

**A FEASIBILITY STUDY OF USING AIR-LIFT PUMPS FOR
AERATION, DEGASIFICATION, AND WATER MOVEMENT
IN A RECIRCULATING AQUACULTURE SYSTEM**

A Thesis

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ABSTRACT

A feasibility study of using air-lift pumps for water movement, aeration, and degasification in a recirculating aquaculture system was conducted. Fluid delivery tests of various air-lift configurations indicated that water flow is a function of the submergence depth, lift height, and air injection rate. The air-lift units were found to transfer O_2 at only 1/5 to 1/2 the rate of comparably operated open-water aeration systems. The standard oxygen transfer rate (SOTR) increased with air injection from 1 - 7 scfm, however, the energy usage also increased, yielding a reduction in the standard aeration efficiency (SAE) from over 2 to less than 0.5 kg O_2 / kw hr. Tests comparing airstones to open-ended tubes as air-lift injectors indicated a similar performance. The carbon dioxide stripping rate increased with air flow while the efficiency decreased. The short-term CO_2 transfer was also shown to decrease as the system alkalinity increased.

A set of empirical equations was developed to predict the water flow and steady state dissolved oxygen and carbon dioxide concentrations for any number of air-lifts used in a typical recirculating system. The air-lift configuration modeled was a 2" diameter pipe submerged 36" with a 6" lift operated at 1 - 5 scfm of air injection. The recirculating system was assumed to be stocked at a fish density of 0.5 lb/gal, fed at 3% per day, and maintained at 30 °C. The minimum oxygen concentration was assumed to be 6 mg/l and the carbon dioxide tolerance was selected as 5 mg/l. The predicted air-lift performance in such a system was compared to the estimated water flow and gas exchange demands and the aeration requirement was found to be the controlling design parameter.