

System Principles

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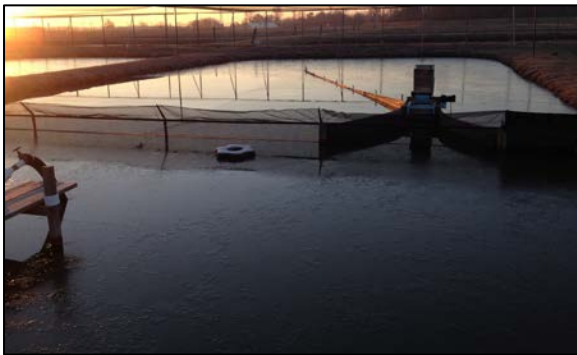


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Systems applicable to Ohio (at least most of them)

- Ponds
- Aquaponics
- Traditional RAS
- Raceways
- Biofloc
- Pond-side tank RAS
- Cage culture
- *Ranching

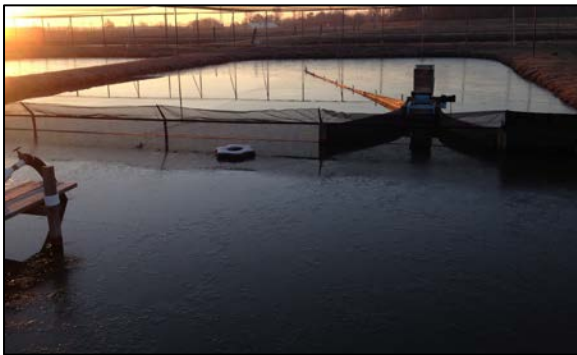


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Culture systems



Ponds

- Average in Ohio is 1 acre; 6-8' (winter refuge)
- Erosion vs. weeds
- Smaller if no tractors on levees – Increases erosion

