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AQUANEWS



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Fisheries for a Secure Future

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

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THE FINAL ISSUE



AquaFish Innovation Lab Host Country Partners gather for a photo along the Oregon Coast during the Oregon State University site visit in February 2018.

Letter from the Director

Dr. Hillary Egna, Director of the AquaFish Innovation Lab, shares her thoughts on her long legacy of international aquaculture grants.

Page 2

What Happens in Vegas

...doesn't always stay in Vegas! AquaFish partners from around the world gather for our last annual meeting, then visit OSU.

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Also Inside

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A FOND GOODBYE FROM THE DIRECTOR

By Dr. Hillary Egna, AquaFish Innovation Lab

Dear Friends and Colleagues,

It has been one of the great joys of my life to work with you. I have little left to say that I haven't already said and that music can't improve upon. Listen up.

Best personal wishes for your good health and peace to all,

Hillary



Dr. Hillary Egna at the AquaFish Innovation Lab's farewell meeting this August in Montpellier, France. Read more about the conference on page 9!

Songs Covering My Many Grants & Partnerships

PD/A CRSP (1982 - 1990)

[Aretha Franklin - Respect](#)

[Bob Dylan - Farewell](#)

ACRSP (1990 - 2008)

[EmmyLou Harris - Goodbye](#)

[Roxy Music - Avalon](#)

Aquaculture & Fisheries CRSP (2006 - 2013)

[Nirvana - Come As You Are](#)

[Chumbawamba - Thubthumping](#)

AquaFish Innovation Lab (2013 - 2018)

[Wooden Shjips - These Shadows](#)

[Ave Maria](#)

A Great Long Legacy (1982 - 2018)

[Leonard Cohen - Hallelujah](#)

[Wang Chung - Everybody Have Fun Tonight](#)

Outtakes

[Robert Plant & Alison Krauss - Rich Woman](#)

[Robert Plant & Alison Krauss - Gone Gone](#)

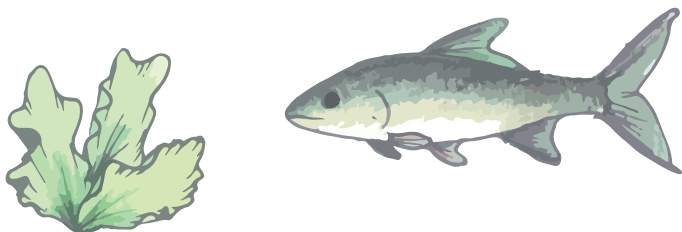
[Gone](#)

[The Cars - Bye Bye Love](#)

[Captain Fantastic - Sweet Child of Mine](#)



The Pacific Northwest Chapter of UNIFEM (The United Nations Development Fund for Women) recognizes Hillary Egna (right) as one of its 1997 awardees.





AQUAFISH PARTNERS HAVE LAST ANNUAL MEETING IN LAS VEGAS

*By Caleb Price and Stephanie Ichien,
AquaFish Innovation Lab*

This February, the AquaFish Innovation Lab (AFIL) hosted a program-wide meeting in Las Vegas, Nevada, involving researchers and partners from 18 countries in Africa, Asia, and South America. The AFIL holds similar meetings every year, but this meeting was particularly nostalgic as the program was months away from closing after 11.5 years of worldwide successes.

The meeting started with a visit to the Willow Beach National Fish Hatchery and a tour of the iconic Hoover Dam. Participants met the next day at the annual Aquaculture America conference of the World Aquaculture Society (WAS).

During a technical session organized and chaired by AFIL Director Dr. Hillary Egna, researchers and students shared research findings, lessons

learned, and stories from their experiences in the AquaFish program. The AFIL Management Team also presented several posters highlighting AFIL's work towards improving gender equity, promoting stakeholder engagement, and advancing sustainable aquaculture practices.

In keeping with their enduring commitment to training the next generation of scientists, AFIL recognized several students with awards for their valuable contributions to international aquaculture and fisheries research.

Following the conclusion of the WAS meeting, the AFIL team reconvened on the campus of Oregon State University (OSU) in Corvallis, Oregon. Program Management staff led tours of OSU research facilities and other aquaculture sites in the area.

Though the program is officially ending this year, the AquaFish Innovation Lab will be remembered by the many researchers, students, program staff, and fish farmers who benefited from AFIL and CRSP's decades-long mission to improve livelihoods through international aquaculture development.

Annual Meeting continued on page 4 ...

... Annual Meeting continued from page 3



Annual Meeting continued on page 5 ...

... Annual Meeting continued from page 4

AQUAFISH PARTNERS VISITING OSU



Cinamon Moffett, Research Facility Coordinator at OSU's Hatfield Marine Science Center (HMSC), leads the AFIL group tour.



Touring the beautiful grounds at HMSC.



A group gathers for a photo in front of the HMSC Visitor Center.



Examining an oyster spawning sample in a lab at HMSC.



Partners gathered in front of the Memorial Union, the heart of OSU's main campus and the oldest student union building in Oregon.



Annual Meeting continued on page 6 ...

... Annual Meeting continued from page 5

AQUAFISH PARTNERS VISITING OSU



Inside OSU's Memorial Union during the campus tour.



Visiting OSU's Smith Farm Genetics and Performance Lab and John L. Fryer Aquatic Animal Health Lab.



