

# Recent Progress in the Recirculating Aquaculture Area: Marine Implications

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# Demand for Seafood in World is Increasing



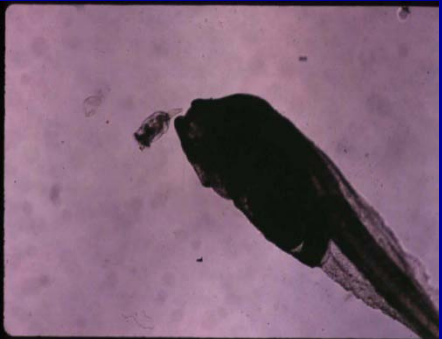
- Fisheries Harvest from Oceans has Internationally Topped Out

# Likely Marine Production Format

# Growout Options

Broodstock

Larvae



Fingerling

Netpens

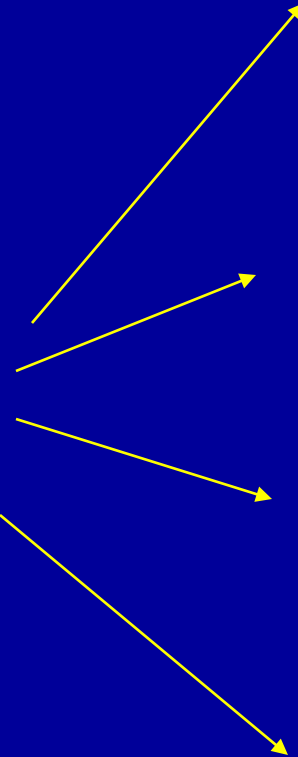
Ponds

Release

Tanks

## Recirculation Likely

- Disease
- Temperature Control
- Value/pound



1998



