

S.A.L.T.

SHARKS AQUACULTURE LIFE TRAINING

Recirculating Systems



2018 Summer SALT Schedule:

Introduction to Florida Aquaculture Commodities

All sessions are scheduled on Mondays from 10 – 11:30 am and will be held at the FWC Marine Lab conference room.

June 18th – Recirculating Aquaculture Systems

Meet with Brian Catanzaro, Pentair Aquatic Ecosystems, Apopka, FL

Website: <https://pentairaes.com>

June 25th – Molluscan Shellfish Aquaculture

Meet with Leslie Sturmer, UF/IFAS Shellfish Extension, Cedar Key, FL

Website: <http://shellfish.ifas.ufl.edu>

July 2nd – No session due to holiday week

July 9th – *Any suggestions for topic?*

July 16th – Aquatic Plant Culture

Meet with Brandon McLane, Florida Aquatic Nurseries, Davie, FL

Website <http://www.floridaaquatic.com/>

July 23rd – Food Fish Culture

Meet with Geno Evans, Evans Fish Farm, Pierson, FL

Website: <http://evansfishfarm.com/>

July 30th – Ornamental Fish Culture

Meet with Eric Cassiano, UF/IFAS Tropical Aquaculture Lab, Ruskin, FL

Website: <http://tal.ifas.ufl.edu>

August 6th – Alligator and Reptile Culture

Meet with Allen Register, Gatorama, Palmdale, FL

Website: <http://gatorama.com/>



AQUACULTURE SCIENCE

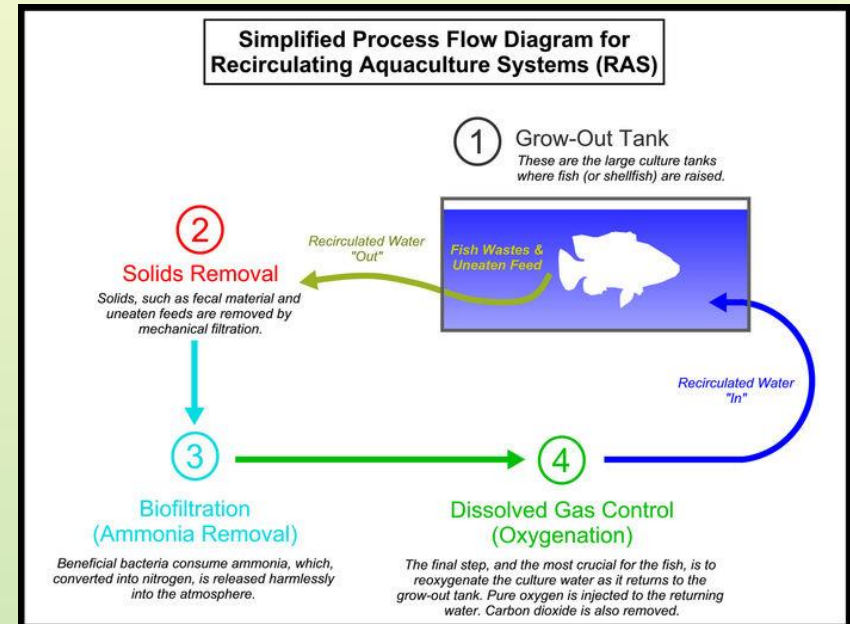
THIRD EDITION ■ RICK PARKER

Chapter 15

Recirculating Systems

Recirculating Aquaculture Systems (RAS) Advantages

- Reduced water and low land requirements
- Control of water's temperature and quality
- Independence from adverse weather conditions
- Year-round production



<http://www.blueridgeaquaculture.com/recirculatingaquaculture.cfm>

RAS Advantages

Ability to use existing buildings

High yields per gallon of water

Improved feed conversion

Reduced reproduction



RAS

Disadvantages

- For commercial:
 - High initial investment
 - Lack of success for lenders
- Complexity
- Chronic sub-lethal effects of ammonia and carbon dioxide
- Inefficiencies in filtration