Touring the AquaFish offices.

All photos courtesy of the AquaFish Innovation Lab.



AQUAFISH INNOVATION LAB TO LIVE ON IN THE OSU ARCHIVES

By Briana Goodwin, AquaFish Innovation Lab

Since 2006, the AquaFish Innovation Lab (formerly AquaFish CRSP) has collected the many technical reports and outreach materials that are produced by our international research in aquaculture and fisheries. These documents, along with program materials used to administer grants across 30 years at Oregon State University (OSU), are being organized into an archive that will be hosted in the Valley Library at OSU. Though we may be closing our doors, all of these resources will remain available for public access into perpetuity.

The archived materials will date back to the beginning of the Pond Dynamics/Aquaculture Collaborative Research Support Program (PD/A CRSP) in 1982, and are being transferred to the Special Collections and Archives Research Center at the Valley Library on the OSU campus in Corvallis, Oregon, USA. Once the collection is complete and fully curated, a list of items will be available by searching on the OSU Libraries website: <http://scarc.library.oregonstate.edu/findingaids/>. Included in the collection are items such as Annual and Technical Reports, AquaNews, Outreach Documents, Conference Proceedings, and much more. The archival collection will be accessible to anybody who is able to visit the collection in person.

In addition to the physical archive, the websites for PD/A CRSP (<http://pdacrsp.oregonstate.edu>) and AquaFish Innovation Lab (<http://aquafishcrsp.oregonstate.edu>) will be fully archived and available using their current web addresses until September 2019. These websites will also be accessible in perpetuity by going to archive-it.org and entering the original web addresses (listed above) in the search bar, and on the OSU Libraries website, which will include information about the full collection.

We are happy that OSU has committed to keeping our archive accessible, which helps to ensure that the valuable research conducted by the AquaFish Innovation Lab and previous grants to Hillary Egna at OSU will be available for future use.

The archiving project took us on a trip down memory lane. Please enjoy a selection of some recently rediscovered photos on Page 7.

AquaFish Lives On continued on page 7 ...

... AquaFish Lives On continued from page 6



A BLAST FROM THE PAST!

PHOTOS FROM THE AQUAFISH
ARCHIVING PROJECT

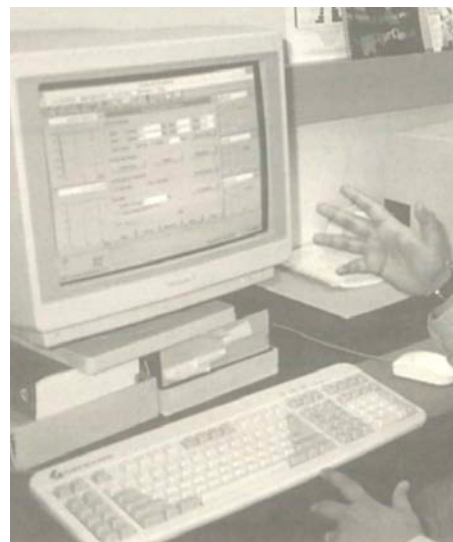
A computer displaying the latest version of POND, a decision support program designed to run on IBM-compatible computers.

Circa 1994



↑
PD/A CRSP researchers Kwei Lin and Yang Yi on-site in Thailand.
Circa 1999

→
Hillary Egna, Lead PI and new PD/A CRSP Director, and Wayne Seim, OSU researcher in Rwanda, on-site in Rwanda.
Circa 1989



← Del McCluskey, USAID representative, cuts the ribbon opening a new laboratory in Honduras.
Circa 1993

→
Christine Crawford, Ziporah Hiuko Mariga, Mucai Muchiri, and Hillary Egna during a visit to a women's farm cooperative in Kenya.
Circa 2001

