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# AQUANEWS



*Sustainable Aquaculture and  
Fisheries for a Secure Future*

**FEED THE FUTURE INNOVATION LAB FOR COLLABORATIVE RESEARCH ON AQUACULTURE & FISHERIES**

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## MOBILE PHONE FISH MARKETING NETWORKS IN UGANDA, KENYA, AND GHANA

**By Lindsay Carroll**

*AquaFish Innovation Lab*

For small-scale aquaculture in Africa, some of the challenges to growth of the sector are caused by limited flow of information along the fish value chain. A value chain is a series of connected activities that add value to a product, including production, processing, marketing and sale of the product. Advancing technologies offer opportunities for key players in the fish value chain to connect where timely communication and knowledge sharing is lacking.

Addressing these challenges is critical because improving aquaculture productivity and expanding market access for rural farmers can greatly increase income generation and food security in developing nations.



(Photo courtesy of Dr. Steve Amisah)

**Training participants from a Fish Market Information System (FMIS) workshop held in Elmina, Ghana.**

For many farmers, mobile phones represent the most appropriate and efficient means of communication, further providing savings in time and money. Mobile phones give farmers access to information on prevailing market prices of

*Mobile Phone continued on page 2 ...*

### Earth Day Fair at OSU

AquaFish engages with Oregon State University (OSU) students and staff at 17th Annual Earth Day Community Fair.

### Asia Regional Meeting

AquaFish partners in Asia gather to provide updates on research progress, share lessons learned, and visit local ponds and aquaculture facilities.

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cultured fish in various markets, providing them with leverage to improve their bargaining position and sell fish at higher prices.

A blog post from November 2016, titled [Feed the Future in a Digital World: Elevating the Role of Digital Technologies in Global Food Security](#) by Christopher Burns and Judy Payne, explains the increased potential to use digital and mobile phone technology in agriculture systems, including aquaculture. Since the start of the [Feed the Future Initiative](#) in 2009, the number of people with access to mobile phones has been on the rise. Between 2010 and 2015, among the [19 countries with Feed the Future programs](#), the number of people subscribing to mobile phones increased by 75%, with an 800% increase in smartphone use.

Burns and Payne highlight that as technological capacity increases, the US Agency for International Development has transitioned from having mobile phone technology as an “add-on” concept to a “core” component needed to achieve agriculture development goals.

According to a survey conducted by the Pew Research Center in 2015, mobile phones are becoming increasingly available in Africa, with 65% of Ugandans, 82% of Kenyans, and 83% of Ghanaians owning mobile phones. To help further the advancement of technology in aquaculture, the AquaFish Innovation Lab has partnered with researchers in Uganda, Kenya, and Ghana to develop mobile-based support systems to advance information transfer on aquaculture production, marketing, and sales.

In Uganda, AquaFish researchers from Auburn University in the US and Uganda's National Fisheries Resources Research Institute (NaFFIRI) and Makerere University initiated a pilot study in 2013 to evaluate the feasibility of establishing a mobile phone system for delivering fish market data. Researchers interviewed groups of fish farmers from five separate regions of the country to assess the current uses, needs, and expectations of mobile phones for information transfer and knowledge sharing.

*Mobile Phone continued on page 3 ...*

## GOINGS-ON IN THE POND



**AQUAFISH STAFF AND PARTNERS**  
**INTERVIEWED BY MAKERERE UNIVERSITY IN UGANDA**

The College of Agricultural and Environmental Sciences at Makerere University interviewed AquaFish staff and partners while in Uganda in January 2017. AquaFish director, Dr. Hillary Egna, highlighted some of the major accomplishments of AquaFish research to increase nutrition and incomes in Ghana, Kenya, Tanzania, and Uganda. Dr. Joseph Molnar, from Auburn University, and Dr. Theodora Hyuha, Associate Professor at Makerere University, emphasized their work related to water quality, African lungfish, and a cell phone application that makes fish market data more accessible to farmers, among others. You can read the full article on Makerere's [College of Agricultural and Environmental Sciences website](#).

### **AQUAFISH RESEARCHERS PUBLISH ARTICLES IN WORLD AQUACULTURE MAGAZINE**

Two articles by AquaFish researchers were recently published in the June issue of World Aquaculture Magazine. AquaFish partners from Agriculture and Forestry University in Nepal and University of Michigan in the US contributed the article titled, “Successful Breeding of *Sahar Tor putitora* in Sub-tropical Nepal.” Partners from Bangladesh Agricultural University published an article on AquaFish work, titled “Mud Crab Aquaculture and Fisheries in Coastal Bangladesh.” Be sure to check out these articles and more on the [World Aquaculture Society Magazine website](#).

