish market in Bwaise, Kampala—In some Kampala suburbs, kiosks that used to sell Nile perch products commonly known as "file" are now substituting African lungfish. Wholesale prices for fresh lungfish range between US \$ 0.90 to 1.80 per kg while retail prices can go beyond US \$ 2.50 per kg depending on the location. (Photo and text excerpted from 09IND07AU Final Report by John Walakira and Gertrude Atukunda)



Photo Courtesy of John Walakira

John has also championed the virtue of the African Lungfish for its resilience to climate change and attending role in long-term food security. Air breathing fishes are less vulnerable to climate variability, specifically the threat of "drought and stressed water quality conditions."

Aquaculture is a fast-growing industry in Uganda, although, according to John, "demand is high but production is still low." He attributes some of the challenges in aquaculture to the "slow improvements in quality and quantity of seed and feed." Additionally, the high cost of commercial feed is "still too high for small-scale farmers." John's most valued experiences with AquaFish include sharing knowledge and learning research skills through working with scientists and farmers globally. He plans to continue to mentor young scientists and managers in aquaculture, and to join farmers in developing the aquaculture industry in Uganda.

AquaFish is proud to announce that John is the recent winner of the SARNISSA-ASAKUA Fish Health Competition. His awarded work focused on bio-control strategies for fish disease in Uganda by using banana leaf extracts in aquaponic systems. His work will reach a broad network of African aquaculturalists through SARNISSA, an organization dedicated to improving communication between the stakeholders in the aquaculture development industry across sub Saharan Africa.

John is now embarking on a new project entitled, "Development of Low-Cost Captive Breeding and Hatching Technologies for the African Lungfish (*Protopterus* spp) to Improve Livelihoods, Nutrition and Income for Vulnerable Communities in Uganda." This project will help determine the genetic diversity of the endemic lungfish and help develop captive breeding techniques through an assessment of reproductive activity and traditional breeding practices. These practices will be evaluated for productivity and profitability with the ultimate goal of developing simple, adoptable and productive breeding techniques. Through this study, John furthers his personal goal to improve lives in communities reliant on the culture of fish.



AQUAFISH STUDENT CORNER

THE THIRD SHANGHAI OCEAN UNIVERSITY-AQUAFISH YANG YI YOUNG SCIENTIST TRAVEL AWARD

The 10th Asian Fisheries and Aquaculture Forum (10AFAF) was held in Yeosu, Korea from 30 April to 4 May 2013. During the opening ceremony, Dr Youji Wang and Ms Dongmei Zhu were conferred the third Shanghai Ocean University-AquaFish Yang Yi Young Scientist Travel Award. The vice president of the selection committee, Prof. Shuoling Huang from Shanghai Ocean University, and the AquaFish Director, Dr. Hillary Egna from Oregon State University presented the two excellent young scientists with this award, with about 600 attendees present.

The Yang Yi Young Scientist Award was proposed by Dr. Hillary Egna and was established in association with Shanghai Ocean University in honor of Professor Yang Yi who passed away in 2010. The award was created in remembrance of Prof. Yang Yi, and to support young scientists in aquaculture and fisheries attending international academic conferences. The selection process began in 2012, when the selection committee nominated six candidates from Bangladesh, Thailand, Malaysia and China. Dr. Wang and Ms. Zhu were selected as recipients of this year's award by selection committee vote.

During the 10AFAF symposium, Dr. Wang gave an enlightening presentation entitled "Anti-predatory responses of the green-lipped mussel *Perna viridis* under hypoxia and low salinity," in which he discussed anti-predatory responses, including production and growth of the cultured green mussel species under low salinity and hypoxic conditions. He evaluated the potential effects of salinity and hypoxia on the green mussel in coastal and estuarine areas. Ms. Zhu gave a talk entitled "Establishment and characterization of a fin cell line from blunt snout bream, *Megalobrama amblycephala*,"



Dongmei Zhu and Youji Wang pose with the award certificates presented to them by Hillary Egna (far left) and Shuoling Huang (far right). (Photo Courtesy of Liping Liu)

showing a new method for fish cell culture in vitro, as well as its application in aquaculture. Both talks aroused much peer attention and many attendees expressed their interest in their studies.

The Shanghai Ocean University-AquaFish travel award has funded four young scientists attending international conferences since 2010 when the fund was established. The awardees said that they would carry forward Prof. Yang's devotion and spirit for aquaculture, and continue to make contributions for development and collaboration of global aquaculture.