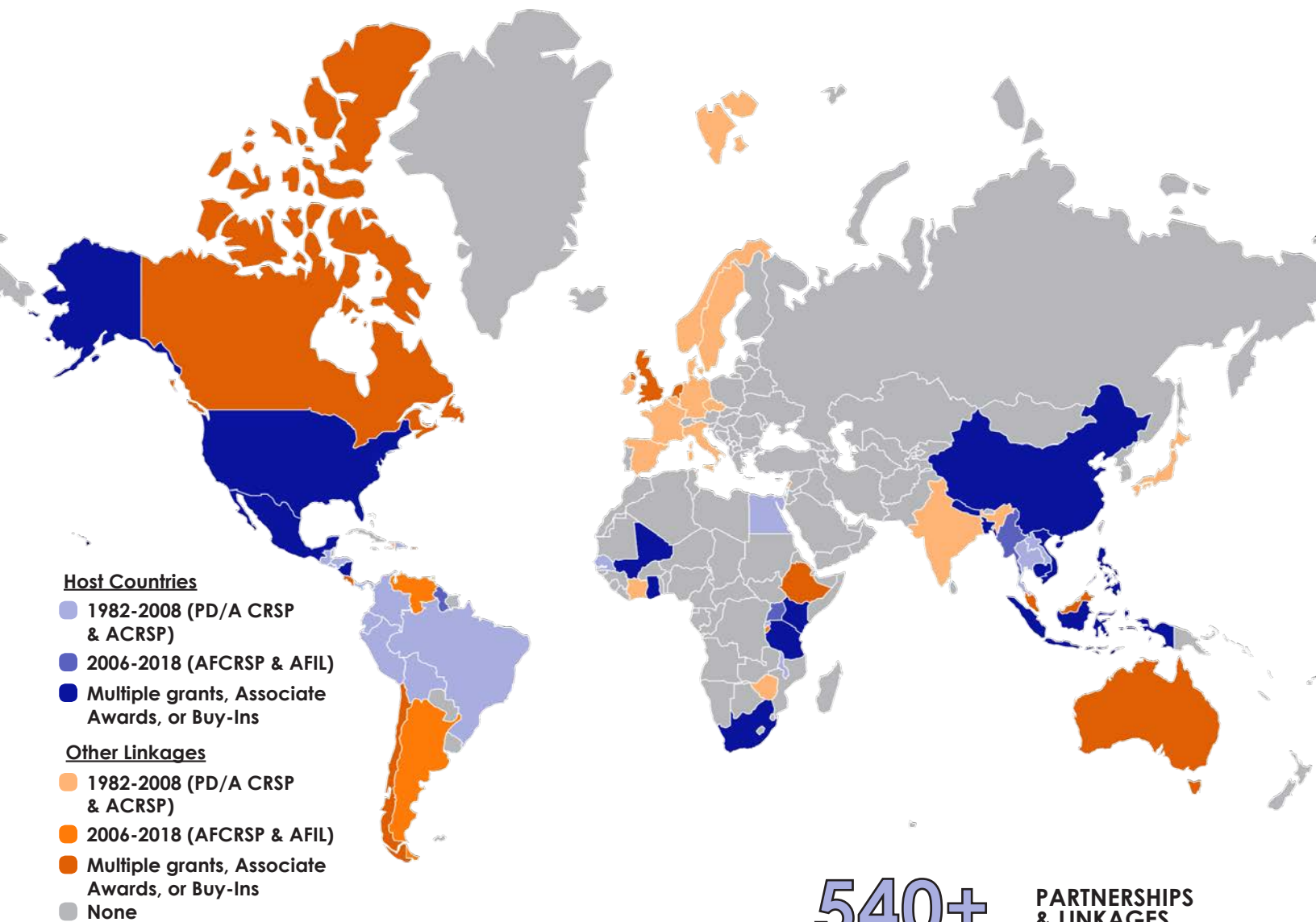


(Photos courtesy of the AquaFish Innovation Lab)



THE GLOBAL AQUAFISH NETWORK

By Jenny Hawkins, AquaFish Innovation Lab



Since 1987, Oregon State University (through Hillary Egna's various grants) has brought together students, researchers, government agencies, non-government organizations, and local fish farmers from around the world with the goal of developing efficient, affordable, and sustainable aquaculture practices. Since 2006, AquaFish-funded researchers have contributed over 325 peer-reviewed publications to the scientific literature. A comprehensive list of these publications will remain available through our archived website in a [searchable database](#).

540+ PARTNERSHIPS & LINKAGES

IN

62 COUNTRIES

PRODUCED

750+ PEER-REVIEWED PUBLICATIONS

AND

20,000+ WORKSHOP TRAINEES



AQUAFISH INNOVATION LAB'S FINAL FAREWELL IN MONTPELLIER, FRANCE

By Stephanie Ichien, AquaFish Innovation Lab

AquaFish Innovation Lab hosted partners from more than 15 countries in Montpellier, France for a series of meetings held in conjunction with the World Aquaculture Society's AQUA2018 conference from 25-29 August 2018. The meeting provided a stage for AFIL researchers to share research results and highlight accomplishments, and served as a final opportunity for AFIL participants to gather, connect, and reflect on the program. In addition to the program-wide meeting, AFIL hosted Regional Meetings for projects in Asia and Africa. As the Program draws to a close, project participants reported to the group on lessons learned, final deliverables, and progress made towards fulfilling exit strategies. More opportunities to connect were offered during several advisory council meetings, and a Host Country Principal Investigator meeting held at a shellfish farm near Montpellier.

Additionally, AFIL Director Dr. Hillary Egna chaired a technical session titled "A Conversation with the AquaFish Innovation Lab on the Future of Sustainable Aquaculture." Held in a panel format, the session involved 32 AFIL participants in a thought-provoking conversation. The panel format provided an innovative platform to discuss four major topics detailed on the following page. The first panel was held during the Program Meeting, and the following three were held in the AQUA2018 conference, where AFIL participants also presented 23 posters and 2 oral presentations.



Final Farewell continued on page 10 ...



AFIL meeting attendees pose for a photo after the Program Meeting in Montpellier, France.

AFIL Panel Session: “A Conversation with the AquaFish Innovation Lab on the Future of Sustainable Aquaculture”

Chaired by Dr. Hillary Egna

Panel Topic: Shared Lessons for Low Aquaculture Food Producing Countries

Co-Chair: Stephanie Ichien
 Moderator: Nancy Gitonga (Kenya)
 Panelists: Diana Asero (Uganda)
 Kwamena Quagraine (USA)
 Madhav Shrestha (Nepal)
 Hap Navy (Cambodia)
 Nazael Madalla (Tanzania)
 Rapporteur: Rebecca Lochmann (USA)

Panel Topic: What is Needed Now in 2018 to Make Aquaculture a Vital Enterprise for Smallholders in Africa?