### **AQUAFISH RESEARCHERS CONTRIBUTE TO AFRICAN REPORT ON TILAPIA**

AquaFish researchers contribute to the publication of the Food and Agriculture Organization (FAO) report titled, “Social and economic performance of tilapia farming in Africa.” The report is a compilation of case studies submitted by international tilapia experts. Dr. Kwamena Quagraine, AquaFish US Principle Investigator at Purdue University, served as an editor for the full report and several AquaFish partners authored the case studies for Ghana, Kenya, and Uganda. Check out the full report on the [FAO website](#).

### **AFRICAN CHAPTER LAUNCHES AT WORLD AQUACULTURE 2017 IN SOUTH AFRICA**

In June, the African Chapter of the World Aquaculture Society launched at World Aquaculture 2017 in Cape Town, South Africa. The WAS African Chapter now joins the United States, Korea, Asia-Pacific, and Latin America and Caribbean as fully affiliated chapters. On the evening of the launch, the Chapter reported already having just over 1,275 members, representing 33 African countries. Be sure to check out the full story in a future issue of AquaNews.



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Results of the Uganda study indicated that many fish farmers currently use their mobile phones to acquire technical guidance on aquaculture and to seek information on agricultural inputs and market data from traders and other farmers. However, many farmers still rely on word-of-mouth communication from extension officers and other farmers, limiting the availability and flow of information. Fish farmers in Uganda also identified limitations and challenges to the use of mobile technology for disseminating fish market data, including poor network coverage, frequent power cuts, lack of calling credit, and lack of awareness of the service.

Armed with farmer feedback, AquaFish researchers partnered with Likamis Software Limited to develop aquaculture training modules to address technical needs, provide market information with current prices, and connect farmers with buyers through Agro Market Day's mobile application (app) (<http://www.agromarketday.com/>). Within the Agro Market Day app, an automatch algorithm populates market prices and connects buyers and sellers.

Eight technical modules were built by Auburn University and NaFFIRI related to pond design, construction, and management; fish stocking, feeding, and harvesting; and overall health and predatory control. The modules are being built for both smartphones and basic, text-based phones and the content have been translated into five languages: English, Luganda, Lunyankore, Ateso, and Acholi.

Aquaculture in Uganda includes scattered small-scale farmers, some commercial-scale pond-based farms, and other newly emerging large-scale cage farmers in the Lake Victoria region. The fast growth of mobile technology and expanding connectivity in Uganda offers great promise for more efficient and easier access to information for fish farmers across the country.

In Kenya, AquaFish researchers evaluated the feasibility of building a farmed fish marketing database into an existing network called the Enhanced Fish Marketing Information System (EFMIS) that provides market information to the capture fisheries sector. Initiated in 2009, EFMIS is a collaborative effort between the Kenya Marine and Fisheries Research Institute



(Photos courtesy of Isaac Omiat)

**AquaFish researchers in Uganda share the Agro Market Day mobile app with locals through public outreach events (upper left), workshops (upper right), and on-farm visits (lower left).**

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(Photo courtesy of AquaFish Innovation Lab)

#### **Data collection at fish market in Nairobi, Kenya.**

and the International Labour Organization. EFMS has already made significant progress in expanding information flow in Kenya.

AquaFish researchers conducted a pilot study and hosted a workshop to train fish farmers on EFMS functionality. They determined that a dedicated system for synthesizing daily market information on farmed fish to buyer and seller user groups would bolster the aquaculture sector in Kenya. Market information is available for more than 150 landing sites on Lake Victoria and demand for services has grown rapidly among users throughout the region. As a result, researchers plan to integrate market prices and data for farmed fish alongside the capture fisheries market data currently distributed through the EFMS, further extending the benefits of the system throughout Kenya.

In Ghana, AquaFish researchers from Purdue University in the US and Ghana's Kwame Nkrumah University of Science and Technology (KNUST) developed a service called the Fish Market Information System (FMIS). FMIS is a web-based tool that provides tilapia market information online as well as via voice and text messaging. AquaFish researchers collaborated with officers from the Ghana Fisheries Commission and a local programming company, Farmerline, to create a central database hosted by researchers at KNUST. The database is populated with the prices for tilapia sold at farms (farm-gate pricing) and tilapia market data from several locations throughout the country.

Farm-gate and market data are collected and uploaded to the FMIS on a regular basis by fisheries officers. Data can be entered and uploaded using mobile phones, tablets, or a computer, providing data collectors quick and easy access. Once new information is uploaded, the system then distributes this data in near real-time to both registered and ad-hoc users. Registered users automatically receive market information relevant to their location of interest, while ad-hoc users must specifically request market information.

As the use of mobile phone technology increases, this method of linking fish farmers and fishers has potential to be very effective in Ghana. Several anticipated benefits highlighted by the researchers include increased fish yields and quality, reduced post-harvest losses, and improved incomes for key people across the value chain. The marketing system could also offer a central location to enter and store tilapia market data and serve as a resource for farmers to build capacity in order to make efficient and effective business decisions.

