

Farmer to Farmer – Aquaculture Without Frontiers
TRIP REPORT
Travel Location: Kenya
Dates Traveled: December 14-23, 2012
Volunteer Traveler: Lukas Manomaitis, Technical Director (Aquaculture)

PURPOSE:

The purpose of this travel was to evaluate the aquaculture situation in the Kisumu/Lake Victoria area of Kenya. Specific focus for my travel was on Dominion Farms which has a soy press operation and an extruder for fish feeds.

ITINERARY:

December 14-15, 2012	BKK-NBO-KIS
December 16, 2012	KIS
December 17, 2012	KIS-Siaya, Kenya
December 18, 2012	Siaya, Kenya-Kendu Bay, Kenya
December 19, 2012	Kendu Bay-KIS-NBO
December 20, 2012	NBO
December 21, 2012	NBO
December 22-23, 2012	NBO-BKK

EXECUTIVE SUMMARY:

Lukas Manomaitis, together with Dr. Amrit Bart, Director of the Asian Institute of Technology, Vietnam travelled to Kisumu, Kenya and met with Mr. Enos Were, his wife Jedida and son Tony as well as a concurrent specialist team from Auburn University, Prof. Joseph Molnar and Prof. John Liu at Le Savannah Hotel. We used this opportunity to develop a tentative itinerary for the travel in Kenya and to receive an update from Joe and John about their experience in Kenya visiting several sites.

We next travelled to Thinqubator Farm to discuss hatchery and production issues with Mr. Otieno Okello. This hatchery and farm uses RAS (recirculating aquaculture system) to both produce fingerlings and for fish growout. RAS systems are high investment/high risk operations and we were surprised to find one here. The rationale was that water supplies in some locations are limited.

Lukas Manomaitis, together with Dr. Amrit Bart, Director of the Asian Institute of Technology, Vietnam met with Dr. Julius Manyala of Moi (Eldoret Campus) University. We had originally planned to visit this institution, but as there was a strike we were unable to go. We discussed

with Julius that future trips should plan for meetings with larger groups to give general seminars and presentations on key topics.

ASA-IM SEA Technical Director – Aquaculture, Lukas Manomaitis, together with Dr. Amrit Bart, Director of the Asian Institute of Technology, Vietnam met with staff of Dominion Farms in Saiya, Kenya. Dominion is a very large integrated operation for farming in general and has a specific focus on aquaculture. We also toured their hatchery, feedmill and production areas.

Lukas Manomaitis, together with Dr. Amrit Bart, Director of the Asian Institute of Technology, Vietnam continued discussions with targeted groups at Dominion Farms in Kenya with Amrit taking the lead with the hatchery/production group and Lukas taking the lead with the feedmill. A list of suggestions was presented to the feedmill supervisor to help improve production and feeds.

Lukas Manomaitis, together with Dr. Amrit Bart, Director of the Asian Institute of Technology, Vietnam traveled to visit Holy Will Farm near Kendu Bay, Kenya to evaluate an Aquaculture Without Frontiers funded project.

Lukas Manomaitis, together with Dr. Amrit Bart, Director of the Asian Institute of Technology, Vietnam visited the farm and hatchery operations of Jewlet Farms in two locations near Kendu Bay, Kenya. Mr. Enos Were is a major producer of sex reversed tilapia fingerlings in the area.

Lukas Manomaitis, met with a group of farmers and government representatives to discuss a plan for livestock feed production (including aqua) in the Bondo area of Kenya. My suggestion was to work with terrestrial animals and discuss with existing feedmills on how to produce better extruded feeds for aquaculture operations. This group could then be a distribution network for aquaculture feeds.

DETAILED REPORT/COMPANY REPORT

Traveler: Lukas Manomaitis

Date: December 15, 2012

Location(s) visited: Le Savanna Hotel, Kisumu, Kenya

Person(s) contacted: Mr. Enos Were (Managing Director, Jewlet Enterprises), Ms. Jedida Were (Jewlet Enterprises), Mr. Tony Were (Jewlet Enterprises), Prof. Joseph Molnar (Auburn University), Prof. John Liu (Auburn University), Dr. Amrit Bart (Director, AIT Vietnam)

Knowledge gained from the discussion:

This was a transitional and planning meeting with an overlapping specialist group from Auburn University. Joe and John had travelled to several of the same areas we had tentatively planned to visit. Joe has had previous

experience in Kenya and Uganda so they had planned their trip in advance. He was able to give us some valuable insights into what to expect and put what we might see into context.

5 contacts (80% male and 20% female)

1 farm family directly impacted

Several farm families benefiting from the contacts (based on this meeting we would be meeting several operations throughout the Lake Victoria area)

Many recommendations:

33% environmental

33% business

33% management of farm

DETAILED REPORT/COMPANY REPORT

Traveler: Lukas Manomaitis

Date: December 16, 2012

Location(s) visited: Thinguobator Hatchery and Farm, Near Kisumu, Kenya

Person(s) contacted: Mr. Otieno Okello (Owner), Mr. David (Hatchery Manager), family and staff of Mr. Okello, Dr. Amrit Bart (Director, AIT Vietnam)

Knowledge gained from the discussion:

This was a very interesting visit to an RAS (recirculating aquaculture system) to both produce tilapia (*Oreochromis niloticus*) fingerlings and for fish growout. RAS systems are high investment/high risk operations and we were surprised to find one here. The rationale was that water supplies in some locations is limited and temperatures in the area are quite variable.