For more information on the Yang Yi Young Scientist Travel Fund and Award, please email AquaFish at: aquafish@oregonstate.edu

The next Shanghai Ocean University-AquaFish Yang Yi Young Scientist Travel Award will be given during the World Aquaculture Society Conference in Vietnam December 2013.

4TH SYMPOSIUM ON GENDER IN AQUACULTURE AND FISHERIES

Held in conjunction with 10AFAF, the Fourth Global Symposium on Gender in Aquaculture and Fisheries (GAF4) took place on 30 April 2013- 4 May 2013 in Yeosu. Sponsored in part by AquaFish, the symposium was chaired by Dr. Meryl Williams, highlighting the gendered nature of change in aquaculture and fisheries. On the first day of the symposium, AquaFish Director, Dr. Hillary Egna chaired Session One, "Gendered Change" with Co-Chair, Dr. Kyoko Kusakabe. The session focused on the capabilities and vulnerabilities with respect to changes in the aquaculture and fisheries sector (environmental, social, cultural, and economic). For more on GAF4, please visit the Gender in Aquaculture and Fisheries website at: genderaquafish.org

BORLAUG LEAP FELLOW: AKUFFO AMANKWAH

Congratulations to Akuffo Amankwah, who was awarded a Borlaug LEAP Fellowship in April 2013. The Borlaug Leadership Enhancement in Agriculture Program (LEAP) provides support for thesis research conducted by graduate students from developing countries, and recognizes students who demonstrate strong scientific and leadership promise. Pursuing his PhD at Purdue University under the mentorship of AquaFish USPI, Dr. Kwamena Quagraine, Akuffo has been involved with the AquaFish Strategic Investment in Rapid Technology Dissemination (SIRTD) Associate Award Project, entitled "Feed the Future: Enhancing the Profitability of Small Aquaculture Operations in Ghana, Kenya, and Tanzania."

For more on Borlaug LEAP: leap.ucdavis.edu/study/leap

Notices of Publication

Notices of Publication announce recently published work carried out under AquaFish sponsorship. To receive a full copy of a report, please contact the author(s). All past and present Notices of Publication can be found on the AquaFish website at:

aquafishcrsp.oregonstate.edu/publications.php

Is lower intensity aquaculture a valuable means of producing food? An evaluation of its effects on near-shore and inland waters (12-307)

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The effects of aquaculture on the environment have been the subject of much examination, but most of the focus has been on shrimp and salmon. These are not the most common species grown in aquaculture, nor the most common systems used. About 60% of production today uses lower intensity culture to produce organisms in natural systems such as ponds. This paper is an overview of the positive and negative environmental impacts of lower intensity aquaculture. The ranked positive impacts of lower intensity aquaculture include: conservation aquaculture that supplements reproduction in natural populations; improving the quality of natural waters through filtering or consuming wastes by cultured organisms; reducing pressure on wild stocks by providing alternative sources in the market; and replacing damaging employment with more sustainable aquaculture jobs. Negative impacts include: escapement of alien species that become invasive; eutrophication of receiving waters from pond effluents; release of parasites and diseases into natural communities; escapement of unique genotypes resulting in genetic alteration of native stocks; land degradation due to pond construction; release of antibiotics or other drugs into receiving waters; depletion of natural resources such as water; loss of benthic biodiversity from settling of sediments; and reductions in natural populations by collection of larval or juvenile fish. Some impacts, especially the use of fishmeal and the transmission of disease, are much less common in lower intensity aquaculture systems. Aquaculture has an important role in current and future food production, and in many cases lower intensity aquaculture provides a sustainable solution to increased aquaculture production.

This abstract was excerpted from the original paper, which was published in *Reviews in Aquaculture* (2012) 4, 234-245

Production of "Chame" (*Dormitator latifrons*, Pisces: Eleotridae) larvae using GnRH α and LHRH α (12-308)

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The Pacific fat sleeper is a potential species for aquaculture in Latin American countries. Nevertheless, production depends on wild-caught juveniles, thus needing hatchery produced larvae. **Objective:** the purpose of this study was to determine the ideal conditions for viable gamete release and larvae laboratory production. **Methods:** a total of 16 mature male and 16 female fish were allocated to one of four groups (n=4) that were injected with either saline solution, Desgly10-Ala6 LHRH α , salmon GnRH α + domperidone, or implanted with salmon GnRH α . **Results:** spermiation was observed in all treatments. Spawning rates were 100% at 24 and 48 h for the GnRH α implanted group, 25% for the LHRH α group, and 0% for the salmon GnRH α + domperidone group (48-72 h post injection). **Conclusion:** GnRH α and LHRH α are a successful tool for chame induced reproduction. A gross morphological description of oocytes, sperm quality, and first stages of larval development is included.