By the end of the first two years of the project (2013-2015), Farmerline reported just over 320 registered users. At the end of the project in 2018, Dr. Steve Amisah, AquaFish researcher from KNUST, said "we are hopeful to have 5,000 registered users, including fish marketers and processors from across the southern sector of Ghana."



(Photo courtesy of Dr. Kwamena Quagrainie)

#### **Mobile phone training targeted toward market women in Ghana.**

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## ALUMNI SPOTLIGHT



Moureen Matuha, originally from Uganda, was an AquaFish student who received a Master's in Fisheries and Allied Aquaculture from Auburn University in 2015. Be sure to check out her publication in the [March 2016 issue of World Aquaculture Magazine](#) titled, "The Role of Mobile Phones in Facilitating Aquaculture Development in Uganda." Currently, Moureen works at the National Fisheries Resources Research Institute and continues to partner with AquaFish in the development and implementation of a mobile phone-based system in Uganda.

Currently, AquaFish researchers are expanding the scope of the FMIS to incorporate marine fishes and to learn and incorporate the knowledge gained from the AquaFish Uganda and Kenya projects. Researchers would like to build the database to reflect market information related to seven major fish markets, including tilapia, African catfish, tuna, dentex (redfish), mackerel, sardinellas (sardines, herrings, shads, and menhandens), and caranx (jacks and kingfishes).

Dr. Amisah and others recently piloted a newer version of the FMIS at workshops with local fishers in Elmina and Accra in Ghana. "The Chief Fisherman expressed satisfaction of the relevance of the training," said Dr. Amisah. "Participants were excited and grateful for the initiative by AquaFish and asked for a continuous refresher training from time to time."

AquaFish research in Uganda, Kenya, and Ghana has already uncovered several benefits and challenges associated with on-the-ground application of digital and mobile phone technologies. This information will allow AquaFish partners and farmers to continue to share knowledge and adapt as future innovations and technologies progress in the future.



## AQUAFISH ENGAGES WITH OREGON STATE UNIVERSITY STUDENTS AT ANNUAL EARTH DAY EVENT

By Lindsay Carroll  
AquaFish Innovation Lab

AquaFish hosted a booth at the 17th Annual Community Fair on 25 April 2017 as part of Oregon State University's (OSU) two week "Beyond Earth Day" celebration. AquaFish joined more than 40 local organizations focusing on holistic approaches to sustainability at the fair. AquaFish staff were able to engage with OSU staff and students and discuss AquaFish research focusing on sustainable aquaculture practices, including strategies related to aquaculture pollution reduction through pond water reuse after harvest, climate change adaptation, and the production of more efficient feeds to reduce waste and cost to farmers. The AquaFish table featured an AquaFish-themed Plinko game that challenged visitors to answer trivia questions related to aquaculture and fisheries. The trivia questions allowed participants to test their knowledge and learn new facts about aquaculture. After answering a series of questions, one student responded, "Wow, I just learned three new facts about aquaculture!"



(Photo credit Briana Goodwin)

**AquaFish staff test aquaculture and fisheries knowledge for a chance to win prizes at OSU's 17th Annual Beyond Earth Day Community Fair.**



## AQUAFISH PARTNERS IN ASIA SHARE PROGRESS AND BEST PRACTICES

*By Lindsay Carroll, AquaFish Innovation Lab*



(Photos courtesy of AquaFish Innovation Lab)

**AquaFish Asia Regional Partners (left) gather in Nepal to provide updates on research progress, share lessons learned, visit local facilities, and engage with women's fish farmer groups (right).**

In March of 2017, AquaFish partners from Asia (Bangladesh, Cambodia, China, Nepal, Thailand, and Vietnam) gathered in Sauraha, Nepal, to give updates on the overall progress of research projects and to share successes and challenges related to their research, outreach, and capacity building efforts.

Researchers from Bangladesh Agricultural University (BAU) reported on aquaculture production challenges that they and other AquaFish projects face: the high price and low quality of feed, obtaining quality seed and fry, and connecting with farmers. AquaFish researchers at BAU are addressing these challenges by improving feed efficiency through nutritional conditioning of larvae and identifying gut biota for increased nutrient absorption. In order to better connect with farmers, they are organizing a nation-wide workshop involving a range of stakeholders to share results and best practices.

AquaFish researchers at Can Tho University in Vietnam and the Inland Fisheries Research and Development Institute in Cambodia were excited to highlight the use of their research in improving the composition of local snakehead feeds. Initial results indicate that adding Vitamin C to pelleted feeds resolved snakehead deformity issues resulting from ascorbic acid (Vitamin C) deficiency. Due to the success of this preliminary work, local feed manufactures are now supplementing pelleted feeds with Vitamin C.