Joe and John had apparently visited this location, but the owner was not here at the time (he was in Nairobi).

We met with the owner, who is Kenyan, but worked for some time in South Africa (SA), where he had his own business for five years (chauffeured car service to foreigners). He is actually a corporate banker by education. During his time in SA he became interested in RAS which he saw as the future of the aquaculture industry. He also took courses in RAS and returned to Kenya about a year ago to start a system here.

His former aquaculture experience was with a *Clarias spp.* (African catfish) hatchery about eight years ago. Fishermen on Lake Victoria were using 40 day old fingerlings as bait for Nile perch. Otieno had seen a small *Clarias* hatchery system in Nigeria in 1999-2000 and had Enos Were help him set up a system in Kenya (concrete tanks) when the government banned wild capture of *Clarias* fingerlings from the lake. According to him, once the hatchery was operational farmers and fishermen would line up every morning to get fingerlings. This was a good business for about 15 months

but the water hyacinth returned and people started to harvest wild fingerlings again so he shut his hatchery. He noted at this time people did not see pond raised fish as “fish”, but stock in the lake were diminishing due to overfishing.

Apparently this experience hooked him on fish and as noted he returned from SA with some experience and training with RAS and freshwater aquaculture. He said that this was not only his passion, but he wanted to make it a “proper” business and promote commercial fish farming. Some highlights from this discussion:

- His operation is unique in that RAS is not common in Kenya, but feels that this is a way to make small pieces of land commercially viable
- Aquaculture a new industry in Kenya (4-5 years old)
- Many low quality hatcheries in existence with stunted fish and mixed sexes
- Government had a stimulus plan to make 48,000 ponds across the country to stimulate jobs
- Government has provided money to dig ponds, buy fingerlings and feed
- However, markets for aquacultured fish not clearly identified, still somewhat difficult to sell even though people need/want fish (no established sales channel for farmed fish despite potential markets in Kisumu and Nairobi)
- Production is not linked to bring volume to market, don't appear to be established “middlemen” in the industry
- Preference for fresh (not live) fish over frozen (Fresh in this case means chilled on ice)
- Water availability can be an issue in many locations
- Temperature variation also an issue, water temp can vary from 13-26C in the open (down to 8C air temperature)
- Otieno is a founding member of the Commercial Aquaculture Society (with Enos) to address feed issues

The operation itself had four separate parts:

1. Greenhouse with lined ponds with water recirculation for fish growout
 - 60m³ lined ponds
 - Temperatures can be maintained between 26-32C
 - 4000-5000 fish stocked
 - Grown to 250-300g
 - Recirculation system: macro solid removal, micro solid removal-gravel and media biofilter-UV light
 - Noted feed quality an issue

2. Greenhouse with broodstock and fingerling production (fiberglass tanks and aquaria) – also recirculating
 - 3:1 ratio (female to male) in lined ponds
 - 10 days to harvest eggs, then rested again in tanks
 - Broodstock from local farms, inbreeding likely
 - Considering YY supermale production
 - Currently getting reproduction a 30g
3. Empty greenhouse that may be in reserve or perhaps for aquaponic type operations
4. Former *Clarias* hatchery room with cement tanks
 - Appears to be prepping this facility to use for tilapia – difficulty is that is not heated.

Considerations and plans for Thinqubator:

- Otieno claimed that he is not looking for funding, but is very much interested in technical advice
- While we were there, they were working on constructing a live hauler, notably to transport new broodstock from Uganda
- Noted that feeds were a big problem – he was importing from several locations, but in an RAS the leaching of feeds was causing water quality issues. Noted that feeds seem to be higher quality (crude protein/fat) levels than needed for tilapia – perhaps more suited to *Clarias*, which is a more carnivorous species?
 - We saw a 44/14 feed being used for growout
 - Feeding on a biomass/feed response model
 - Claimed 10g-300g in 5-6 months with an FCR of 1.3
 - Using both Skretting and Aquanatro feeds (Aquanatro best price and feeds)
 - Aquanatro qualities:
 - Starter 45% protein
 - Grower 39% protein
 - Finisher 35% protein
- Noted that he does use KMnO₄ (potassium permanganate) and also mentioned occasional use of malachite green
- Has had some occasional disease issues, particularly fungus (ick?), but not a big issue.
- Claims to quarantine new fish
- Consults for others that want to create RAS
- Plans to develop a consolidation/middleman arrangement for fish produced by other farms – talked about putting in a cold storage unit within five months
- Targeting 300-500g fish, 300g fish sell for 280-300KES/kg

In general the overall issue here is that there is a large risk in RAS systems. In a nation like Kenya where power supplies are not reliable, this means that RAS owners both have to have alternate power generation and have

staff that can turn it on at a moment's notice. We did not expect to see RAS in Kenya, even with the water availability and temperature issue. Although it does not seem to be an appropriate use of resources (the capital and operational expenses would reduce possible profits) if run correctly and well this might make sense for a hatchery operation. However, there were several things that gave pause at this operation, and also indicated that we are not understanding the full story.

- From a hatchery standpoint, it is critical that they get better quality broodstock. Reproduction at 30g is not reasonable. Taking 5-6 months to get to 300g is too long.
- Feeds are an issue, first there appears to be a quality issue (leaching from the feeds) but also these feeds don't seem to be formulated or suited for tilapia in my experience. There would be a cost savings but using better targeted feeds for tilapia
- Several time Otieno had negative comments about his hatchery manager, David, who is a graduate of Moi University. Staffing is a critical part of any operation, but particularly for a RAS.
- The overall idea of forming a group to address feeds and the commercial industry is a good one, future trips might incorporate seminars/presentations to groups such as this.