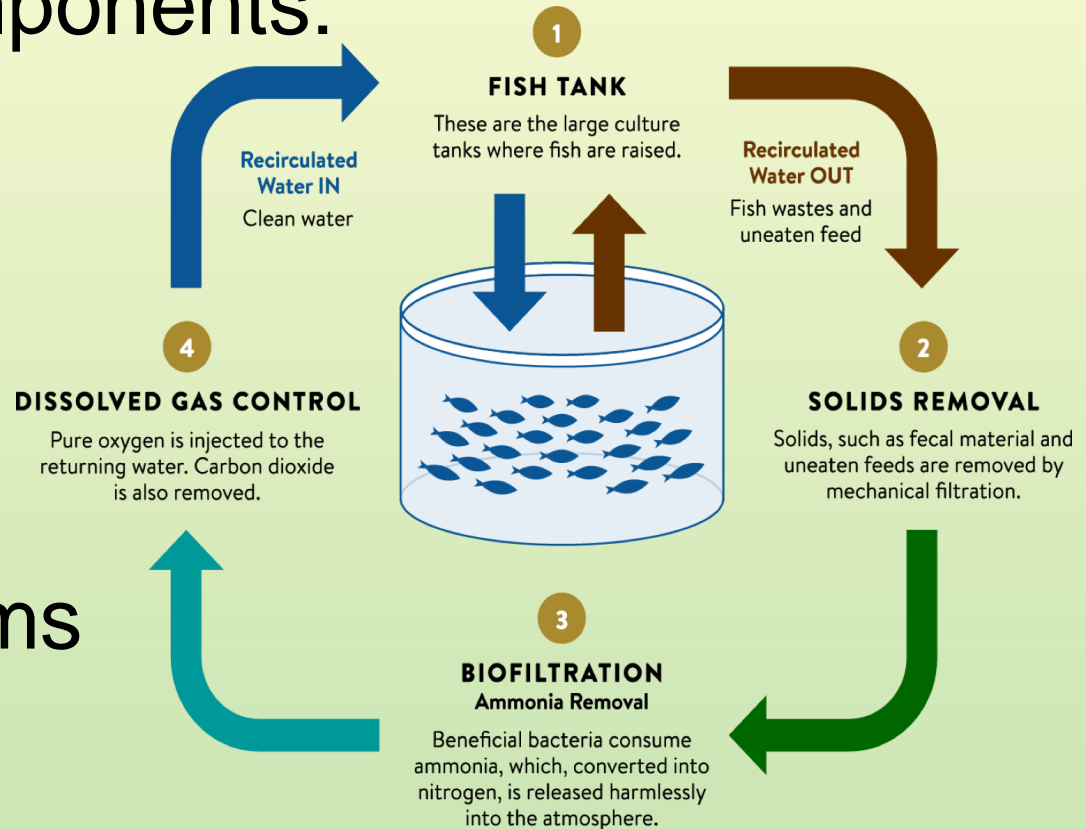
RAS System Design

- Most often used where sufficient water is not available to wash wastes out of the production tank
- Recirculates water through water treatment system
 - Remove ammonia and solid wastes
 - Oxidize ammonia and nitrite-nitrogen
- Aerates and/or oxygenates the water

RAS System Design

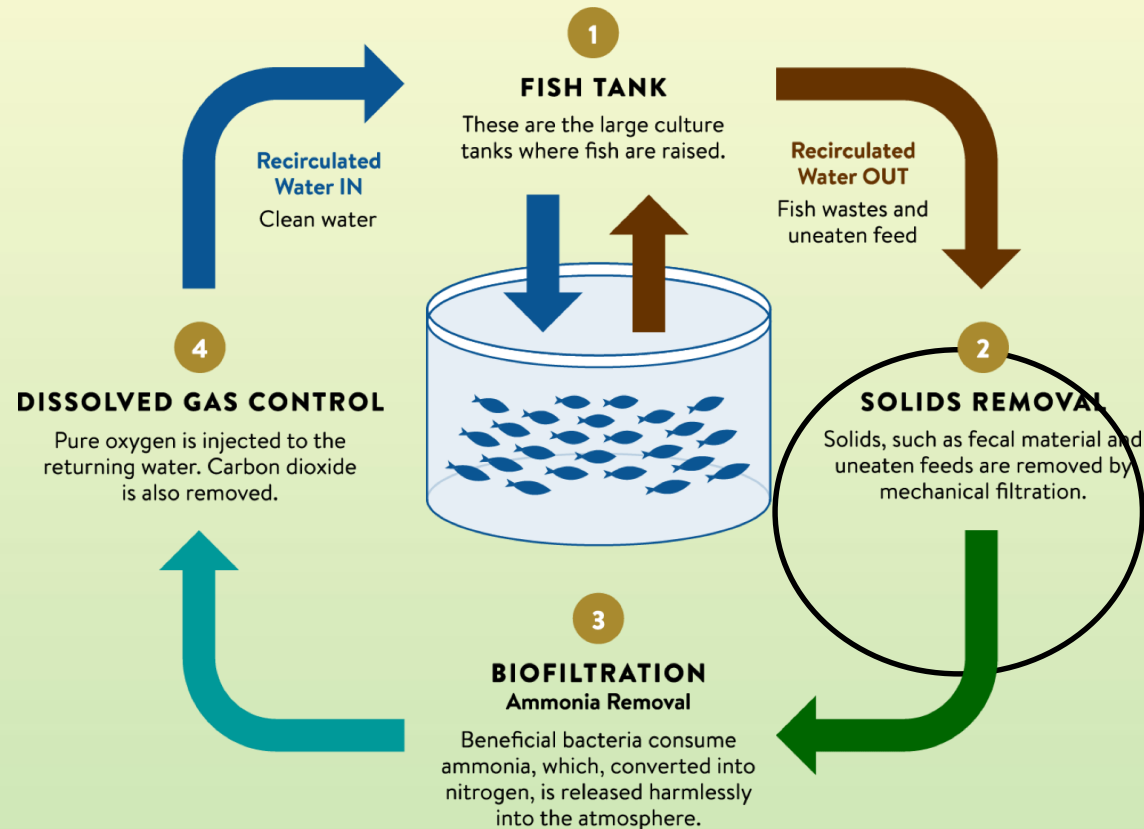
- Basic system components:

