

MITIGATING THE NEGATIVE ENVIRONMENTAL IMPACTS OF AQUACULTURE PRACTICES: DEVELOPING SUSTAINABLE FEED TECHNOLOGIES

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THROUGH COLLABORATIVE PARTNERSHIPS, AQUAFISH CRSP INVESTIGATES SUSTAINABLE FEED TECHNOLOGIES AS PART OF A BROAD RESEARCH FOCUS

With the rapid growth of aquaculture production worldwide, negative environmental impacts are of increasing concern. Aquaculture practices can be associated with a range of issues including dependence on fishmeal, habitat degradation, contaminated water systems, increases in the spread of fish diseases, and the introduction of alien species. Mitigation of these adverse effects is key to developing sustainable end-user level aquaculture systems. Fish feeds are a major expense for small-scale aquaculture farms. Ingredients can be costly, particularly protein sources such as fishmeal. Other costs are attributed to feed wastage due to uneaten feed or poor feed conversion efficiency. In moving away from the dependence on fishmeal, feed research is now focusing on locally available protein sources derived from plant materials and food processing by-products. Therefore, the development of nutritionally efficient diets and optimal feeding strategies will not only reduce operating costs but also minimize environmental impacts.

The Aquaculture & Fisheries Collaborative Research Support Program (AquaFish CRSP) strives to enrich livelihoods and promote health through international multidisciplinary partnerships that advance science, research, education, and outreach in aquatic resources. AquaFish CRSP is currently supporting research on sustainable feed technologies, as part of a larger research portfolio. The goal of this work is to lower costs and to improve feed efficiencies while reducing the ecological footprint of fish culture. AquaFish CRSP investigations in Africa, Asia, and Latin America are exploring different sustainable feed technology approaches, including:

- Replacement of fishmeal and other costly protein sources in diets of omnivorous and carnivorous fish with protein from sustainable local sources;
- Optimizing feeding schedules to lower feed input;
- Adoption of least-cost formulation and feed manufacturing technologies to develop less expensive and more efficient feeds.

This poster highlights AquaFish CRSP investigations in Vietnam, Cambodia, Philippines, Guyana, Tanzania, and Kenya.



Sampling tilapia in feed studies in the Philippines.



Converting local fish byproducts into aquaculture feed in Guyana

UTILIZING LOCAL INGREDIENTS IN AQUACULTURE FEEDS

The culture of some fish is highly dependent on expensive fishmeal as a key dietary input. In an effort to reduce production costs and relieve pressures on wild fish stocks that support fishmeal production, these AquaFish CRSP projects aim to reduce dependence on fishmeal and identify local and more readily available ingredients.

VIETNAM AND CAMBODIA

Alternative Feeds for Freshwater Aquaculture Species in Vietnam

- Identified species composition, size, and chemical composition of the small-size/low value fish commonly used in fishmeal.
- Developed a weaning strategy for snakehead larvae: transition to formulated feed at 17 days at a 10%/day replacement rate.
- Determined that soybean meal with a phytase supplement can replace fishmeal protein without negative effects in cultured snakehead (*Channa striata* and *Channa micropeltes*).
- Determined that different feeds do not significantly affect the quality of fish fillet.
- Continued development of alternative feeds through further laboratory experiments and on-farm trials.

GUYANA

Utilization of Local Feed Ingredients for Tilapia and Pacu Production

- Determined that a diet consisting of a 50-50% mix of a locally available poultry and shrimp fishmeal replacement provided tilapia growth comparable with the control diet.
- Available at a lower cost, this diet provided significant savings for farmers.
- Work continues on the development of alternative feeds for tilapia and pacu aquaculture.

TANZANIA

Develop Feeding Strategies for *Moringa oleifera* and *Leucaena leucocephala* as Protein Sources in Tilapia Diets

- Evaluated the dietary value of *M. oleifera* and *L. leucocephala*, two locally available plant resources in sub-Saharan Africa.
- Determined that fish on the control diet, which contained soybean meal as its only source of protein, had the greatest weight gain, while fish on a *M. oleifera* based diet had a slightly greater weight gain than fish on a *L. leucocephala* based diet.
- Fish mortality was not significantly affected by the diets.
- Diets resulting in the highest profits consisted of 100% *M. oleifera* leaf meal (highest profit) and 100% *L. leucocephala* leaf meal (second highest) followed by diets containing 25% *M. oleifera* and diets containing 25% *L. leucocephala*. In general profits decreased as soybean meal in the diets increased.
- Work continues to determine ideal feeding regimes and digestibility of the local leaf meal diets.

ALTERNATIVE AQUACULTURE PRACTICES FOR FEED REDUCTION AND MORE EFFICIENT PRODUCTION

For rural aquaculture farmers, production costs are a major hurdle, with feed costs as a primary issue. The research highlighted here aims to reduce production costs through the implementation of innovative culture techniques in Kenya and alternative feeding strategies in the Philippines.

KENYA

Assessment of an Integrated Pond-Cage System for the Production of Nile Tilapia for Improved Livelihood of Small-Scale Fish Farmers in Kenya

- Work is in progress to analyze the effects of three different stocking densities of tilapia in cages in an integrated cage-pond system whereby wastes generated in the cages promotes the production of natural foods for the culture of filter feeding species, reducing feeding costs.
- Work is in progress to compare alternative feeding regimes on growth and yield performance.
- On-farm trials will be conducted to test the integrated cage-pond system technologies and evaluate the costs and benefits to local fish farmers in Kenya.