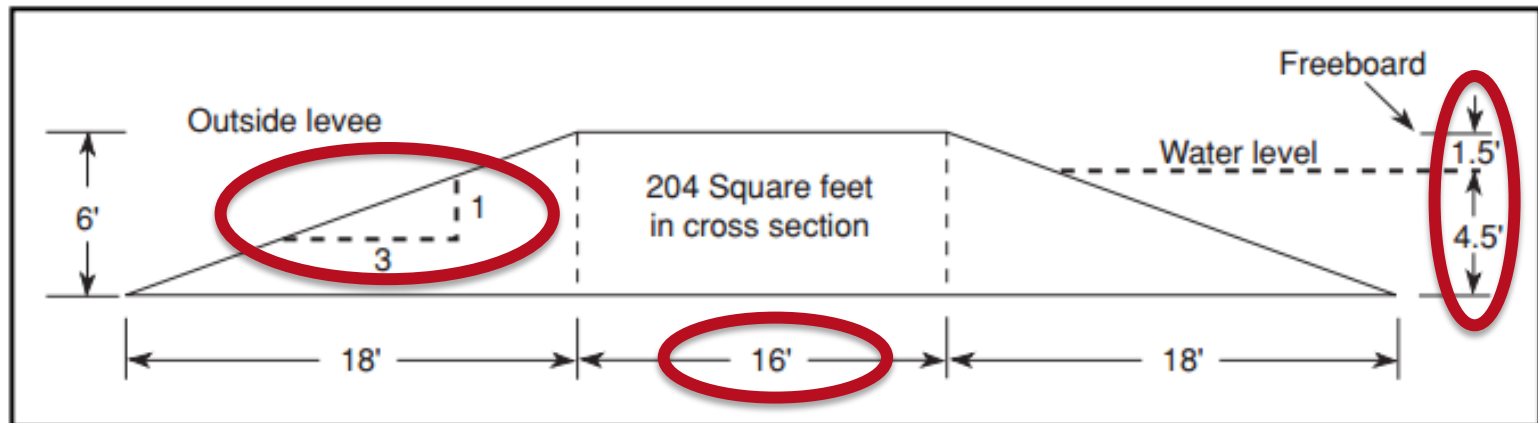
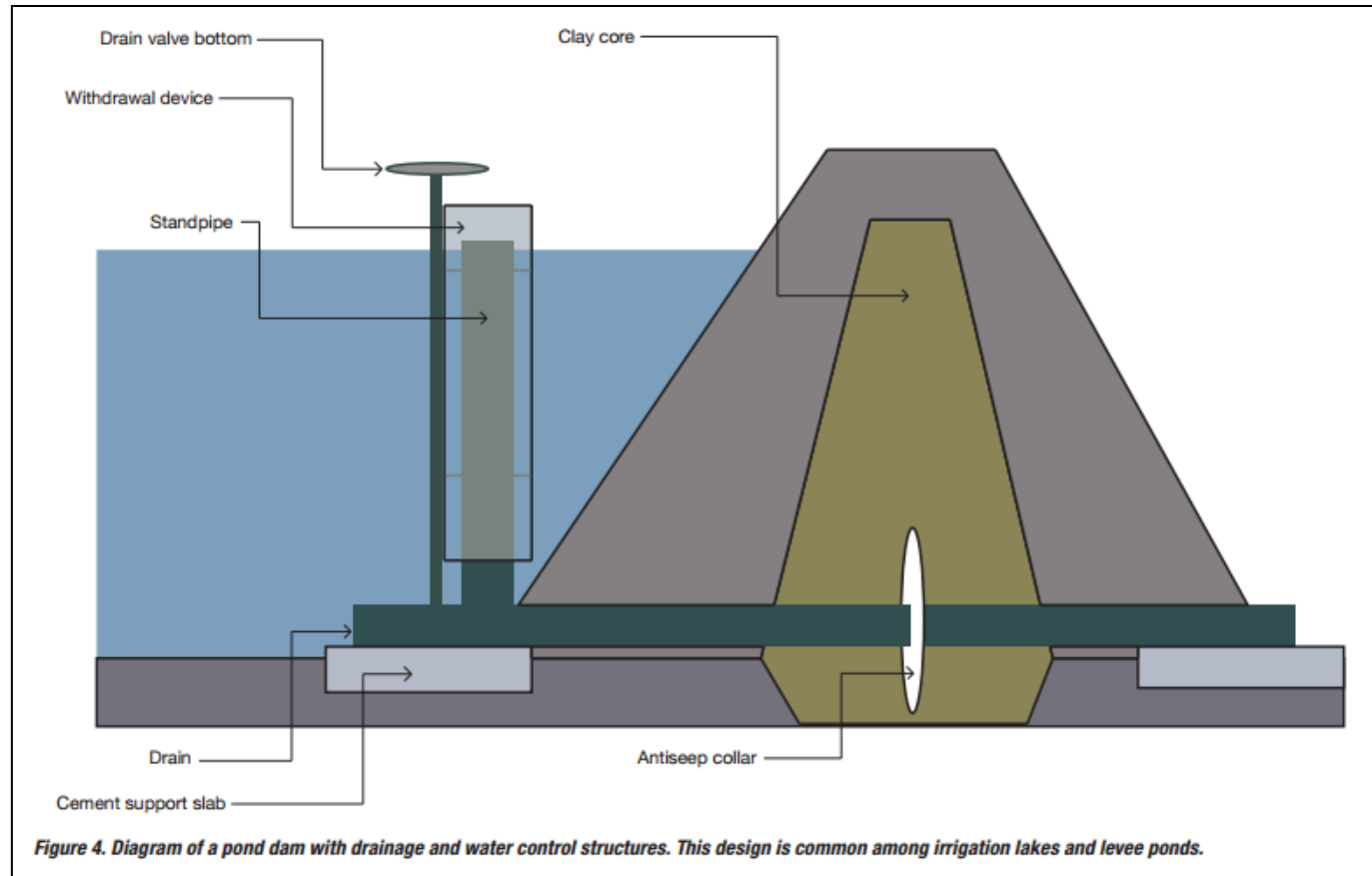


Figure 2. Cross-section of a typical levee for a commercial catfish pond. Each linear foot of this levee contains 7.6 cubic feet of fill material.