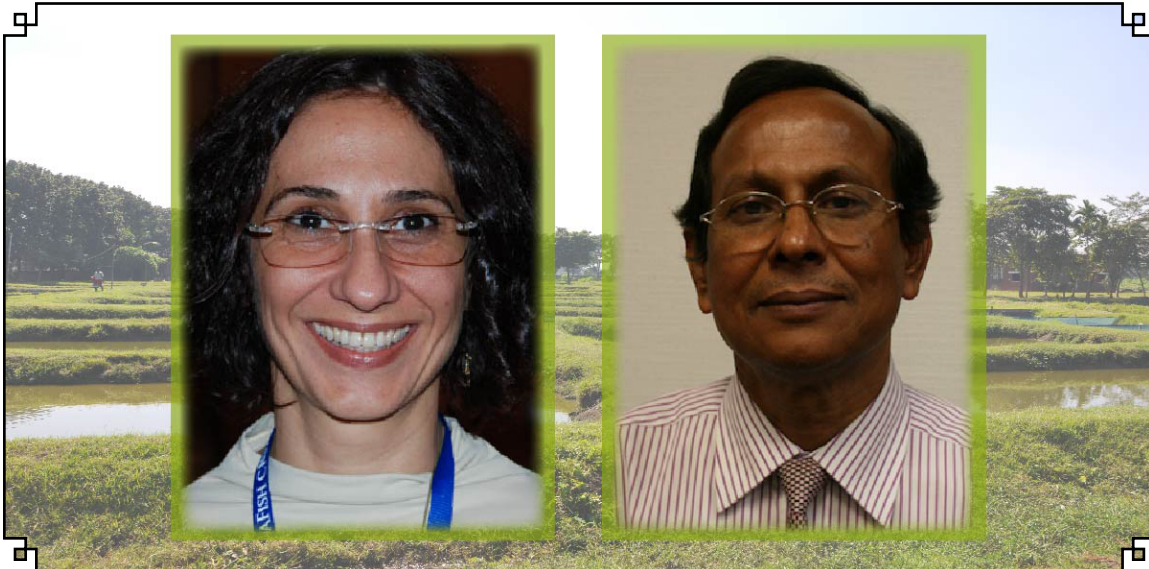
AquaFish regional partners also had the opportunity to tour local research sites and facilities in Nepal. Participants visited nearby schools, where Agriculture and Forestry University (AFU) researchers worked with students and teachers to establish ponds to teach students about fish farming and the benefits of fish for household nutrition. Students shared that they enjoyed learning about how to grow fish and maintain fish ponds.

AquaFish researchers from AFU are also working to reduce feed costs and increase pond water quality by enhancing carp polyculture systems with periphyton. Periphyton is a mixture of algae and microbes that live on surfaces within aquaculture ponds. Ongoing AquaFish research is investigating the most suitable surfaces for periphyton growth by reaching out to farmers through workshops and testing the surfaces through on-farm trials. During the site visits, AquaFish regional partners were able to engage with women's fish farmer groups where the on-site trials are conducted and discuss women's empowerment and best approaches to on-farm applications.

The regional gathering in Nepal provided a way for partners to connect, generate conversation on shared challenges, and continue to build strong networks. Local AquaFish researchers were able to showcase their projects and facilities, further contributing to the transfer of technology and knowledge to other nearby countries.







(Photos courtesy of AquaFish Innovation Lab)

**Dr. Maria Celia Portella (left) elected as the next World Aquaculture Society President, and Dr. Md. Abdul Wahab (right) recognized as a top researcher in the Bangladesh Agricultural University Research System.**

## AQUAFISH PARTNERS, DR. MARIA CELIA PORTELLA AND DR. MD. ABDUL WAHAB, IN THE NEWS

By Lindsay Carroll  
*AquaFish Innovation Lab*

**D**r. Maria Celia Portella, a long-time AquaFish and ACRSP partner, was recently elected to serve as the President of the World Aquaculture Society's (WAS) Board of Directors. Dr. Portella is currently a professor at Sao Paulo State University (Universidade Estadual Paulista) and Associate Professor at the University's Aquaculture Center. She brings many years of experience in research, education, and extension to the position as she served as a scientist at the Fisheries Institute in Brazil for 16 years, as the Co-Coordinator of the Latin America & Caribbean Regional Center of Excellence for AquaFish since 2013, and is the current coordinator of the Advisory Committee on Aquaculture and Fisheries of the National Council for Scientific and Technological Development of the Ministry of Science, Technology, and Innovation in Brazil.

As President, Dr. Portella hopes to broaden WAS membership and reach, as she said, "the Society should expand its borders, strengthening its commitment to excellence in aquaculture through science, technology, and education, and definitely establish itself as a main leader

in the sector." She intends to focus on locations "where aquaculture production is high and the Society is underrepresented." Given the fast growth of the aquaculture sector, Dr. Portella is hopeful that WAS can serve as a primary source of aquaculture information moving forward.

