AQUANEWS

Sustainable Aquaculture and Fisheries for a Secure Future

AquaFish Collaborative Research Support Program Newsletter

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In This Issue...

Snakehead Fish Aquaculture and Capture Fisheries in Vietnam and Cambodia: Value Chain Analysis and Technology Transfer

By LeXuan Sinh, Hap Navy, So Nam, David Bengtson, and Robert Pomeroy

Processing snakehead into a salted, dried product. Photo by Hap Navy

Snakehead retailer in Cambodia. Photo by Hap Navy

Snakehead is a very popular food fish in Vietnam and Cambodia. Aquaculture of this species has been going on for many years in Vietnam, using small-sized fish as feed for the cultured product, although recent research funded by the AquaFish CRSP has led to the development of pelleted diets with much of the fish meal replaced by plant proteins (see the Winter 2011 issue of Aquanews). In Cambodia there is a thriving wild snakehead capture fishery, but snakehead farming has been banned due to the use of small-sized fish as feed and because snakehead farming is based on collecting juvenile snakehead from the wild for stocking.

In order to better understand the economic structure of the aquaculture and capture fisheries industries and markets, two value-chain analyses were conducted--one for farmed snakehead in Vietnam and one for the wild-capture snakehead fishery in Cambodia. Value-chain analysis is an examination of all the activities involved in production and distribution from inputs to the end users. The goal of these analyses was to propose solutions for the expansion of the industries in the two countries, especially given that efforts are being made to develop a sustainable Cambodian snakehead aquaculture industry as well.

Snakehead value chain continued on page 8...

Tilapia Research and Public Outreach Improve Hondurans' Diets and Incomes

A new video produced by Oregon State University science writer Tiffany Woods is now available on the AquaFish CRSP website. The video captures the successes of CRSP research and outreach work in Honduras, starting back in 1983 under the Pond Dynamics/Aquaculture CRSP, which is still having positive impacts on the aquaculture industry there today. The video can be viewed at: aquafishcrsp.oregonstate.edu/video/index.php?video=6

Photo: *Faviola Acosta sells tilapia at a market in Honduras.* Photo by Tiffany Woods

5th ANNUAL FISH FARMER'S SYMPOSIUM & COMMERCIAL TRADE SHOW

Date: 11th -13th January 2012 Venue: UMA Hall Lugogo, Kampala

"Increasing Fish Production and Consumption in Uganda"

Now into its 5th successful year: A focus and meeting place for the key persons & companies in the East African Regional Aquaculture Sector: production, market chain, input suppliers, investors, research, government etc.

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Rates: WAFICOS Members: Ugshs. 10,000 (US $ 4)

Non-members: Ugshs. 20,000 (US $ 8)

Exhibition stalls: Ugshs. 100,000 (US $ 40) For Ugandan companies

Ugshs 250,000 (US$100) For international companies

Optional: Field Tour on Day 3 -Ugshs. 20,000 (US $ 8)

Organiser: Walimi Fish Cooperative Society (WAFICOS)

Access PDF of the flyer here: http://bit.ly/v2dIH9

Goings-on in the Pond...

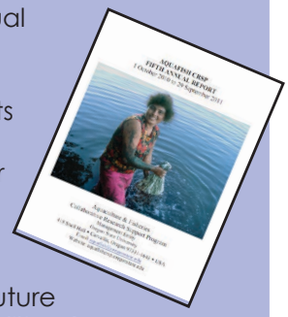
In Memorium

It is with great sadness that we announce the passing of Dr. Goro Uehara.

Former Director of the Soil Manangement CRSP, Goro celebrated his retirement from the University of Hawaii in 2011 after a long, successful career. Six months ago he was diagnosed with cancer and passed away peacefully in his home on 2 January 2012. Our condolences go out to his family.

Goro (third from the right) with fellow CRSP Direcotors in 2008. Photo courtesy of HIllary Egna.

See our website for a collection of AquaFish CRSP Success Stories, reporting on the accomplishments of CRSP researchers in bringing innovative technologies and practices to stakeholders in Africa, Asia, and Latin America. The Success Stories can be found at: aquafishcrsp.oregonstate.edu/publications.php



The AquaFish CRSP Fifth Annual Report is available on our website. The report covers the activities and accomplishments of AquaFish CRSP from 1 October 2010 to 29 September 2011.

The First Annual Report for the AquaFish CRSP Feed the Future Project, *Enhancing the Profitability of Small Aquaculture Operations in Ghana, Kenya, and Tanzania* is also available. The report covers the progress of work under this new Associate Award from USAID's Strategic Investment in Rapid Technology Dissemination Program. Both reports can be found at: aquafishcrsp.oregonstate.edu/publications.php

AquaFish CRSP Sponsored Events for 2012 include the **WAFICOS Annual Fish Farmer's Symposium and Trade Show** in Uganda 11-13 January 2012 (see flyer at left) and **IIFET 2012 Tanzania** in Dar es Salaam on 16-20 July 2012 (see page 11).

