



NEPAL'S AQUACULTURE CAPACITY GROWS THANKS TO UNIVERSITY'S DEVELOPMENT AND AQUAFISH SUPPORT

By **Susannah L. Bodman**,
AquaFish Innovation Lab

Education and capacity building in aquaculture can help individuals and communities make strides toward better incomes, improved food security, and increased gender equity. However, efforts don't end with individual fish farmers or fishing communities. Lasting impacts often rely on the growth and development of institutions, including those of governments and higher education.

Central to AquaFish Innovation Lab's mission are efforts to build capacity in aquaculture at universities and other educational institutions. These efforts reach students at nearly every academic level and support faculty researchers from their early careers onward.

In Nepal, a series of partnerships stretching back nearly two decades has helped to build aquaculture



(Photo courtesy of Stephanie Ichien)

AquaFish participants - professors and graduate students - gather near aquaculture demonstration ponds on the Agriculture and Forestry University campus in Chitwan, Nepal.

capacity at a university level, generating knowledge and technologies that can help address food security and nutrition in rural communities throughout the country.

That effort ultimately led to the formation of Nepal's first state-owned technical university — Agriculture and Forestry University (AFU) — in 2010.

Nepal continued on page 2 ...

Meeting Gender Goals

AquaFish reaches its benchmark of 50% women degree-seeking students and short-term trainees.

Page 4

Fish Farmer Award

Ghana's Ministry of Fisheries and Aquaculture Development recognize AquaFish partners with National Best Pond Fish Farmer Award.

Page 5

Also Inside

Student Corner 7
Alumni Corner 9
Publications 10
Meetings and Events 11

... Nepal continued from page 1

"AquaFish support has been immense [in developing AFU's] Aquaculture and Fisheries Department as a strong department under the Faculty of Animal Science, Veterinary Science and Fisheries," as well as helping to launch the university's undergraduate fisheries program, said AquaFish Host Country Investigator Dr. Sunila Rai, who is Assistant Dean of Academics within Animal Science at AFU.

AFU was established through the merger of programs at the Institute for Agriculture and Animal Sciences (IAAS) and Tribhuvan University. Today, AFU's academic programs are divided into three faculties: Agriculture; Forestry; and Animal Science, Veterinary Science and Fisheries. Each boast several departments, such as horticulture and agronomy in Agriculture and animal breeding and aquaculture in Animal Science. Agriculture also houses two centers, focusing on development studies and biotechnology.

AFU began creating its academic program, which heavily focuses on aquaculture and fisheries curricula, in 2013 with a mandate for teaching, research, and extension. With the help of AquaFish and Nepalese government agencies, AFU now offers Nepal's only bachelor of science (BS) program in Fisheries, which admitted its first class in 2014.

Over the years, support in building this capacity came from partners, including the Pond Dynamics/Aquaculture Collaborative Research Support Program (CRSP), Aquaculture CRSP, AquaFish CRSP/Innovation Lab, IAAS's Aquaculture Department, Asian Institute of Technology, University of Michigan, and Shanghai Ocean University (formerly Shanghai Fisheries University).

AquaFish support has led to several faculty, government researchers, and students working on projects that produced innovative technologies, including sahar breeding technologies, polyculture strategies, and the incorporation of small indigenous fish species into ponds.



GOINGS-ON IN THE POND



AWF WOMAN OF THE YEAR AWARD

Aquaculture without Frontiers (AwF) honored Dr. Hillary Egna (pictured right), Director of AquaFish Innovation Lab, as the woman of the month in September 2016. AwF honors a woman each month who provides a positive role model for women in aquaculture. The honoree is recognized for her time, dedication, and achievements in aquaculture, and the award highlights the diversity and depth of achievements within women in aquaculture. Read more about her award and her successes throughout the years in the [Aquaculture without Frontiers article](#).