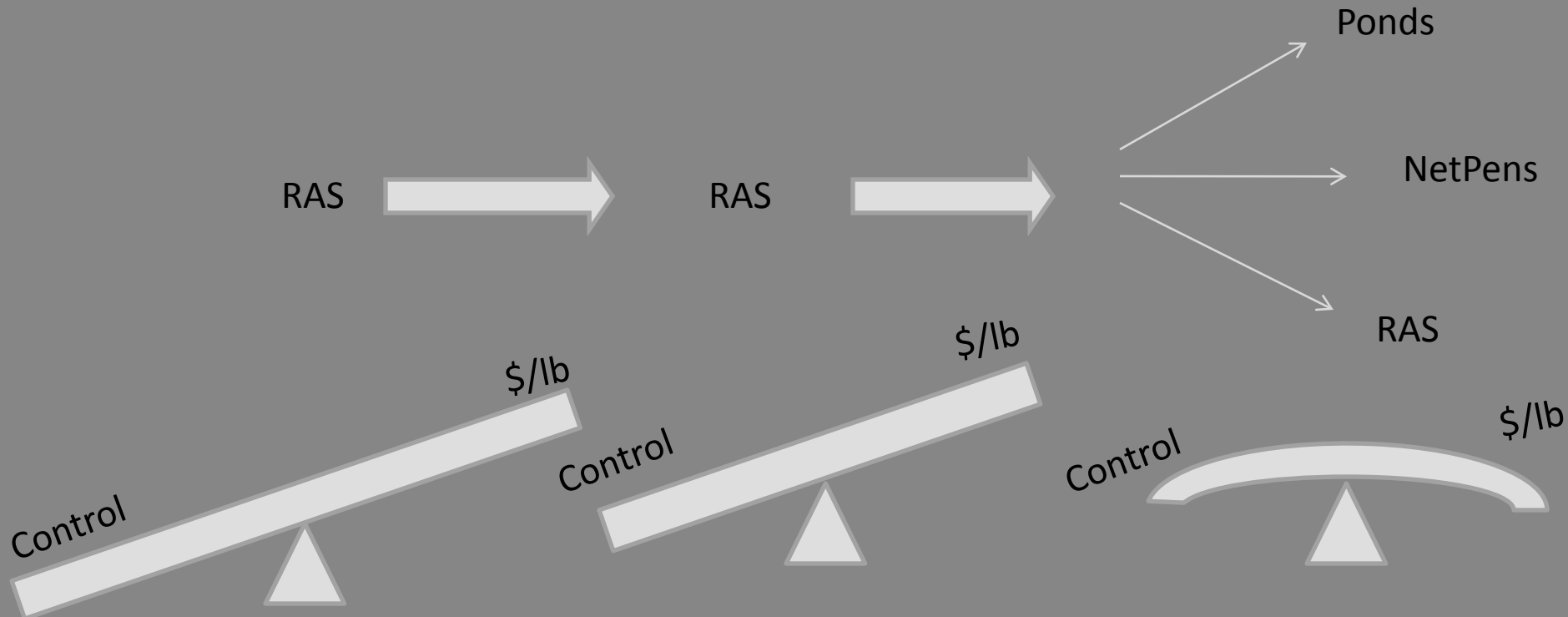
## Shrimp Maturation in South America



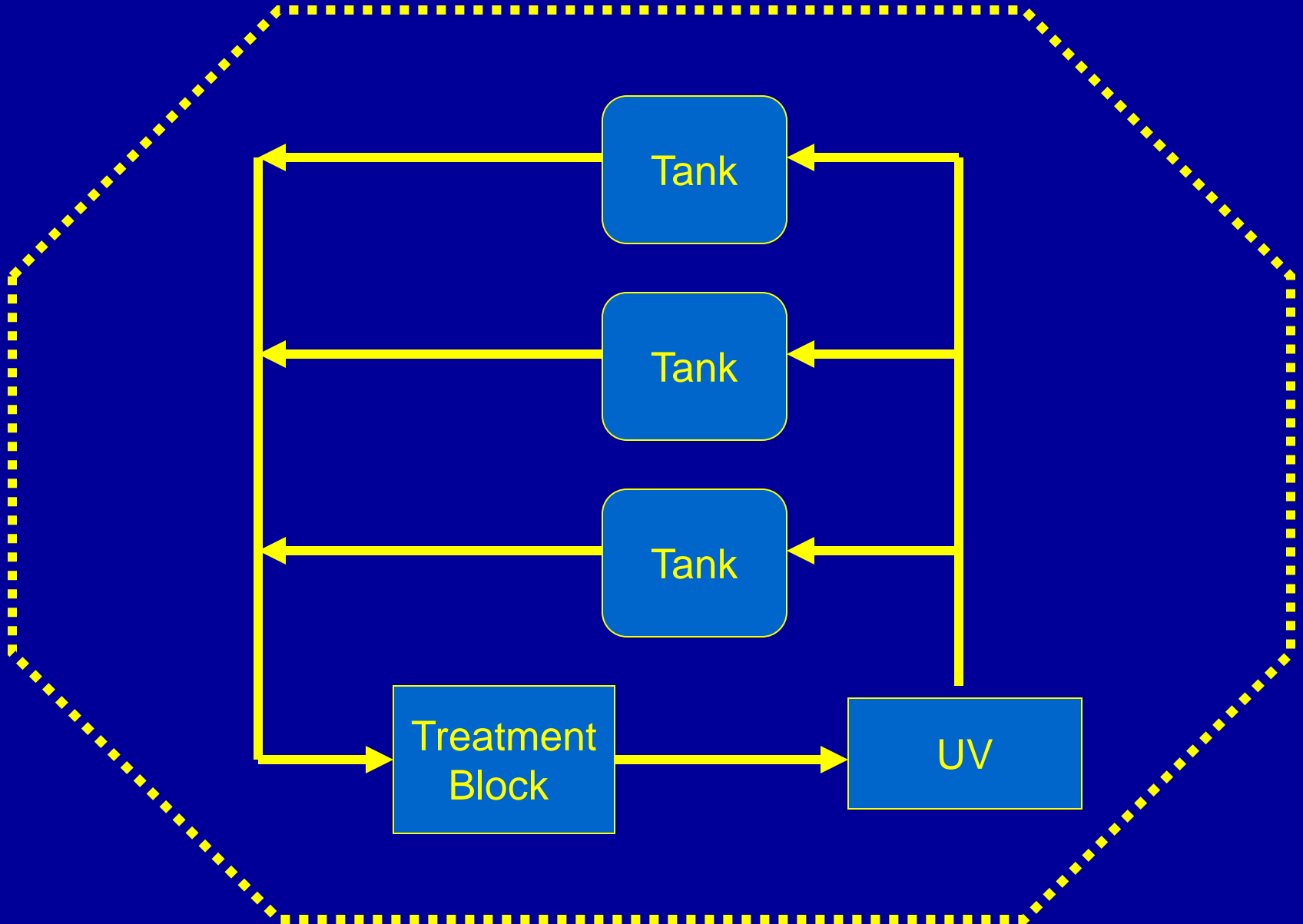
Southern Mexico

# Balance of advantage (Marine 2010)

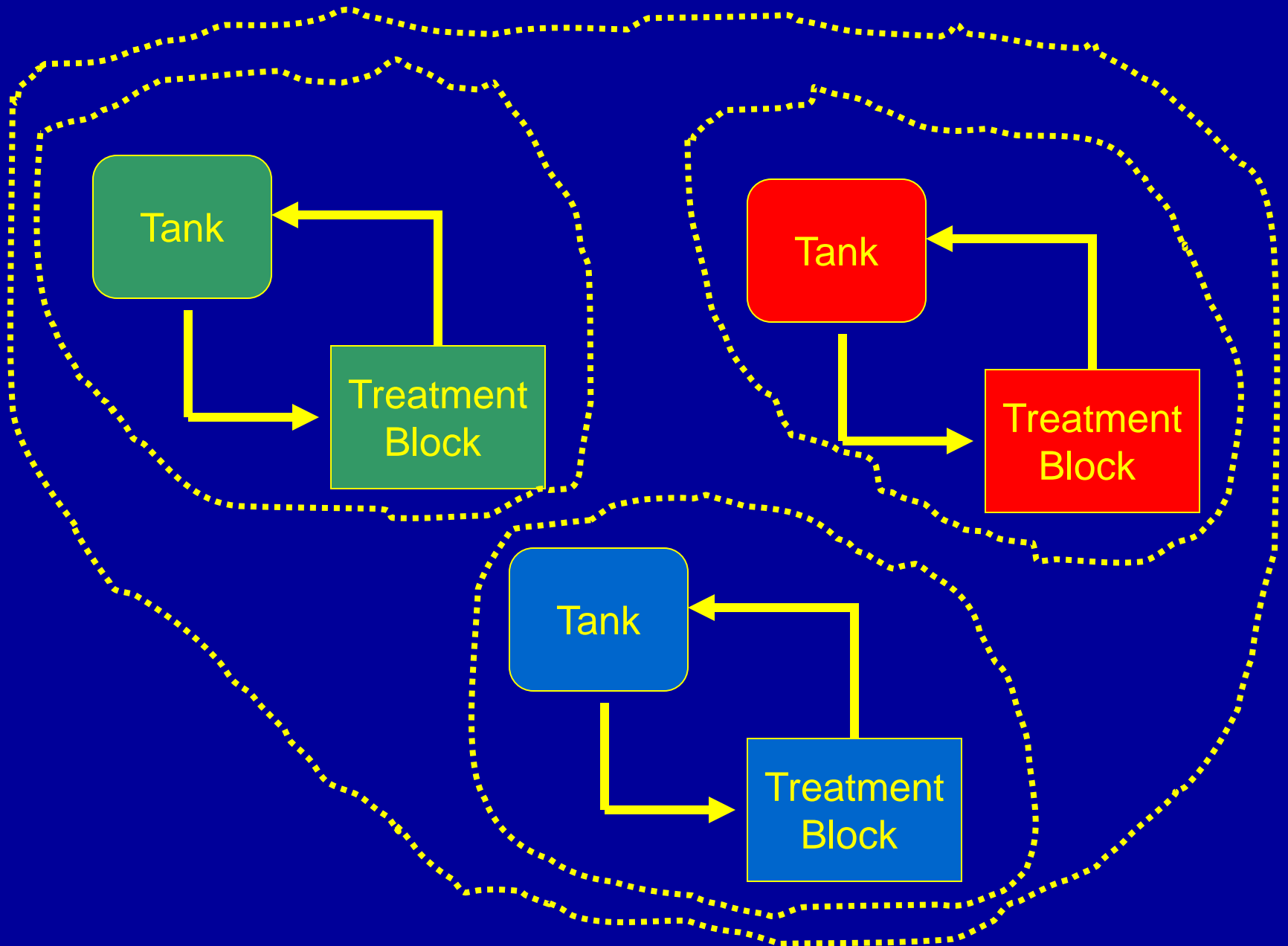
|          | Broodstock | Fingerlings | Growout           |
|----------|------------|-------------|-------------------|
| Ponds    |            | x           | X (\$)            |
| RAS      | X          | X (disease) | x (control, NGOs) |
| Net pens |            |             | X (scale)         |