The Bangladesh Agricultural University Research System (BAURES) honored Dr. Md. Abdul Wahab, former AquaFish Host Country Principal Investigator, as one of the top five researchers. The top five researchers were identified by BAURES based on their contributions, overall productivity, and global research impact of their publications. Read more on the recognition in the article published in the [Daily Observer](#).

Currently, Dr. Wahab is a professor in the Department of Fisheries Management at Bangladesh Agricultural University (BAU) with 35+ years of experience in teaching, research, and extension. As a professor at BAU, he has supervised and mentored over 100 Master's and PhD students. Some of his research interests include water quality management, the environmental impacts of aquaculture, periphyton (mixture of algae and microbes) enhancement in aquaculture, and climate change. Check out some of his AquaFish publications on the [AquaFish pubs webpage](#).

Congratulations to Dr. Portella and Dr. Wahab for their recent accolades! We are honored to work with such strong leaders in the aquaculture field.



## PONDERINGS... ANAGRAMS

Solve the Anagrams below by rearranging the words to spell an aquaculture-themed word. Be mindful that some answers are two words. Answers will be posted to AquaFish's [Twitter](#) and [Facebook](#) pages. Good Luck!

1. Racquet luau

\_\_\_\_\_

2. Initial leap (2 words)

\_\_\_\_\_

3. Python pier

\_\_\_\_\_

4. Poultry clue

\_\_\_\_\_

5. Orphaned net (2 words)

\_\_\_\_\_

6. A keen dash

\_\_\_\_\_

7. Quiet dry gene (2 words)

\_\_\_\_\_

8. Society do fur (2 words)

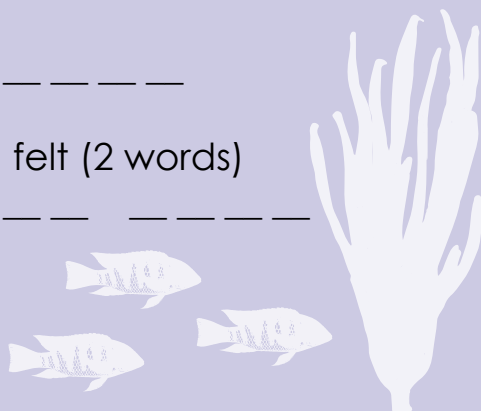
\_\_\_\_\_

9. Flushing

\_\_\_\_\_

10. Peeled felt (2 words)

\_\_\_\_\_



## AQUAFISH STUDENT CORNER

### GRADUATE STUDENT PROFILE: NUSRAT HOSSAIN

*By Lindsay Carroll, AquaFish Innovation Lab*



(Photo courtesy of Nusrat Hossain)

**Nusrat Hossain, an AquaFish Master's degree student at Bangladesh Agricultural University.**

**N**ative Bangladeshi, Nusrat Hossain, was drawn to aquaculture because she was interested in finding "sustainable ways to increase fish production for poverty alleviation and nutritional security," she said.

Hossain is an AquaFish Master's student at Bangladesh Agricultural University (BAU), seeking a degree in Fisheries Management. She is working under the mentorship of Dr. Mst. Kaniz Fatema on the impacts of nutritional conditioning on the growth performance and nutrient uptake of tilapia.

Nutritional conditioning is the process of programming an animal by adding or removing key dietary nutrients early in development in order to influence growth and function during later stages of life. Studies show that conditioning can lead to more efficient uptake and use of nutrients leading to increased growth and better overall health.

*Student continued on page 9 ...*



## AQUAFISH STUDENT CORNER

... Student continued from page 8

Since fish feed contributes to 50-80% of production costs, understanding how fish uptake and use nutrients is a necessity. Taken a step further, it becomes important to understand how nutritional conditioning influences diets and if this practice could be used to help reduce production costs for aquaculture farmers.

For her research project, Hossain is applying nutritional conditioning methods to the larvae of Nile tilapia (*Oreochromis niloticus*), one of the most commonly cultured finfish. With the goal to improve protein uptake and efficiency during later grow-out stages, Hossain will reduce the dietary protein amounts fed during the larval development stage.

When asked how the tilapia larvae will be nutritionally conditioned, Hossain said, "larvae will be assigned to one of four treatment groups and restricted of protein for either 0, 7, 14, or 24 days and then subsequently fed a normal (40% crude protein) or submaximal protein diet (25% crude protein), [which is] lower than the recommended level."