Co-Chair: Tran Thi Thanh Hien (Vietnam)
 Moderator: Nikita Gopal (India)
 Panelists: Gertrude Atukunda (Uganda)
 Daniel Adjei-Boateng (Ghana)
 Renalda Munubi (Tanzania)
 Enos Mac'Were (Kenya)
 Abudala Napuru (Uganda)
 Rapporteur: James Bukenya (USA)

Panel Topic: Emerging Technologies from AquaFish Innovation Lab Research

Co-Chair: Judith Amadiva (Kenya)
 Moderator: Kay Lwintun (Myanmar)
 Panelists: Pham Minh Duc (Vietnam)
 Nen Phanna (Cambodia)
 Shahroz Mahean Haque (Bangladesh)
 Sunil Rai (Nepal)
 John Walakira (Uganda)
 Rapporteur: Russell Borski (USA)

Panel Topic: Shared Lessons from High-Producing Asian and LAC Countries for High Producing African Countries

Co-Chair: Nelson Agbo (Ghana)
 Moderator: Maymyat Noe Lwin (Myanmar)
 Panelists: Phu Hoa (Vietnam)
 Yuan Derun (Thailand)
 Md. Abdul Wahab (Bangladesh)
 Oludare Adeogun (Nigeria)
 Victoria Tarus (Kenya)
 Rapporteur: Wilfrido Contreras (Mexico)

... Final Farewell continued from page 10

AquaFish Host Country PI Meeting at the Tarbouriech Shellfish Farm



Photos courtesy of the AquaFish Innovation Lab.



NOTICES OF PUBLICATION

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



Assessment of faecal collection methods for determination of digestibilities of snakehead fish (*Channa striata*) with protein feed ingredients sources (17-388)

Ngo Minh Dung and Tran Thi Thanh Hien

College of Agriculture and Fisheries
Can Tho University, Can Tho City, Vietnam

This study was conducted to determine suitable faecal collection methods applied for digestibility studies of different protein ingredients for snakehead fish (*Channa striata*). The study included three experiments: in the first experiment, faecal collection was done every 2 hours within 24-hour period by settling technique; in the second experiment, different feces collection were applied such as settling, stripping and dissection; and in the last experiment, ADC of dry matter, protein, and energy of fish meal, soy bean meal, meat bone meal, and blood meal was evaluated as feed ingredients for snakehead. The results showed the suitable time for collecting snakehead feces was 8 hours; faecal collection by settlement method was more suitable than dissection and stripping methods for snakehead digestibility study; and the best ADC of dry matter was found in fish meal (85.8%), then deflated soybean meal (69.7%), blood meal (69.0%) and meat bone meal (52.3%). Similar results on ADC protein and ADC energy of these ingredient used as feed for snakehead were confirmed.

This abstract was excerpted from the original paper, published in [Journal of Vietnam Agricultural Science and Technology \(2017\) 8\(81\): 114-120.](#)

Production of periphyton to enhance yield in polyculture ponds with carps and small indigenous species (18-389)

Sabita Jha¹, Sunila Rai¹, Madhav Shrestha¹, James S. Diana², Ram Bhajan Mandal¹, and Hillary Egna³

1. Agriculture and Forestry University, Rampur, Chitwan, Nepal

2. University of Michigan, School for Environment and Sustainability, 520 E. Liberty Street, Suite 310, Ann Arbor, MI 48104, USA

Publications continued on page 12 ...

... Publications continued from page 11

3. Oregon State University, 1500 SW Jefferson Street, Corvallis, OR 97331, USA

Although carp polyculture is well established throughout southern Asia, its overall efficiency in providing sufficient nutrients and financial profit remains variable. Site-specific adjustments are needed to improve efficiencies of polyculture under local circumstances. We evaluated variations of carp polyculture systems in two separate trials: one on a research station (on-station), and one in farmers' ponds (on-farm). The on-station experiment included four treatments: TF (carp + 100% feed), TFS (carp + SIS (small indigenous species) +100% feed), TFSP (carp + SIS + 50% feed + bamboo substrate) and TSP (carp + SIS+ bamboo substrate with no feed), each done with three replicates. Silver carp (*Hypophthalmichthys molitrix*), bighead carp (*Aristichthys nobilis*), grass carp (*Ctenopharyngodon idella*), common carp (*Cyprinus carpio*), rohu (*Labeo rohita*), and mrigal (*Cirrhinus mrigala*) were stocked at a ratio of 4:1:4:3:5:5 and a rate of 15,000 fish/ha. Additionally, 2 SIS, dedhuwa (*Esomus danricus*) and pothi (*Puntius sophore*), were stocked at 1:1 and a combined density of 50,000 fish/ha. Carps were fed daily at 5% of body weight (BW) for 60 days, then 2% BW for 150 days, using a supplemental feed composed of dough (mustard oil cake and rice bran (1:1)), or using grass (for grass carp). Total carp yield and FCR were highest in TFSP ponds. Gross margin was also higher in treatments enhanced with periphyton (TFSP and TSP). Overall, TFSP was determined the best on-station result, based on total production of fish and profit. The two treatments with the highest net fish yield, TF and TFSP, were introduced to 37 women farmers in Chitwan and Nawalparasi districts for on-farm trials. After 8 months of culture, total fish weight and gross margin were 24.0% and 51.2% higher, respectively, in TFSP ponds than in TF ponds. Reduced feed application with increased periphyton enhancement dramatically improved profit while maintaining fish yields similar to those of traditional polyculture systems with full feeding.