# Centralized Treatment



# Decentralized Treatment





2004

Larval Pompano



Harbor Branch, Florida



1994

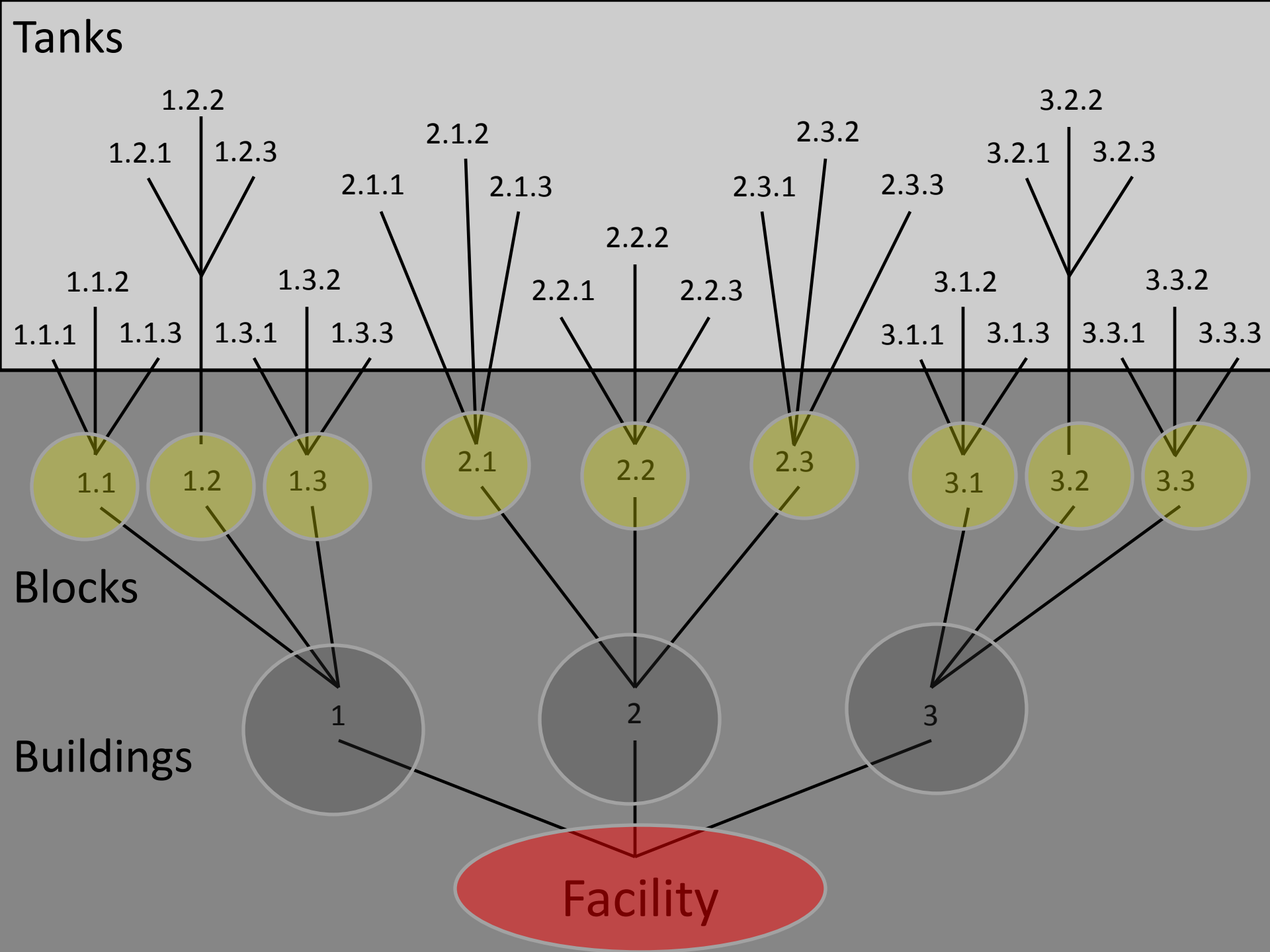
# ADM Tilapia System Pumps & Prop-Washed Bead Filters

