URBAN AQUACULTURE FOR THE 21ST CENTURY

Urban Aquaculture for the 21st Century—Using Recirculating Systems

Producing soft-shelled crabs in the backyard? Raising fish in the basement? Not only are both possible, but people are doing it, with recirculating aquaculture systems. Pollution, expensive energy, scarce water, and stringent waste disposal laws are making it difficult for aquaculturists to raise fish and shellfish in farm ponds and natural streams, but recirculating systems, in which filtered water continuously circulates through culture trays or tanks, can be operated indoors on city tap water. From backyard koi tanks to huge commercial trout farms, recirculating systems conserve energy, save water, and allow producers to control all the environmental factors—temperature, salinity, oxygen, and solid wastes—that might kill their animals. Species being raised in recirculating systems include a variety of food and ornamental fish, soft-shelled crabs and crawfish, oysters, clams, and alligators.

How Does a Recirculating System Work?

A basic recirculating system contains a tank or tray for holding live aquatic animals, a biofilter, an aerator to supply oxygen, and pumps for water circulation. The heart of an efficient recirculating system is the biofilter, which works continuously to sustain life by cleaning and detoxifying the water. Without it, the animals in the tanks would die, poisoned by their own metabolic waste products.

Biofilters are available in a variety of designs and sizes, but all employ bacteria to neutralize toxins. There are trickling biofilters, in which the water is sprayed over a stationary bed of porous material containing bacteria, and rotating biological contacters, in which bacteria are attached to moving surfaces that alternately dip into the water and emerge into the air. Other types include the upflow sand and fluidized bed filters. Some are efficient at removing toxins but aren't able to remove solid waste (sludge).

Among the most efficient is the innovative bead biofilter, developed with the support of Louisiana Sea Grant by Dr. Ronald Malone of Louisiana State University. The filter contains thousands of tiny polyethylene beads. As tank water is continuously pumped through the filter, bacteria clinging to the beads neutralize toxic ammonia and nitrites. Sludge, a mixture of uneaten food and bacterial growth, also collects on the beads and is removed by periodic flushing of the filter. Sludge can be collected in a settling cone and later removed or, if the system is connected to a sewerage system, simply flushed down a drain. Water loss during this process can be as low as

one percent per day. The patented bead filter requires little maintenance and can be easily automated to run by computer, which make it especially suitable for large commercial aquaculture facilities.

Who Uses Recirculating Systems?

Urban culturists range from the hobbyist who raises koi in a backyard water garden to the commercial food-fish producer raising tilapia, trout, flounder, or striped bass in greenhouses or converted warehouses containing 40,000-gallon tanks. For extra income, families are raising soft-shelled crabs and crawfish in their garages and baitfish in small greenhouses. Ornamental fish producers culture exotic species for home aquaria and garden pools. State and federal hatcheries reproduce popular recreational fish for restocking natural waters and work to restore endangered species. In research laboratories, aquatic scientists are discovering the benefits of recirculating systems for holding fish indoors to study fish disease, nutrition, growth, genetics, and a host of other topics. Recirculating systems also have applications in the cultivation of plants. Hydroponic vegetables and aquatic plants can be grown indoors, or fish effluent can easily be pumped from a system to fertilize outdoor fruit and vegetable gardens.

In the last decade, agriscience programs in secondary schools throughout the country have introduced aquaculture into their curricula. Recirculating technology has made it possible to teach aquaculture in inner city schools, and such programs have proven effective for teaching a variety of occupational skills to at-risk youth. For example, at Booker T. Washington, a New Orleans high school, a tilapia aquaculture program also embraces intensive education in communication skills, business management, chemistry, and mathematics, so that after graduation students are more fully equipped to find jobs. The Bridgeport Regional Vocational Aquaculture School in Connecticut's largest city trains students to raise tilapia, brown trout, American eels, and clams in recirculating systems, as well as scallops in the natural waters of Long Island Sound.

Sea Grant and Aquaculture Research

In 1993, consumers spent more than $38 billion on 3.86 billion pounds of seafood, and the National Research Council estimates that by 2000, an additional one billion pounds of edible fish and shellfish will be required to meet demand. But natural fishery production has peaked globally and, plagued by overfishing, ocean pollution, habitat loss, and other ills, is not likely to increase. Likewise, water quality problems and rising land prices limit the expansion potential of aquaculture in ponds and

natural waterbodies. Thus, though the domestic aquaculture industry has grown more than 15 percent annually since 1980, it cannot yet fill the gap left by natural fisheries without extensive research and development in recirculating technology.

Member programs of the National Sea Grant College Program network are in the forefront of recirculating aquaculture research, working to develop technology for aquaculture in an urban setting. Research includes a variety of applications for recirculating systems—fish and shellfish production, disease research, genetic studies, and environmental waste management. States involved in this effort include Louisiana, Texas, Virginia, New York, North Carolina, Connecticut, Pennsylvania, Maryland, California, Minnesota, and Massachusetts.

Urban Aquaculture—Here To Stay

Recirculating systems offer an efficient energy and water saving method for producing sustainable harvests of highly valued fish and shellfish. Because they free the culturist from dependence on natural sources of water and favorable climate, indoor systems can be operated almost anywhere with a minimum of labor. Recirculating technology has enhanced existing aquaculture businesses and launched new enterprises. As research continues, new species will come under management and be brought to the marketplace.

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