- Tanks
- Solids filter
- Biological filter
- Aeration
- Buffering systems



Waste Solids

- Four categories:
 - Settleable
 - Suspended
 - Floatable
 - Dissolved solids



Waste Solids: Settleable

- Easiest of four
- Within round culture tanks, accumulate bottom-center
- Kept in suspension with continuous agitation and removed with sedimentation tank (clarifier) or filter

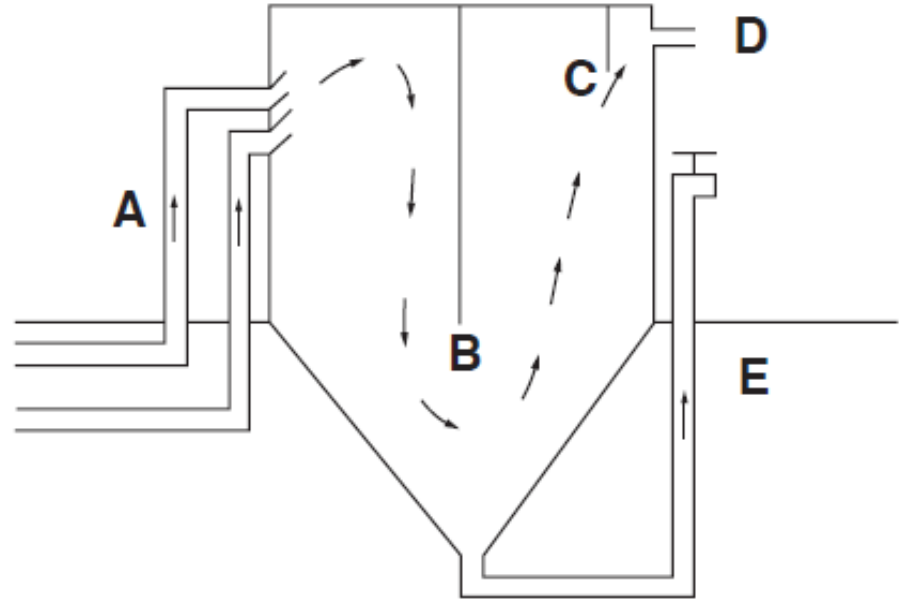
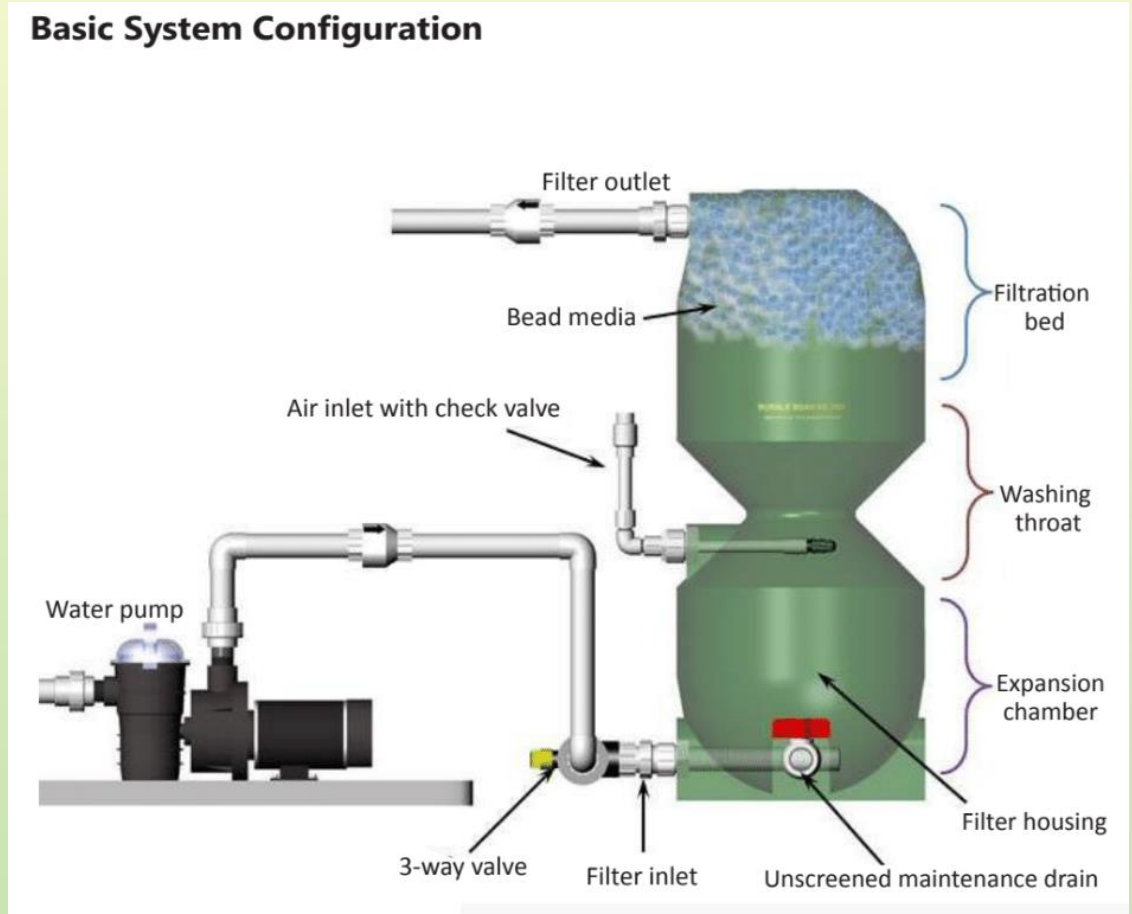