2 contacts (100% male)

1 farm family directly impacted

Several farm families benefiting from the contacts (Thinqubator extends its technology and fingerlings to others)

Many recommendations:

20% environmental

40% business

40% management of farm



Thinqubator's Fingerling RAS Operation (Lukas, David, Otiello)



Thinqubator's Growout RAS



Thinqubator's Broodstock RAS (Otiello, Amrit)

DETAILED REPORT/COMPANY REPORT

Traveler: Lukas Manomaitis

Date: December 16, 2012

Location(s) visited: Public Servant's Club, Kisumu, Kenya

Person(s) contacted: Dr. Julius Manyala (Professor, Moi University), Dr. Amrit Bart (Director, AIT Vietnam)

Knowledge gained from the discussion:

Dinner meeting with Julius, who is a professor of Moi University in Eldoret. We had originally planned to visit this institution, but as there was a strike we were unable to go. We discussed with Julius that future trips should plan for meetings with larger groups to give general seminars and presentations on key topics.

Specific targets:

- Meeting with government and industry representatives to discuss proper aquaculture feed formulation, production and quality
- Meeting with farmer groups to discuss better production approaches and discussions on commercialization/planning/distribution of product
- Meeting with hatchery groups to discuss critical hatchery issues

1 contacts and 100% male

0 farm families directly impacted

Several potential farm families benefiting from the contacts (we discussed how future trips should be structured to have more impact)

Many recommendations:

33% environmental

33% business

33% management of farm



Meeting with Julius (Amrit, Julius)

DETAILED REPORT/COMPANY REPORT

Traveler: Lukas Manomaitis

Date: December 17, 2012

Location(s) visited: Dominion Farms, Siaya, Kenya

Person(s) contacted: Mr. Chris Abrir (Director), Mr. George (Hatchery manager), Mr. Wilfred Okoth Arende (Rice Mill Manager), Mr. Joseph (Extruder Operator), Dr. Amrit Bart (Director, AIT Vietnam)

Knowledge gained from the discussion:

We met with staff of Dominion Farms in Saiya. Dominion is a very large integrated operation for farming in general and has a specific focus on aquaculture. We also toured their hatchery, feedmill and production areas. This visit was the primary target for my participation in this visit as I was to discuss the issues related to feed production and feed quality with Dominion. It should be noted that Enos Were used to work here for nine years before leaving to work on his own operation full time.



Dominion Farms *Clarias* Hatchery (front row Chris, Amrit, Lukas, George)

We first started with a general discussion with George, the hatchery manager for Dominion. He outlined what they were doing at Dominion with the tilapia hatchery. Some highlights:

- **In operation since 2004**
- **Use spawning ponds**
- **Breed fish naturally then collect young fish**
- **Use harvest basin – drain ponds, remove brooders and collect fry**
- **All fry passed through a grader – use fry below 11mm**
- **Sex reversal done in ponds, put in 3000m² pond and fed MT treated feeds to 20-30mm size**

- Claimed 98% success rate for reversing sex, based on checking sex of fry with microscope (300 fish per pond)
- Larger fry selected for broodstock replacement
- They both use fingerlings on farm and sell them
- Do not use hapas, said that survival was poor
- Also produce Clarias at times, using a tank system (this was near the guesthouse), tilapia are produced on the farm itself

We also discussed the growout with George:

- Stocking density 1 acre pond = 50,000 fish
- Have a new consultant from Honduras (Carlos) who has proposed a new plan and design (but we missed Carlos by three days – he returned home for the holidays) We obtained a copy of the plan from Chris
- Earthen ponds get 60% survival
- Concrete (circular) ponds get ~100% survival
- Stocking size 0.5g
- Considering use of nursery ponds to 7g size
- Preparation of ponds is done with lime at 100kg/1000m²
- Pond depth 1.5m
- Water temperature from 20-29C



Hatchery ponds at Dominion Farms

We then had a general discussion with Chris, the Director of Dominion:

- The “Dominion Group of Companies” is the informal identity of a number of companies founded and owned by Calvin Burgess of Guthrie, Oklahoma
- Has operations in Kenya and Nigeria
- A strong religious/social aspect to this operation

- Dominion is a large integrated farm operation with row crops, milling, a soy press and a feedmill
- See http://www.businessweek.com/magazine/content/09_49/b4158038757158.htm
- See http://www.jaluo.com/wangwach/200703/Calvin_Burgess031807.html
- Also developing a new training center, including training their Nigeria staff and plans to work with street children in Kenya
- Train on all food production: rowcrops, technology, aqua, etc.
- Calvin is trying to identify good staff and start satellite farms
- Have worked with Oral Roberts University to do training in past
- Training center 80% in English, 15% theory, 85% practical
- New training center is looking for basic knowledge and training information
- Aquaculture unit has 45 people at the low peak and 60 people at high peak times
- George works with two graduates of Moi University (women – we met them the next day), George does not have formal training, only practical training
- Asked about the future of fish farming in this area, said that originally planned to export product, but now cannot even meet domestic demand
 - 20MT/wk desired in Nairobi
 - 10MT/wk can be sold locally
 - 40MT/wk in Kisumu market
- Target size is 450-500g size
- Claim 8th or 9th “genetic generation”

Clarias Hatchery Facility with George: We briefly toured this facility, which was not apparently being used at present. It is a semi-enclosed structure with fiberglass tanks and an office. The only notable thing here was that they seem to have a lab facility.