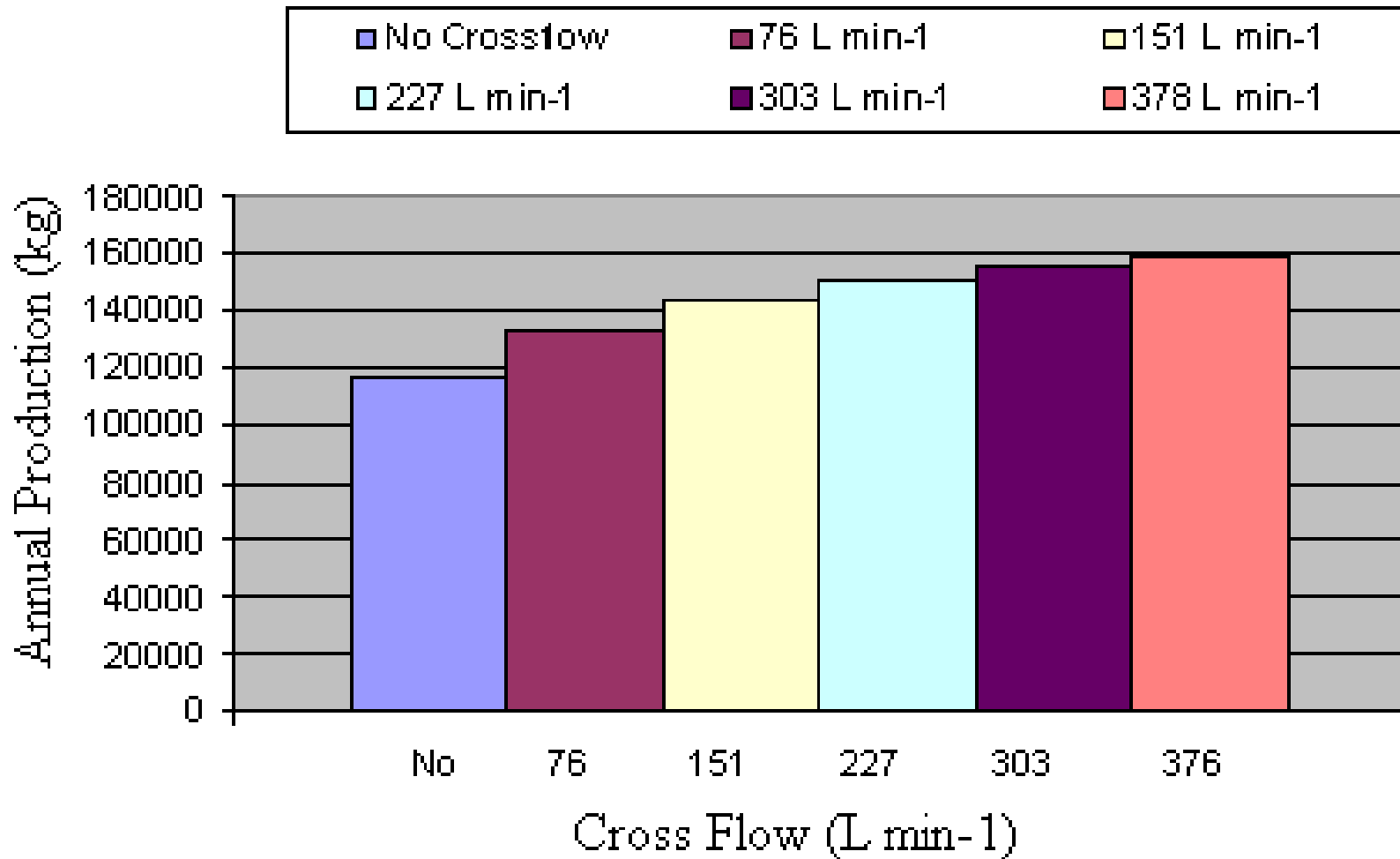


Decatur, Illinois

# ADM Tilapia System

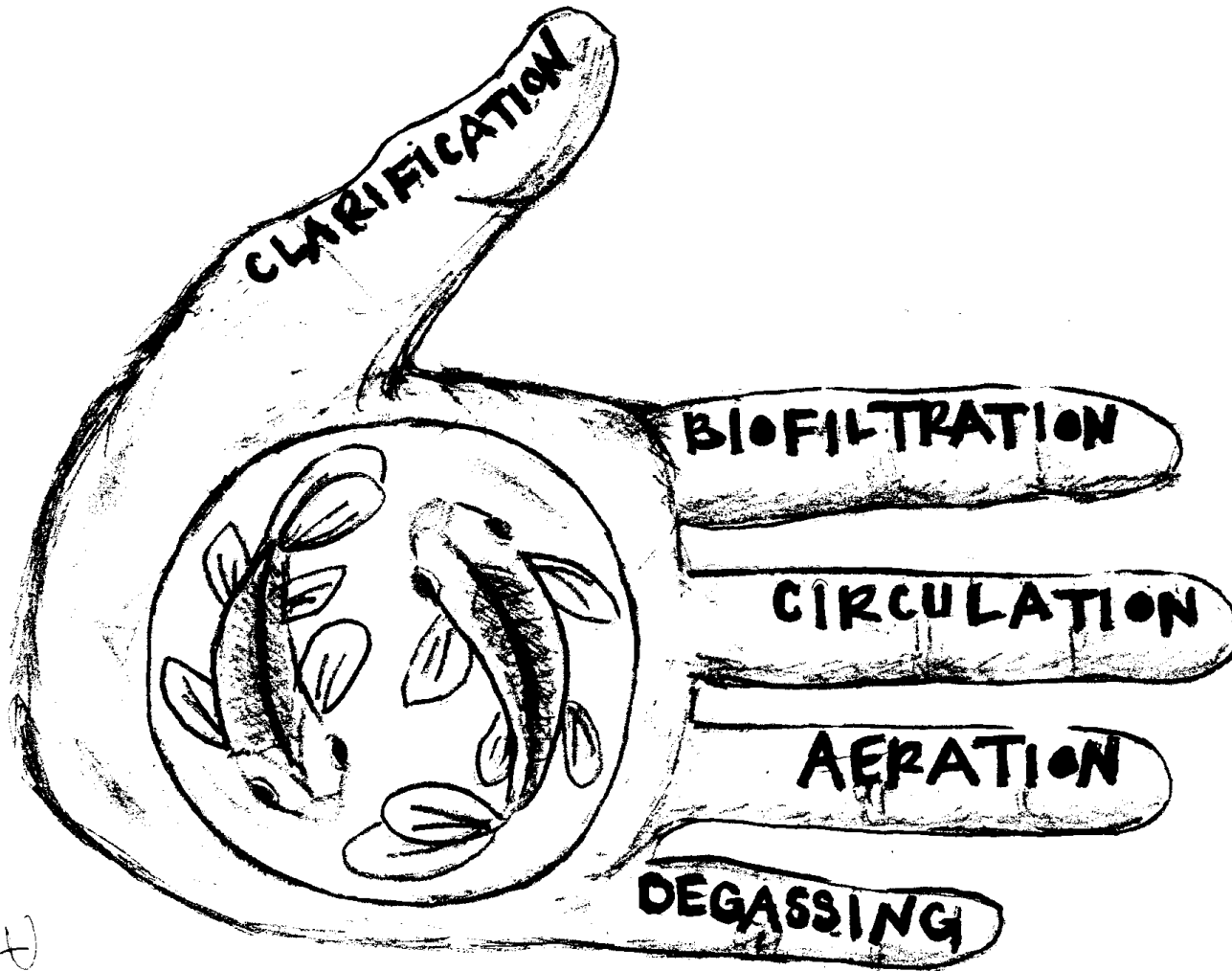






**Cross-flowing water in between tanks in a small block reduces labor and increases Production by 20 Percent**





You must only address five fundamental processes if you want Your recirculating system to work.