Once the tilapia reach the fry life stage, meaning the fish are able to start eating on their own, they will be raised in hapas (fish cages) and fed either the normal (40% crude protein) or submaximal protein (25% crude protein) diet. This will occur until the tilapia reach 2-3 gram (just under 1 ounce) fingerling size. The fingerlings will then be distributed among ponds and fed a normal protein diet for 150 days. "All fish will be fed the respective diets on alternate days at a rate of 10% then down to 3% body weight per day," she said.

As the experiment progresses, Hossain will be measuring growth (length and weight), yield, and water quality parameters, including ammonia, nitrites, nitrates, dissolved oxygen, and alkalinity. Hossain will also be assessing feed conversion ratios (FCR), or the rate to which inputs (food) are converted to output (body mass). Understanding the FCR among all of the treatment groups will enable Hossain



(Photo courtesy of Nurat Hossain)

**Nurat Hossain measuring nitrate in the Water Quality and Pond Dynamics Laboratory at Bangladesh Agricultural University.**

to understand the overall impact of larval nutritional conditioning on growth and nutrient uptake during later life stages.

So far, Hossain has primarily been monitoring water quality parameters and plans to enter the nutritional conditioning phase of her research in the coming months.

After she graduates, she hopes to study abroad in order to gain more aquaculture knowledge and research experience.

In speaking of the overall impact of her research, Hossain said that she hopes that her research will lead to "a new method of nutritional conditioning in rearing post yolk-sac fry that improves nutrient uptake and utilization and production efficiency of tilapia culture."

Finding ways to minimize production costs to farmers through alternative feed sources and feeding routines has been a focus of AquaFish research since 2006. Hossain's research findings will contribute to the continued commitment of finding helpful options for farmers.



## AQUAFISH ALUMNI CORNER

### WHERE ARE THEY NOW?: ENOS WERE

By Lindsay Carroll, AquaFish Innovation Lab

Enos Were, a former Aquaculture Collaborative Research Support Program (ACRSP) student, first became interested in aquaculture because of its economic viability. Were earned his Master's degree in Aquaculture in 2002 from Moi University in Kenya under the mentorship of Dr. Charles Ngugi. His thesis was titled, "Comparison of Tilapia and Clarias Polyculture Yields and Economic Benefits Resulting from Rice Bran, Pig Finisher Pellet, and a Pelleted Test Diet in Fertilized Ponds."

At the time of Were's graduate work, using formulated feeds in fish culture was relatively new and still under development. Therefore, Were set out to investigate cost-effective feed and fertilizer alternatives for use in African aquaculture, with the overall goal of increasing farmer profits. To do this, he compared the overall performance and economic benefits of three different feed diets in Nile tilapia (*Oreochromis niloticus*) and African catfish (*Clarias gariepinus*) polyculture. Polyculture (growth of one species alongside another) of tilapia and catfish has proven beneficial because catfish serve a predatory role in reducing tilapia breeding.

The feeds consisted of locally-sourced and commonly used rice bran (6.5% crude protein) and two other locally-sourced formulated feeds, pig finisher pellets and test diet pellets. Pig finisher pellet (14% crude protein) served as a nutrient-dense formulated feed alternative fortified with protein, amino acids, vitamins, and minerals, while the primary ingredients of the test diet pellet (20% crude protein) included cottonseed cake and maize.

Were's research results revealed that the pig finisher pellet and test diet pellet (formulated diets) led to higher fish yields compared to rice bran (single ingredient diet). The profitability



(Photo courtesy of Enos Were)

**Enos Were, former ACRSP Master's student from Moi University in Kenya.**

analysis showed that the pig finisher pellet was the most profitable compared to the other two feed treatments.

Were is grateful for his connection to ACRSP, as he "learned practical skills in aquaculture, [gained] lots of scientific background, and learned the feasibility of warm water aquaculture in Kenya."

Now, he is the Founder and Managing Director of Jewlet Enterprises ([www.jewlet.com](http://www.jewlet.com)), a fish farm and hatchery for fingerlings and fish feed. Jewlet Enterprises supplies 6 million fingerlings annually, averaging 0.5 million fingerlings monthly, making the company one of the biggest tilapia and catfish fingerling producers in Kenya.

Jewlet Enterprises consists of three fish farms located across Kenya, including Kajiei, Kamwala, and Mariwa Fish Farm. The Kamwala site is primarily used for mass breeding and hatchery operations while the Kajiei and Mariwa Fish Farm locations are used for selective breeding.

"There is a need to produce reliable and readily available high quality tilapia seeds," said Were. Jewlet's Preferred Jew Feed is quickly becoming one of the more popular fish feeds of Kenya. Jewlet serves as the supplier for several counties located in Central, Western,

*Alumni continued on page 11 ...*

... Alumni continued from page 10

and Coastal Kenya, including cage farmers in the Lake Victoria region.

On a daily basis, two tons of floating pellets, one ton of starter powder, and two tons of mash are produced. The feed is formulated with 28% crude protein for tilapia diets and appears to have a positive impact on tilapia growth performance. Fish feed with 46% crude protein is also produced to be fed to catfish and tilapia at different life stages.