This abstract was excerpted from the original paper, published in [Aquaculture Reports \(2018\) 9: 74-81](#).

Effect of iron amino acid chelate supplemented fish feeds on nutrients composition of spinach (*Spinacia oleracea*) in an aquaponic system in Kenya (18-390)

Kenneth Rono, Julius O. Manyala, and David Lusegac

University of Eldoret, Kenya, P.O. Box 1125, Eldoret, Kenya

Aquaponics is an environmentally friendly production system involving reuse of waste and nutrients in production of fish and vegetables. Currently aquaponic system is the only solution for fish and plants production but one unique challenge is the maintaining of micro and macro-nutrient and the pH balance in the system. The study was conducted at the University of Eldoret for

119 days. A complete randomized design was used. The supplementation rates in fish diets constituted 30g, 20g, 10g and 0g Fe kg⁻¹ respectively. Nile tilapia fry with a mean weight of 0.475 ± 0.025g and nine spinach (height 3 ± 0.131 cm, 2 leaves) were stocked in 12 aquaria in an aquaponic system. 30g Fe kg⁻¹ treatment exhibited higher minerals content than other treatments with Phosphorus 67.51 ± 2.42 mgL⁻¹, Zinc 9.068 ± 0.45 mgL⁻¹, Iron 5.2 ± 0.218 mgL⁻¹, Manganese 7.655 ± 0.344 mgL⁻¹, Total Nitrogen 11.248 ± 0.141 mgL⁻¹ and Sodium 7.218 ± 0.028 mgL⁻¹. There was improved water quality at 30g Fe kg⁻¹ compared to other treatments. These results revealed that 30g Fe kg⁻¹ iron amino acid chelate supplementation had better nutritional attributes as feedstuff for spinach growth than the three other dietary treatments. The study recommends the incorporation of 30g Fe kg⁻¹ iron amino acid chelate in on-farm formulated diets for aquaponic system where complete diets are not easily accessible for small scale farmers.

This abstract was excerpted from the original paper, published in International Journal of Sciences: Basic and Applied Research (2018) 37(2): 162-172.

Effects of lysine and methionine supplementation and cost effectiveness in production of Nile tilapia diets (*Oreochromis niloticus*) in western Kenya (18-391)

Elizabeth Obado¹, Josiah Ani¹, Phillip O. Raburu¹, Julius O. Manyala¹, Charles Ngugi², Kevin Fitzsimmons³, and Hillary Egna⁴

1. University of Eldoret, Kenya, P.O. Box 1125, Eldoret, Kenya

2. Mwea AquaFish Farm P.O. Box 101040-00101 Nairobi, Kenya

3. University of Arizona, 1140 E, South Campus Drive, Forbes 306, Tucson, AZ 85719 USA

4. College of Agricultural Sciences, Oregon State University, Corvallis, Oregon 97331 USA

The proximate composition of local feed ingredient is limited by unbalanced dietary amino acid contents, thereby increasing de-amination and ammonia levels in water. This study formulated experimental diets and balanced the Essential Amino Acids (EAA) to enhance the feed nutritive value for culture of *Oreochromis niloticus*. Four diets comprising methionine+lysine and lysine supplemented at 5.1 g kg⁻¹, 2.7 g kg⁻¹ to non-EAAs supplemented and commercial diets at the University of Eldoret Fish Farm were tested. Growth performance was conducted in hapas suspended in earthen pond 150 m² in a randomized design for 105 days. There were significant variations in temperature (24 to 26 °C), Dissolved oxygen (4.8 to 6.2 mg L⁻¹) and pH (7.2-7.6) but within optimal range for tilapia. The diets provided about 17.17 MJ kg⁻¹ with 22.9% digestible Crude Protein and 8.03% ash content. Lysine supplemented Diet 2 induced highest mean final weight of 156.05 ± 1.74 g, 2.4 Specific

Publications continued on page 13 ...

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Growth Rate, 1.42 Feed Conversion Ratio and 2.68 Protein Efficiency Ratio. A high profit index (2.286 ± 0.07) at low incidence cost (0.437 ± 0.05) was observed in Diet 2. The study reports reduced production cost by supplementing plant proteins with limiting amino acids hence increasing nutritive value of aquafeeds.

This abstract was excerpted from the original paper, published in *International Journal of Research Science & Management* (2018) 5(3): 12-23.

Survey of fish consumption by women and children in An Giang province (18-392)

Huynh Van Hien, Nguyen Thi Kim Quyen, Tran Minh Phu, Tran Thi Thanh Hien, and Pham Minh Duc

College of Agriculture and Fisheries
Can Tho University, Can Tho City, Vietnam

The aim of this study is to assess amount of food and energy provided within 24 hours for women and children and to analyze the role of food fish for daily consumption. The study was conducted from January to November 2017 in An Giang province by interviewing 300 women and 300 children in the dry and wet seasons. The study found that women's daily dietary intake in dry and wet seasons was 750.3 g/day (1,411.8 kcal) and 780.6 g/day (1,403.5 kcal), respectively. For children, daily food intake in dry and wet seasons was 683.1 g/day (764.7 kcal) and 616.5 g/day (983.7 kcal), respectively. Food fish consumption by women accounted for 18.1-18.8% in quantity (10.9 - 12.8% in energy). For children, food fish products constituted 9.5 - 9.8% in quantity (6.8 - 9.3% in energy).

