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FISH

Water Usage in Recirculating Aquaculture/Aquaponic Systems

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Clean water is a precious resource to be wisely utilized and conserved. Irrigation claims 70 percent of the water that we use.[1] The excess water leaving industrial farms is often contaminated with silt, pesticides, herbicides and fertilizers, making it unfit for reuse.[2]

Recirculating aquaculture systems (RAS) are a method of growing fish that provides an opportunity to supplement wild-caught fish with other seafood produced in an ecologically and economically sustainable manner. RAS are closed-loop facilities that retain, treat and reuse the water within the system. The water in RAS flows from a fish tank through a treatment process and is then returned to the tank, hence the term recirculating aquaculture systems.[3] RAS are environmentally sustainable, using 90-99 percent less water than other aquaculture systems.[4]

Various methods can be used to treat and clean the water from the fish tanks and make it reusable. Many RAS use components to treat the water by removing waste mechanically and breaking the remainder of the waste down biologically. When the waste is removed some of the water is also removed from the system. Ideally, RAS only replace very small percentages of the total water volume, due to some loss during waste removal and/or evaporation (less than 1 percent daily water exchange).[5]

Some RAS incorporate aquaponics — the practice of growing herbs and vegetables in water — into their systems. The plants thrive in the nutrient-rich system water, and they actually help to purify it for reuse — the plants absorb the nutrients and the "cleaned" water can go back to the fish tanks. Aquaponic systems are even more water-efficient than traditional hydroponic systems (growing plants in water in which chemical nutrients are added). Aquaponic systems do not require complete water exchanges for a year or much longer compared to hydroponic systems that need to have full water changes every three months.

Water usage is especially important in dry climates, like in the U.S. Virgin Islands. The University of the Virgin Islands (UVI) Agricultural Experiment Station operates an aquaponic RAS designed with this in mind and they continue to conduct research with new techniques for conserving water. The commercial-sized aquaponic RAS at UVI is 29,000 gallons and produces 1,400 cases (24-30 heads per case) of leaf lettuce and 11,000 lbs of fish over the course of a year.[6] This system requires a daily water addition of 1-1½ percent of the total system's volume due to water lost in waste removal, evaporation and evapotranspiration from plants. An addition of 1½ percent of the system's volume amounts to 435 gallons daily. This may sound like a lot of water, but if you compare this to the amount of water used to produce lettuce traditionally, in the ground, you get a better sense of the efficiency of aquaponic RAS. According to United Nations Educa-

tional, Scientific and Cultural Organization (UNESCO), a one-pound head of lettuce requires an average of 15.9 gallons of water to grow.

For the sake of comparison, set aside the 11,000 pounds of fish the UVI system produces for a moment and focus just on the lettuce and total water usage. The system produces approximately 37,800 heads of lettuce with the estimated weight of 0.65 pounds per head. This would equal 24,570 lbs of lettuce per year. Over that same year, the system is filled once with 29,000 gallons of water and has 435 gallons added daily equaling 158,775 gallons added over the year. With all of this in mind, the overall total to run the system for a year is 187,775 gallons of water. Therefore, the UVI aquaponic RAS can produce one pound of lettuce using less than half the water of traditional farming techniques — about 7.6 gallons of water. Aquaponic RAS can produce the same amount of lettuce using half the water, *plus* 11,000 pounds of fish!

RAS can be a cleaner, greener, safer and more sustainable aquaculture and agriculture option to supplement wild-caught fish for consumers interested in making every drop count.

Endnotes

1 Despommier, Dickson. "A farm on every floor." *New York Times*. August 24, 2009.
2 Ibid.
3 Timmons, Michael and James Ebeling. (2007). Recirculating Aquaculture. Ithaca, NY: Cayuga Aqua Ventures at 30.
4 Timmons at 6.
5 Torsten, E.I. Wik, et al. "Integrated dynamic aquaculture and wastewater treatment modeling for recirculating aquaculture systems." Aquaculture. 287. 2009 at 361-370.
6 Rakocy, James. "The UVI Aquaponic System." Clean, Green, Sustainable Recirculating Aquaculture Summit. Washington D.C.: hosted by Food and Water Watch. January 2009.

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