ARTICLE PUBLISHED IN FEED THE FUTURE NEWSLETTER

AquaFish researchers from Nepal's Agriculture and Forestry University in Nepal established four school ponds and used them to train 121 students and eight teachers on how to manage pond water levels; fertilize, feed, and harvest fish; and prepare fish for household consumption. To read more, check out the AquaFish article titled, "Fish Fill Ponds, Plates, and Pocketbooks in Nepal," published in the [Feed the Future Newsletter](#).

As for outreach achievements, AFU and AquaFish have worked in Chitwan and Nawalparasi districts, including launching a school pond program that helps educate children, parents, and teachers about the benefits of aquaculture. Further efforts include research collaborations between AFU and government agencies — such as the Nepal Agricultural Research Council and the Nepal Directorate of Fisheries Development — and extension work with various cooperatives in Nepal (three of which are women-only).

Getting to this point of outreach and technology output at AFU first required improvements to the research and

Nepal continued on page 3 ...

... *Nepal continued from page 2*

educational infrastructure in Nepal. At IAAS, the number of cement research ponds was increased from three to 18, and 28 earthen ponds were developed for research between 2001 and 2009. All of the ponds are still in use, said Host Country Project PI Dr. Madhav Shrestha, who is also the coordinator/dean of AFU's graduate school. A tilapia hatchery, wet lab, feed mill, farmhouse, open water lab, academic facilities, and lab equipment also were added to Nepal's research and teaching infrastructure.

Going forward academically, Drs. Rai and Shrestha said they'd like to see AFU's programs expand with the addition of courses in aquaculture business and financial management, aquatic resources management, and food quality and safety. New academic fields to be developed include post-harvest technologies, freshwater shellfish culture, nutrition and hatchery technology involving new and fast-growing species, and aquaculture socioeconomics.

In the future, Dr. Shrestha also projected that AFU will create a separate Faculty of Aquaculture and Fisheries Science, with three to four departments under it. AquaFish's capacity-building support in teaching and research is one of the major factors that's prepared AFU to go in this direction, he said.

Dr. Rai, meanwhile, said the university will continue to diversify its programs during that time frame and increase the number of faculty and students, not only as its central campus but at affiliated campuses in other areas of Nepal.

"AFU will lead in producing human resources in aquaculture, which will help to develop aquaculture in Nepal," Dr. Rai said. "AquaFish support ... has helped AFU to develop its aquaculture and fisheries program to this level."

As of spring 2016, that level included an enrollment in AFU's fisheries program of 45 students at the BS level, 14 students pursuing MS degrees, and three students seeking PhDs.

Four more students graduated with MS degrees in December 2015, and students in the BS program are expected to begin graduating at the end of 2017. The program also has succeeded in enrolling a 50:50 ratio of male and female students, Dr. Rai told AquaNews in [Volume 31, Number 2/Spring 2016](#) (pg. 4).

Among the students who have received AquaFish support in Nepal is Khop Narayan Shrestha, who was profiled in AquaNews [Volume 31, Number 3/Summer 2016](#) (pg. 13). Several of AFU's faculty members also received support from AquaFish, as well as from previous related grants dating back to 1982, during their graduate studies and beyond: Kamala Gharti and Drs. Shrestha, Rai, and Narayan Pandit.

Since 2002, AFU students and faculty presented more than 50 presentations at national and international conferences and also attended and presented at the first Nepal Fisheries Society convention in January 2015 in Kathmandu, an event sponsored by AquaFish. Overall, AFU's students and faculty produced about 25 publications in journals and proceedings.

In the end, though, to keep propelling AFU forward, the university's "faculties will have to seek extra funds through national and international research projects to maintain the pace of progress in aquaculture and fisheries," Dr. Shrestha said.

By 2018, AFU researchers aim to complete AquaFish-supported research. And 10 years from now, their goal is to pull in research grants from abroad and within Nepal, including the Nepal Agriculture Research Development Fund, said Dr. Rai.

Ultimately, it's all pushing AFU toward becoming "the leading university [in Nepal] in the field of agriculture, animal science, veterinary science, aquaculture and fisheries science and forestry," Dr. Shrestha said.

