

# POND TO PLATTER:



## Linking Human Nutrition and Sustainable Aquaculture in Africa

*The Feed the Future Innovation Lab for  
Collaborative Research on Aquaculture & Fisheries*

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# Why Aquaculture & Why Fish?

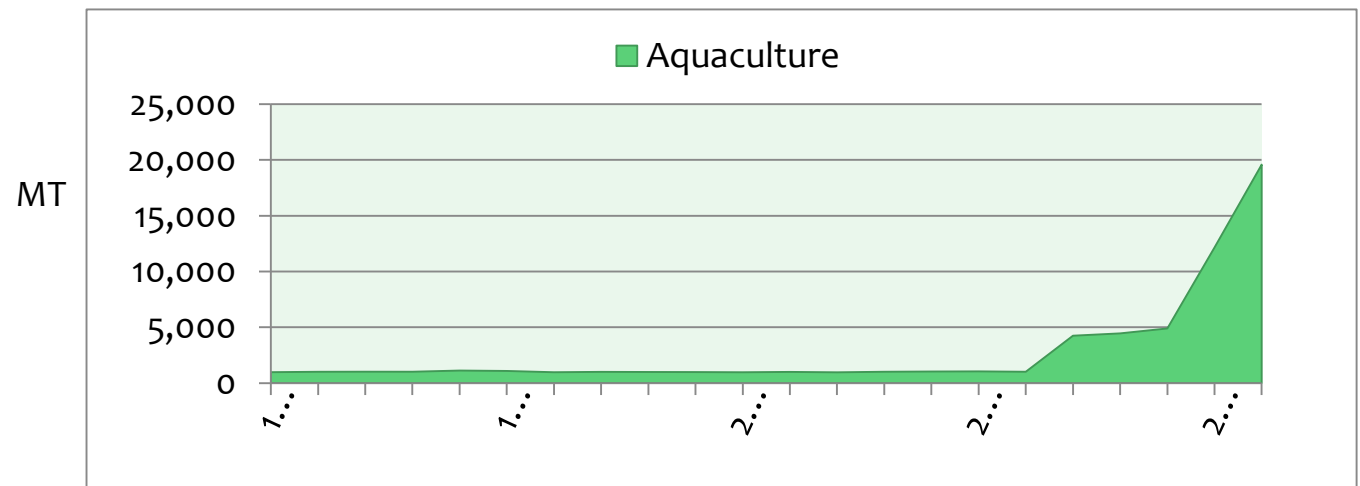
Defn. : aquaculture = agriculture; fisheries = hunting

most aquaculture production occurs in warmer climates; climate smart responses considered

3x faster growth than agriculture -- 8%/yr since 1970 (Blue Rev)

now accounts for ~50% of world's seafood consumption

recent improvement in Africa, ex. Kenya: **Annual fish production**



- \* Fish comprise a substantial portion of the animal protein consumed throughout much of the world, including over half of animal protein intake in several African countries.
- \* As demand for animal-source protein continues to grow, aquaculture stands out as an efficient, sustainable, and affordable method of food production. Challenges for responsible aquaculture: risk – reward tradeoffs.
- \* AquaFish response has utilized a systems approach, working with a number of species (commodities), and scales to sustainably intensify productivity of small holder farms.
- \* **The nutrition focus in FTF –emphasis placed on animal source and nutrient rich foods.**



# Nutritional Value of Fish (Seafood) Products

- \* The nutrients available in fish can help fill the gaps that represent some of the most **widespread deficiencies among vulnerable populations, specifically iron, zinc, and vitamin A.**
- \* Many species of fish, particularly **small-sized fish eaten whole, are densely packed with fat-soluble vitamins** (A, D and E), water-soluble vitamins (B complex), and minerals (calcium, phosphorus, iron, iodine and selenium).
- \* **Humans can more effectively metabolize fish oils** than many other sources of long-chain **omega-3** polyunsaturated fatty acids that are critical to **pregnant women and developing children for optimal brain and neurodevelopment**, as well as long-term vascular health.
- \* Regular consumption of fish is recommended to reduce the risk of vascular illnesses such as coronary heart disease and ischemic stroke.
- \* The food value of farmed aquatic plants are also significant, with **seaweeds**, in particular, being a rich source **of essential and trace minerals** such as copper, boron, nickel, cobalt, zinc, iron, and iodine.
- \* Fish and other aquatic products can be dried and saved as **post-harvest food** reserves, thus extending food availability throughout the year and reducing vulnerability to undernutrition and its broad set of health consequences.