This abstract was excerpted from the original paper, which was published in Spanish in *Revista Colombiana de Ciencias Pecuarias* (2012) 25, 422-429

Comparison of proximate composition, amino acid and fatty acid profiles in wild, pond- and cage-cultured longsnout catfish (*Leiocassis longirostris*) (12-309)

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The proximate composition, amino acid and fatty acid profiles in the filets of wild, pond- and cage-cultured longsnout catfish (*Leiocassis longirostris*) were determined to identify nutritional differences. Wild fish showed higher (P < 0.05) moisture and viscerosomatic index (VSI), but lower (P < 0.05) protein, ash and gross energy than cage-cultured fish. Pond-cultured fish contained lower (P < 0.05) protein and ash contents, but higher VSI compared to cage-cultured fish. The amino acid of glycine content was higher (P < 0.05) in wild fish than in pond- and cage-cultured fish. Most of the fatty acids had a significant difference among all fish groups. The percentages of total polyunsaturated fatty acids (\sum PUFAs) were higher (P < 0.05) in wild and pond-cultured fish than in cage-cultured fish. Pond-cultured fish had higher (P < 0.05) \sum n-3 PUFAs, eicosapentaenoic acid (EPA), docosahexaenoic acid (DHA) and \sum n-3/ \sum n-6 PUFAs ratio than wild and cage-cultured fish. The differences among

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the wild, pond- and cage-cultured fish may be attributed to dietary components and environmental conditions of the fish.

This abstract was excerpted from the original paper, which was published in International Journal of Food Science and Technology (2012) 7, 1772-1776.

Open-water integrated multi-trophic aquaculture: environmental biomitigation and economic diversification of fed aquaculture by extractive aquaculture (12-310)

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Integrated multi-trophic aquaculture (IMTA) seeks to biodiversify fed aquaculture (e.g. finfish or shrimps) with extractive aquaculture, recapturing the inorganic (e.g. seaweeds) and organic (e.g. suspension- and deposit-feeders) nutrients from fed aquaculture for their growth. The combination fed/extractive aquaculture aims to engineer food production systems providing both biomitigative services to the ecosystem and improved economic farm output through the co-cultivation of complementary species. Major rethinking is needed regarding the definition of an 'aquaculture farm' and how it works within an ecosystem. The economic values of the environmental/societal services of extractive species should be recognized and accounted for in the evaluation of the full value of these IMTA components. Seaweeds and invertebrates produced in IMTA systems should be considered as candidates for nutrient/carbon trading credits. While organic loading from aquaculture has been associated with localized benthic impacts, there have also been occurrences of increased biodiversity and abundance of wild species in response to moderate nutrient enrichment and the use of infrastructures as substrates. To develop efficient food production systems, it will be important to understand and use the duality of nutrients (essential when limiting/polluting when in excess) to engineer systems producing them in moderation so that they can be partially recaptured while maintaining their concentrations optimal for healthy and productive ecosystems. Measures of species diversity, colonization rates, abundance, growth and ecosystem functions with respect to nutrient partitioning and recycling, species interactions and

control of diseases could represent valid indicators for the development of robust performance metrics.

This abstract was excerpted from the original paper, which was published in Reviews in Aquaculture. (December 2012), 4:4, pages 209–220.

