

"Effluent Management in Small Recirculating Aquaculture Systems in Guam"

David Crisostomo

Aquaculture Specialist

University of Guam

Cooperative Extension Service

Aquaculture Systems

➤ Traditional Systems in Guam

- Earthen Ponds
- Approximately 80 acres built



Traditional Systems

EFFLUENT TREATMENT

- Heavy aeration and water circulation
- Water held in retention ponds for 48 hours before release to surface waters.



Introduction of Recirculation Technology

- Workshop sponsored by UOG CES - 1995
- Attended by over 50 people.
- Concept - intensive system transferring crops between tanks. Maximizing space. Footprint 40'x40'
- Production claim - 10,000 pounds/year



Recirculating System

- Fish Farm System components
 - Three culture tanks - 9, 12, 15 foot diameter with pvc liner.
 - Heavy gauge galvanized corrugated metal ring



Recirculating System



➤ Filtration system:

- Two stage system
 - Solids removal using electro-statically charged beads.
 - Biological filtration through Bio strata media

Recirculating System

- Efficiency in collecting solid waste is critical to maximize fish production
 - Pumped waste removal



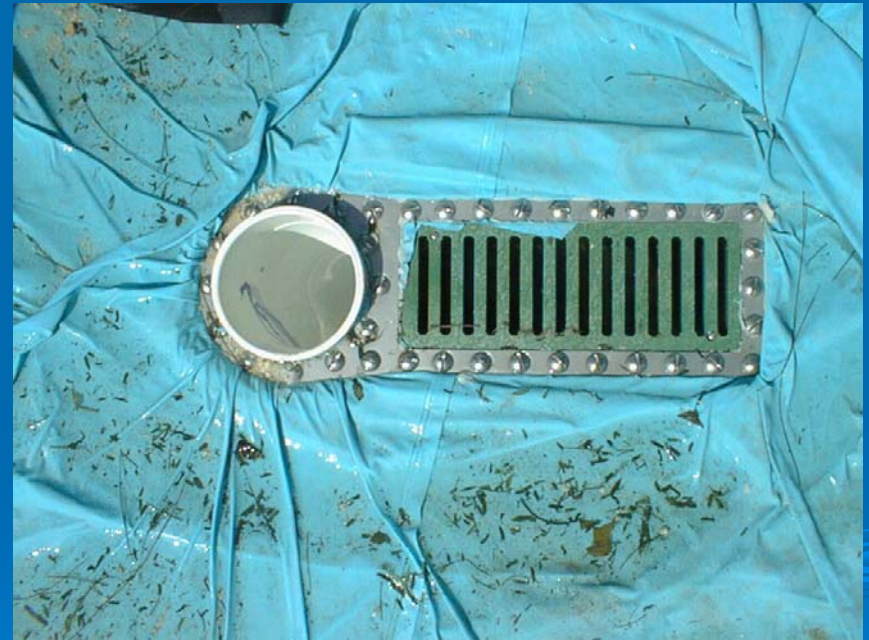
Recirculating System

- Efficiency in collecting solid waste is critical to maximize fish production
 - Pumped waste removal
 - Gravity removal system



Recirculating System

- Passive removal of solids w/central drain.
 - Relies on water movement to move solids to center.
 - Solids fall through grate and settle in 4" elbow
 - Collected solids are easily drained to selected destination



Recirculating System

- Small, lighter solids float and eventually enter biological filter through the standpipe



Recirculating System

- Water flows due to difference in water levels.
- Filter tank is filled halfway with bio-media.



Recirculating System

- Water returns to culture tank via centrifugal pump (1/2 hp)



Effluent management

- Effluent: Waste water discharge from fish tank.
- Characteristically high in nitrogen (nitrate) with significant phosphorous and sulfur, depending on feed used.



Effluent management

- Management schemes to harness the power of effluent
 - ADVANTAGES
 - effluent is an aqueous solution. Water is valuable resource
 - Nutrients in effluent is valuable fertilizer.
 - Aquaculture effluent is free from pesticides, heavy metals or toxic chemicals.

Effluent management

➤ TREATMENTS

- Compost
 - Increases nutrient content of compost.
 - Allows nitrification of organic material in effluent.



Effluent management

- Direct application to plants
- Provides nutrient rich water to plants (fertigation)



Effluent management

- Hydroponics: Culture of plants without soil.
- Aquaponics: Integration of hydroponics with aquaculture
- Small-scale-no solids removal



Effluent management

- Mid-sized tanks
 - Solids removal becomes more important. Plant selection is important



Effluent management

- Large systems
- Commercial systems
 - developed at UVI
 - Shown to grow vegetable, fruit and herb crops.

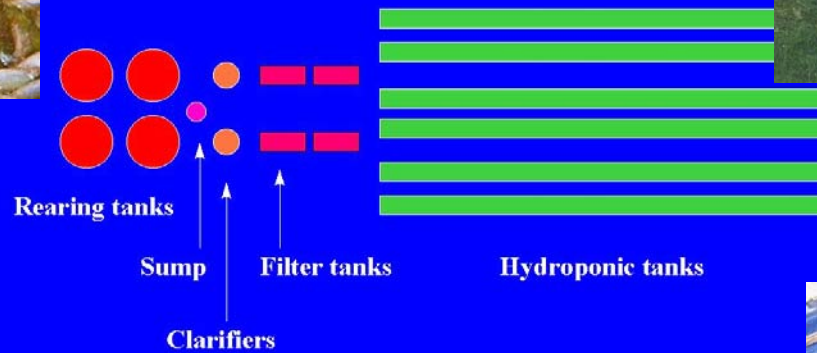


Effluent management

- University of the Virgin Islands Commercial Aquaponic system



SYSTEM LAYOUT



Effluent management

- Smaller Systems demonstrated in Guam
- Culture tank and filter tank



Effluent management

- Hydroponic troughs and water return system

QuickTime™ and a
TIFF (LZW) decompressor
are needed to see this picture.



Effluent management

- Attached system using Ebb & Flow style hydroponics



Effluent management

- Water pumped to tank via submersible water pump on a repeat cycle timer



Effluent management

- Timer allows plant tank to fill with water, then shuts off and drains back to fish tank.



Future Direction

- Maximize use of aquaculture effluent to allow for at least 2 uses and possibly more.
 - Reduce overall water consumption.
 - Encouraging Water Conservation and use of grey water from other sources.
 - Encourage regional approach to solving regional issues.
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