# Nutritional Comparison of Aquatic and Terrestrial 'Livestock' Products

Nutritional Value (raw, 100g serving)	Tilapia	Carp	Catfish (Channel, farmed)	Oyster (farmed)	Shrimp	Pig ( pork loin)	Chicken (broilers, fryers, meat only)	Cow (ground beef)	Goat	Eggs (chicken)	Milk (cow)
<b>Macronutrients</b>											
Calories (kcal)	96	127	119	59	71	120	119	333	109	143	61
Fat (g)	1.7	5.6	5.9	1.6	1.0	3.5	3.1	30	2.31	9.5	3.3
Protein (g)	20.1	17.8	15.2	5.2	13.6	20.6	21.4	14.4	20.6	12.6	3.2
<b>Vitamins</b>											
Vit. A (e.g. mola)(µg)	0	9	0	8	54	0	16	14	0	160	46
Vit. B6 (mg)	1.62	0.19	0.15	0.06	0.16	0.80	0.43	0.30	NA	0.17	0.01
Niacin (mg)	3.91	1.64	2.11	1.23	1.78	6.60	8.20	3.40	3.80	0.07	0.10
Folate (µg)	24	15	10	18	19	0	7	9	5	47	5
<b>Minerals</b>											
Iron (mg)	0.56	1.24	0.23	5.78	0.21	0.97	0.89	1.64	2.83	1.75	0.03
Zinc (mg)	0.33	1.48	0.48	37.92	0.97	1.90	1.54	3.60	4.00	1.30	0.37
Calcium (mg)	10	41	8	44	54	6	12	24	13	56	113
Magnesium (mg)	27	29	19	33	22	27	25	14	NA	12	10
<b>Fatty Acids</b>											
omega-3 Poly-unsat (g)	0.36	1.43	1.12	0.59	0.30	0.57	0.75	0.70	0.17	1.90	0.19
<b>Feed conversion ratio</b>	1.5	1.5	1.4	NA	1.6	3.7	2.9	27	8.6	2.3	1.2
antibiotics etc.											

Nutritional value of fish varies by species

Land animals v aquatic animals bioenergetics; carnivores; domestication

Focus on most common aq sp (in Africa: tilapia, catfish, shellfish)– lower on food chain

Feed Conversion Ratio- varies by scale (intensification); mgnt practices; meas method



- \* As Intensification occurs –feed and feed costs become a major challenge. ~80% of op costs. Other Feed Issues: Effluent; reliability. BMPS.
- \* Response to this challenge:
- \* improving feed efficiencies (eg digestibility);
- \* producing lower cost feed while maintaining quality (fishmeal/plant proteins);
- \* using natural feeds...



- \*pioneered by PDA CRSP (modelled, global exp; bioecon DSS tools)
- \*demand dependent: when feed costs are high; for herbivores/opportunists
- \*relies on natural pond productivity & advanced mgnt practices
- \*current SH farms are typically not well managed and much more fish can be produced by improving mgnt practices; outreach/ext/finance role.
- \*yield gap- researchable area AquaFish has made much headway; BMPs



## \* Green Water Technology



Most fish produced are sold to increase income, provide choice, improve diet and lifestyle. Pond to platter usu involves a lengthy pathway & VC.