Comparative analysis of water quality in *Litopenaeus vannamei* ponds and nutritional quality of shrimp muscle (12-311)

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From May to September in 2010, water quality parameters such as water temperature, total dissolved salt, dissolved oxygen, pH, transparency, nitrite nitrogen, ammonia nitrogen, nitrate nitrogen, total nitrogen, reactive phosphorus, chlorophyll-a and biochemical oxygen demand were analyzed in 22 *Litopenaeus vannamei* ponds with different culturing methods in Fengxian District, Shanghai. Water used for Farm No. 1 was natural fresh water which had been precipitated before being introduced to the ponds. Mixed salt were added to the freshwater for culturing shrimp in Farm No. 2. Results were as follows: water temperature, dissolved oxygen and pH didn't change dramatically and could match the demand of *Litopenaeus vannamei*. The Proportion of nitrate nitrogen in ponds to TIN was the highest, the ratio of ammonia nitrogen to TIN increased with time extension, and that of nitrite nitrogen to TIN increased obviously in the later period of the culture cycle. Contents of reactive phosphorus decreased gradually while the total phosphorus increased in the whole process of culture. Biochemical oxygen demand and chlorophyll-a also increased gradually with the shrimp growing up. Muscle nutritional quality of *Litopenaeus vannamei* from the two farms were analyzed and the result were as follows: contents of crude protein and crude fat of shrimp muscle in Farm No. 1 were 16.30% and 1.42% respectively, lower than those in shrimp muscle from Farm No. 2 which were 18.30% and 1.61%. Content of total amino acids in shrimp from Farm No. 1 was 23.27%, and the essential amino-acid was 9.09%. While those in shrimp from Farm No. 2 were 27.52% and 10.74% respectively. Contents of flavor amino acids in shrimp Farms No. 1 and 2 were 8.52% and 10.16% respectively.

This abstract was excerpted from the original paper, which was published in the Journal of Shanghai Ocean University. (2012) 21(6), 955-964 (In Chinese with English abstract)

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Research on artificial seawater quality in the *Penaeus vannamei* larval breeding ponds (12-312)

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In order to overcome the losses caused by long-distance transportation, we try to use artificial seawater for *Penaeus vannamei* larval breeding locally. In 2011, we added seawater crystal and coarse salt to the natural freshwater from adjacent river for *Penaeus vannamei* larval breeding in Fengxian district of Shanghai. During the breeding period, we monitored water quality everyday and the results were as following: DO was 7.3(±0.10) mg/L, pH was 8.00(±0.04), temperature was 28.2(±0.20)°C, PO₄-P was 0.88(±0.14) mg/L, TP was 1.46(±0.14) mg/L, NO₂-N was 0.21(±0.02) mg/L, NO₃-N was 1.52(±0.10) mg/L, TNH₄-N was 2.88(±0.34) mg/L, TN was 7.01(±0.36) mg/L, and CODMn was 18.05 (±1.40) mg/L. Biological and chemical methods were used for water quality control to create a good environment for larval growth.

This abstract was excerpted from the original paper, which was published in Guangdong Agricultural Science. (2012)1, 120-123 (In Chinese with English abstract)

Study on variation characteristics and correlation analysis of major ecological factors in intensive shrimp ponds (12-313)

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To study the variation characteristics and correlation of major ecological factors in intensive shrimp farming ponds, we measured 16 aquatic ecological factors including the concentration of chlorophyll a (Chl-a) as well as the density of zooplankton, heterotrophic bacteria and vibrio, active phosphorus (PO₄-P), etc. in 3 farming ponds of *Litopenaeus vannamei* in Paipu, Danzhou, from April to July in 2011. The results show that the values of DO, pH and transparency decreased slowly, and the total suspended solids (TSS), chemical oxygen demand (COD), nitrite nitrogen (NO₂-N), ammonia nitrogen (NH₄⁺-N) as well as the density of zooplankton, heterotrophic bacteria and vibrio slowly increased during the culture period. The concentration of Chl-a was low in the earlier stage but increased gradually in the mid and latter stages; Chl-a had a very significant positive correlation with NO₃-N and a negative correlation with PO₄-P. The density of Copepod had a very significantly positive correlation with TSS and a significantly positive correlation with the density of heterotrophic bacteria, vibrio and rotifer, but had no significant correlation with Chl-a and COD. The density of heterotrophic bacteria had a very significant positive correlation with COD and

TSS, but had a significantly negative correlation with transparency. The density of vibrio was very significantly correlated with TSS and COD, but had a significantly negative correlation with pH and DO.