Figure 6. Cross-sectional view (not to scale) of UVI clarifier showing drain lines from two fish rearing tanks (A), central baffle (B) and discharge baffle (C), outlet to filter tanks (D), sludge drain line (E) and direction of water flow (arrows).

Waste Solids: Suspended

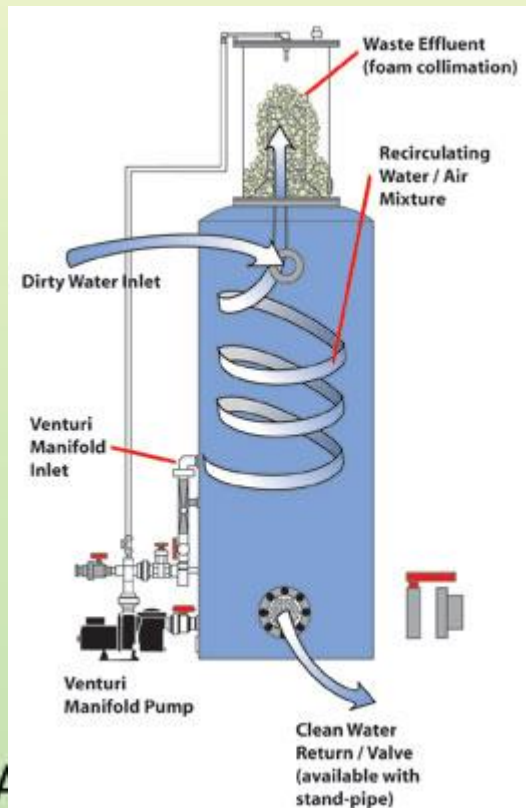
- Two types of mechanical filtration:

- Screen
- Granular media filtration
 - Bead filter
 - Sand filter



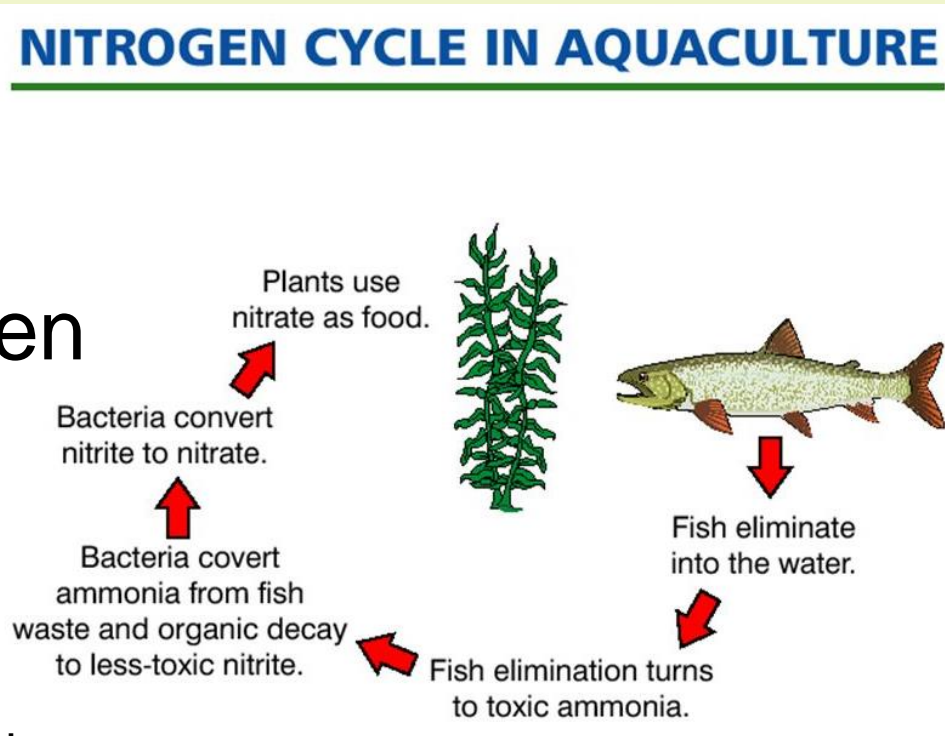
Waste Solids: Foam, Fine and Dissolved

- Fine particles
- Proteins outside air bubbles- Protein Skimming
- Fractionator to constantly remove foam