This abstract was excerpted from the original paper, published in *Journal of Vietnam Agricultural Science and Technology* (2018) 86(1): 106-112.

Aquaculture development and Uganda's agricultural extension system: The case of fish farmers in central and northern region (18-393)

Gertrude Atukunda^{1,2}, Andrew Elias State², Joseph Molnar³, and Peter Atekyereza²

1. National Fisheries Resources Research Institute, National Agricultural Research Organization, Uganda

2. Department of Sociology and Social Anthropology, Makerere University, Uganda

3. Department of Agricultural Economics and Rural Sociology, Auburn University, Uganda

Agricultural extension services are critical to the development of crops, livestock and fish farming in order to bring about social change. Fish farming, though introduced over 50 years ago through research and

extension, remains at a slow pace of growth. There is a consensus in academic and policy literature about the potential benefits of fish farming, particularly nutrition and income generation. So why has extension not been more successful in improving the status of fish farming? Most explanations focus on supply side issues highlighting lack of inputs, particularly fingerlings and feeds with little consideration given to how the extension services themselves are organized in view of fish farming under general agriculture. Equally absent in the discourse are the perspectives on the motivations and experiences of individual fish farmers. Drawing from the Actor Oriented Perspective, this paper examines the organization and current status of extension service provision in aquaculture based on perspectives of policy makers, extension workers and fish farmers. Interviews were conducted with 246 fish farmers, eight extension workers and 11 key informants from government institutions. Secondary sources of information included various government documents on agriculture. Results revealed slow growth of aquaculture due to institutional and social factors regarding alignment of extension service provision to the needs of fish farmers. Reforms instituted over the past decades in search of better ways to avail farmers with improved farming knowledge have had minimal success. Less than 50% of fish farmers received extension visits from district extension staff with moderate difference ($p < 0.05$) between frequency of extension visits in central and northern regions. Bias of extension service provision towards production related technical and information aspects above building and strengthening social capital of fish farmers was noted. Extension interventions should be socially negotiated and adapted in view of aspirations and limitations of fish farmers.

This abstract was excerpted from the original paper, published in [Journal of Fisheries and Aquaculture Development](#) (2018) 1.

Larval development of the Mexican Snook, *Centropomus poeyi* (Teleostei: Centropomidae) (18-394)

Kole M. Kubicek¹, Carlos Alfonso Álvarez-González², Rafael Martínez-García², Wilfrido Miguel Contreras-Sánchez², Camilo Pohlenz³, and Kevin W. Conway¹

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2. Laboratorio de Acuicultura Tropical, División Académica de Ciencias Biológicas. Universidad Juárez Autónoma de Tabasco, Villahermosa, Tabasco, Mexico C.P. 86039

3. Fish Nutrition Laboratory, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, TX, 77843. Phibro Animal Health Corporation, Guadalajara, JA 44130 México

We document for the first time the early ontogeny

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of *Centropomus poeyi* based on captive raised material representing 0-19 days posthatch (dph). The achievement of early developmental landmarks (i.e., yolk-sac depletion, flexion, development of fins) and changes in pigmentation are described (1.4 mm NL-10.6 mm SL; 0-19 dph) and documented for a subset of individuals using high quality photographs. The ontogeny of the viscerocranium is also described (2.4 mm NL-10.6 mm SL; 6-19 dph). Development in *C. poeyi* occurs over a short period with attainment of the juvenile stage (i.e., full complement of fin rays present in each fin) occurring by 6.9 mm SL. The ontogeny of external pigmentation in *C. poeyi* is marked by two trends throughout growth: (1) a decrease in pigmentation dorsally; and (2) an increase in pigmentation ventrally along the midline. Development of the viscerocranium begins with the appearance of the maxilla and dentary in individuals of 2.4 mm NL, coinciding with the depletion of the yolk-sac. By 10.6 mm SL all bones of the viscerocranium are present and teeth are present on all teeth-bearing bones of the adult. Aspects of early development in *C. poeyi* are compared with the congeners *C. undecimalis* and *C. parallelus*.

This abstract was excerpted from the original paper, published in [Neotropical Ichthyology \(2018\) 16\(1\)](#).

Analysis of efficiency of snakehead (*Channa striata*) model culturing in earthen pond in the Mekong Delta (18-395)

