

NUITS & BOLTS

BY GENNY WEST

Have No Fear – Retrofit for Re-use in Your Hatchery!

Water, water everywhere? Not so!

We are learning about water shortages and water quality problems from every industry these days, aquaculture included. Decreasing availability of water, and progressively stringent discharge regulations make it increasingly important to control and regulate the supply and discharge of hatchery water. Surprisingly, in aquaculture facilities generally, flow-through technology is still the most common strategy, but water re-use is quickly becoming popular since less water is required, or productivity can be increased. It is not difficult to convert a flow-through hatchery to partial re-use: not a lot of equipment is required and it can be retrofitted in most hatcheries to both raceways and circular tank layouts.

Partial re-use takes water out of a raceway or tank and treats it so that it can be put back into the same culture system. Not all contaminants are treated. Many continue to be flushed from the system before they reach toxic limits. The partial re-use treatment processes usually include gas balancing. They may also include solids removal and disinfection. Recirculation processes typically include biological treatment for ammonia and other nitrogenous compounds. This is the fundamental difference between re-use and recirculation.

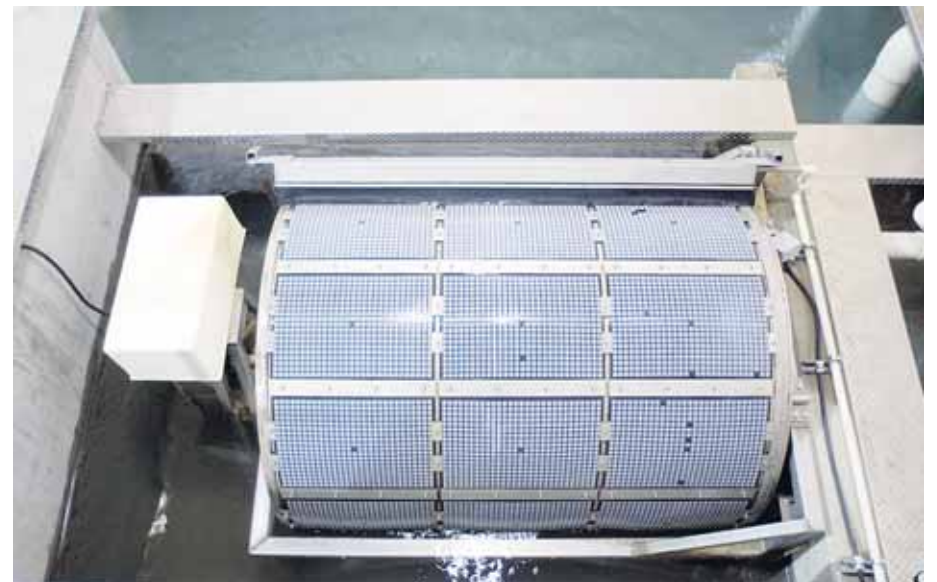
Aside from the very important advantage of water conservation, adopting re-use technology has many other benefits:

- It can assist greatly where there are consumption- or disposal limits – such as overdrawn aquifers or receiving water bodies that are degrading over time
- It can make available water go farther, so production can be increased without increasing water demand
- It can result in reduced pumping costs if the energy needed to treat and re-use the water is less than that needed to lift new water to the facility
- If influent water treatment is required, by reducing the total water consumed, the pre-treatment costs can be reduced.
- Similarly, effluent treatment costs can be reduced if flow rates are lower.
- In flow through systems, therapeutants like salt used to control fungal infections are quickly flushed away. In a re-use system these therapeutants are also captured and returned to the system, which greatly reduces the amounts needed.

There are drawbacks to re-use systems. Any contaminant that is not removed before re-use will build up in the system. For example, if you choose



Centralized treatment systems may be more cost-effective than treating individual tanks.



A drum filter (or some other system) will likely be needed for removing suspended solids from raceway effluent, but may not be needed with self-cleaning circular tanks.

not to filter for solids, then they will be re-introduced into the culture tank or raceway.