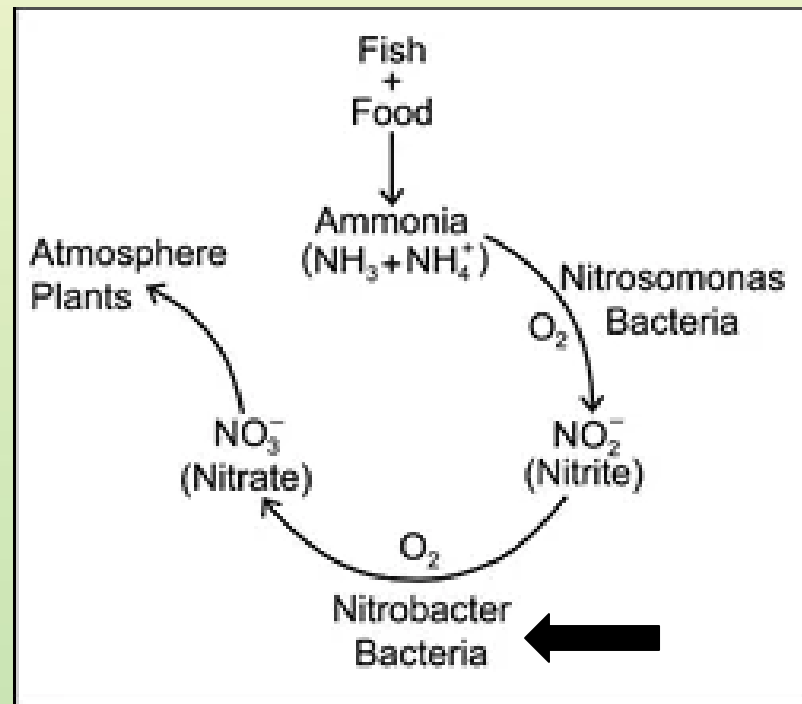
Nitrogen

- By-product of protein metabolism
 - Excreted from gills
 - Toxic
- Total ammonia-nitrogen (TAN) two chemical compounds
 - Unionized NH_3
 - Ionized ammonia NH_4^+



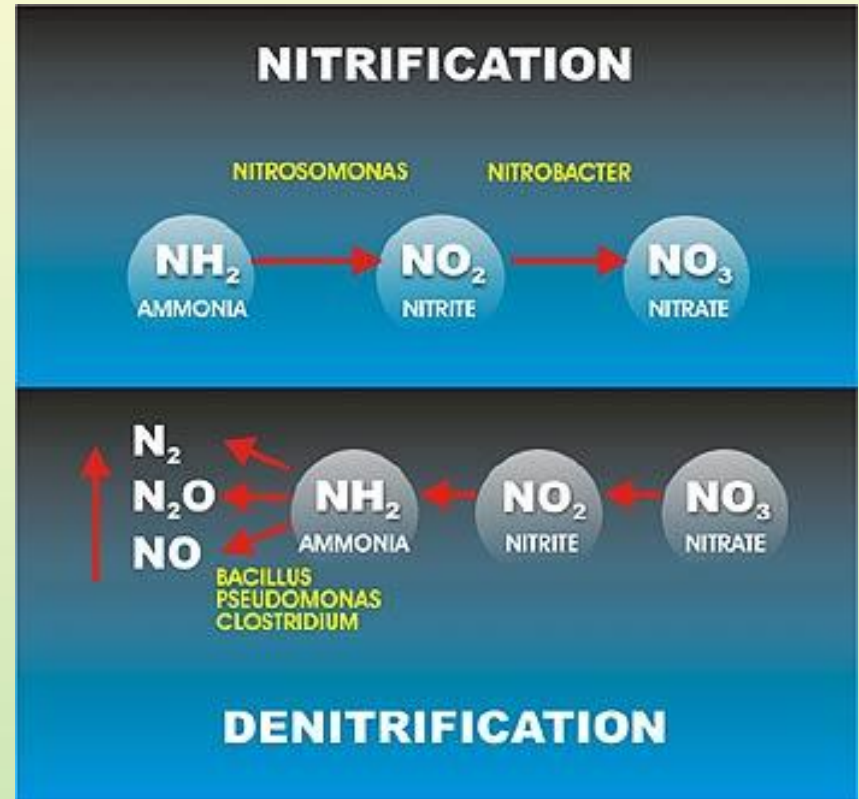
Nitrogen

- Nitrification Cycle
 - Oxidizes ammonia and nitrite to nitrate
- Two bacteria:
 - *Nitrosomonas*
 - *Nitrobacter*