Huynh Van Hien¹, Tran Thi Thanh Hien¹, Pham Minh Duc¹, and Robert S. Pomeroy²

1. College of Aquaculture & Fisheries, Can Tho University
2. University of Connecticut

A survey of 131 households culturing snakehead with three scales production as following: 30 households with small scale (SS) 300-700 m²; 70 households with medium scale (MS) 700-1,500 m² and 31 households with large scale (LS) > 1,500-8,000 m² was carried out in the main snakehead culture areas in three provinces of An Giang, Dong Thap and Tra Vinh from January to December 2017. The study aimed to analyze production efficiency of snakehead culture to find out the optimal scale for recommend of sustainable culturing scale in the Mekong Delta. The technical analysis showed that the stocking density of small scale (SS) (55.1 ind/m²) was higher than that of medium scale (MS) (51.3 ind/m²) and large scale (LS) (51.9 ind/m²); survival rate of SS (63.1%) was lower than MS (64.5%) and higher than LS (57.5%); yield of SS (15.6 kg/m²) was lower than MS (16.2 kg/m²) and LS (16.9 kg/m²). In terms of economic efficiency: Direct cost of SS (485.2 thousand VND/m²) was lower than that of MS (502.5 thousand VND/m²) and LS (525.6 thousand VND/m²); the production cost of SS (30.9 thousand VND/kg) was lower than that of MS (31 thousand VND/kg) and LS (31.2 thousand VND/kg); profit ratio of SS (4.3%) was higher than that of MS (1.4%) and lower than that of LS (5.8%). Feed cost accounts for the largest proportion (78.4-81.8%) of total cost at all farming scales. In

summary, based on technical and economic aspects and actual conditions of production scale, SS is suitable for the sustainable development of snakehead fish in household culture in the Mekong Delta.

This abstract was excerpted from the original paper, published in *Journal of Vietnam Agricultural Science and Technology* (2018) 88(3): 107-112.

Impact of aquaculture feed technology on fish income and poverty in Kenya (18-396)

Akuffo Amankwah, Kwamena K. Quagrainie, and Paul V. Preckel

Department of Agricultural Economics, Purdue University, West Lafayette, Indiana, USA

The impacts of improved agricultural technologies on smallholder households in Africa are well documented in the literature. However, the literature on the welfare impacts of aquaculture technologies, especially in the context of smallholder households, is very scanty. This paper applies the propensity score matching technique to household survey data to examine the impact of improved feed technology on fish income and poverty in Kenya. After controlling for observable household characteristics, the results indicate that improved feed technology increases aquaculture income and reduces poverty among fish farming households. Specifically, the income effect of the technology is 23–37%, with resultant poverty reduction effect of 19–23% points. Evidence from the study indicates that the likelihood of adopting improved feed in Kenya will surge with improved extension service delivery, access to government subsidized feed, and easy market access for purchasing improved feed and sale of mature fish.

This abstract was excerpted from the original paper, published in [Aquaculture Economics & Management \(2018\): 1-21](#).

Alternative feeding strategies and feed ingredients for snakehead farming in Cambodia and Vietnam (18-397)

Tran Thi Thanh Hien¹, Pham Minh Duc¹, Nen Phanna², Hap Navy², Chheng Phen², So Nam², Robert Pomeroy³, and David A. Bengtson⁴

1. College of Aquaculture and Fisheries, Can Tho University, Can Tho, Vietnam
2. Inland Fishery Research and Development Institute, Phnom Penh, Cambodia
3. University of Connecticut, Avery Point, Groton, CT, USA
4. University of Rhode Island, Kingston, RI, USA

Prior to 2006, the predominant method for culturing snakehead in Vietnam and Cambodia was to collect

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wild juveniles from natural sources like the Mekong River and Tonle Sap. Particularly in Cambodia, aquaculture farmers, who were also fishermen, would collect their own fingerling snakehead. They would then also collect "small fish" (also known as low-value fish or trash fish) from natural sources, chop them up and feed them to the snakehead in culture. A conflict existed between users of these fish: the aquaculture/fishing people and the remainder of the Cambodian population who rely on small fish (Fig. 1) for a variety of products, including fish sauce and prahok, that provide protein to the Cambodian people throughout the year. As a result, and to protect the nutrition of the Cambodian people, aquaculture of snakehead was banned in the country in 2004.

This abstract was excerpted from the original paper, published in [World Aquaculture \(2018\) 49\(2\): 49-53](#).

Effects of Vitamin C on growth and immune parameters of snakehead culture in hapa (18-398)

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The experiment was carried out to evaluate the appropriate supplementation method and dose of vitamin C supplemented in feed in order to stimulate on growth and healthy parameters of snakehead (*Channa striata*). The study was conducted in 5 months, including 2 experiments. The first experiment consisted of 4 treatments of feed A supplemented with different vitamin C of 0, 500, 750 and 1000 mg/kg of feed during processing. The second experiment also included 4 treatments of feed B mixed with the same level of vitamin C as with feed A by traditional method. The results showed that the inclusion of vitamin C in pellet feed before extrusion was recorded better growth performance, survival rate and fish health compared to addition of vitamin C by traditional method in daily. Addition of vitamin C in diet for snakehead in commercial pellet feed at a level of 500 mg/kg of feed enhanced fish growth performance, survival rate, fish health and increasing profit.

This abstract was excerpted from the original paper, published in *Journal of Vietnam Agricultural Science and Technology* (2018) 89(4): 109-114.