"Aquaculture has proved [to be] a visionary venture that is a turnkey in rural development and employment opportunity in Kenya," said Were. Through Jewlet Enterprises, Were and his business partner provide employment to 18 permanent employees. Working for Jewlet enables employees to broaden skillsets and knowledge, further contributing to capacity development in Kenya.

Were is proud to be contributing to the development of reliable feeds and aquaculture equipment. When asked what he enjoys the most about his work, he said, "turning theory into economic benefits." Were brings over 15 years of experience to Jewlet Enterprises. Continuing to build the business further enables him to follow his passion of refining production and feed methods to best serve aquaculture in Kenya.



(Photo courtesy of Enos Were)

**Enos Were tests water quality at a Jewlet Enterprises site.**



## NOTICES OF PUBLICATION

Notices of Publication announce recently published peer-reviewed work carried out with AquaFish support. To receive a full copy of a publication, please contact the author(s) directly.



### **Assessing the Functional Role of Leptin in Energy Homeostasis and the Stress Response in Vertebrates (17-371)**

Courtney A. Deck, Jamie L. Honeycutt, Eugene Cheung, Hannah. M, Reynolds, Russel J. Borski

Department of Biological Sciences, North Carolina State University, Raleigh, NC, USA

Leptin is a pleiotropic hormone that plays a critical role in regulating appetite, energy metabolism, growth, stress, and immune function across vertebrate groups. In mammals, it has been classically described as an adipostat, relaying information regarding energy status to the brain. While retaining poor sequence conservation with mammalian leptins, teleostean leptins elicit a number of similar regulatory properties, although current evidence suggests that it does not function as an adipostat in this group of vertebrates. Teleostean leptin also exhibits functionally divergent properties, however, possibly playing a role in glucoregulation similar to what is observed in lizards. Further, leptin has been recently implicated as a mediator of immune function and the endocrine stress response in teleosts. Here, we provide a review of leptin physiology in vertebrates, with a particular focus on its actions and regulatory properties in the context of stress and the regulation of energy homeostasis.

This abstract was excerpted from the original paper, which was published in *Frontiers in Endocrinology* (2017), DOI: <https://doi.org/10.3389/fendo.2017.00063>

## GET FEATURED IN AQUA NEWS

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*Publications continued on page 12 ...*



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### **Assessment of Price Volatility in the Fisheries Sector in Uganda (17-372)**

James O. Bukenya

College of Agricultural Life, and Natural Sciences,  
Alabama A&M University, USA

This paper examines price volatility in the African catfish (*Clarias gariepinus*) supply chain in Uganda. The volatility process in the catfish markets was analyzed based on monthly price data from January 2006 to August 2013. A GARCH model is used to estimate the volatility parameters. Empirical results revealed that the value of the first-order autoregressive term and the value of the first-order moving average term were significant for both aquaculture and wild harvest catfish supply chains. The observed long persistence of volatility in both supply channels suggests a fundamental level of uncertainty and risk in the catfish subsector over the studied period.

This abstract was excerpted from the original paper, which was published in [Food Distribution Research Society \(2017\) 48\(1\): 81-88](#).

### **Social Economic Performance of Tilapia Farming in Ghana (17-373)**

Emmanuel A. Frimpong<sup>1</sup> and Gifty Anane-Taabeah<sup>2</sup>

1. Department of Fish and Wildlife Conservation, Virginia Polytechnic Institute and State University Blacksburg, Virginia, USA
2. Department of Fisheries and Watershed Management, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana

This report presents an overview of the social and economic performance of tilapia farming in Ghana from a value-chain perspective. The content is based primarily on the synthesis of the relevant literature on fisheries and aquaculture in Ghana, and the information gathered by the authors from interviews and interactions with key leaders of the sector in Ghana from 2009 to 2015. In addition, information is also included from postings on Ghana to the Sustainable Aquaculture Research Networks in sub-Saharan Africa (SARNISSA) listserv, unpublished material from the authors' recently completed and ongoing research involving more than 500 fish farmers, processors and traders, government administrators and field officers, and researchers in Ghana, and the reanalysis of information from a combination of all these sources. The social and economic analysis uses the framework of

Trienekens (2011), and draws heavily on almost a dozen recently completed value chain and related studies and reviews of the aquaculture and fisheries sectors of Ghana (Asmah, 2008; Abban et al., 2009; Cobbina, 2010; Ofori et al., 2010; Antwi-Asare and Abbey, 2011; Hamenoo, 2011; Nunoo et al., 2012; Simpson, 2012; Anane-Taabeah, Quagrainie and Amisah, 2015). [Note that this is the first paragraph of the introduction.]