Development of household ponds in Nepal

The CRSP continues work on developing local pond systems to improve nutrition and increase income for poor farmers

By James Diana and Madhav Shrestha

In the Spring of 2000 in the village of Kathar in Chitwan, Nepal, a project started with German NGO support in collaboration with the Aquaculture and Aquatic Resource Management (AARM) Program of the Asian Institute of Technology (AIT) and the Aquaculture Department of Tribhuvan University's Institute of Agriculture and Animal Science (IAAS). The project, entitled "Women in Aquaculture in Nepal," was initiated and managed by IAAS Professor Dr. Madhav Shrestha, who has been involved with the CRSP since 1994. Project goals were to construct fish ponds and train local women in sustainable aquaculture techniques to help supplement their family food security. Dr. Shrestha hoped that the project would help to increase the limited availability of consumable animal protein for rural families in Kathar, to create additional income for households through the sales of raised fish, and to empower women whose traditional roles left them with limited opportunities.

Initial training for project participants included their involvement in the construction of 26 fish ponds. Upon completion in 2002, the community was left to manage the system on its own. The people of Kathar have taken this role to heart, organizing a committee to help maintain and develop the aquaculture system. They have continued to look after their ponds for the past nine years and have been responsible for remarkable changes. Not only has the community maintained the integrity of the original project, they have made major adjustments that have led to increased fish production. There are now over 100 fish ponds in Kathar, and nearly every family in the community has regular access to fresh fish.

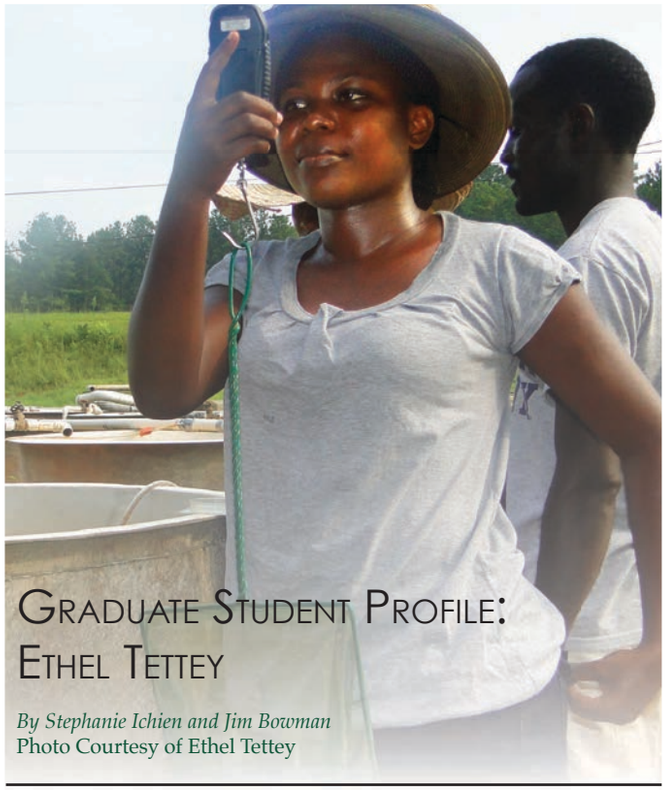
A woman farmer feeds the caged fish in her household pond. Photos courtesy of the authors.

A typical household with a cage-cum-pond system in Kathar, Nepal. Photos courtesy of the authors.

The Aquaculture CRSP became involved in Nepal in 2001, with Dr. Shrestha serving as a Host-Country PI for several investigations. Early work dealt with transferring fish production technologies from Thailand (AIT) to Nepal, investigating effects of introduced tilapia on native species, and conducting experiments on grass carp/tilapia polyculture. More recent work has focused on the development of cage-cum-pond systems, in which small cages are placed in ponds and stocked with tilapia or catfish reared for regular household consumption. They also have fish at large in the ponds that are harvested more irregularly. Income has been generated from the sales of these cultured fish, and the knowledge possessed by women regarding small scale aquaculture is revered. The end project has really fulfilled the dreams of long time CRSP researcher Dr. Yang Yi (now deceased) and many others who worked hard on cage-cum-pond systems for just such an application. Similarly, polyculture of sahar and tilapia has been successfully tested with those small-scale farmers of Kathar with the support of the AquaFish CRSP. Outcomes of on-station and on-farm research on tilapia-sahar polyculture were shared in a workshop conducted on 18 December 2009 at IAAS. A total of 41 participants attended the workshop. More farmers are ready to adopt this technology as sahar fingerlings become available.