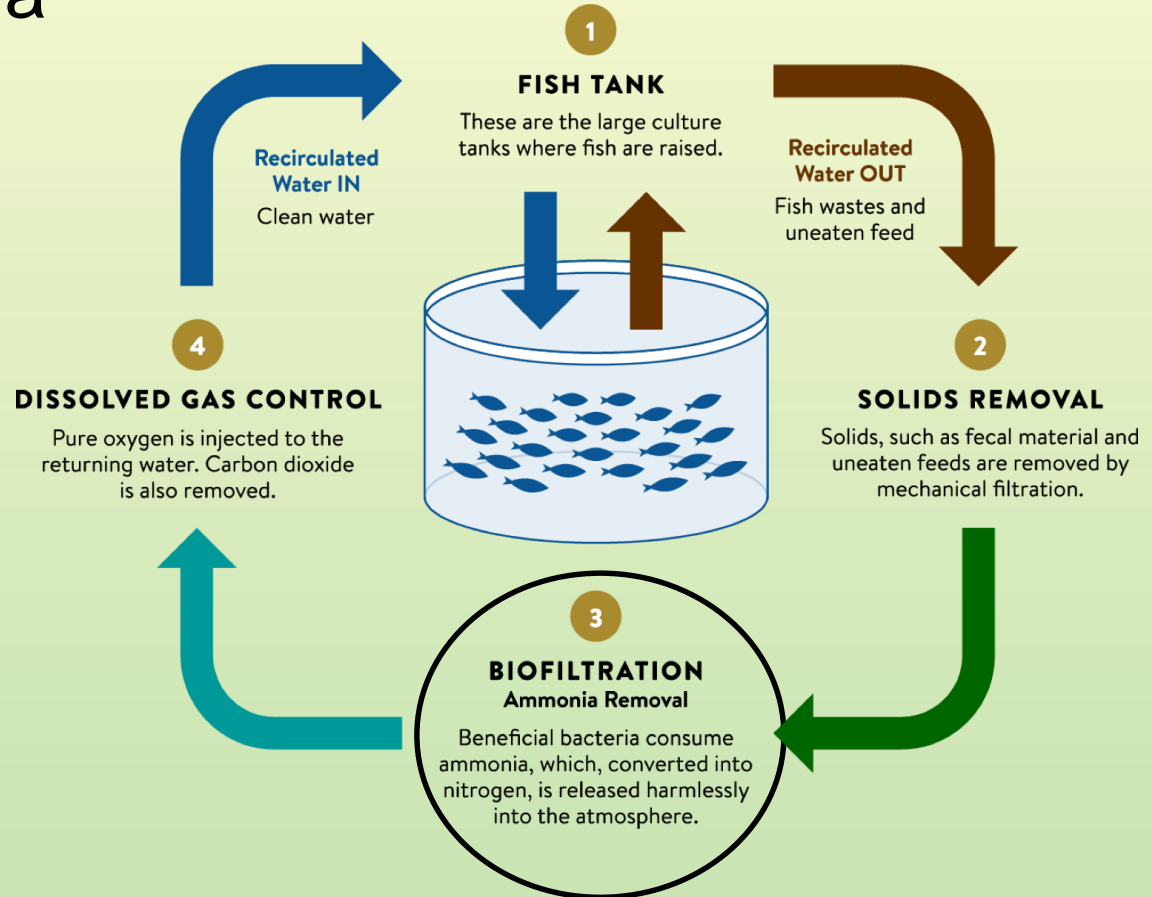
Nitrogen

- Denitrification
 - Mainly due to metabolism of nitrate-nitrogen by anaerobic bacteria
 - Produces nitrogen gas
 - Released during aeration processes
 - nitric oxide (NO) and nitrous oxide (N₂O)



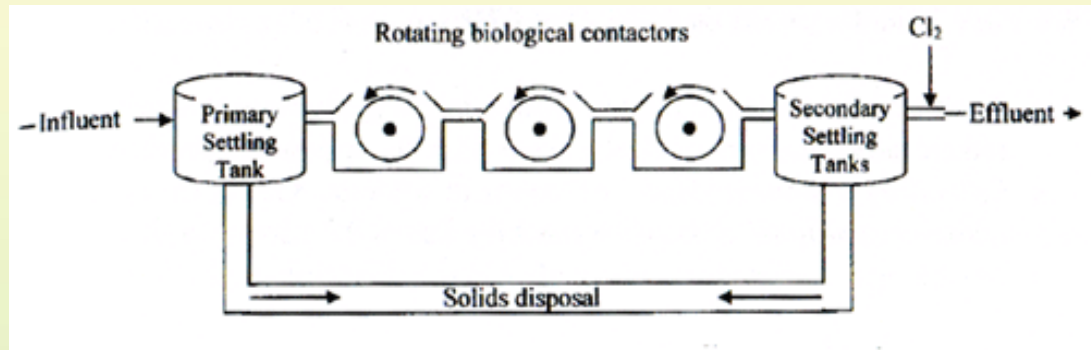
Nitrogen Control

- Unionized ammonia nitrogen
- Air stripping, ion exchange, and biological filtration
- Biological filtration (**biofiltration**)
 - Substrate large surface area