And with AFU maturing into such a leadership role, aquaculture is poised to continue its expansion in Nepal for the benefit of the lives and livelihoods of the Nepalese people.



AQUAFISH MEETS KEY GOALS IN EFFORTS TO BRING MORE WOMEN INTO AQUACULTURE

By AquaFish Innovation Lab

Successful aquaculture development depends on building and sustaining a gender-balanced community of students, professionals, and community members. Gender equality and female empowerment are core development objectives of the US Agency for International Development (USAID) research agenda and are fundamental to accomplishing effective and sustainable development outcomes.

With a commitment to creating meaningful and equitable opportunities for women and men alike in the aquaculture and fisheries sectors, AquaFish has made strides toward gender integration across program activities. Improvements in gender integration, including increases in the number of women involved in training activities, earning educational degrees, and serving in lead project roles, could not have been accomplished without our long-standing US and Host Country partners.

AquaFish takes a holistic approach to integrating women into all programmatic activities, with a goal of extending gender equity beyond the life of any given project and of AquaFish itself. Women are involved in every aspect of AquaFish work, from administration to research and education, as the program more broadly seeks to advance the development of responsible aquaculture technologies and systems through investment in research and capacity building. AquaFish continuously fosters this goal by laying the groundwork, year after year, for participation, leadership development, and retention of women through several efforts:

- Monitoring and evaluating gender inclusiveness by collecting separate gender data and taking appropriate actions as indicated through data analysis;



(Photo courtesy of AquaFish Innovation Lab)

A member of the Chaza Cooperative Society in Tanzania shares experiences on pearl farming and crafting shellfish jewelry for extra household income.

- Ensuring equal opportunities in all AquaFish training activities, with a 50% benchmark for women and men participants;
- Providing project leadership roles to empower women scientists and administrators to lead aquaculture research and to mentor and train the next generation of women aquaculturists;
- Conducting research that focuses on women's roles in the aquaculture industry, barriers to participation, and their roles in household nutrition;
- Sharing the importance of gender integration through outreach, dissemination, and leading by example.

In 2016, AquaFish successfully reached its benchmark of 50% women participants for both short-term training (non-degree training activities such as workshops, trainings, and on-

Women continued on page 5 ...

... *Women continued from page 4*

farm trainings) and degree-seeking students. This is an increase from women comprising 43% of degree-seeking students and 33% of short-term trainees in 2008. Since 2006, AquaFish has provided training for more than 3,000 women in short-term trainings and has supported more than 230 women earning post-secondary degrees.

AquaFish research in Nepal exemplifies successful program efforts of supporting higher education of women, involving women scientists in leadership roles, and conducting research aiming to improve health and nutrition of women and children. Since 2008, the Institute of Agriculture and Animal Science (now Agriculture and Forestry University, AFU) has been developing and promoting an innovative carp and small indigenous species (SIS) polyculture system with a goal of improving household nutrition. Currently, this research is being led by Dr. Sunila Rai, an Associate Professor and Assistant Dean at AFU whose MS and PhD degrees were supported by awards under the AquaFish Director. Read more about Dr. Rai and her role in developing programs at AFU in AquaNews [Volume 31/ Number 2/Spring 2016](#) (pg. 4).

In Zanzibar, Tanzania, AquaFish researchers are combining the development of aquaculture with integrated coastal and fisheries management to advance alternative livelihoods and improve nutrition. Shellfish provide one of the main income sources



(Photo courtesy of Madhav Shrestha)

Nepal training participants learn the benefits of culturing multiple species together.

for coastal Tanzanian women where they farm pearls to craft and sell shellfish jewelry, among other products. Women involved in the research earn \$160 to \$220 per month in supplemental income from pearl farming (equivalent to the lowest salary earned by an employed person in Tanzania). The extra income has allowed women to pay school fees, build houses, and, in one case, even buy a fishing boat.