Serious food security issues in Nepal were addressed through the simple dissemination of knowledge of aquaculture practices to a local community. The creation of sustainable fish ponds in Kathar has resulted in improvements in health, economic development, and the equality of women.

Dr. Shrestha earned his PhD at AIT in 1994 with support from the former Pond Dynamics/Aquaculture CRSP. There, Dr. Shrestha worked with Dr. Yang Yi, another long time CRSP researcher, who also completed his graduate education at AIT under CRSP. Both were students under emeritus CRSP PI Dr. C. Kwei Lin.



Graduate Student Profile: Ethel Tettey

By Stephanie Ichien and Jim Bowman
Photo Courtesy of Ethel Tettey

The aquaculture industry in Ghana is growing rapidly and is helping fill the shortage in food fish supplies created by declines in fish captured from the wild. However, the industry still faces challenges as it moves forward. AquaFish CRSP graduate student Ethel Tettey is working on these issues. In her graduate degree at Kwame Nkrumah University of Science and Technology (KNUST), Ethel is evaluating indigenous species as alternatives for culture in Ghana to diversify the aquaculture industry and help meet the increasing demands for food fish. According to Ethel, "a very high percentage of tilapia consumed is from aquaculture, but this is still inadequate to support the demand [for food] fish," which is where her work will have great impact. Working under the guidance of her major professor, AquaFish CRSP investigator Dr. Nelson Agbo of KNUST's Department of Fisheries and Watershed Management, Ethel has been conducting a case study on one of the potential alternate species, the mudfish (*Chrysichthys nigrodigitatus*). The case study includes assessments of its digestibility, growth performance, feed utilization, and body composition. Ultimately, the hope is to determine the feasibility of culturing the mudfish as an alternative species to the more commonly cultured tilapia and catfish.

Ethel comes from the small town of Somanya, situated between Lake Volta and the southern coast of the country in. She first became interested in aquaculture when, as an undergraduate at KNUST, she participated in experiments on fish from the Kpeshie Lagoon in Accra. This work was part of a student attachment at the Water Research Institute, one of the 13 component institutes of Ghana's Council for Scientific and Industrial Research (CSIR). Ethel completed her undergraduate work at KNUST in Natural Resource Management in June of 2006, and began work on an MPhil in Aquaculture Management in 2009.

Ethel initially chose to attend KNUST for her MPhil due to its prestige among aquaculture professionals in Ghana. Her thesis research, "Assessment of Alternative Indigenous Species for Culture in Ghana; A Case Study on *Chrysichthtys nigrodigitatus*," is a component of an AquaFish CRSP investigation called "Development and Diversification of Species for Aquaculture in Ghana" conducted by the Purdue University Project. As of November 2011, Ethel has completed her experimental work, in which she characterized *C. nigrodigitatus* for use in aquaculture. Next Ethel will run on-farm trials of *C. nigrodigitatus* for culture. and publish her results.

Ethel notes other challenges to the growth of the aquaculture industry in Ghana that need to be addressed: farmer access to funds, to high quality seed and feed, and to information from qualified aquaculture professionals, along with extension services. Through her work with the AquaFish CRSP, Ethel is not only making a contribution to the industry, but is also working hard as an aquaculture professional. As of the summer of 2011, Ethel has been participating in the AquaFish CRSP Master Training Program, which is helping her to become a qualified trainer with the capacity to provide technical assistance and disseminate innovative skills to the fish farming community in Ghana. The program began with a month-long advanced field training exercise in June-July 2011 at the International Center for Aquaculture and Aquatic Environments at Auburn University. In the follow-up portion of the CRSP Master Training Program, Ethel participated as a trainer in two aquaculture workshops in Ghana in September and October 2011, providing her with valuable experience from

The subject of Ethel's wok, the mudfish (Chrysichthys nigrodigitatus).
Photo courtesy of Kwamena Quagrainie.

Graduate student profile continued on page 5...

AquaFish CRSP Leadership in Iowa

By Stephanie Ichien, Ford Evans, and Jim Bowman

This past fall, AquaFish CRSP Director Hillary Egna and Research Projects Manager Ford Evans traveled to Des Moines Iowa during the 2011 Norman E. Borlaug International Symposium entitled "The Next Generation: Confronting the Hunger Challenges of Tomorrow," put on by the World Food Prize 12-14 October. Carrying the "Next Generation" theme throughout the event, presentations and dialogues explored the perspectives from around the world. At a time when the AquaFish CRSP is potentially drawing to a close and with several representatives from USAID in attendance, this was a significant opportunity to learn about and provide input for the path forward.