Wenger X-25 Extruder at Dominion Farms (Joseph)



Explaining feed concepts to Dominion Farms Staff (Joseph, Wilfred, Lukas)

Feedmill with Wilfred:

- **Feedmill to produce feeds for fish and dogs**
- **Purchased used, reconditioned Wenger X-25 unit (originally this was a unit targeted to snack foods)**
- **Noted an issue that many parts were already worn**

- Have been using feedmill for one year, typically twice a week for nine hours
- Currently unit is not functioning due to a bad bearing (under repair while we were there)
- No stock of common replacement parts – as pieces wear out/break new ones are ordered from US
- Was producing 400-600kg/hr 4.5mm die size (6mm pellet size), noted target rate was 1000kg/hour
- Using a 4mm and 6mm die (die is not a solid unit but uses four inserts)
- Fixed formulation from previous manager (Enos Were) –the formulation:

Ingredient	Formula %	Ingredient Cost (KSc)
Soybean Cake	26.0	50
Lake Shrimp (Caridina nilotica)	12.0	65
Meat and Bone Meal	4.0	60
Sunflower (cake)	29.0	25
Maize meal	4.0	65
Maize germ	13.00	26
Cassava	4.8	40
Salt	1.00	30
Vitamin Premix	0.3	40
Rice Bran	6.00	14.2

- 10 fixed ingredients, could get a wider variety (but no one to formulate), estimated quality:

Ingredient	Initial Values				Ingredient					
	Protein %	Lipid %	Fiber %	Starch %	Protein Amount (%)	Fat Amount (%)	Fiber Amount (%)	Starch Amount (%)	Cost	Formula Cost
Soybean Cake	40.1	8.1	6.6	26.0	10.4	2.1	1.7	0.0	50	13000
Lake Shrimp (Caridina nilotica)	63.5	1.3	5	12.0	7.6	0.2	0.6	0.0	65	7800
Meat and Bone Meal	49	9		4.0	2.0	0.4	0.0	0.0	60	2400
Sunflower (cake)	25.9	5.4	36.8	29.0	7.5	1.6	10.7	0.0	25	7250
Maize meal	8.08	3.52	3.63	19	4.0	0.3	0.1	0.8	65	2600
Maize germ	11.8	10.7	15.5	13.00	1.5	1.4	2.0	0.0	26	3380
Cassava	2.63	1.04	4.93	69	4.8	0.1	0.0	3.3	40	1900
Salt	0	0		1.00	0.0	0.0	0.0	0.0	30	300
Vitamin Premix	0	0		0.3	0.0	0.0	0.0	0.0	40	100
Rice Bran	12	13	6	36	6.00	0.7	0.8	2.2	14.2	852
Total					100.00	30.2	6.5	15.7	6.2	39582

The above quality estimation seems to indicate a formulation that may have a reasonable protein and lipid amount (though a little high in lipid/energy). The fiber is far too high, it is largely indigestible to fish and therefore essentially becomes a filler (but may also have other effects). Starch appears low for good extrusion, typically we would expect 13% minimum, this may explain the poor expansion, gelatinization and appearance of the pellets. Pellet may be floating by default because density is low enough with the ingredients used.

- Batch size is 250kg, have an issue because grinder and mixer are linked, and cannot keep pace with extruder. Extruder uses up mix in

about 15-20minutes, but need 30 minutes for grinder/mixer to produce a new batch. Need either another holding bin and/or delink the grinder and mixer and bag ingredients.

- **Moisture target it 10%**
- **Floatability reported between 90-100%**
- **Most production for internal use (90%) and 10% for sale**
- **Feed pellets rough, irregular and elongated**
- **Vitamin premix reported to be two years old (should not be kept more than six months, no mineral premix used)**
- **Rice bran not used immediately after processing, nor processed to stabilize it, so may become rancid before use**
- **Using soybean expeller cake, so likely high fiber and possibly high anti-nutritional factors**
- **Using maize meal and germ – mycotoxins/aflatoxin issues**
- **Likely high fiber content**
- **Pre-conditioner retention time estimated to be 30 seconds**
- **Conveyor from extruder to dryer not moved while initial product comes out (may damage conveyor)**
- **Feeds are not cooled prior to bagging – currently appear not to have plastic liners**

Target issues:

- **Obtain a sample seine grader (several different sizes)**
- **Obtain a rapid moisture reader**
- **Obtain and maintain a set of replacement parts for parts that commonly wear out, for example as a minimum:**
 - **Screw components**
 - **Cutting knives for die**
 - **Grinder screens**
 - **Grinding hammers**
- **Ingredient holding area: all ingredients off floor on pallets and away from walls, also keep area clean and policed**
- **Identify and catalogue locally available ingredients by type, cost and seasonal availability, ideally a representative sample of each will be tested by proximate analysis for:**
 - **Crude protein**
 - **Crude lipid**
 - **Moisture**
 - **Crude Fiber**
 - **Ash**
 - **Starch content (for major starch sources, i.e. cassava, wheat, rice)**
 - **Mycotoxins (for target ingredients that typically have this issue, especially maize or groundnut)**