AquaFish collaborators realize the importance of gender equality and equity for the longevity of sustainable aquaculture and the health of communities. Their efforts have built a legacy and a network of aquaculturists dedicated to carrying forward inclusive research and capacity building in developing countries.



KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY FISH FARM NETS NATIONAL AWARD FOR AQUACULTURAL EXCELLENCE

By Susannah L. Bodman,
AquaFish Innovation Lab

Poverty reduction, improved nutrition, and greater food security are the focal points of development efforts by many African governments. Supporting aquaculture growth and sustainability on the continent helps increase access to fish — an important source of protein and essential micronutrients in African households — and creates a means of addressing income and nutrition concerns.

AquaFish Innovation Lab researchers in Ghana, including those at Kwame Nkrumah University of Science and Technology (KNUST), have been working to bolster food security, nutrition, and aquaculture through research and technology development, including creating innovative tilapia feeds that increase the fish's nutritional value in human diets and developing a market information system to close gaps in the fish value chain.

Farm Award continued on page 6 ...

... Farm Award continued from page 5



(Photo courtesy of AquaFish Innovation Lab)

“Aboboyaa,” the 200-horse power farm tricycle awarded to KNUST as part of the National Best Pond Fish Farmer Award at National Farmers’ Day in Ghana.

During the last 10 years, collaborations between KNUST and AquaFish partners at Purdue University, Virginia Tech, and Oregon State University, developed new programs and curricula in aquaculture and fisheries, establishing KNUST as a leading aquaculture research program in Ghana. The program includes a fish farm operated by the university’s Department of Fisheries and Watershed Management.

In December 2015, the fish farm was recognized by Ghana’s Ministry of Fisheries and Aquaculture Development with a National Best Pond Fish Farmer Award during the country’s 31st National Farmers’ Day, which acknowledges the vital role farmers and fish farmers play in Ghana’s socio-economic development.

AquaFish Host Country Project PI Dr. Steve Amisah, of KNUST, said the award makes researchers at the university feel appreciated for their work to help alleviate hunger, poverty, and malnutrition among Ghana’s rural poor.

“It definitely feels gratifying and good to be recognized this way. We share this honor with AquaFish in general and with the Purdue and Virginia Tech teams ... We feel very much humbled by it, yet we appreciate the heart in it all,” Dr. Amisah said.

The national award helps to shine a bright spotlight on KNUST and to position it as a center of aquacultural excellence based on its research, teaching and outreach efforts, training and extension programs, and farm infrastructure. The university has been featured in news reports across Ghana, thanks to the award recognition.

That attention is helping the Ghanaian public see that KNUST is expanding beyond academia by translating the relevancy and practical application of engineering and science. Dr. Amisah said the university is being “inundated with new inquiries from across the nation about training in fish farming.”

KNUST received the National Best Pond Fish Farmer Award based on its use of best management practices (e.g., water reuse, record keeping, and fertilizer reduction) and its contributions to aquaculture development in Ghana.

Another criterion for the honor was KNUST’s commitment to environmental safety without compromising economic gains. KNUST accomplished this by adapting earlier Aquaculture Collaborative Research Support Program (ACRSP) and AquaFish CRSP/ Innovation Lab fish production methodologies that recycle benthic nutrients for vegetable crop production.



(Photo courtesy of AquaFish Innovation Lab)

The award-winning fish ponds located at KNUST.

Farm Award continued on page 7 ...

... *Farm Award continued from page 6*

Over time, KNUST has scaled its farm up from a simple training and research facility for undergraduate and graduate students into a commercialized operation that includes 18 fish ponds of various sizes. The farm now generates income from fish sales, allowing it to maintain and improve facilities as the need arises. It is also used for educational and training purposes, further building capacity around aquaculture in Ghana.

In addition to recognition, several pieces of equipment — including diggers, fishing nets, machetes, shovels, chest waders and Wellington boots — came with the national award. However, the biggest prize — or “king,” if you will — among the equipment may be the farm tricycle KNUST received. Locals have named it “Aboboyaa.”