PHILIPPINES

Feed Formulation Strategies to Reduce Production Costs of Tilapia Culture

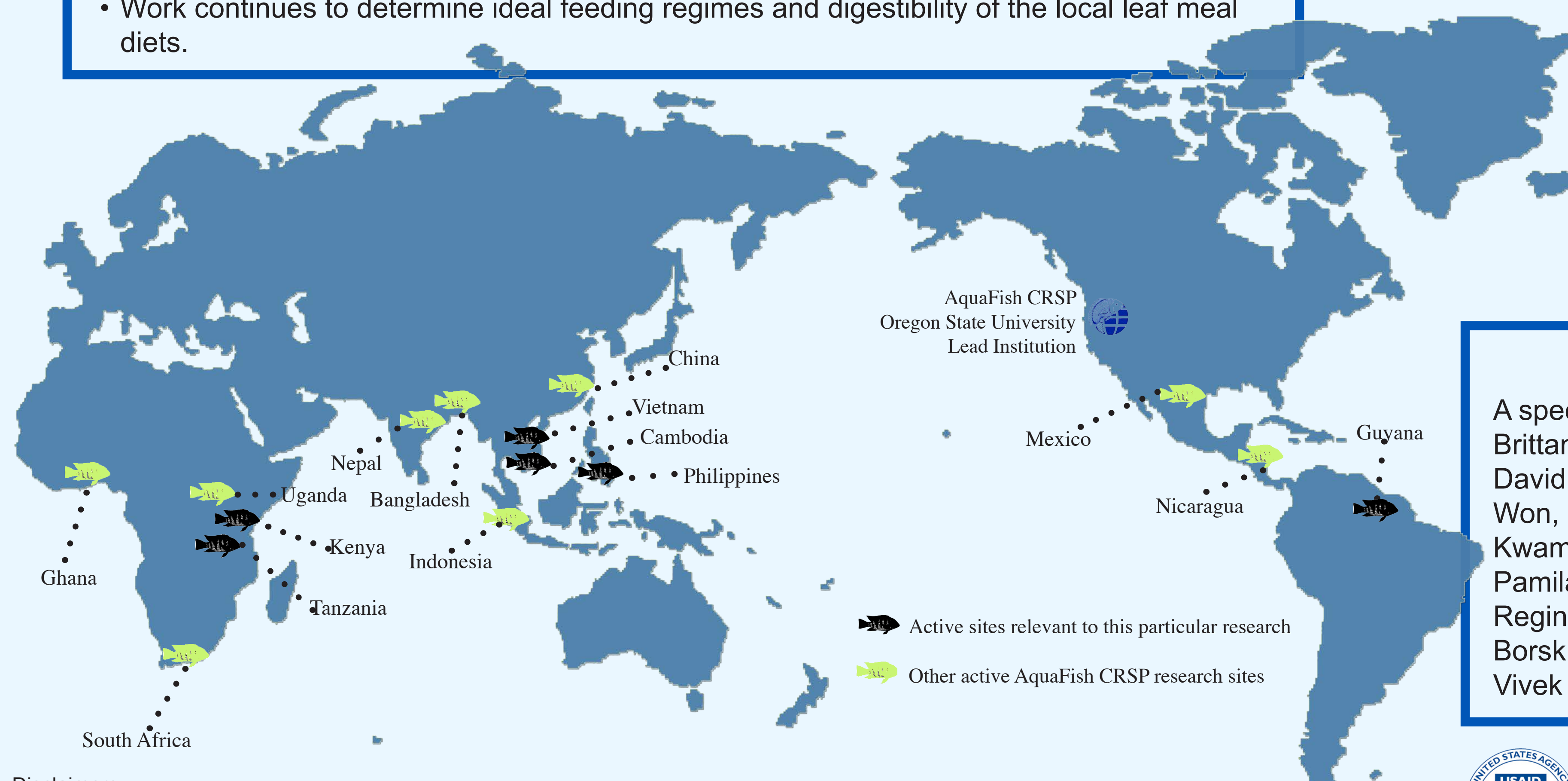
- Six separate farms found that feeding at 50% subsatiation was effective in producing tilapia of similar gross yield as fish grown on full satiation feedings.
- A cost-return analysis shows that incorporation of a diet lacking fishmeal results in an 8% feed cost saving (almost US\$100) per hectare.
- Fermented deboned meat poultry byproduct, NuPro™ yeast extract, and poultry meal show strong promise as substitutes for fishmeal.
- Work continues to compare the effects of higher and lower crude protein diets with and without pond fertilization.
- Work continues to replace fishmeal in tilapia feeds with alternative protein sources and to identify feed manufacturing factors that reduce adverse environmental impacts.



Margareth Kibodya measuring crude fiber of local plants for use as fish feed in Tanzania



Feeding small sized marine fish to snakehead grown in floating wooden cages in the Mekong Delta, Vietnam



Active sites relevant to this particular research
Other active AquaFish CRSP research sites

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