- If fixed formulations are to be used, need to create the potential ingredient list and then determine 5-10 specific scenarios and have a professional aquaculture formulator formulate appropriate diets
- Consider addition of a mycotoxin binder to formulation. With the dry heat in this area, mold formation after production may not be as much of an issue with a final feed moisture of 10%, but many of these ingredients may already have myco- and aflatoxins.
- Produce/purchase standard vitamin and mineral premixes to the diets. These could possibly be sourced locally and ASA-IM standard premixes could be used:

Mineral Supplementation for Practical Diets

(ASAIM Mineral Premix F-1)

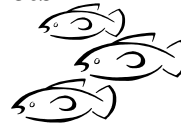


Element	Units	Amount in Premix	Amount In Feed
Selenium	mg / kg	200	0.5
Zinc	mg / kg	40000	100
Iron	mg / kg	40000	100
Manganese	mg / kg	10000	25
Iodine	mg / kg	1800	4.5
Copper	mg / kg	4000	10
Cobalt	mg / kg	20	0.05

The intended usage rate of this premix is 0.25% of the diet.

Vitamin Supplementation for Practical Diets

(ASAIM Vitamin Premix F-2)



Vitamin	Units	Amount in Premix	Amount In Feed	
Vitamin A	IU/kg	1200000	6000	The intended usage rate of this premix is 0.5% of the diet.
Vitamin D3	IU/kg	200000	1000	
Vitamin E	IU/kg	20000	100	
Biotin	mg/kg	40	0.2	Vitamin C is not included, should be included separately in a stabilized form according to health and environmental conditions
Folic Acid	mg/kg	1800	9	
Niacin	mg/kg	40000	200	
Pantothenate	mg/kg	20000	100	
Pyridoxine (B6)	mg/kg	5000	25	
Riboflavin (B2)	mg/kg	8000	40	
Thiamin (B1)	mg/kg	8000	40	
Vitamin B12	µg/kg	2000	10	
Ethoxyquin	mg/kg	500	2.5	

- Increase retention time in the pre-conditioner. Ideal would be three minutes, but with this machine and size of the pre-conditioner, just increasing it to whatever maximum possible (by adjusting internal paddles and rotation speed) will help to better cook ingredients and make them more digestible.
- Short term: current diet plates and inserts should be cleaned, oiled and stored
- Longer term: replace die plate (currently using inserts) with high quality fixed die plates to produce feeds in three standard sizes: 2mm, 4mm, 6mm. These should be high quality die plates, i.e. from Nixon Tool and Die, not local manufacture, as all product eventually will come through this one area. This will also allow more efficient use of extruder.

Example Tilapia Feed Sizes by Weight:

<u>Size of Fish</u>	<u>Feed Type</u>	<u>Size of Feed</u>
2-5g	36/7	1.5-2.0
5-50g	36/7	2.0-3.0
50-100g	32/6	3.0-4.0
100-200g	32/6	4.0
200-300g	32/6	5.0
300-400g	32/6	6.5
400-600g	32/6	8.0

- Plan out production process better to prevent bottlenecks of ground/mixed ingredients
- Plan out methods and approaches to maintain/improve quality of ingredients that are available/produced on Dominion, for example:

- Parboil rice bran to prevent rancidity
- De-hull and/or toast soybeans to reduce fiber and anti-nutritional factors
- Ensure maize is dried very well prior to storage
- Add one step between dryer and bagging. Want to cool feeds and may have issues with fines and dust. Both of these may be somewhat addressed by putting in a sifter unit to allow feed to cool and remove fines. Fines may be reprocessed or used as starter feeds. Could use a fan to further cool product while on sifter.
- Be more careful with initial product coming out of extruder, put into separate container and either discard or reprocess.

Essentially, target should be to address basic short, medium and long term issues and gather required information. Then bring in a professional feedmill, nutrition and formulation expert to train production staff, create range of formulated diets and ideally run some example diets with staff.

Tilapia Hatchery Ponds with George:

- Amrit took the lead on the discussion related to this as I was focused on the feedmill aspect. These were earthen ponds used to hold broodstock and produce fingerlings
- Obvious bird predation issues here
- Genetics likely an issue



Large new production pond at Dominion Farms

Pond Farm Tour with Chris:

- There were two types of ponds here. Circular cement and rectangular earthen ponds. They are expanding the line of earthen ponds.
- Bird predation - this was a former wetland, so many birds are likely from this area – we also saw many pelicans (Chris said up to 50% loss?). Nets may help with this issue.
- Otters may be an issue
- Flushing, water exchange appear constant – we did not meet with any production managers at this point, so hard to say why they have constant water flowing
- Erosion seen around outlet pipes
- Obvious that they plan a lot of production, but some basics don't seem to be paid attention to
- Reported slow growth of fish – genetics or culture approach (or both)?
- I discussed the 90% satiation feeding model with the feedmill staff, but this is something that really should be done with the production unit

4 contacts and 100% male

1 farm family directly impacted (considering all staff of Dominion farms as one family)

Potentially many farm families benefiting from the contacts (Dominion claims to have a CSR [Corporate Social Responsibility] approach and wants to help others outside the organization)

Many recommendations:

10% environmental

30% business

60% management of farm

DETAILED REPORT/COMPANY REPORT

Traveler: Lukas Manomaitis

Date: December 18, 2012

Location(s) visited: Dominion Farms, Siaya, Kenya

Person(s) contacted: Mr. Chris Abrir (Director), Mr. George (Hatchery manager), Mr. Wilfred Okoth Arende (Rice Mill Manager), Mr. Joseph (Extruder Operator), Ms. Gentrax Wanyonyi (Pond supervisor), Ms. Doreen (Pond attendant), Ms. Rispa Ochieng (Parts/Stores Supervisor), Mr. Morris (Commercial Pond Supervisor), Dr. Amrit Bart (Director, AIT Vietnam)

Knowledge gained from the discussion:

Amrit and I decided to split and have targeted discussions with the different groups. I sat briefly with Amrit's group; Mr. George (Hatchery manager), Ms. Gentrax Wanyonyi (Pond supervisor), Ms. Doreen (Pond attendant), Mr. Morris (Commercial Pond Supervisor) before returning to the feedmill.