Ponds

- Drainable
- 20% clay
- Test the soil



Ponds

- Smaller ponds easier to manage
- Watershed vs. levee
- Drainable
- 20% clay
- Test the soil

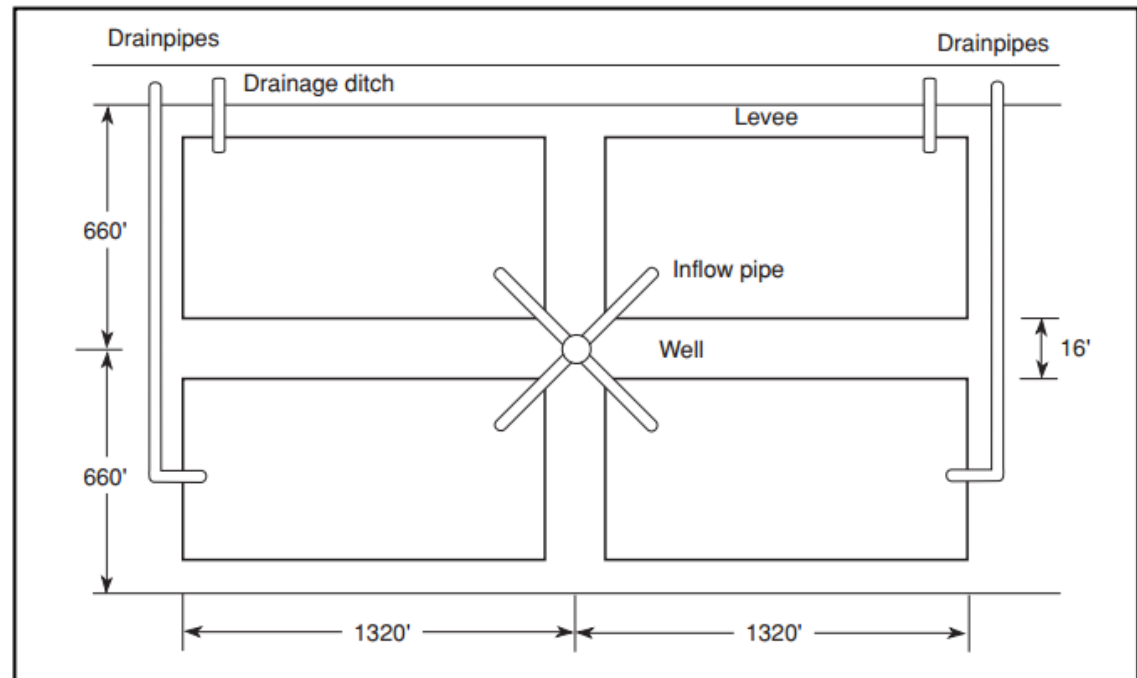


Figure 1. Layout of a typical levee-type catfish pond.



Ponds

- Smaller ponds easier to manage
- Predation, biosecurity, theft/vandalism
- Much more forgiving than indoor systems



Principles of ponds

- Ponds “work” because of photosynthesis
- Phytoplankton
- Zoops
- Small fish
- Big fish
- Homo sapiens



Principles of ponds – SRAC 468

“A pond breaths in and out once a day”