Prior to the formal symposium, Hillary and Ford attended the CRSP Council meeting on 10 October. This was an opportunity for the CRSP leadership to follow up on the CRSP Council meeting held in Uganda earlier this summer and to meet with the Board for International Food and Agricultural Development (BIFAD), a presidentially-appointed advisory council to USAID, whose primary role is to advise on agriculture, rural development, and nutrition issues related to global food security. This session helped to communicate to BIFAD the role of the CRSPs in leveraging a powerful system of research and education to conduct cutting edge work. Also in attendance were delegates from USAID including Rob Bertram, Director of the Office of Agriculture, Research, and Policy for the Bureau for Food Safety (BFS); and Sahara Moon, Team Leader in Agricultural Research with BFS. During the meeting, Bertram updated attendees on the processes through USAID in developing strategies for the future, and provided the group with a sense of where the resources in the Agency research budget are flowing. Bertram closed his comments by noting "that human and institutional capacity building is at the heart and soul of the CRSPs and it is something that USAID thinks about in all of its programs." The following day Hillary and Ford attended a BIFAD Public Meeting on "The next Generation: Global Food Security Through Human and Institutional Capacity Building," in which the Board drew on perspectives from the public to strategize on improving the work of USAID. (meeting minutes are located on the BIFAD website at: www.usaid.gov/our_work/agriculture/bifad/documents.html)

Five CRSP Directors from left to right: Hillary Egna (AquaFish), Dick Bowen (LCC), Muni Muniappan (IPM), Irv Widders (DGP), and John Yohe (INTSORMIL). Photo courtesy of Hillary Egna.

On 12 October Hillary was invited to present at the BIFAD Human and International Capacity Development (HICD) Working Group attended by other international agriculture directors and university representatives. With AquaFish as a leader in capacity building and in the number of mechanisms on the ground in host countries and in the US for outreach, Hillary was the primary speaker stimulating discussion and conversation.

The event also provided an opportunity for Hillary to catch up with CRSP graduate student and Borlaug LEAP fellow, Yaw Ansah. Ready to carry the torch for aquaculture in international development, Yaw is the most recent of four LEAP Fellows from AquaFish in the past three years. For more information on the LEAP fellowship and the current RFA please visit: leap.ucdavis.edu/

The Cultural Practice LLC team, who is receiving AquaFish funding to conduct the "CRSP Council Knowledge and Data Management (KDM) Project" hosted a "Learning from Sucess" booth at the symposium. The team had brochures and six new CRSP flyers available for attendees demonstrating wealth of information accumulated by all the CRSPs.

...Graduate student profile continued from page 4

which she can continue to grow professionally. (To learn more about the AquaFish CRSP Master Training Program, see page 9 of the Summer-Fall 2011 issue of Aquanews.)

The successes of aquaculture in Ghana are many, including increased public awareness in fish farming and a growing cage culture industry on Lake Volta. As Ethel finishes her graduate work, she hopes to continue "to work actively in the aquaculture industry in Ghana and to become a principal tool for the development of aquaculture in [her] country Ghana through research and useful collaborations with farmers and other stakeholders in the industry."

CRSP Research Increases Profits For Small-Scale Fish Farmers in Southeast Asia

By Peg Herring

Nueva Ecija, Philippines - The Philippines made its debut at the world's largest seafood fair in Brussels, Belgium, this year, showcasing some of the products that have made the Philippines the 8th leading fish-producer in the world.

Back home and out of the limelight, equally important breakthroughs are occurring for the more than 40 percent of fish farmers in the Philippines who live in poverty. Small-scale, low-income Filipino fish farmers are increasing profits and protecting water quality by changing the way they feed their fish.

As much as 70 percent of a fish farmer's variable production costs go to buying supplemental feed. And some of the uneaten feed inevitably drops to the bottom of their freshwater ponds, wasted as food for fish and polluting the water.

The solution? Feed fish less food.

Remedios Bolivar, a professor at the College of Fisheries, Central Luzon State University in the Science City of Muñoz, and her U.S. research partners Russell Borski, a professor of biology at North Carolina State University in Raleigh, and Christopher Brown of the National Oceanic Atmospheric Administration are working with small-scale fish farmers in the Philippines to develop feed reduction strategies that save farmers money and still produce healthy, full-size tilapia within the standard 150-day grow-out period to reach market size.

Brown, Borski and Bolivar tested three different approaches to reducing feed for pond-raised tilapia: delay the start of supplementary feeding, feed every other day, or feed below the level of satiation.

Their results document that tilapia grown in earthen ponds with plenty of algae and other natural pond foods can do just fine with any of these reduced feeding regimes, effectively reducing supplemental feed costs without significantly reducing growth, survival or market yield.

"By reducing feed rations, fish farmers can save as much as 60 percent of the cost of feeds which can enhance the profitability of growing fish by as much as 40 percent relative to fish grown on a typical full daily ration," Borski said. "That's big."