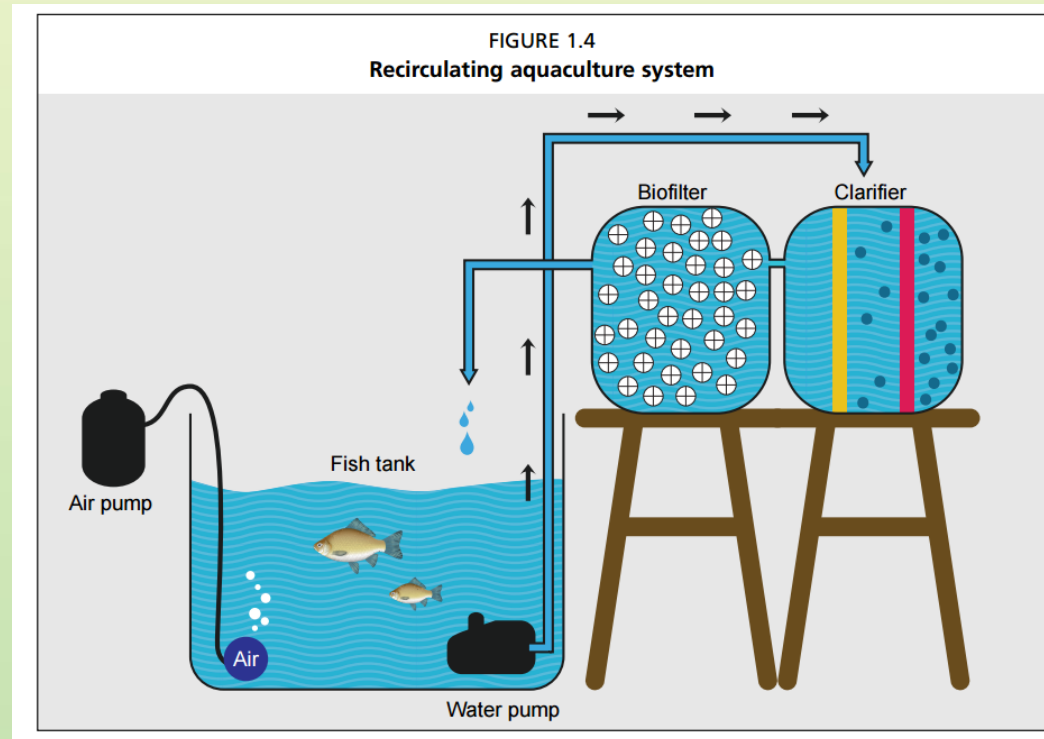
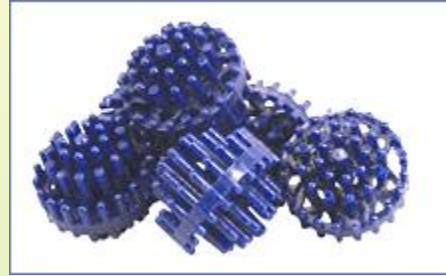
Nitrogen Control

- Rotating biological contactor (RBC)
 - Exchanges carbon dioxide (bacteria and fish) for oxygen



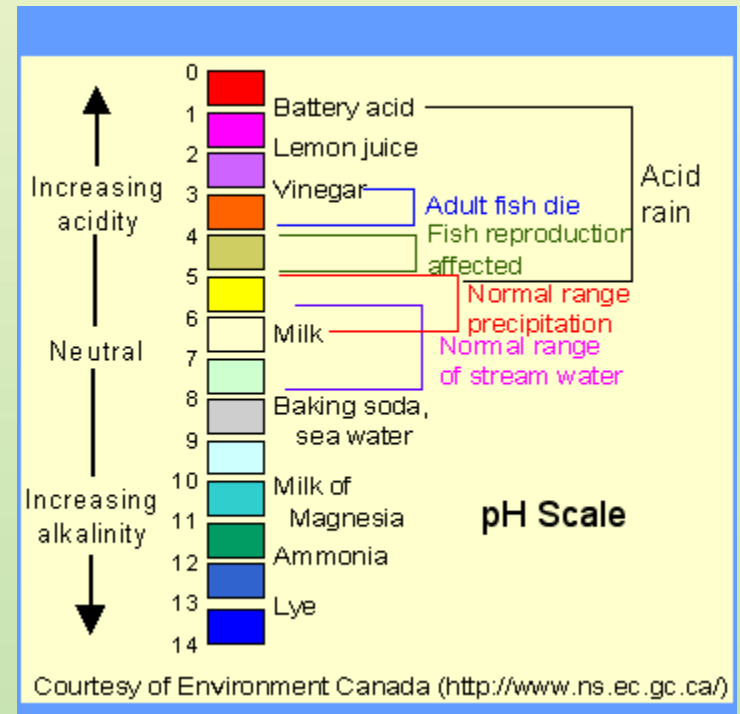
Start-up of a New System

- Activate new biofilter
 - Requires at least one month
- Pre-activate
 - Seed filter with nitrifying bacteria
- Provide synthetic growth medium for two weeks



pH and Alkalinity

- To replace lost alkalinity, add limestone or other common sources
- Biofilter media (oyster shell)
 - Source of carbonates
- Monitoring of water hardness, alkalinity, and pH may be required depending on species