Farm Staff At Dominion (Doreen, Gentrax, Lukas, George, Morris, Amrit)



Amrit educating Dominion Farm Staff (Doreen, Gentrax, George, Morris, Amrit)

I started by going to visit the parts manager. I was surprised yesterday that there were no spare parts for the extruder. There are many parts that need regular replacement and typically a set of those parts are kept on hand. I had seen lots of modern farm machinery (combines, tractors, etc.) that I

assumed had spare parts. In fact this is the case for most equipment, but not for the extruder. Whenever something breaks or wears out on the extruder they have to custom order it and this can take some time. I suggested that while that might still be the case for large or unusual items breaking down or wearing out, typical spares should be maintained. Perhaps Joe Kearns of Wenger can suggest a list of typical parts that should be on hand. As Dominion puts ramps up aquaculture production they will need a consistently working feedmill to supply the farm(s).



Dominion Parts Storehouse (Rispa, Lukas)

I then went to visit the soy press. Soybeans are produced locally and processed here to remove the oil and make soybean cake. This cake is then used in the aquafeeds. I do not have any experience with soy presses, so this was mostly for me to see what one looked like up close.

My main goal was to discuss the list of thoughts and suggestions listed in the report of the previous day with Wilfred. I also took the time to use parts of several presentations to highlight what I was talking about.



Steam Boiler for Dominion Farms (Lukas, Wilfred)

An important issue was revealed during the meeting. The feedmill experiences power cuts up to five times per day. Although they have a generator that is capable of running the feedmill, it is not linked to “power on” in advance of a power cut. Both for the machinery’s sake and for feed production, power cuts to an extruder are not advisable. This is a very critical issue that needs to be resolved to get better and more consistent production. Otherwise they can expect to continue to have equipment issues (literal equipment damage is done by unscheduled power cuts) and poor production.

Another issue I learned later from Enos, was that Dominion feeds did experience molding, this could be from uneven drying, bagging while feed is hot, improper storage, existing mold in the ingredients or a combination of factors. Proper formulation, extrusion, drying and storage should address this issue.

Wilfred also mentioned that they had sent their ingredient for proximate testing, they expected the results in a week. At that point they should have a better idea what their formulation is resulting in. Not sure if they also sent the final product (feed) to be tested.

8 contacts and 62% male and 38% female

1 farm family directly impacted (considering all staff of Dominion farms as one family)

Potentially many farm families benefiting from the contacts (Dominion claims to have a CSR [Corporate Social Responsibility] approach and wants to help others outside the organization)

Many recommendations:

5% environmental

10% business

85% management of farm

DETAILED REPORT/COMPANY REPORT

Traveler: Lukas Manomaitis

Date: December 19, 2012

Location(s) visited: Holy Will Farm, near Kendu Bay, Kenya

Person(s) contacted: Mr. Henry (Farm Manager), Mr. Enos Were (Managing Director, Jewlet Enterprises), one staff member of Holy Will Farm not identified (male), Dr. Amrit Bart (Director, AIT Vietnam)

Knowledge gained from the discussion:

This was an inspection of AwF (Aquaculture Without Frontiers) Project.

Some background highlights:

- **Led by Henry, the manager of the overall farm (the aquaculture ponds were only part of the farm, which also has row crops like maize)**
- **Henry originally worked with an NGO for extension work, not from this area but from near Enos**
- **Self help women's group CBO (Community Based Organization) which also meets to self fund projects**
- **Mostly widows, 25 participants (six male, 19 female, most reportedly widows)**
- **Started to enhance nutrition**
- **As the price in the market was high, also used to create income**
- **All work is voluntary**
- **Land for fish ponds was donated by Henry, part of a 5 acre plot purchased 10 years ago for 250,000KES (reportedly the area for the ponds was degraded from brick making operations)**
- **Water source from a distant spring that flows almost year round (except for maybe two weeks), also near a stream**
- **Group dug 1st pond on their own**
- **2nd pond dug with grant from Fisheries/government of 25,000KES**
- **Three remaining ponds constructed with funds from AWF**
- **Approximately 25x20m (500m²)**
- **Only one harvest so far from ponds 1-3:**
 - **Pond 1, targeted local market, net return 20,000KES (1070 fish, average 300g)**
 - **Pond 2, 960 fish, 23,000KES net profit**
 - **Pond 3, currently harvesting, only 500 fish harvested**
 - **Best sizes 350-400g in eight months**

- Pond 4 stocked with *Clarias* catfish only
- Pond 5 being repaired, having seepage issues
- Most ponds have primarily tilapia with *Clarias* to control reproduction
- Feeds:
 - Tilapia mostly sweet potato leaves
 - *Clarias* given dried lake shrimp
- Economics:
 - 35,000KES to construct pond and start production:
 - 25,000KES digging pond
 - 5,000KES for fingerlings
 - 3,000KES for fertilizer
 - 2,000KES for manure/feeds
 - Subsequently 25,000KES net profit expected at harvest
- Planning three more ponds, maybe start small fingerling production
- Mentioned two other ponds elsewhere, unclear if this is related to the three other ponds planned
- We noted that for tilapia ponds, fertilization was a good approach, but that they should be careful not to flow water through and prevent excessive seepage
- We noted that for *Clarias*, fertilization was not necessary and should be avoided
- We suggested that they should remove all visible macrophytes/plants on the water as they would remove nutrients
- We also made some suggestions, as did Enos, on better sales approaches, as it seemed surprising that Henry reported that the market was “oversupplied” by the time of the third harvest.