Evelyn Grace D.J. Ayson, who also works with Borski, found similar results--up to 60 percent savings in feed costs--with reduced feeding of milkfish, a regional favorite marine fish.

"Equally important are the reduced environmental impacts that come with reduced feeding strategies," said Ayson, who heads the Research Division of the Southeast Asian Fisheries Development Center in Iloilo.

Ayson and her research team documented reductions in dissolved nitrogen and phosphorus in the water and reduced hydrogen sulfide in marine sediments around the cages where feed was reduced, compared to cages where milkfish received regular full daily rations.

Southeast Asia continued on page 7...

...Southeast Asia continued from page 6

This research means big change for low-income fish farmers in the Philippines and elsewhere in developing parts of the world. It is the work of the Aquaculture & Fisheries Collaborative Research Support Program (AquaFish CRSP) which is funded by the U.S. Agency for International Development (USAID).

Ayson, Bolivar and Borski are part of the AquaFish CRSP, an international research program headquartered at Oregon State University that connects U.S. university scientists with research partners in developing countries.

The idea of delayed feeding came from another AquaFish CRSP researcher, James Diana of the University of Michigan, while he was working with fish farmers and scientists in Thailand during the 1990s.

"We saw how reduced feeding of tilapia could save money on feed costs and reduce pollution of the water ," Diana said. Through the AquaFish CRSP network, reduced feeding strategies are now being tested by fish farmers and researchers in other parts of Asia, Africa and Latin America.

Like most larval fish, tilapia retain a yolk-sac for the first few days of life. Living off the stored nutrients in this sac, young tilapia can gradually adjust to the plant-eating life of an adult. Historically, fish farmers added no supplemental feed for tilapia, choosing instead to fertilize the pond to feed the plankton and let the pond feed the fish.

As tilapia aquaculture developed and became more intensive, fish farmers began using supplemental feed to speed the growth and increase the size of fish at harvest. But as the cost of feeding fish increases, it may be worthwhile to consider these cost-saving strategies, according to Bolivar.

To reach Filipino fish farmers, and anyone else in the world, with information on these new strategies, Borski and his colleagues have produced a series of podcasts describing the reduced feeding strategies. The Tilapia Podcasts are available at: *deimos.apple.com/WebObjects/Core.woa/BrowsePrivately/ncsu.edu.1784740579.01784740581*

Photos: Opposite page: *A tilapia farm in the Philippines where feeding trials are underway.* This page: *Harvested tilapia (center), and Aquaculture workers netting market-size tilapia in the Philippines.* All three photos courtesy of Russell Borski.

...Snakehead value chain continued from page 1

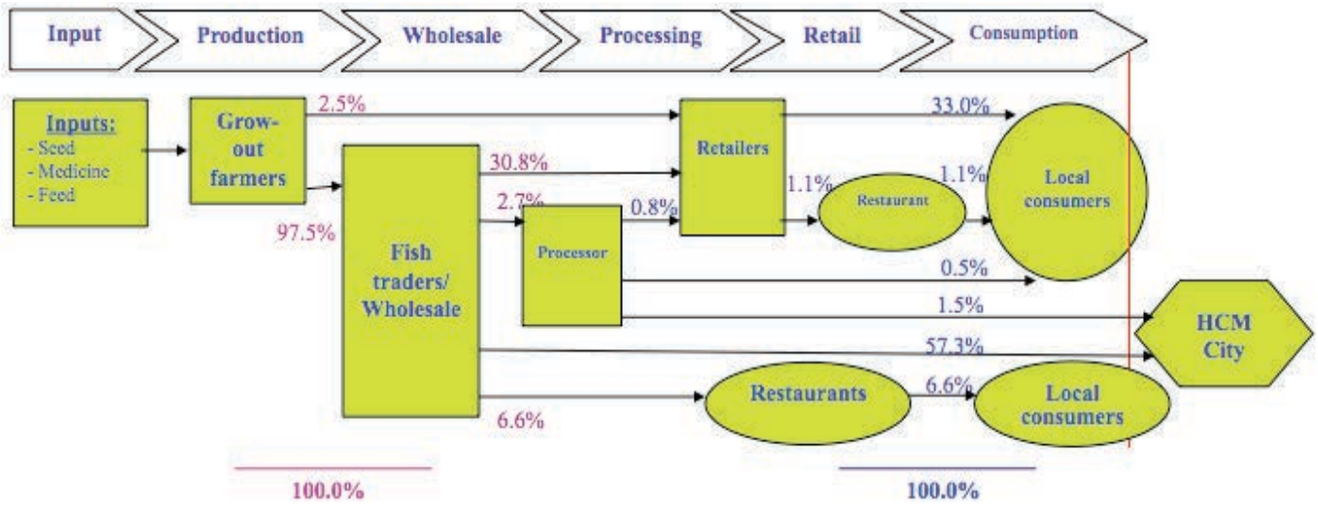


Figure 1: Map of cultured snakehead value chain in the Mekong Delta of Vietnam.