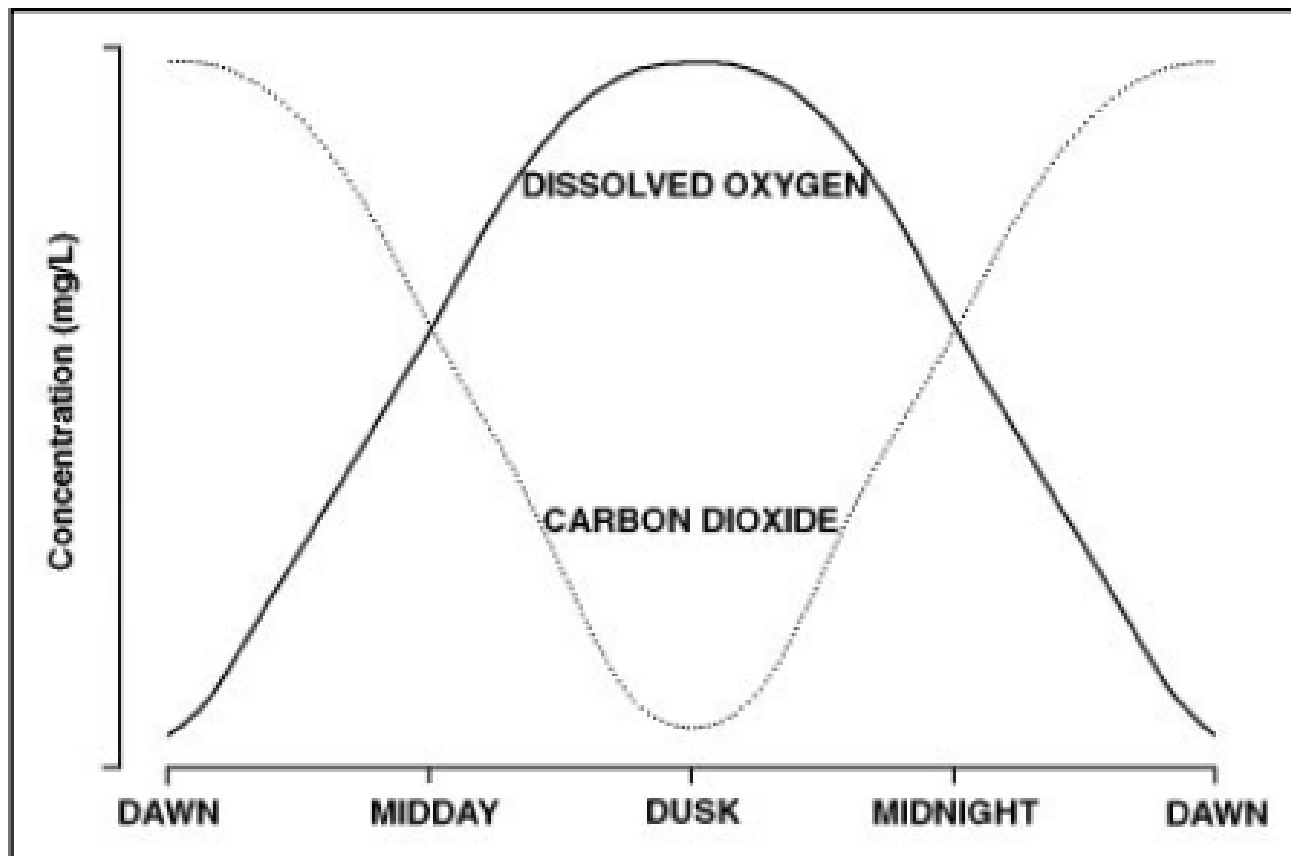


Figure 1. The daily cycle of oxygen and carbon dioxide in a fish pond.

Principles of ponds

- At the mercy of mother nature
- Fish are poikilothermic
- Water too hot/cold?



What is the recirculating aquaculture system (RAS)?

- General description
 - A land-based aquaculture system that recycles and reuses water through treatment devices for the culture of aquatic organisms (assumed indoors for this talk)
- Categories
 - Not well defined and usually is based on the volume of water exchanged each day → less exchange needed means more efficient water usage



SRAC 451

- “Assuming an annual pond yield of 5,000 pounds of fish per acre, approximately 100 gallons of water are required per pound of fish production.” (equal to 0.005 pound of fish per gallon of pond water)
- “The carrying capacity of tank systems must be high to provide for cost effective fish production because of the higher initial capital costs...”
- ****RAS can/should push 0.05 pound of fish per gallon of tank water to improve economic viability**