# Consolidation Strategy

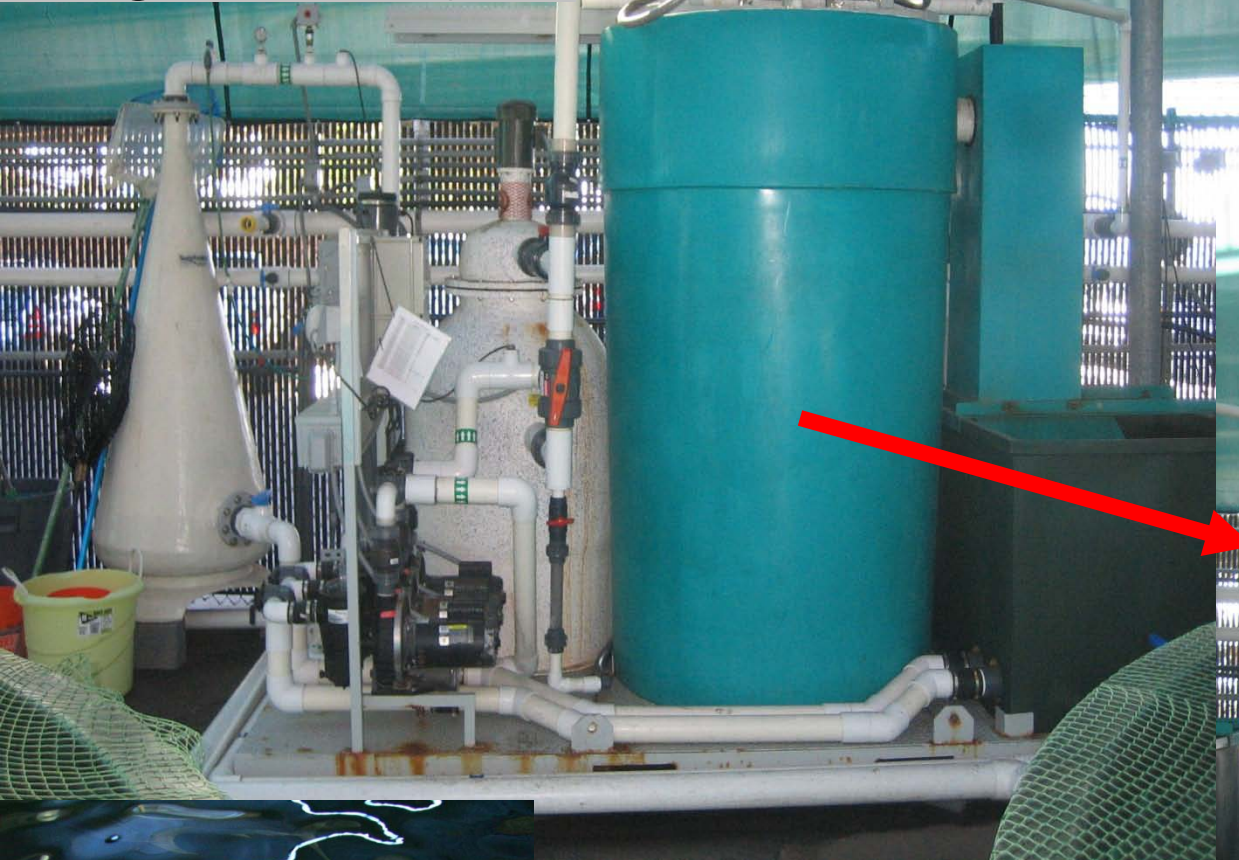


- **Utilize multi-functioning components with the objective of:**

**Minimizing the Number of  
Treatment Components  
Improving the Stability  
Reducing Costs**

So, let's use  
an Airlift

Hubbs SeaWorld  
San Diego, 2007



Airlift

PolyGeyser®



Simplify  
Improve Reliability  
Save Energy  
Reduce Labor



Clarification



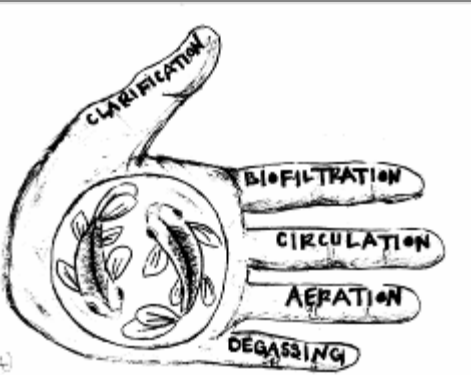
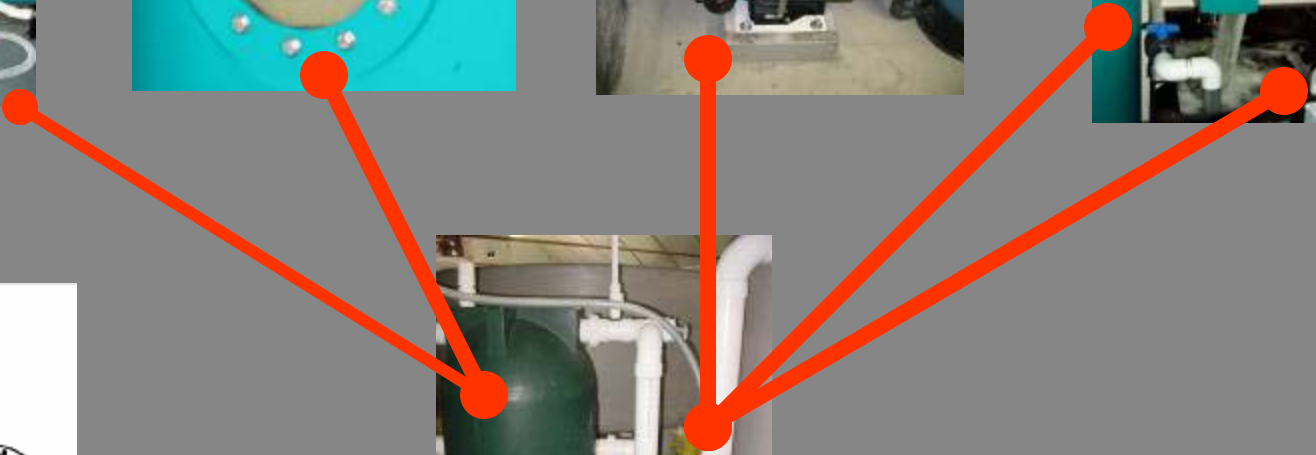
Biofiltration