It was a bit hard to get a clear picture of what was going on here community-wise. The ponds themselves looked very nice, with the exception of the 5th one undergoing renovations. There was a boy/young man who was working around the pond, but as a primarily women’s group, we would have expected to meet with some women. It did not seem that there were any available, and the only two we heard about (Mercy and Judith) are both wives of Henry (polygamy is practiced in Kenya).

2 contacts and 100% male (however, the project itself was reported to have 25 people total, six males and 19 females)

1 farm families directly impacted (see note above)

25 people benefiting from the contacts

Several recommendations:

10% environmental

20% business

70% management of farm



Visit to Holy Will Farm (Amrit, Henry)

DETAILED REPORT/COMPANY REPORT

Traveler: Lukas Manomaitis

Date: December 19, 2012

Location(s) visited: Upper and Lower Farms of Jewlet Enterprises, Kendu Bay, Kenya

Person(s) contacted: Mr. Enos Were (Managing Director, Jewlet Enterprises), Ms. Jedida Were (Jewlet Enterprises), Dr. Amrit Bart (Director, AIT Vietnam), large numbers of workers (particularly women)

Knowledge gained from the discussion:

We visited the farm and hatchery operations of Jewlet Farms in two locations near Kendu Bay, Kenya. Mr. Enos Were is a major producer of sex reversed tilapia fingerlings in the area and Enos was instrumental in our trip overall in helping us navigate Kenya and meet with people in the industry.

This farm is split into two sections, the upper farm and lower farm. The upper farm is in the hills above Kendu Bay, while the lower farm is literally against Lake Victoria. Enos is a businessman, he and his family have many operations. At minimum it appears that he does the hatchery, consulting for aquaculture, owns a petrol station, has row crop farms and likely other activities as well. He was the manager for aquaculture at Dominion Farms for nine years and his only wife Jedida also worked there. At some point they began their own operations and then left Dominion, first Jedida, then Enos (about three months ago).

Some highlights from the visit:

- They make their own mash feed from sunflower, wheat and lake shrimp (they have a grinder and mixer to homogenize mix)
- Do not use red tilapia but indicated that there would likely be an interest in red tilapia
- Upper station:
 - 16 ponds
 - VERY deep ponds, angle is extreme to allow more water volume
 - Topsoil was sand for first meter
 - Ponds created by hand labor except for first four ponds
 - Porous soil, was “kneaded” to stop leakage
 - Uses about 80 female workers – said that they are harder workers and the money typically goes to family expenses (seems to have a strong social responsibility sense)
 - Saw issues with birds
 - Uses springs to fill ponds, also access to a seasonal stream
 - Use a complete harvest system
 - This farm is used to produce fry, sent to lower farm for sex reversal
 - Accessed via a “road”, which is a fairly rough track
- Lower station:
 - 46 ponds
 - Currently also reducing slope of dikes to increase volume of ponds (we saw the women working on this)
 - Increasing the barrier dike next to the lake
 - Do have issues with hippos nearby
 - Have a small hatchery packing shed on site
 - Seems well laid out
- Resource center:
 - Used to store hapas and other equipment, but quite large and equipped with tables and chairs
 - Good location for a future meeting
 - This is where I met a government group about feeds

Overall it seemed that Enos had his operation running well. He could probably benefit from better strains of tilapia and a basic genetics program, and Amrit discussed this with him in detail. Better feeds might help, but the investment to move from the mash to something better might be prohibitive for what he is doing (maintaining brooders and producing fingerlings).

Working with Enos would be ideal for a future trip to gather a group to have a seminar, workshop and presentations, particularly at his resource center and targeting his clients.

2 contacts and 50% male and 50% female

1 farm families directly impacted

Many farm families benefiting from the contacts (as a hatchery this operation supplies fingerlings to many farms. Also on site Enos reportedly hires 80 local women to help with construction and maintenance of the farms as well as many farm workers)

Many recommendations:

33% environmental

33% business

33% management of farm



Upper station of Jewlet Farms (Amrit, three staff, Enos, another staff)



Jewlet Farm Lower Station Pond Renovation

DETAILED REPORT/COMPANY REPORT

Traveler: Lukas Manomaitis

Date: December 19, 2012

Location(s) visited: Resource Center of Jewlet Enterprises, Kendu Bay, Kenya

Person(s) contacted: Mr. Enos Were (Managing Director, Jewlet Enterprises), Dr. Amrit Bart (Director, AIT Vietnam), Mr. Ogolla James (Farmer from Bondo), Mr. Alfred Onloro (Farmer from Bondo), Ms. Roseline Okwach (District Fisheries Officer – Bondo), Ms. Wasama Nancy (Director of Special Projects – Bondo)

Knowledge gained from the discussion:

A group that is interested in setting up a feedmill travelled from the Bondo region specifically to meet with me. While Amrit and Enos discussed

hatchery issues, I met with this group to discuss feeds and feedmills. We had already learned that the Kenyan government was purchasing extruded feeds to give or sell to farmers, but that is was of low quality. This group was comprised of a fisheries officer, a government special projects lead and two farmers. They wanted to know if they could create a feedmill to produce feeds for a variety of livestock (both terrestrial and aquatic) with about US\$60,000.