This abstract was excerpted from the original paper, which was published in South China Fisheries Science. (2012) 8(4), 49-56 (In Chinese with English abstract)

Responsible aquaculture in 2050: valuing local conditions and human innovations will be key to success (13-314)

James S. Diana, Hillary S. Egna, Thierry Chopin, Mark S. Peterson, Ling Cao, Robert Pomeroy, Marc Verdegem, William T. Slack, Melba G. Bondad-Reantaso, and Felipe Cabello

As aquaculture production expands, we must avoid mistakes made during increasing intensification of agriculture. Understanding environmental impacts and measures to mitigate them is important for designing responsible aquaculture production systems. There are four realistic goals that can make future aquaculture operations more sustainable and productive: (1) improvement of management practices to create more efficient and diverse systems at every production level; (2) emphasis on local decisionmaking, human capacity development, and collective action to generate productive aquaculture systems that fit into societal constraints and demands; (3) development of risk management efforts for all systems that reduce disease problems, eliminate antibiotic and drug abuse, and prevent exotic organism introduction into local waters; and (4) creation of systems to better identify more sustainably grown aquaculture products in the market and promote them to individual consumers. By 2050, seafood will be predominantly sourced through aquaculture, including not only finfish and invertebrates but also seaweeds.

This abstract was excerpted from the original paper, which was published in Bioscience (2013) Vol. 63 No.4, pp. 255-262.

Governance of global value chains in response to food safety and certification standards: the case of shrimp from vietnam (13-315)

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We use global value chain (GVC) theory to understand governance of Vietnam's shrimp farming industry. We describe this GVC as buyer-driven with important food safety standards imposed by governments of importing countries and new certification systems promoted by nongovernmental organizations (NGOs). Governance relations are clear between governments in importing countries and Vietnam, and between importers and

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IN MEMORIAM— DR. LE XUAN SINH

It is with regret and great sorrow that we announce the sudden passing of our dear friend and colleague, Dr. Le Xuan Sinh who passed away on 5 May 2013. A long time partner with the CRSPs and with plans to continue into the next phase of the program, Dr. Sinh will be deeply missed by the whole AquaFish community. Please visit the AquaFish memorial page for Dr. Sinh on our website where you may add condolences and share memories: aquafishcrsp.oregonstate.edu/sinhmemorial/



Dr. Le Xuan Sinh with his friend and colleague, Dr. Bob Pomeroy in Shanghai, China 2011. (Photo courtesy of Bob Pomeroy)

Upcoming Meetings and Events...

The AquaFish Innovation Lab promotes workshops and meetings designed to facilitate increased knowledge and communication in aquaculture.

The 10th International Symposium on Tilapia in Aquaculture (ISTA10)

6-10 October 2013
Crown Plaza Hotel
Jerusalem, Israel
<http://www.ista10.com/>

LAQUA13: IV Latin American Conference on Culture of Native Fish

8-11 October 2013
Sonesta Hotel Convention Center
Villavicencia, Meta, Colombia
<http://www.conferenciapecesnativos2013.com/>

Aquaculture Conference: To the Next 40 Years of Sustainable Global Aquaculture

3-7 November 2013
Palacio de Congresos de Canarias, Las Palmas, Gran Canaria, Spain
<http://www.aquaculture-conference.com/>

Asian Pacific Aquaculture 2013 (WAS)

10-13 December 2013
Ho Chi Minh City, Vietnam
www.was.org

Aquaculture America 2014 (AA2014)

9-12 February 2014
Seattle, Washington, USA
www.was.org

PONDERINGS...

"Crossing the Swamp"

By Mary Oliver

Here is the endless
wet thick
cosmos, the center
of everything—the nugget
of dense sap, branching
vines, the dark burred
faintly belching
bogs. Here
is swamp, here
is struggle,
closure—
pathless, seamless,
peerless mud. My bones
knock together at the pale
joints, trying
for foothold, fingerhold,
mindhold over
such slick crossings, deep
hipholes, hummocks
that sink silently
into the black, slack
earthsoup. I feel
not wet so much as
painted and glittered
with the fat grassy
mires, the rich
and succulent marrows
of earth—a poor
dry stick given
one more chance by the whims
of swamp water—a bough
that still, after all these years,
could take root,
sprout, branch out, bud—
make of its life a breathing
palace of leaves."

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NGOs. Governance relations become more fragmented further down the chain where large numbers of small-scale producers and traders operate. This fragmentation may adversely affect access to the most lucrative markets and have the unanticipated effect of marginalizing small-scale farmers and traders.

This abstract was excerpted from the original paper, which was published in *World Development* (2013) Vol. 45, pp. 325-336.

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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).

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