Circulation

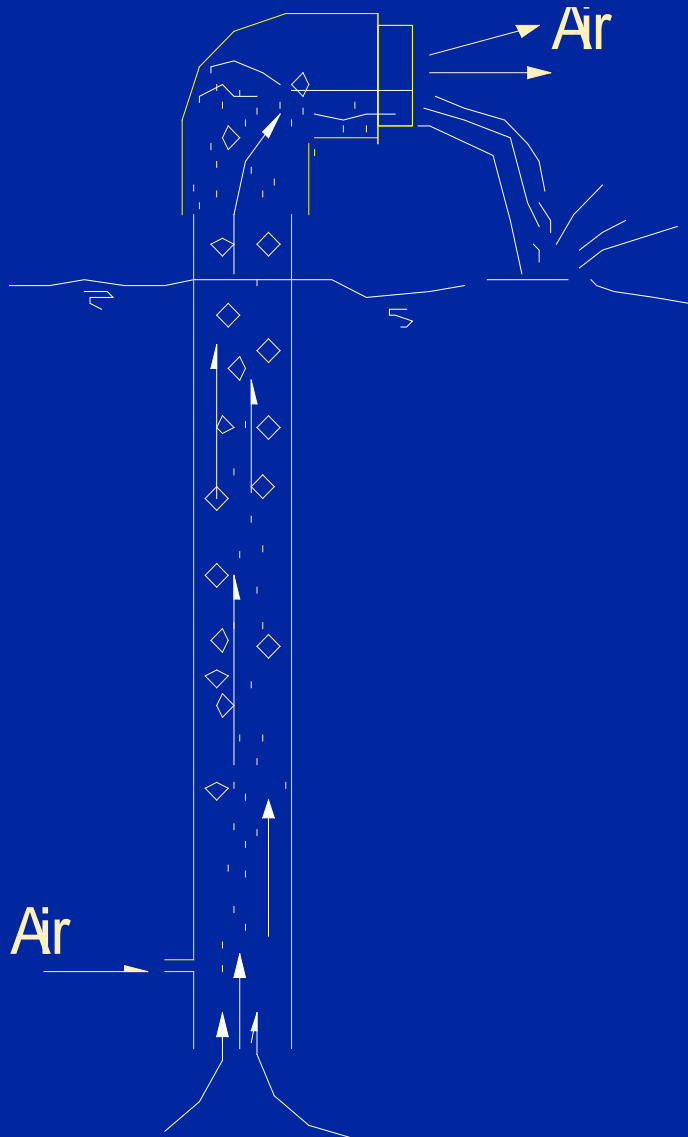


Degassing  
Aeration

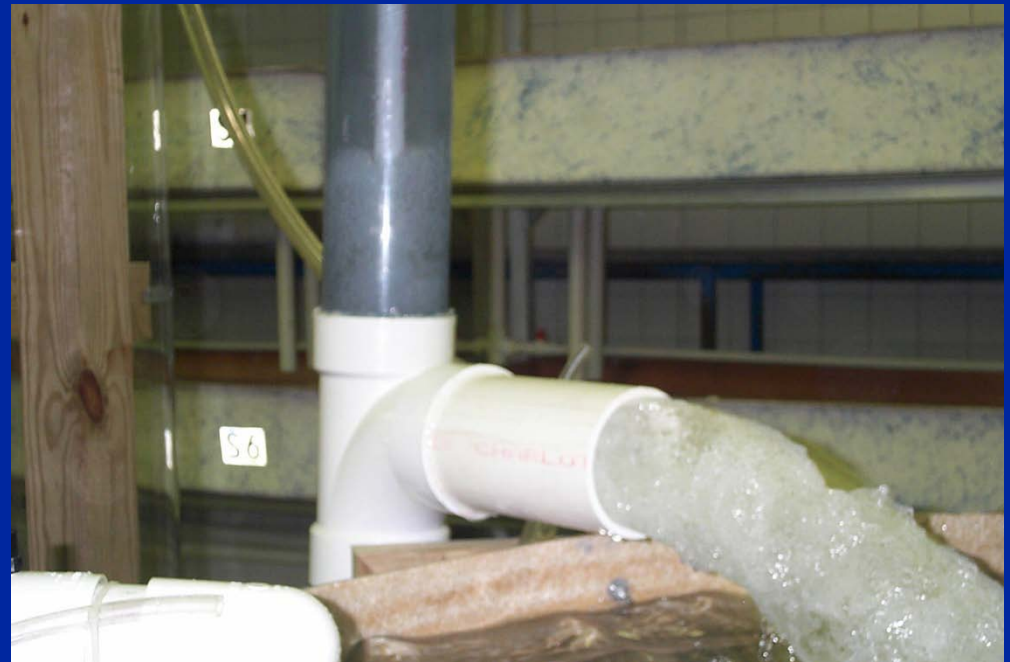


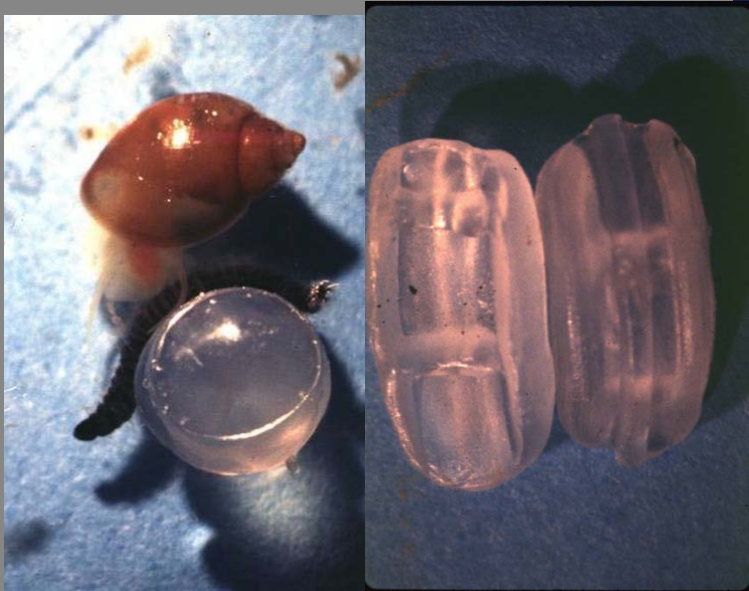
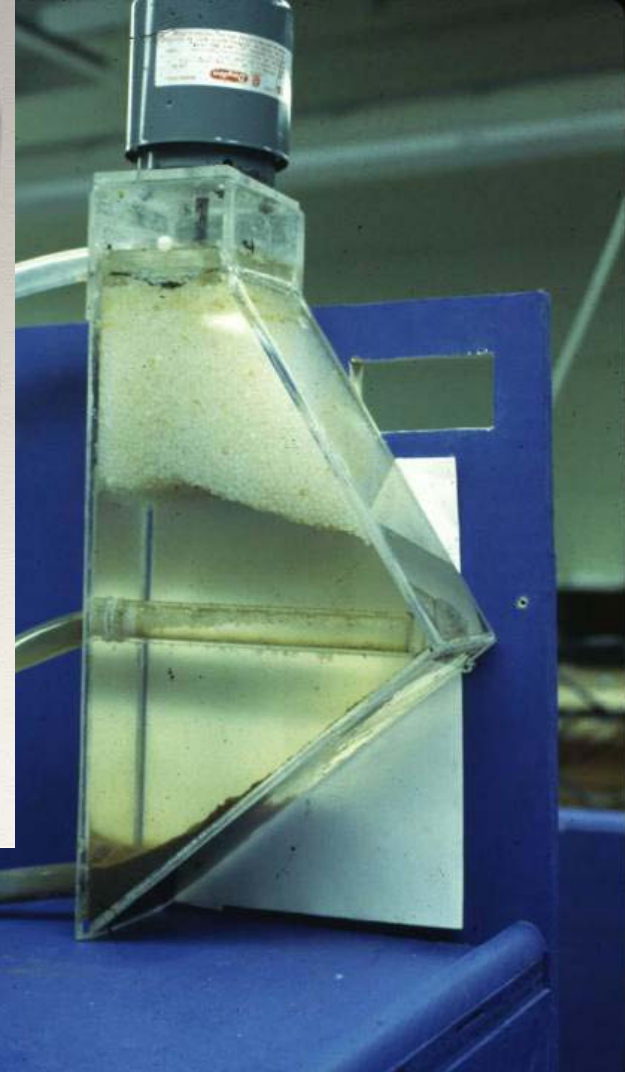
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# Airlifts Perform Several Functions