RAS daily water exchange percentages

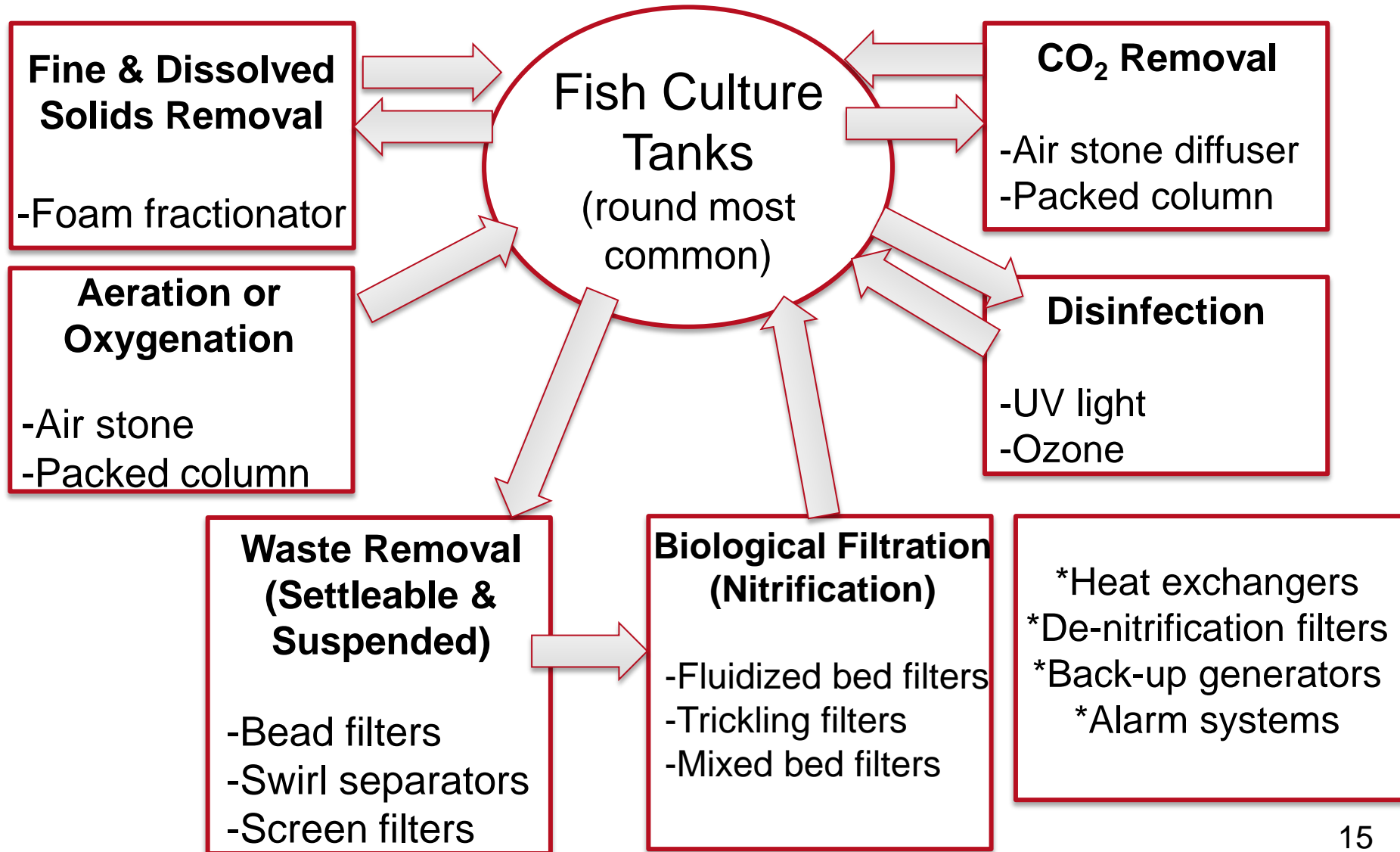
- **>20% is not very common**
- **Average 7 – 15%**
- **2 – 5% has been achieved commercially**
- **0% is not very common and is currently very expensive to achieve (at least on a large scale)**



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System design/considerations (SRAC 451)