“I am told ‘Aboboyaa’ is from an original local language (Asante Twi) term that tends to suggest ‘something quite lovely and friendly, though not too beautiful,’ ” Dr. Amisah said. “Other versions of the same thing exist, depending on which part of the country you are in. Others even call it ‘King Bike.’ ”

All of the prize equipment is already in use on the existing fish farm, and several additional fish ponds are being created to expand training and research opportunities for an ever-increasing student population at KNUST, Dr. Amisah said.

From here, KNUST and its fish farm will continue to contribute to aquaculture development in Ghana through AquaFish-support and by engaging in research and capacity-building efforts, including training, professional development, and exposure at international conferences for KNUST students and faculty. Building capacity at KNUST has been part of AquaFish’s longtime effort to support fish farmers around the globe — through advancement of aquaculture systems that promote and model small-scale fish farming, development of feeding strategies that reduce operating costs while maintaining optimal fish growth, and promoting environmentally sustainable technologies.



AQUAFISH STUDENT CORNER

GRADUATE STUDENT PROFILE: JOSIAH ANI-SABWA

By Lindsay Carroll, AquaFish Innovation Lab



(Photo courtesy of Josiah Ani-Sabwa)

Josiah Ani-Sabwa observing the growth of lettuce in an aquaponics raft system.

Finding low cost, sustainable aquaculture opportunities while maximizing fish production is a challenge facing aquaculture farmers worldwide. As a native Kenyan with a farming background, Josiah Ani-Sabwa's passion lies in helping to develop aquaculture technologies that minimize environmental impacts and reduce costs to farmers.

Ani-Sabwa, an AquaFish-supported PhD candidate in Aquaculture Management at Kenya's University of Eldoret, said some of his most rewarding experiences have been learning about fish pond construction, hatchery design, and management under the mentorship of AquaFish researchers.

For his PhD, Ani-Sabwa is researching how nutrients and water quality within an aquaponics system affect the growth of Nile tilapia (*Oreochromis niloticus*), one of the most commonly farmed fish worldwide. Aquaponics, a system in which plants are farmed alongside aquatic animals, creates a mutually beneficial environment for plants and fish. Ani-Sabwa is culturing lettuce, a popular garden crop, along with tilapia.

Student continued on page 8 ...

AQUAFISH STUDENT CORNER

... *Student continued from page 7*

In his experimental aquaponics system, tilapia waste, which is rich in nutrients, serves as fertilizer for lettuce plants. The plants absorb these nutrients from the water, which helps them grow. The plants, in turn, act as a natural water filtration system, helping to improve overall water quality for the tilapia.

Within this aquaponics design, Ani-Sabwa is attempting to characterize how well the lettuce plants absorb nutrients and increase water clarity. Ani-Sabwa said he is excited about the potential benefits of aquaponics because of the system's low environmental impact "since all waste from the fish are reabsorbed by the plants."

Meanwhile, Ani-Sabwa said he also hopes to determine how much tilapia and lettuce can be produced at a time using the aquaponics system. To do so, he is testing various stocking densities of tilapia in aquaponics tanks. Stocking densities refer to the number of fish or plants per unit of area. This approach will allow Ani-Sabwa to find the ideal number of fish and plants needed to maximize fish growth. Understanding the yields and limitations of the aquaponics system will also enable him to compare its efficiency against traditional aquaculture methods.

For his experiments, Ani-Sabwa used 15 individual aquaponics systems. He developed a raft system where the lettuce plants were supported on top of the water by a floating piece of Styrofoam. He planted 16 lettuce plants in each system and only altered the stocking density of tilapia. Given Ani-Sabwa's interest in understanding growth performance, starting with tilapia of the same size and weight was key. Fish weighing 10 g, or just over a third of an ounce, were stocked at 15, 30, and 45 fish per tank, repeating each stocking density five times, respectively.