- Circulation
- Aeration
- CO<sub>2</sub> stripping
- Foam control

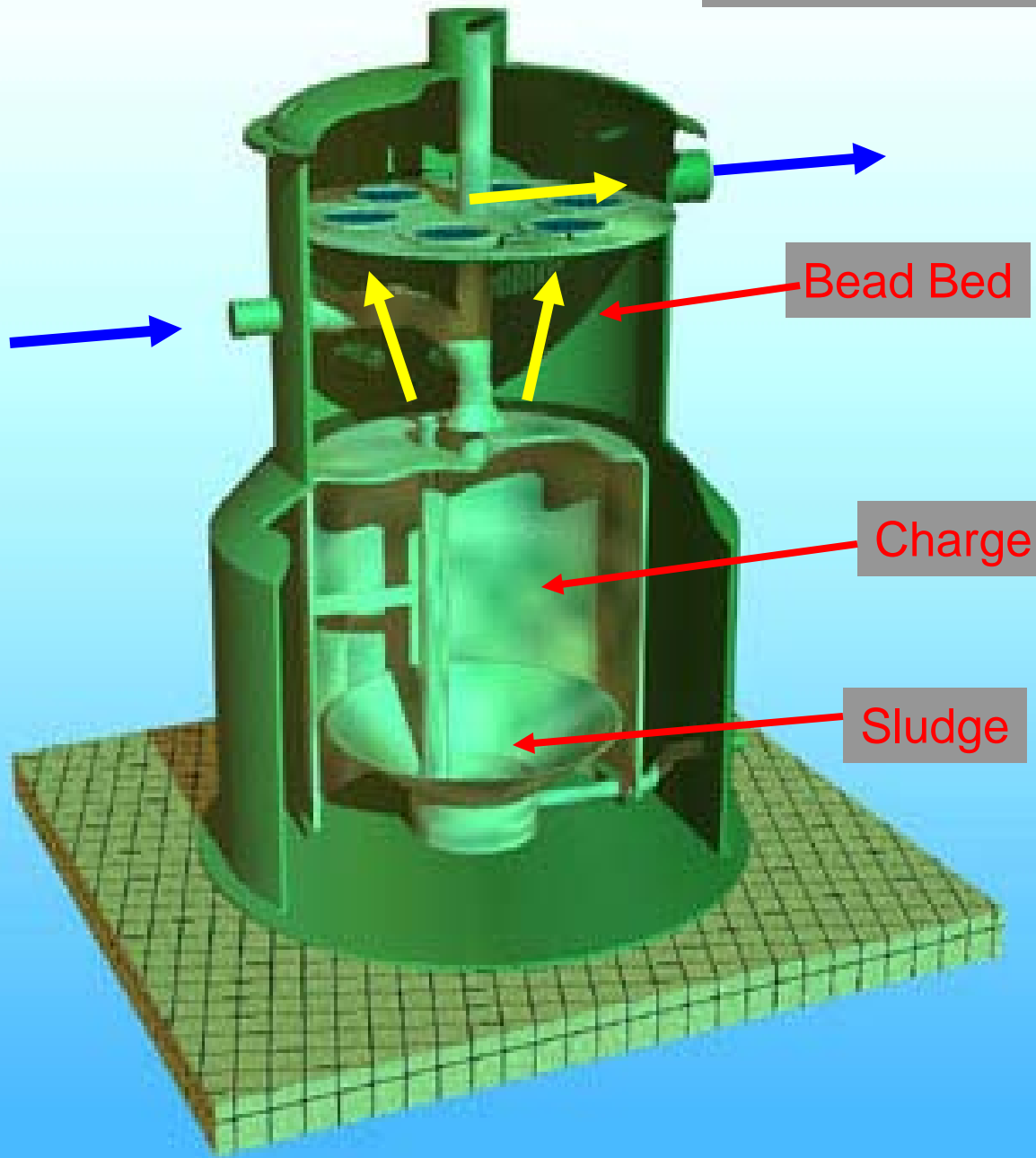




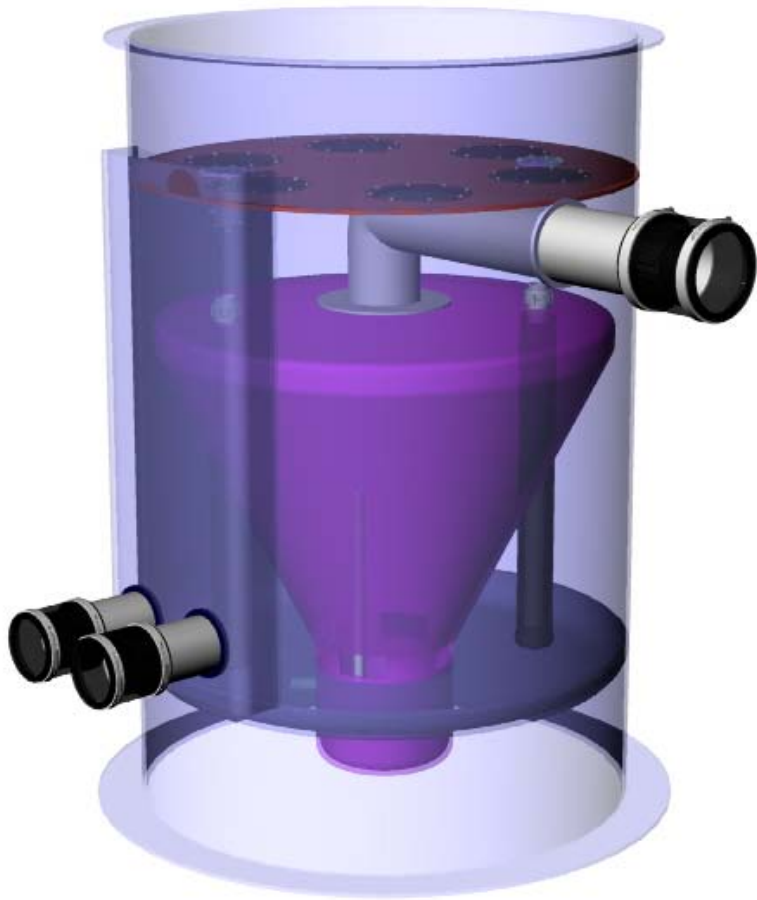
Removes suspended Solids  
Removes dissolved organics  
Removes Ammonia



# PolyGeyser™ Bead Filter



**PolyGeysers recycle  
their own backwash  
Water**



PolyGeysers Model DF-25  
U.S. Patent # 5,770,080 & 6,517,724  
European Patent # EP0977713B  
Canadian Patent # 2,287,191