Temperature Control

- Depends on species
- Warmwater species
 - Range of 75 to 80° F
- Coldwater species
 - 70° F or less



Aeration

- Should maintain adequate dissolved oxygen
- Keep low carbon dioxide
- Diffused aeration
 - Low pressure air from type of blower to form diffuser near or on bottom of culture tank



Oxygenation

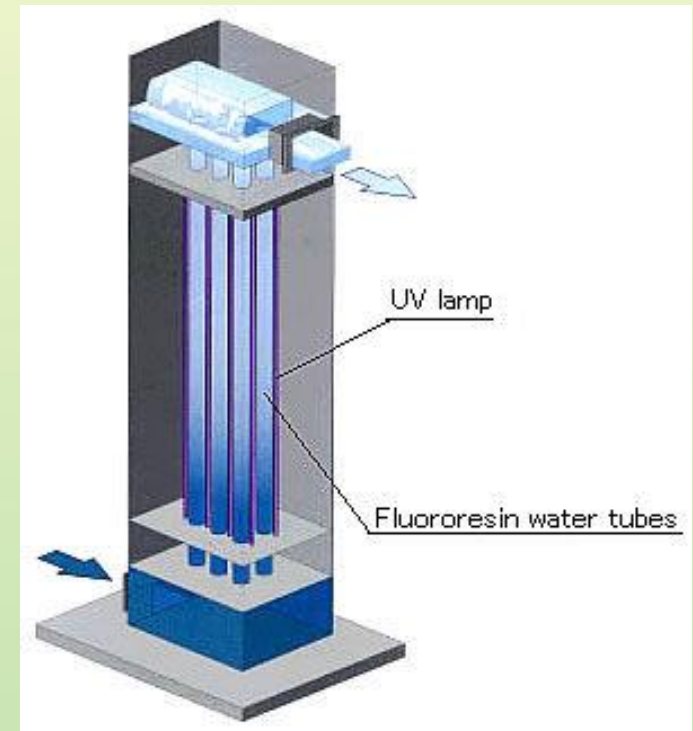
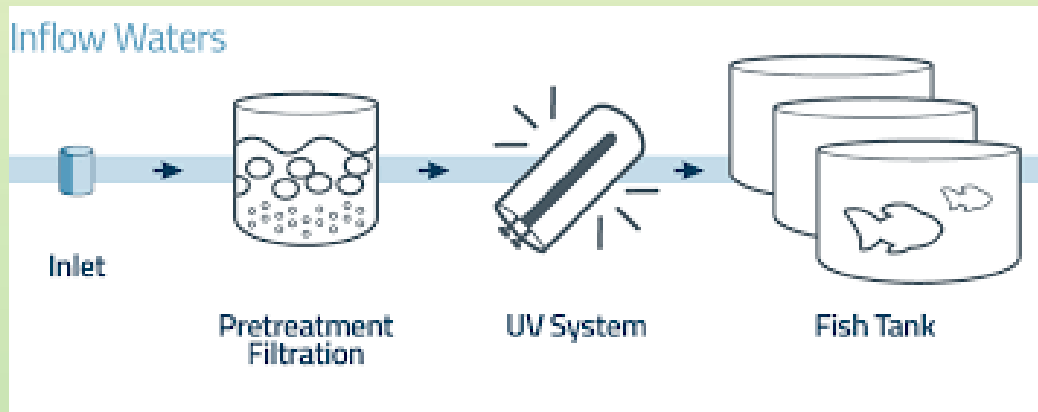
- Pure oxygen used
- Sources of oxygen injection:
 - Compressed oxygen cylinders
 - Liquid oxygen
 - Onsite oxygen generators

An oxygenation cone commonly used in pure oxygen systems.



Disinfection

- Disease can spread quickly
- Some chemicals have devastating effects
- Alternatives:
 - Ozone
 - Ultraviolet irradiation



Water Quality Monitoring

- Observe day-to-day fish behavior
- Imhoff cone determines solids and thermometer
- Oxygen requires several tests per day
 - Oxygen meter



Routine Maintenance

- Depends on species
- Must clean drain lines and screens on drains
- Add new water to fish tanks



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Handouts

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Break Time

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Tour: Pentair Aquatic Eco-Systems

Host: Brian Catanzaro

<https://pentairaes.com/tours>