His research so far shows a relationship between stocking density of the tilapia and fish growth. Average fish growth was greatest in the tanks with 15 fish per tank, likely due to

fish having more space in which to grow. In contrast, lettuce plant growth was greatest in tanks with higher stocking density (45 fish per tank). The presence of more fish means more waste is generated to serve as fertilizer, or "plant food," for the lettuce.

Ani-Sabwa said he hopes that farming the tilapia and lettuce together will produce a greater yield than from systems in which each are produced separately.

Beyond yields, Ani-Sabwa sees several other potential benefits of aquaponics. First, because these systems allow for efficient water use, they could help aquaculture expand into dry regions where water resources are limited. Second, land access is a common challenge facing aquaculture farmers. Aquaponics systems require less space and could serve as a promising option in locations where space is limited.

Use of aquaponics systems has potential health benefits for farmers and communities since farming fish and plants together reduces the need to apply chemicals and pesticides. And by replacing water with soil, "there would be 100% soil-related disease prevention," said Ani-Sabwa.

Moving forward, Ani-Sabwa plans to evaluate the economic performance of the aquaponics system used in his research. Understanding the overall cost of the system combined with production yields will enable farmers to compare whether aquaponics would be a cost-effective option.

Ani-Sabwa is set to complete his PhD in 2018. After graduation, he said he would like to continue working on aquaponics systems and other fish-breeding technologies.

Armed with his experience and education, he said he hopes to have a fish farm of his own one day so that he can provide food and education to local children's homes.



AQUAFISH ALUMNI CORNER

WHERE ARE THEY NOW?: JAMES BUNDI MUGO

By Lindsay Carroll, AquaFish Innovation Lab

Breeding fish and designing fish ponds got James Bundi Mugo hooked on the field of aquaculture many years ago. As a youth, he spent many days catching fish in rice field canals and roasting them to eat on the spot.

It wasn't long before this youthful activity became his life's passion. With a desire to culture fish and manage ponds of his own someday, Mugo decided to pursue a Bachelor's degree in Fisheries and Aquatic Sciences at Kenya's Moi University.

While there, he became connected with current AquaFish Host Country Co-PI, Dr. Charles Ngugi. Under his mentorship, Mugo learned about key components of fish pond management, including fish breeding, pond design, and construction.

The connection made with Dr. Ngugi served Mugo well. After completing his Bachelor's degree in 2003, Mugo returned to Moi University a few years later to complete his Master's degree in Aquaculture with Dr. Ngugi serving as his adviser.

For his Master's research, Mugo addressed a challenge plaguing small-scale farmers: finding low-cost feed options that also maximize fish production. Protein is often the most expensive ingredient in fish feed, which represents nearly half of overall production costs to fish farmers.

Finding ideal supplementary feed is only one piece of the puzzle for fish production and pond management. Farmers also must consider water quality, fish stocking, and feeding routines. Management of all of these factors is critical, as research shows proper fish pond management enhances overall fish reproductive success.



(Photo courtesy of James Mugo)

James Mugo training local farmers.

Using improper fish feed can cause reduced fish growth; premature growth of reproductive organs; and lower numbers of eggs produced per fish, also known as fecundity.

This background, plus his own interest in finding best practices in fish pond management, set Mugo on a path of trying to understand how feeding female Nile tilapia (*Oreochromis niloticus*) diets with altered protein levels would impact overall reproduction. He said he hoped his research would reveal the minimum amount of protein needed to supplement fish feeds without compromising female reproductive performance.

Mugo completed his Master's thesis, titled "Effect of varying dietary crude protein levels on reproductive performance of Nile tilapia (*Oreochromis niloticus*) reared in earthen ponds" in 2008. His results showed that dietary protein levels did have an overall impact on reproductive performance of female Nile tilapia.

The tilapia fed higher protein diets (fish feed containing 25% and 35% crude protein) reached greater body weights and lengths at sexual maturity compared to tilapia fed lower protein diets (fish feed containing 15% crude protein). Fish fed higher protein diets also produced more eggs, resulting in higher fecundity.