The analyses were based on interviews with 485 households in Vietnam and 465 households in Cambodia. Participants were from all segments of the value chain, including farmers, fishers, wholesalers, retailers, processors, restauranteurs, and others. Surveys were conducted in four provinces in each country plus the major cities of Phnom Penh, Cambodia, and Ho Chi Minh City, Vietnam.

In Vietnam, ten significant market channels were identified (Figure 1), with the two most prominent being "Fish farmers – Wholesalers – Retailers – End consumers in the Mekong Delta (MKD)," and "Fish farmers – Wholesalers – Wholesalers in Ho Chi Minh City". In Cambodia, 11 significant market channels were identified (Figure 3), with 25% of the wild-caught snakehead going directly from fishers to end users. An examination of profits throughout the Vietnamese value chain indicates that wholesalers reap about 90% of the total profits in the system, based on the large volume (728 kg) that each processor handles and a profit of 1200 VDN per kg. Farmers, on the other hand, make only about 6% of the profit in the system, based on production of a small amount (about 14 tons) per farm and a profit of 4400 VDN per kg. Retailers make the greatest profit per kg (7500 - 9700 VDN), but only account for a small percentage of total profits in the system due to the small number of kg that each retailer handles.

*Figure 2: An AquaFish CRSP earthen pond of wild striped snakehead breeders (*Channa striata*) collected from the Tonle Sap Great Lake for the FARDeC hatchery in Cambodia.* Photo courtesy of the authors.

In order to help develop snakehead aquaculture in Cambodia, AquaFish CRSP researchers have adapted the pelleted feed and breeding technologies from Vietnam to Cambodia. Cambodian fisheries biologists from the Inland Fisheries Research and Development Institute in Phnom Penh and the Freshwater Aquaculture Research and Development Center (FARDeC) in Prey Veng province were trained for two months at Can Tho University in Vietnam. After returning to Cambodia, they brought wild striped snakehead (*Channa striata*) from Cambodia's Tonle Sap Great Lake into the FARDeC hatchery (Figure 2). This was a conscious decision to use native Cambodian genetic stocks to start the domestication program, rather than introducing Vietnamese stocks. Can Tho University scientists assisted the Cambodian scientists in conducting experiments on hormonal induction of spawning and larval rearing at the FARDeC hatchery

Snakehead value chain continued on page 9...

...Snakehead value chain continued from page 8

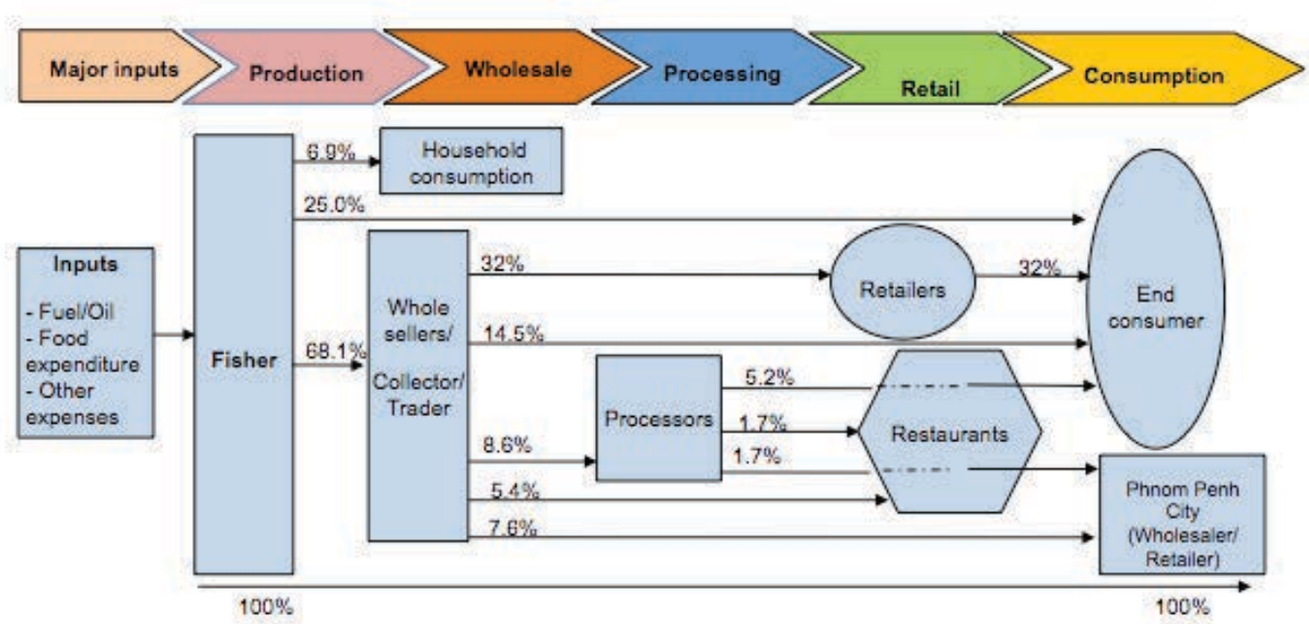


Figure 3 : Map of the cultured snakehead value chain in Cambodia.

