"Effluent Management in Small Recirculating Aquaculture Systems in Guam"

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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

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  - 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

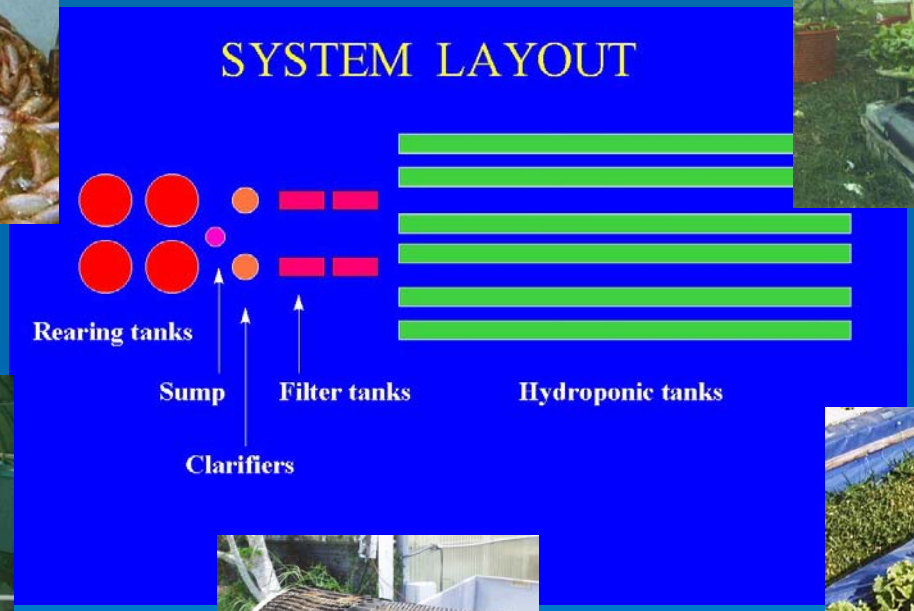
Effluent management

- Large systems

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

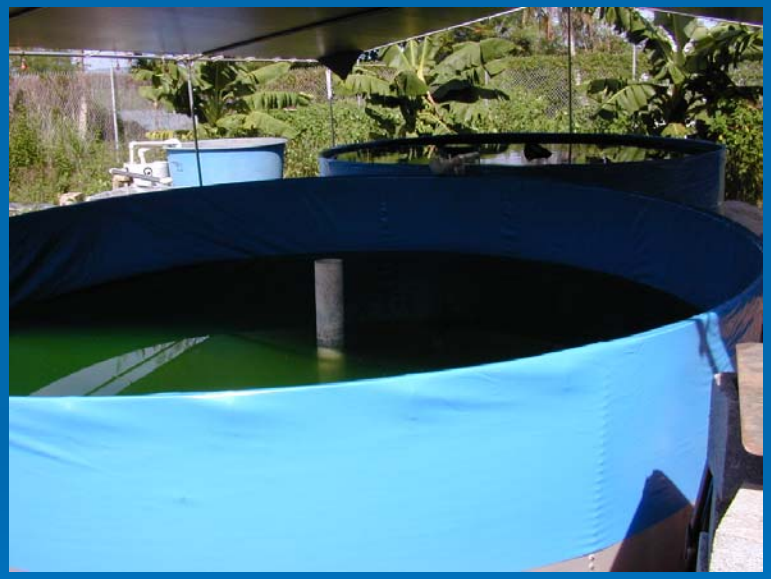
Effluent management

- University of the Virgin Islands Commercial Aquaponic system



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.