- \* Value chain- focus on women
- \* Market development- Cell phone networks
- \* Value added products (leather, pearls, sausage)
- \* Business development – record keeping for loans
- \* Behavior change comm--School fishponds, etc





# AquaFish Global Themes

**A. Improved Human Health and Nutrition: Food Quality and Food Safety**



**B. Income Generation for Small-Scale Fish Farmers and Fishers**

**C. Environmental Management for Sustainable Aquatic Resources Use**

**D. Enhanced Trade Opportunities for Global Fishery Markets**

# Aquaculture Development in Kenya and Uganda: Advancing Cost-Effective Technology, Market Assessment, and End-User Engagement

Funded and Affiliated Partners\* (2013 – 2015)

*\* non-funded/leveraged partners and Personal Service Contracts (PSCs)*

## Kenya

Kenyatta University, University of Eldoret, GOK Ministry Fisheries, FishAfrica\*, Bidii Fish Farmer Association\*, Uasin Gishu County Government\*, KMFD Sagana\*, Moi University\*, Mwea Aquafish Farm\*, University of Nairobi\*

## Uganda

Makerere University, Gulu University\*, National Fisheries Resources Research Institute-Aquaculture Research and Development Center, Walimi Fish Cooperative Society\*

## USA

Auburn University, Alabama A&M, Univ of Arizona, Oregon State University

This project aims to solve or clarify bottlenecks that limit the advancement of fish culture in Uganda and Kenya to improve livelihoods, nutrition, and income for fishers, farmers, and vulnerable communities.

## NUTRITION FOCUSED OBJECTIVES INCLUDE:

- \* Developing low-cost breeding and hatching technologies of **native Lungfish to improve nutrition and income for vulnerable communities** in Uganda (**climate smart**)
- \* **Assessing market opportunities** for fishers and farmers in Central Uganda
- \* Improving nutrition through **Best Management Practices** training for tilapia cage culture in Kenya
- \* Improving household income for small-scale farmers through the development of low-cost **aquaponics** systems in Kenya

# Aquaculture Development and the Impact on Food Supply, Nutrition and Health in Ghana and Tanzania

Funded and Affiliated Partners\* (2013 – 2015)

*\* non-funded/leveraged partners and Personal Service Contracts (PSCs)*

## Ghana

Kwame Nkrumah University of Science and Technology, University for Development Studies, Ministry of Fisheries and Aquaculture Development\*, FarmerLine\*

## Tanzania

Sokoine University of Agriculture, Institute of Marine Sciences at University of Dar es Salaam, Western Indian Ocean Marine Sciences Association

## USA

Purdue Univ, Virginia Tech, Univ Arkansas PB, Univ Hawaii Hilo, Oregon State Univ

This project aims to examine various facets of aquaculture sciences and the contributions to food supply, nutrition, and health in Ghana and Tanzania. The research looks beyond the direct production outcomes from fish farming in rural communities to consider the additional benefits that manifest in nutritional outcomes.

## NUTRITION FOCUSED OBJECTIVES INCLUDE:

- \* Assessing improvements in household food **security** and nutrition in selected fish farming communities in Tanzania and Ghana
- \* Measuring the effect of aquaculture as an input and technology transfer program on household food security using **nutritional indicators** in Tanzania and Ghana
- \* **Enhancing the omega-3 fatty acid content** of tilapia for human health in Ghana
- \* Improving food security and family income for **women shellfish farmers** through spat collection and nursery methods in Tanzania

# AquaFish Innovation Lab

Cross cutting issues: gender, climate change, capacity building, HC priority focus, respectful partnerships, systems approach, FTF aligned

**Mission -- enrich livelihoods and promote health** by cultivating international multidisciplinary partnerships that **advance science, research, education, and outreach in aquaculture and fisheries** in **environmentally sensitive and socially acceptable** ways. Bringing together resources from US and Host Country institutions, AquaFish strives to:

- \* Strengthen the **capacities** of its partnering institutions and participants
- \* Sustainably increase the efficiency of aquaculture technologies
- \* Improve aquaculture farm management practices
- \* Disseminate research results to a broad audience





# Questions?

*visit our website at:*  
[aquafish.oregonstate.edu](http://aquafish.oregonstate.edu)