(Figure 4) and the new generation of fish is now approaching maturity, when they will become the domesticated broodstock for the future of snakehead culture in Cambodia.

When snakehead juveniles are collected from the wild for use in aquaculture, they cannot be trained to feed on pelleted diets and must be fed small-sized fish from the wild. These small-sized fish are also used by the rural poor to make fermented fish, fish paste, and smoked fish products that Cambodians rely on throughout the year as a source of protein. Thus there is a user conflict between fish farmers and fish consumers for the small-sized fish resource.

Figure 4: Researchers at the FARDeC induce spawning of a striped snakehead. Photo courtesy of the authors.

Hatchery-raised snakehead can be trained from the earliest stages to feed on pelleted diets. As the fish grow, they can continue be raised to harvest size on pelleted diets, thereby leaving the small-sized fish for human consumption. The "trainability" of the fish in the hatchery appears to be related to the degree to which the breeding stock has been domesticated. AquaFish CRSP research in Vietnam suggests that the striped snakehead, which has been domesticated for more than two decades, transitions to pelleted feed more readily than does the giant snakehead, *Channa micropeltes*, which has been domesticated for less than a decade. Given that the fish in the FARDeC hatchery in Cambodia are first- and second-generation striped snakehead, it may take a while for their offspring to readily accept pelleted diets. The success of this hatchery program is critical to the development of a viable and environmentally sustainable farmed snakehead culture industry in Cambodia.

AquaFish CRSP support has produced great benefits for snakehead aquaculture and protection of freshwater fisheries in Vietnam and Cambodia. The low-fishmeal pelleted feed and Cambodia's hatchery program will lessen aquaculture's environmental footprint while also lowering the competition for small-sized fish that are such important food sources for the poor. Collaboration between Vietnamese and Cambodian scientists is another essential component for the development of sustainabile snakehead aquaculture.

Notices of Publication

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

Differential effects of cortisol and 1-deoxycorticosterone on ion transport protein mRNA levels in gills of two euryhaline teleosts, Mozambique tilapia *(Oreochromis mossambicus)* and striped bass *(Morone saxatilis) (11-276)*

Pia Kiilerich[1], Christian K. Tipsmark[1,2], Russell J. Borski[2] and Steffen S. Madsen[1]

[1]Institute of Biology, University of Southern Denmark, Campusvej 55, DK-5230 Odense M, Denmark
[2]Department of Biology, North Carolina State University, Raleigh, North Carolina 27695-7617, USA

The role of cortisol as the only corticosteroid in fish osmoregulation has recently been challenged with the discovery of a mineralocorticoid-like hormone, 11-deoxycorticosterone (DOC), and necessitates new studies of the endocrinology of osmoregulation in fish. Using an in vitro gill explant incubation approach, DOC-mediated regulation of selected osmoregulatory target genes in the gill was investigated and compared with that of cortisol in two euryhaline teleosts, Mozambique tilapia (*Oreochromis mossambicus)* and striped bass (*Morone saxatilis*). The effects were tested in gills from both fresh water (FW)- and seawater (SW)-acclimated fish. Both cortisol and DOC caused an up-regulation of the Na^+,K^+-ATPase α1 subunit in SW-acclimated tilapia but had no effect in FW-acclimated fish. Cortisol conferred an increase in $Na^+,K^+,2Cl^-$ cotransporter (NKCC) isoform 1a transcript levels in FW- and SW-acclimated tilapia, whereas DOC had a stimulatory effect only in SW-acclimated fish. Cortisol had no effect on NKCC isoform 1b mRNA levels at both salinities, while DOC stimulated this isoform in SW-acclimated fish. In striped bass, cortisol conferred an up-regulation of Na^+,K^+-ATPase α1 and NKCC transcript levels in FW- and SW-acclimated fish, whereas DOC resulted in down-regulation of these transcripts in FW-acclimated fish. It was also found that both corticosteroids may rapidly (30 min) alter the mitogen-activated protein kinase signalling pathway in gill, inducing phosphorylation of extracellular signalregulated kinase 1 (ERK1) and ERK2 in a salinity-dependent manner. The study shows a disparate organisation of corticosteroid signalling mechanisms involved in ion regulation in the two species and adds new evidence to a role of DOC as a mineralocorticoid hormone in teleosts.