Growth performance of spinach (*Spinacia oleracea*) on diets supplemented with iron-amino acid complex in an aquaponic system in Kenya (18-399)

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Aquaponic is an environmental-friendly production system involving reuse of waste and nutrients in production of fish and vegetables. Currently the system experiences unbalance in pH and nutrients deficiency in plants. This study investigated the effect of iron amino acid chelate supplement in fish feeds on growth performance of spinach (*Spinacia oleracea*) in aquaponic system. The experimental research was conducted at the University of Eldoret from August-December 2016. A complete randomized design was used in triplicate treatments. The supplementation quantity in fish diets constituted 30 Fe kg⁻¹, 20 Fe kg⁻¹, 10 Fe kg⁻¹ and 0 Fe kg⁻¹ of iron amino acid chelate respectively. At 30 Fe kg⁻¹ treatments spinach indicated a significant growth at ($p < 0.05$) than other treatments with final mean height (52.44 ± 0.798 cm) and 19.33 leaves. The least growth of spinach was at 0 Fe kg⁻¹ treatments with final mean (25.36 ± 0.72 cm, 9.704) height and leaves respectively. 30 Fe kg⁻¹ exhibited highest nutrients and improved water quality as compared to other treatments. The results revealed that 30 Fe kg⁻¹ iron amino acid chelate supplementation had significant nutritional attributes as feedstuff in aquaponic system for spinach growth than other dietary treatment tested.

This abstract was excerpted from the original paper, published in *International Journal of Research Science and Management* (2018) 5(7): 117-127.

Price seasonality in the catfish value chain in Uganda (18-400)

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Seasonal patterns in production and demand are common in many agricultural markets. Charting these patterns provides information that complements fundamental and technical analyses. It is in this spirit that this paper seeks to examine price seasonality in the catfish value chain in Uganda. The analysis draws on monthly prices taken from secondary source recorded data and uses moving average index to chart price patterns. The results reveal distinct seasonal patterns in the farm-gate, ex-vessel, retail, and wholesale market channels. Across market channels, the results for farm gate versus ex-vessel prices reveal that farmgate prices are more affected by seasonal effects compared to ex-vessel prices. On the contrary, both price series in the retail versus wholesale market channels show a declining trend, with the wholesale price series showing stronger

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variability compared to the retail price series.

This abstract was excerpted from the original paper, published in [Professional Agricultural Workers Journal \(2018\) 6\(1\): 13-25.](#)

Dietary methionine and lysine requirement of snakehead (*Channa striata*) fingerlings (18-401)

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This study was aimed determine the dietary methionine (Met) and lysine (Lys) requirement for snakehead fingerlings (2-4 g fish⁻¹). Basal diets in two experiments contained approximately isonitrogenous 42% and isoenergetic 20.3 KJ g⁻¹. In the first experiment on Met requirement, L-Met was added to the basal diets including six treatments containing from 7.3 to 14.8 g Met kg⁻¹ diet (17.5 to 35.3 g Met kg⁻¹ protein) interval increasing of 1.5 g kg⁻¹ diet. In the second experiment determining Lys requirement, L-Lys HCL was added to basal diets including seven treatments containing from 12.6 to 36.6 g Lys kg⁻¹ diet (30.1 to 87.2 g Lys kg⁻¹ protein), interval increasing of about 4 g kg⁻¹ diet. The experiments were randomly designed with four replications for each treatment. The first experiment indicated that optimal weight gain, special growth rate, protein efficiency ratio was found in the diet containing 28.2 g Met kg⁻¹ protein and there were significant differences in those parameters between diet treatment containing 24.8 g Met kg⁻¹ protein and other diets containing lower Met levels. The hepatosomatic index and protein content in whole-body fish were significantly affected by dietary Met levels. Feed conversion ratio (FCR) was significantly improved with the increase of dietary Met level in diet to 28.2 g kg⁻¹ protein (P < 0.05). Results of the second experiment showed that optimal growth rate and protein efficiency ratio were found in diet containing 73.1 g Lys kg⁻¹ protein and there were significant differences in those parameters between diet treatment containing 73.1 g Lys kg⁻¹ protein and other diets containing lower Lys levels. The hepatosomatic index, protein and fat content in whole-body fish were significantly affected by dietary Lys levels. The FCR was significantly improved by increasing dietary Lys concentration to approximately 77.9 g Lys kg⁻¹ protein. Fish survival rate were not significant differences among treatments in both experiments. Broken-line analysis on the basis of optimal growth rate showed that the dietary Met requirement was 11.9 g Met kg⁻¹ diet (28.4 g kg⁻¹ protein) and the dietary Lys requirement of snakehead was 30.7 g Lys kg⁻¹ diet (73.1 g kg⁻¹ protein).

This abstract was excerpted from the original paper, published in International Journal of Scientific and Research Publications (2018) 8(8): 795-805.

UPCOMING MEETINGS AND EVENTS

GOAL 2018

25-27 September 2018

Guayaquil, Ecuador

www.aquaculturealliance.org/goal

13th International Aquaculture Forum

27-28 September 2018

Guadalajara, Mexico

fiacui.com/en/

10th Euro-Global Summit on Aquaculture & Fisheries

8-9 October 2018

London, United Kingdom

aquaculture-fisheries.aquaconferences.com

7th Global Conference on Gender in Aquaculture & Fisheries

18-21 October 2018

Bangkok, Thailand

www.gafconference.org

Aquaculture Research 2018

19-20 October 2018

Rome, Italy

aquaculture-fisheries.pulsusconference.com

LAQUA 18

23-26 October 2018

Bogota, Columbia

www.was.org/meetings/default.aspx?code=lacqua18

PARTING SHOT



Taking in the sights of Montpellier, France during AquaFish's final farewell.

Photo courtesy of the AquaFish Innovation Lab.

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