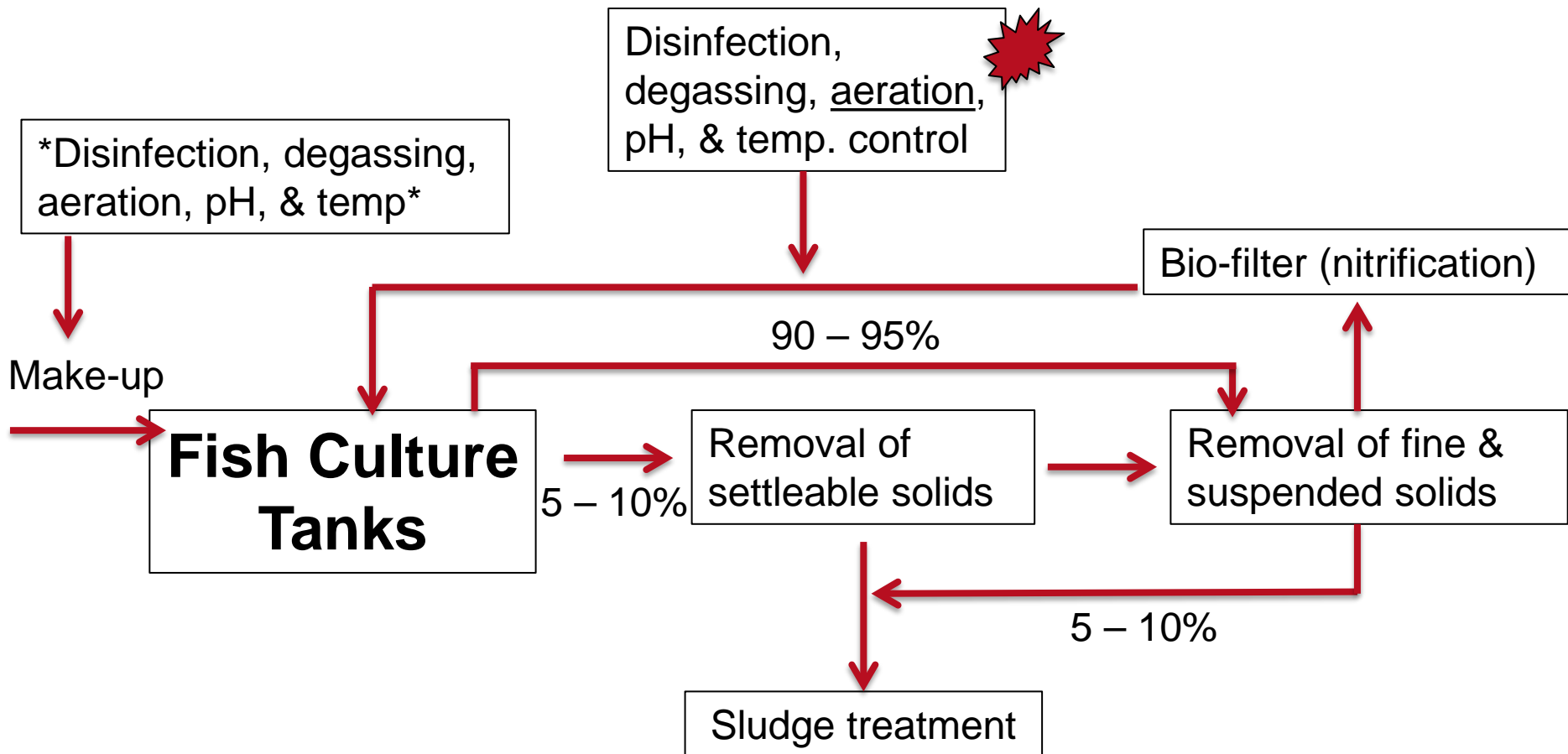


Why are there so many filters/disinfectors involved?

- ✓ Approx. half the feed consumed is excreted as solids
- ✓ Multiple filters improves efficiency (micrometer size specific)
- ✓ Those bi-products produced must be treated/removed or else the water will become toxic to the fish (&/or too turbid)
- ✓ Pathogens can be present in a system and need to be killed
- ✓ Water quality parameters to test for and that cause stress are available on our website...pH, temp, DO, ammonia, nitrite, alkalinity, etc.
- ✓ Alkalinity/pH/nitrifying bacteria relationship



General water flow in a RAS



Positives: improved biosecurity/survival

- Limited predation
 - Fish raised outdoors commonly fall prey to
 - Waterfowl and other migratory birds
 - Resident herons/egrets
 - Snakes, turtles, otters, humans



Positives in RAS

- Limited pathogens
 - The best water source for outdoor aquaculture is ground water. Surface water usage is a risk!
 - Indoor systems can use ground water or potentially tap (may not be suitable or need treating before adding to the system)



Aquaponics

- As most have figured out already...
- Multiple system types
- DWC vs. ebb and flow vs. NFT
- Coupled vs. de-coupled



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Basic Aquaponic Concept

Feed fish

Clean water back to fish

Fish excrete
waste

Plants uptake nutrients

Bacteria convert waste



Fish food

- Micro and macronutrients supplied, mostly
- Deficiencies; depend on the amount of feed fed (your nutrients) and the source water
- Missing are...
 - Iron, Calcium, Potassium
 - Important to remember most systems are closed loop (protect fish)
- Many types of fish feed – depends on the species, size, and cost
- Source water (well, city, rain, etc.)



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OSU South Centers



Biofloc

- Small water usage
- Rely on microbial communities
- Shrimp/tilapia
- Control biofloc
- Settling chambers



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Research biofloc system at Kentucky State University 24
(Photo by Dr. Andrew J. Ray)



Questions?

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