Pumping needed

Pumping is necessary to lift the water from the system discharge back to the head, and is usually needed to lift the water to the head of the treatment equipment. The main water quality problem when reusing culture water is oxygen depletion. Oxygen concentration is an important limiting factor when raising fish, so the treatment equipment usually includes an oxygenator (typically a low head oxygenator or LHO, which uses pure oxygen to supersaturate the water.) For every oxygen molecule consumed by the fish almost one molecule of carbon dioxide is created. Therefore, CO₂ stripping will likely be required. This can be accomplished using a forced air stripper which also helps to add oxygen back into the water. Gas balancing is the term used to describe

the combined the treatment processes of CO₂ stripping and oxygenation. Additional re-use treatment technologies include solids filtration and disinfection.

There are two approaches to treatment system lay out that can be adopted: point of use- and centralized treatments. Simple gas balancing systems may be added at each tank. However, if expensive equipment like disinfection units and solids filters are to be included, it may be economically advantageous to combine treatments for many tanks in one large, centrally located system.

Circular tank systems lend themselves very well to re-use technologies because the solid wastes are removed rapidly through the bottom drain with 5 to 20% of the total flow, while the relatively clean side box flows can be returned for re-use. The circular production tank itself becomes the solids-removal system. Since the water motion in circular tanks rotates the water past the water addition point, the tank

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remains completely mixed making the addition of treated water back into the tank relatively easy.

Raceways are a little more challenging to retrofit than circular tanks because they don't mix well. Water quality degrades from the head of the raceway to the lower end, so water could be supersaturated with oxygen at the top and oxygen-deficient at the bottom end if the raceway is too long or the flow rate is too low. Raceways are also not as efficient at removing solid wastes. Frequently, the re-use water is added at several points along the raceway, adding oxygen supersaturated water at regular intervals. This will significantly improve the distribution of oxygen. Another alternative is to

combine the re-use water with new incoming water at the head of the raceway to give a greatly increased overall flow. This will improve the transport of both oxygen and solids down the raceway, and overall water quality.

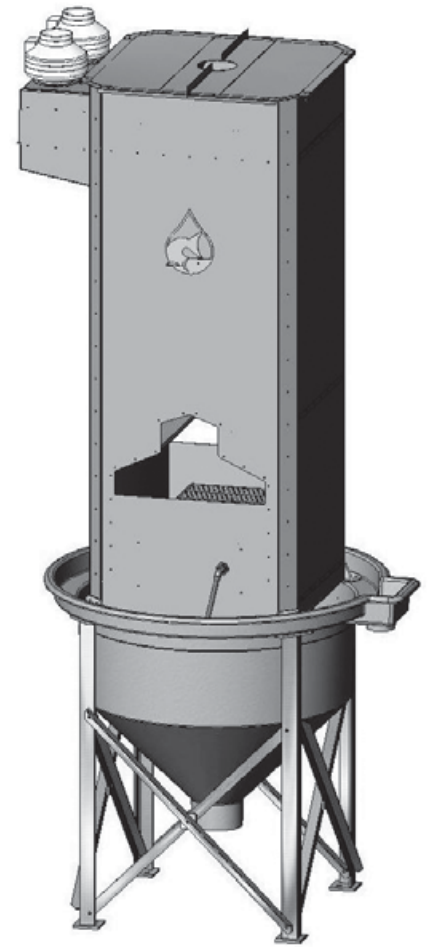
How much will it cost?

The cost of partial re-use equipment will depend on the volume of water that is actually treated. The amount (percentage) of available water flow that can be re-used without toxin build-up will be determined primarily by culture densities, the quality of the incoming raw water, the amount of feed used, the oxygen requirements of the fish, and the method of solids removal. Remember, you will not need an expensive biofilter,

so these needed functions may be provided relatively inexpensively.

Water re-use is a versatile technology that can easily be added to flow-through raceways and circular tanks without serious disruption to the current layout of most hatcheries. So if fish production at your hatchery is limited by a shortage of water, discharge regulations, or water quality problems you should seriously consider the payoff of adopting partial re-use as a solution.

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Cut-away schematic diagram of an oxygenation tower



Individual tank re-use treatment system comprising a CO2 stripper/aerator and blower.



UV disinfection systems help control pathogens

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