This introductory section was excerpted from the original publication, a section which was published in J. Cai, K.K. Quagrainie, and N. Hishamunda (editors), [Social and economic performance of tilapia farming in Africa \(2017\)](#), FAO Fisheries and Aquaculture Circular No. 1130, Rome, Italy, pages 49-90.

### **Social and Economic Performance of Tilapia Farming in Kenya (17-374)**

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Aquaculture makes an important contribution to livelihoods, economic development and food security in Africa (Quagrainie, Amisah and Ngugi, 2009). The effective start of aquaculture in most of sub-Saharan Africa was, in the 1950s, under the impetus of the various colonial administrations. The Abuja Declaration on sustainable fisheries and aquaculture called for increased fish production, focusing more on aquaculture promotion and development (Kaliba et al., 2007). It is increasingly recognized that promoting aquaculture as a business could yield adequate and solid benefits from the sector, and thereby leading to its sustainable development.

Similar to many countries in Africa, aquaculture production in Kenya has been low and stagnated over the past decade (Hetch, 2006). The slow progress of aquaculture growth in sub-Saharan Africa has been attributed to institutional, biotechnical and economic factors (Hecht, 2006).

Rural fish farming in Kenya dates back to the 1940s and was popularized in the 1960s by the Kenya Government through the "Eat More Fish Campaign." The number of small-scale farmers increased and peaked at about 20,000 in 1985, with annual production of slightly over 1,000 tonnes (Aloo and Ngugi, 2005). [Note that this is the first three

*Publications continued on page 13 ...*

... Publications continued from page 12

paragraphs of the introduction.]

This introductory section was excerpted from the original publication, a section which was published in J. Cai, K.K. Quagrainie, and N. Hishamunda (editors), [Social and economic performance of tilapia farming in Africa \(2017\)](#), FAO Fisheries and Aquaculture Circular No. 1130, Rome, Italy, pages 91-111.

### **Social and Economic Performance of Tilapia Farming in Uganda (17-375)**

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Uganda is a landlocked country in Eastern Africa bordering Kenya to the east, the United Republic of Tanzania to the south, Rwanda to the southwest, the Democratic Republic of the Congo to the west and South Sudan to the north. It has a surface area of 241,038 km<sup>2</sup> with about 18 percent covered by open waters and 3 percent by swamps. This offers enormous potential for aquaculture and fisheries development, as the sector contributed about 12 percent of agricultural GDP and 2.5 percent of GDP and provided a livelihood to 3.5 million people, who make up 4 percent of the population (Mulonde, 2013; MAAIF, 2012). Uganda has five major inland lakes out of about 165 lakes, which, together with the Nile River, are responsible for most of the capture fisheries production. The lakes, namely Lake Victoria, Lake Albert, Lake Kyoga, Lake Edward and Lake George, contribute 80 percent to Uganda's capture fisheries production. Lake Victoria accounts for about 58 percent of the total catch for the important export species, Nile perch and Nile tilapia. Main rivers in Uganda include the Victoria Nile, Albert Nile, Achwa River (called Aswa in South Sudan) and Kazinga Channel (Keizire, 2006). [Note that this is the first paragraph of the introduction.]

This introductory section was excerpted from the original publication, a section which was published in J. Cai, K.K. Quagrainie, and N. Hishamunda (editors), [Social and economic performance of tilapia farming in Africa \(2017\)](#), FAO Fisheries and Aquaculture Circular No. 1130, Rome, Italy, pages 127-144.

## **UPCOMING MEETINGS AND EVENTS**

8th International Conference on Fisheries & Aquaculture  
2-4 October 2017  
Toronto, Canada  
<http://fisheries.conferenceseries.com/>

Aquaculture Europe 2017  
16-20 October 2017  
Dubrovnik, Croatia  
[bit.ly/AquaEuro2017](http://bit.ly/AquaEuro2017)

LAQUA 17  
7-10 November 2017  
Mazatlan, Mexico  
<https://www.was.org/meetings/>

Aquaculture America 2018  
19-22 February 2018  
Las Vegas, Nevada, USA  
<https://www.was.org/meetings/default.aspx?code=AA2018>

### **SEEKING OPPORTUNITIES?**

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Are you a current AquaFish Innovation Lab student or a former AquaFish, ACRSP, or PD/A CRSP student? Do you have story ideas or photos you want to send to us? Email us your story suggestions and photos for consideration to [aquafish@oregonstate.edu](mailto:aquafish@oregonstate.edu).

## **PARTING SHOT**



(Photo courtesy of Dr. Charles Ngugi)

**Many gather in anticipation for the launch of the World Aquaculture Society African Chapter.**

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## AQUAFISH INNOVATION LAB CONTACT INFORMATION

AquaFish Innovation Lab and aquaculture publications can be accessed online at <http://aquafishcrsp.oregonstate.edu/nop>

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