Alumni continued on page 10 ...

... Alumni continued from page 9

Mugo said he is grateful for the AquaFish and Aquaculture Collaborative Research Support Program (ACRSP) assistance he received toward earning his degrees, as he is still applying his practical training to his work today. Since completing his Master's degree, Mugo has served as a trainer at AquaFish workshops and has started his own ornamental fish farm in Kenya. He is currently an Assistant Lecturer at Kenya's Karatina University (KU), where he is a firm believer in "training what [you] practice," he said.

At KU, Mugo is using four ponds, each about 360 square yards (300 square meters), to train students in aquaculture and fisheries. Mugo also mentors students on pond upkeep and management.

As a trained professional in aquaculture and now an active farmer himself, Mugo said that one challenge still confronting fish farmers in Kenya is that many of the farmers "haven't received adequate information that equip them to start fish farming as an aquabusiness."

"If more training is supported based on farm trials, it could assist our fish farmers," he said.

Mugo said he considers himself lucky to be able to work with KU, a university that not only prioritizes the training of students, but also the training of local farmers. In addition to teaching students, the university uses the four ponds to host trainings on pond management with the goal of promoting local farm entrepreneurship and community development.

Mugo is further expanding his aquaculture knowledge by pursuing his PhD at the University of Eldoret. Mugo said he hopes to continue to "teach from past experience both theoretically and practically," he said.



GET FEATURED IN AQUANEWS

Are you a current or former AquaFish Innovation Lab-supported student? Are you an AquaFish alumni? Know someone who is? We'd like to hear from you for a possible future feature in AquaNews. Email aquafish@oregonstate.edu.

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. All past and present Notices of Publication can be found on the AquaFish website at: aquafish.oregonstate.edu/nop.php

The mobilization of science and technology fisheries innovations towards an ecosystem approach to fisheries management in the Coral Triangle and Southeast Asia (16-363)

Kelvin D. Gorospe^{1,2}, William Michaels³, Robert Pomeroy⁴, Christopher Elvidge⁵, Patrick Lynch³, Supin Wongbusaraku^{1,2}, Russell E. Brainard¹

1. Coral Reef Ecosystem Program, Pacific Islands Fisheries Science Center, National Marine Fisheries Service, U.S. National Oceanic and Atmospheric Administration, Honolulu, HI 96818, United States
2. Joint Institute for Marine and Atmospheric Research, University of Hawai'i at Mānoa, Honolulu, HI 96822, United States
3. Office of Science and Technology, National Marine Fisheries Service, U.S. National Oceanic and Atmospheric Administration, Silver Spring, MD 20910, United States
4. Department of Agriculture and Resource Economics, University of Connecticut-Avery Point, Groton, CT 06340, United States
5. National Geophysical Data Center, National Environmental Satellite, Data, and Information Service, U.S. National Oceanic and Atmospheric Administration, Boulder, CO 80305, United States

Several regional fisheries and marine conservation organizations in the Coral Triangle (CT) and Southeast Asia have indicated their support for an ecosystem approach to fisheries management (EAFM). It is also likely that science and technology (S&T) innovations will play a role in the region for the purposes of filling gaps in fisheries data, enhancing the coordination of fisheries management efforts, and implementing and operationalizing an EAFM. Here, we outline the methodology and results of an expert-opinion survey designed to elucidate and prioritize the implementation of these S&T innovations. As a first step and case study, the survey presented here was conducted on U.S. government experts. The U.S. market is one of the world's largest importers of seafood, and therefore, in the framework of this study, is considered to be

Publications continued on page 11 ...

... Publications continued from page 10

a stakeholder in the seafood supply chain that originates in the CT and Southeast Asia region. Results are discussed in terms of the data needs and principles of an EAFM, as well as current trends and contexts of the CT and Southeast Asia region. Next steps and recommendations are also provided on how S&T innovations can be implemented to enhance the cooperation and coordination of regional marine resource management efforts.