## Simple Low Water Loss Marine System Designs







Waddell, South Carolina, 2003





Lazy Cajun, Inc  
Baton Rouge, LA

2004



2003



Airlift

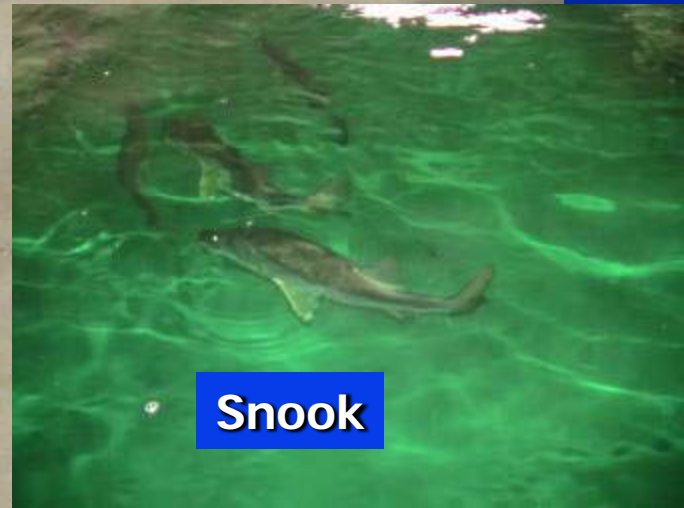


Cobia  
Marine Fingerlings



Gulf Shores, Florida

Marine Broodstock  
2004

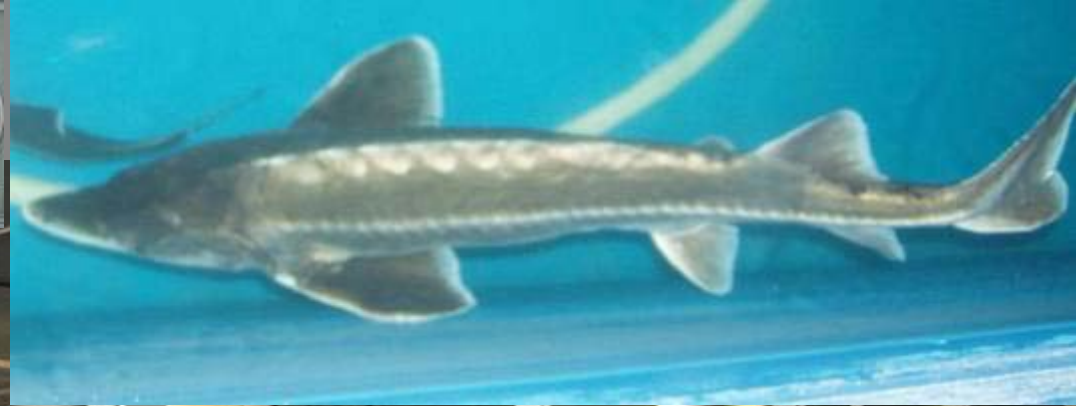


Snook



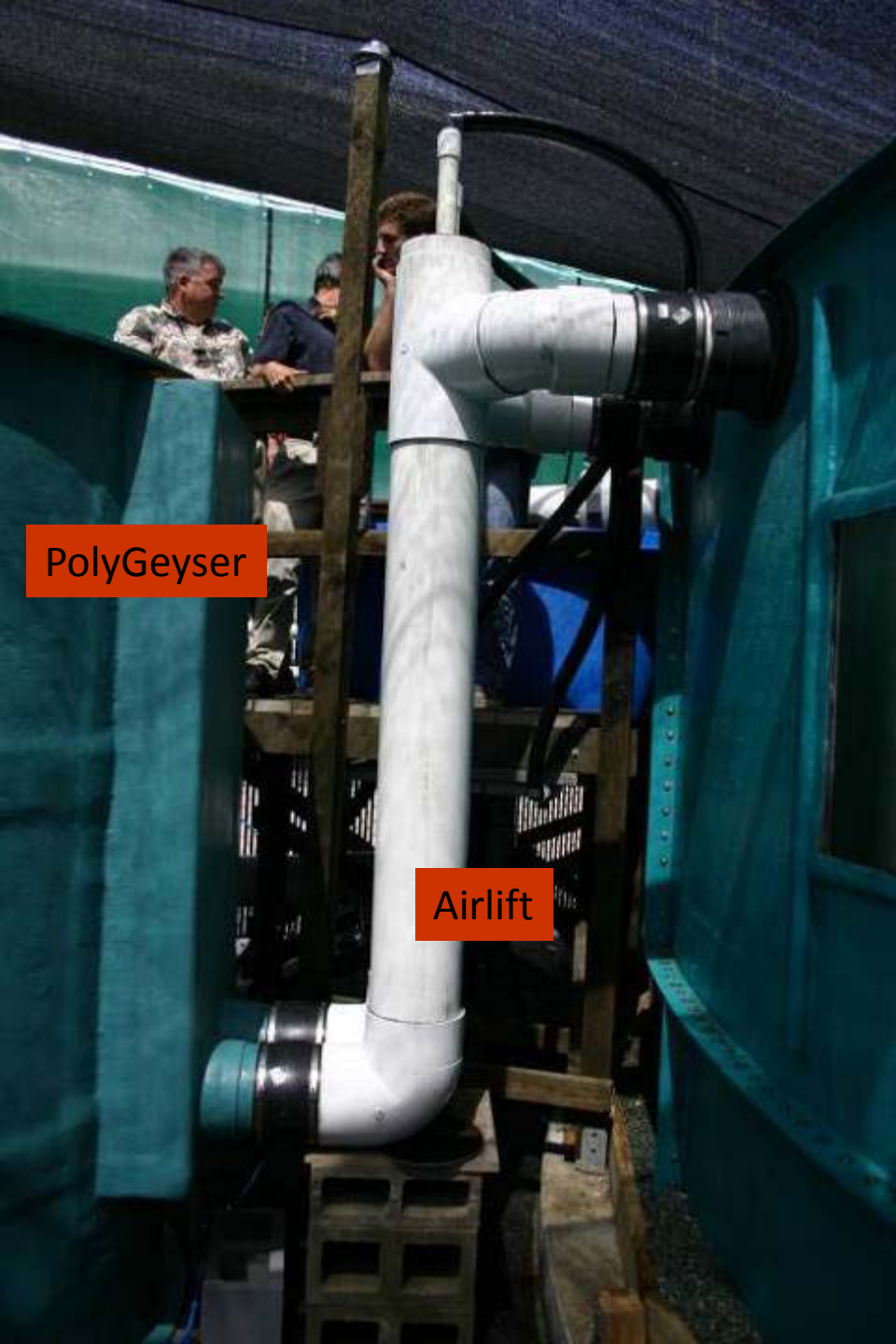
# Sturgeon...Caviar

Mote Aquaculture Park  
Sturgeon  
Growout 1



Mote Marine, Sarasota, Florida

August, 2004



PolyGeyser

Airlift



Documented for 4 years under  
USDA Funding and the Yellowtail  
spawned regularly

Hubbs, 2004









**PolyGeyser**

**Airlifts**

**Sump**





















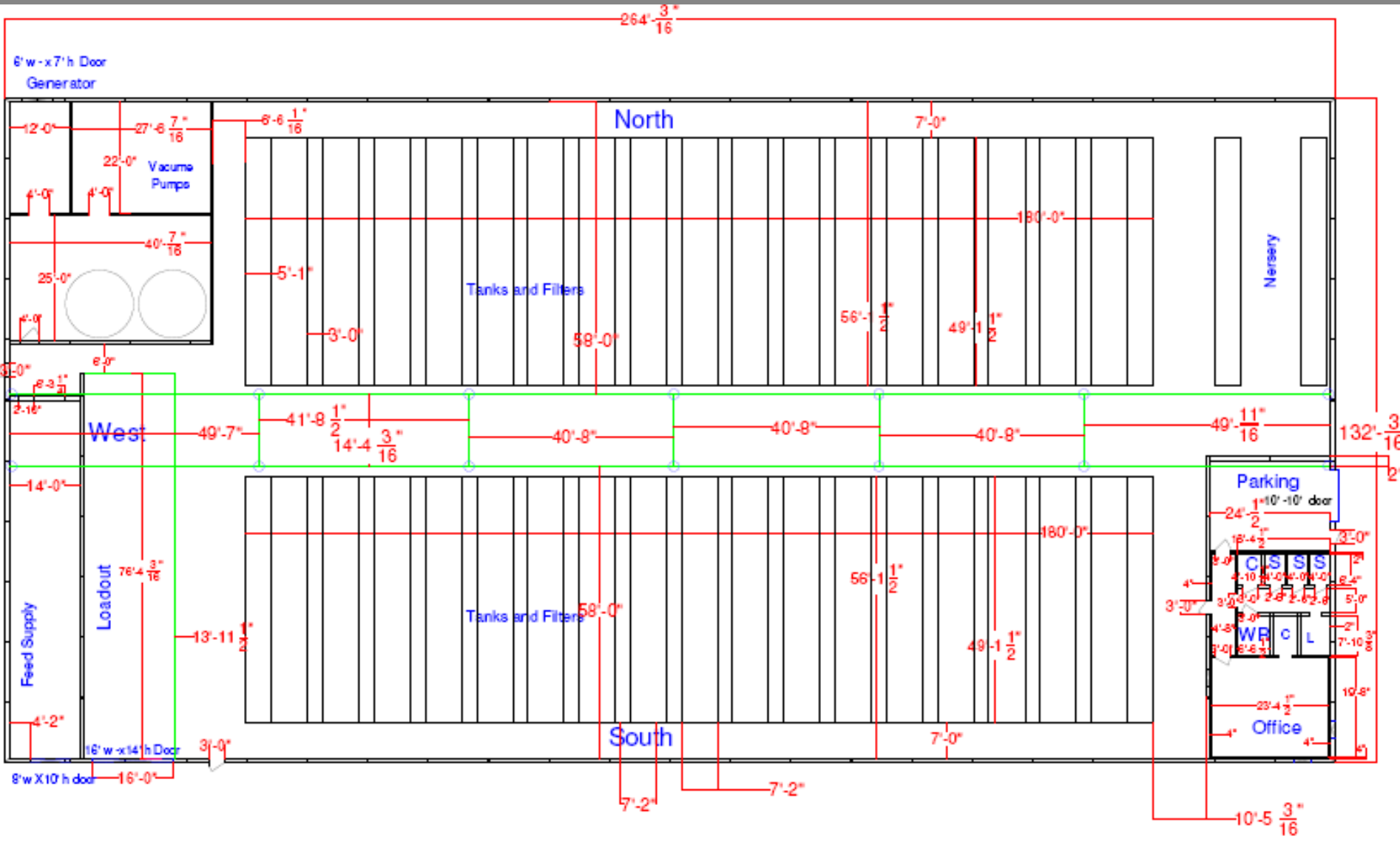
Indiana, 2008





Indiana, 2008





















Collins, South Dakota,  
June, 2008



Tilapia Growout  
TAN < 1.0 mg/L



80 hp\*\*

820 kg feed/day

0.1 hp/Kg-feed-d \*\*

Growout mode

\*\* US hp

Circa, 2008



# Summary

- Marine production will be heavily dependent on RAS based fingerlings
- Expect large complex marine fingerling RAS designs to emerge spontaneously
  - Decentralized treatment
  - High fractal numbers
- Differences of opinion are being resolved by a brutal process of economic elimination

A photograph of a coastal scene. In the foreground, a wooden post is partially submerged in the water, with a bird perched on top. A thought bubble is drawn above the bird, containing the word "Questions?". The background shows a body of water extending to a distant shoreline under a blue sky with light clouds.

**Questions?**