Some items they highlighted:

- Want to create their own production unit with investment from government and private funds
- Looking for technology advice
- What machinery should they use?
- Wanted to put together the framework within six months
- Want to use locally available ingredients
- Target about 2000 farmers with about 1800m² of water surface each (I estimated this to mean about 2880MT of feed per year, based on current production levels and 1.5 FCR)
- Ingredients they felt were available:
 - Local FM
 - Bloodmeal
 - Rice bran
 - Cottonseed meal
 - Sunflower meal
 - Simsim (capsicum)
 - Lake shrimp
 - Cassava
 - Maize
 - Bonemeal
 - Poultry Byproduct Meal

I am not sure I gave them the answer that they wanted. I said that while they could almost certainly easily put together a small feedmill to make terrestrial livestock feeds, that they should not expect to make aqua feeds this way. Assuming that farmers have gotten used to using floating feeds (and floating feeds have many advantages) there is no way they could put together an extrusion operation with the finances they have.

What I suggested was that they concentrate on making feeds for terrestrial animals and contact existing extrusion feedmills to toll mill feeds for them. They were very obviously unhappy with this suggestion! However, I explained to them that aquaculture formulation and extrusion production is much more complicated than for terrestrial animals because aquaculture is in water and even expert formulators don't know as much about the nutritional requirements for fish and shrimp as they do for poultry, swine and cattle.

In places such as India, the first ones to make feeds for fish were actually poultry feedmills. It would be much more efficient and worthwhile to work with the existing extrusion feedmills to produce an extruded, floating aquaculture diet of some basic quality and this group to be the distributors of that product. In Asia we often “toll mill” from a feedmill, that is we have custom feeds produced according to a formula given to a feedmill.

4 contacts and 50% male and 50% female

2 farm families directly impacted

Many farm families benefiting from the contacts (relates to production of feeds for a wider community in the Bondo region)

Many recommendations:

0% environmental

30% business

70% management of farm (technically feedmill operations)



Group of farmers and government workers interested in a feedmill (Nancy, Rosaline, Lukas, James, Alfred)

DETAILED REPORT/COMPANY REPORT

Traveler: Lukas Manomaitis

Date: December 20-22, 2012

Location(s) visited: Hilton Hotel, Nairobi, Kenya

Person(s) contacted: Dr. Amrit Bart (Director, AIT Vietnam)

Knowledge gained from the discussion:

Discussion and write-up of trip with Amrit.

COMMENTS AND RECOMMENDATIONS:

1. Both Amrit and I had no prior experience or contact in this region, so we could not preplan our trip. If another specialist team is sent, a basic plan should be created either by past teams or by looking at trip reports.
2. Group meetings, seminar, workshops and presentations would have been invaluable during this trip, and in future should be set up in advance. This could be done at low cost if needed, for example the resource center at Enos' farm would be ideal. Some meetings could be in-house meetings (such as with feedmills). Some targeted groups:
 - Government fisheries officers for a wide range of topics
 - Existing feedmills to discuss the challenges and opportunities of producing aquafeeds
 - Farmer groups to discuss basic production methodology
 - Meeting with the Commercial Aquaculture Society to discuss the experiences of other
3. While Thinqubator's approach with RAS is novel, it didn't seem practical for Kenya. However, Otiello's thoughts on rationalizing and coordinating production of fish overall are good ideas. There appears to be a market, but not a coordinated way to connect the market and the producers yet. Better coordination will help all players in the value chain to improve.
4. Need to put Dominion farms and Wenger in contact. They purchased a Wenger machine, which is typically a very good brand, but they are not making the best use of it. I will follow up with an email to Mr. Joe Kearns of Wenger to see what can be done.
5. There was a long list of recommendations to Dominion farms feedmill manager that won't be repeated here. My suggestion is that when they have made some adjustments that they bring in an expert to do more with them. Specifically someone that has experience with adjusting the machinery to improve production and can formulate basic diets. A range of basic template diets (4-6?) should be created that can be used with only slight modification by the operator is what is desired.
6. Genetics of the tilapia came up time and time again. The fish grew slowly, the fish reproduced early – all signs of inbreeding and poor (if any) strain selection. Even hatchery people were simply taking the largest fish to use them as broodstock. There are five "pillars" of fish farming:
 - Market
 - Seed
 - Feed

- Water
- Management

Each of these needs to be kept in mind, and each of these had issues where we went. But with poor seed, really there isn't much you can do otherwise to change the dynamic. The environment here needs to be determined in order for the proper strain to be identified that will prosper in this area. And thought given to bringing outside strains (and managing them carefully in the hatcheries) to improve the industry.

7. Finally, I would like to specifically thank:

- The USAID program
- Dr. Kevin Fitzsimmons
- The University of Arizona staff
- Aquaculture Without Frontiers
- Enos, Jedida and Tony Were
- The ASA-IM/USSEC
- The USB
- The United States Soybean Farmers

For sending and supporting me to go to meet with these groups. I hope that I have added value to the Kenyan aquaculture industry.

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