This abstract was excerpted from the original paper, which was published in Journal of Endocrinology (2011) 209: 115-126.

Anatomical and histological characteristics of the intestine of the Topmouth Culter (*Culter alburnus*) (11-277)

X. J. Cao, W. M. Wang and F. Song

College of Fisheries, Key Lab of Agricuitural Animal Genetics, Breeding and Reproduction of Ministry of Education, Huazhong Agricultural University, Wuhan, Hubei, 430070, China

Topmouth culter (*Cuiter alburnus*), a freshwater carnivorous fish of the Cyprinidae, is one of the most popular fish species in aquatic market in China. The anatomy and histology features of fish intestine are veq useful for understanding digestive physiology, diagnosing some intestinal diseases and formulating suitable feeds. Thus, here we first characterize topmouth culter intestine via light microscope, transmission electron microscope and scan electron microscope. The 'Z' shaped intestine can be divided into three parts (e.g. the anterior intestine, middle intestine and posterior intestine), with an intestinal coefficient of 0.68. The anterior intestine possessed the longest mucosa folds and thickest muscularis among the three intestinal parts, and microvilli were very well-developed whilst many mitochondria, endoplasmic reticulums and lysosomes were found in which. This indicated the anterior intestine was a main region for digestion and absorption of food in the topmouth culter. While the vacuoles observed in the posterior intestine may be closely related to the intracellular digestion. Neutral and acid mucus were strongly present throughout the intestine. This detailed descriptive paper will be very helpful for studies of toprnouth culter related to its digestive physiology, intestinal diseasecontrol and feed nutrient.

This abstract was excerpted from the original paper, which was published in Anatomia Histologia Embryologia: Journal of Veterinary Medicine (2011) 40: 292-298.

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

Upcoming Meetings and Events...

The AquaFish CRSP promotes workshops and meetings designed to facilitate increased knowledge and communication in aquaculture. Meetings and workshops coming up include...

Aquaculture America 2012: Bringing Players to the Table
29 February- 2 March 2012
Las Vegas, Nevada USA
www.was.org/WasMeetings/meetings/Default.aspx?code=AA2012

Australasian Aquaculture 2012
1-4 May 2012
Melbourne, Victoria, Australia
www.was.org/AA12/Default.aspx

Aquaculture UK 2012
23-24 May 2012
Aviemore, Scotland
http://www.aquacultureuk.com/

IIFET 2012 Biennial Conference
16-20 July 2012
The University of Dar es Salaam
Dar es Salaam, Tanzania
http://oregonstate.edu/dept/IIFET/

The Ninth International Conference on Recirculating Aquaculture
24-26 August 2012
Roanoke, Virginia
http://www.recircaqua.com/icra.html

Aqua 2012: Global Aquaculture Securing Our Future
1-5 September 2012
Prague, Czech Republic
www.was.org/WasMeetings/meetings/Default.aspx?code=Aqua2012

Aquaculture 2013
21-25 February 2013
Nashville, Tennessee

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PONDerings...

The Travelled Oyster

By John Kenyon

An oyster, upon oozy bed,
Like his forefathers, born and bred,
It chanced, was wafted far and wide
By force of wind and force of tide;
Nor are there wanting folk to say
He drifted fairly round the bay.
At last he drifted back agen;
The very finest one might ken
Of travelled oyster-gentlemen.
For, though ne'er out of his own shell,
He saw, or thought he saw, as well,
And was, or deemed himself, as wise
As fishes who use fins and eyes.
In secret news he yields to none;
Knows all the deeds by muscles done;
'Mong limpets what dark plots are hatching,
What territory prawns are snatching;
And has—from information—glimpse
Of coming war among the shrimps.
On all who hap within his reach,
(For 'tis his darling pride to teach)
He rolls that tongue which none may quell;
While every brother of the shell
Is sadly bound to stand the shock,
Chained, like Prometheus, to his rock.

And, Reader! we have seen, I wis,
Full many a dull-brained fish like this,
Who, having drifted Europe round,
Floats back at last to his old ground;
And though, like oyster, shut within
His sulky shell, he nought hath seen,
Yet still, in right of foreign travel,
Assumes to talk—instruct and cavil.
Speak of a church—he quotes Saint Peter's;
A watch—he cites Breguet's repeaters ;
And e'en the trout, on which we dine,
Would have been better from the Rhine;
While we, chair-bound and wretched quite,
Are forced to feign a mien polite.

Good Reader! were it ours to choose,
Such ne'er should quit their native ooze;
Or ne'er, at least, should hit the track
Which brings them, for our torture, back.

Excerpted from "Poems: For The Most Part Occasional" by John Kenyon. London, British Library, Historical Print Editions, 1838. p. 95-96.

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