

**WATER, WATER QUALITY, AND POND BOTTOM SOIL MANAGEMENT IN UGANDAN AQUACULTURE**

AFRICA PROJECT: KENYA & UGANDA

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Production System Design and Best Management Alternatives/Study/16BMA05AU

**Collaborating Institutions and Lead Investigators**

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**Objectives**

1. Measure water quality in reservoirs, lakes, and ponds, ponds soil characteristics in relation to climatic conditions, pond hydrology, and quality of liming materials.
2. Develop generalized water budgets for rain-fed ponds to ascertain likely variation in water levels.
3. Estimate water inputs necessary for ponds filled from external sources.
4. Evaluate the need for liming and the quality of local liming materials.
5. Assess water quality amendments required in aquaculture ponds.

**Significance**

Previous AquaFish research compared the results of several commercially available water quality test kits compared to standard methods. The results suggest that water analysis kits can be used to make aquaculture decisions that are as good as those drawn from standard methods, except when measuring nitrate concentrations (Naigaga, 2015).

The present study builds on the water quality testing results to profile aquaculture waters in Uganda. The study will obtain information on water quality in reservoirs, lakes, and ponds, ponds soil characteristics, aquaculture management, climatic conditions and pond hydrology, and quality of liming materials in Uganda. These data will be assessed and recommendations on water, water quality, and pond soil management in Ugandan aquaculture will be developed. NaFIRRI researchers will collaborate and support the water sampling collection.

**Quantified Anticipated Benefits**

- Manual on pond soil and water best management practices.
- Three presentations to fish farmer cooperatives will address technical needs and issues, as well as specific gender-related concerns in the operation of farmer associations.
- Climate change impacts on aquaculture and possible ways for mitigation.
- Increases awareness on the water and soil quality for Ugandan aquaculture among farmers, extension workers, Government and institutions hence better networking.

### **Research Design and Activity Plan**

#### ***Location***

Aquaculture Research and Development Center-Kajjansi.<sup>2</sup>

#### ***Methods***

Water samples will be collected from at least 50 ponds across the Uganda aquaculture area, and from reservoirs and lakes in Uganda that have appreciable amounts of aquaculture. The pH, temperature, and dissolved oxygen concentration will be measured at time of collection. Water samples of 1 L, each stored in plastic bottles, will be shipped to Auburn University for measurement of specific conductance, alkalinity, hardness, major ions, chemical oxygen demand, and trace elements by standard protocol (Eaton et al., 2005).

Soil samples will be collected from five locations in each pond, samples from each pond will be combined into a composite sample, dried at 60 °C in an oven, and shipped to Auburn University. The samples will be analyzed for pH, organic carbon, cation exchange capacity, phosphorus, nitrogen, major ions, trace metals, free carbonate, and particle size.

While in Uganda, we will obtain weather records from at least one location, but preferably from several locations. The records should contain monthly average temperatures, maximum and minimum temperatures, rainfall, and if possible, pan evaporation. We also will measure the water loss rate from five to ten representative ponds over a period of two to four days without rainfall with aid of a stilling well and hook gauge (Yoo and Boyd, 1994).

We will collect samples of liming materials (200 g each) used in Uganda. These samples should come from several sources. They will be analyzed for neutralizing value and particle size at Auburn University.

We will collect information on typical production levels in ponds, amounts of fertilizers, liming materials, feeds, and other inputs. The use of aeration in ponds will be noted. If aerators are used, information on type, size, and typical operating schedule of aerators will be obtained. The data will be used to conduct an assessment of the suitability of water and soil quality for aquaculture in Uganda. This assessment will include the following:

- General water quality conditions – including one or more maps showing variation in water quality across regions. The possible influence of water quality in lakes, ponds, and reservoirs will be considered.
- Generalized water budgets for rain-fed ponds will be estimated to ascertain likely variation in water levels. Estimates of water inputs necessary for ponds filled from external sources also will be made.

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<sup>2</sup> Additional resources can be found at:

[http://aquafishcrsp.oregonstate.edu/Documents/Uploads/FileManager/Pond%20Dynamics:Aquaculture%20Collaborative%20Research%20Data%20Reports\\_Volume%201.pdf](http://aquafishcrsp.oregonstate.edu/Documents/Uploads/FileManager/Pond%20Dynamics:Aquaculture%20Collaborative%20Research%20Data%20Reports_Volume%201.pdf)

<http://aquafishcrsp.oregonstate.edu/page/globalexp>

<http://aquafishcrsp.oregonstate.edu/globalexp/>

## Research Project Investigations: Production System Design and Best Management Alternatives

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- The need for liming will be evaluated and the quality of local liming materials will be determined.
- An assessment of other water quality amendments that might be required in ponds will be made.
- Climatic variation over the country will be assessed for possible effects on aquaculture.
- The assessment results will be used to prepare recommendations for water, water quality, and pond bottom soil management in Ugandan aquaculture.

### **Trainings and Deliverables**

<b>Item</b>	<b>Mechanism (e.g. podcast, reports, factsheets).</b>
Information on water and soil quality	Water and soil quality manual
Awareness raising and networking	Conference
Information on climate change effects on aquaculture	Aquaculture and climate change manual

### **Schedule**

<b>Task</b>	<b>10/16</b>	<b>1/17</b>	<b>3/17</b>	<b>6/17</b>	<b>12/17</b>	<b>2/17</b>
Document development	x	x				
Collecting data		x	x	x	x	x
Collecting and analyzing data	x	x	x	x	x	x
Dissertation writing	x	x	x	x	x	x