This abstract was excerpted from the original paper, which was published in *Marine Policy* (2016). DOI: 10.1016/j.marpol.2016.09.014.

Impacts of climate change on snakehead fish value chains in the Lower Mekong Basin of Cambodia and Vietnam (16-364)

Hap Navy¹, Truong Hoang Minh², and Robert Pomeroy³

1. Inland Fisheries and Research Development Institute, Fisheries Administration, Phnom Penh, Cambodia
2. College of Aquaculture and Fisheries, Can Tho University, Cantho, Vietnam
3. University of Connecticut-Avery Point, Agricultural and Resource Economics/CT Sea Grant, Groton, Connecticut, USA

The productive fisheries of the Lower Mekong Basin of Cambodia and Vietnam are essential to the food security and nutrition of 60 million people. Yet these fisheries, both culture and capture, are susceptible to the impacts of climate change. This article reports on a study undertaken to examine the vulnerability, as perceived by snakehead (*Channa striata*) fish farmers in Vietnam and fishers in Cambodia, to the impacts from climate change. Perceived impacts on various actors in the value chain are identified, as well as adaptation strategies currently being utilized and planned for the future. Recommendations are suggested to contribute to assisting snakehead farmers and fishers in adapting and preparing for the impacts of climate change.

This abstract was excerpted from the original paper, which was published in *Aquaculture Economics & Management* (2016). DOI: <http://dx.doi.org/10.1080/13657305.2016.1185196>.

UPCOMING MEETINGS AND EVENTS

Aquaculture America
19–22 February 2017
San Antonio, Texas, US
www.was.org

World Aquaculture 2017
27–30 June 2017
Cape Town, South Africa
www.was.org

Asia Pacific Aquaculture 2017
25–27 July 2017
Kuala Lumpur, Malaysia
www.was.org

Aquaculture Europe 2017
16–20 October 2017
Dubrovnik, Croatia
bit.ly/AquaEuro2017

For more meeting and employment opportunities visit our Education and Employment Opportunities network database online, EdOpNet, at aquafishcrsp.oregonstate.edu/edop.php

SEND US YOUR STORY IDEAS AND PHOTOS

Are you working on a currently funded AquaFish Innovation Lab project? Do you have story ideas or photos you want to send us? Email your story suggestions and photo submissions for consideration to aquafish@oregonstate.edu.

PARTING SHOT



(Photo courtesy of Charles Ngugi)

Participants harvest a pond at an aquaculture best management practices workshop in Kenya.

AquaFish Innovation Lab
Oregon State University
Corvallis, OR 97331 USA
aquafish.oregonstate.edu



USAID
FROM THE AMERICAN PEOPLE



AQUAFISH
INNOVATION LAB

AQUAFISH INNOVATION LAB CONTACT INFORMATION

AquaFish Innovation Lab and aquaculture publications can be accessed online at aquafish.oregonstate.edu/publications.php

AquaNews is available on-line at aquafish.oregonstate.edu/aquanews.php. Past issues also can be accessed online at aquafish.oregonstate.edu/AquaNewsArchives.php

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

Director: Dr. Hillary S. Eгна
AquaNews Editor: Susannah Bodman
Assistant Editor: Kathryn Goetting
AquaNews Staff: Lindsay Carroll, Briana Goodwin, and Jenna Borberg

AquaNews is published by the AquaFish Innovation Lab, Oregon State University, Corvallis, OR 97331, USA.
aquafish@oregonstate.edu

The contents of this newsletter are copyright of the AquaFish Innovation Lab © 2016. All rights reserved, including mechanical and electronic reproduction.

Mention of trade names or commercial products does not constitute endorsement or recommendation for use on the part of USAID or the AquaFish Innovation Lab.

AquaFish Innovation Lab activities are funded by Grant No. EPP-A-00-06-00012-00 from the United States Agency for International Development (USAID) and by participating US and Host Country institutions.

Oregon State University is an Affirmative Action/ Equal Opportunity Employer.