NOTICE OF PUBLICATION

RESEARCH REPORTS
TITLE XII POND DYNAMICS/AQUACULTURE COLLABORATIVE RESEARCH SUPPORT PROGRAM

Title: Comparison of three mixing devices in earthen culture ponds of four different surface areas

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Date: 16 April 1997 **Publication Number:** CRSP Research Report 97-106

Price: The CRSP will not be distributing this publication. Copies may be obtained by writing to the authors.

Abstract: Mechanical mixing of culture ponds with low-powered devices can conserve photosynthetically-produced dissolved oxygen, and so reduce the need for more expensive aeration. This work aimed to test inexpensive, easily obtained devices and to establish the utility of quantifying stratification and mixing processes in power units to facilitate comparisons and projection of requirements to new situations. Three mixing devices of power consumption less than 0·25 hp (63·5-173·6 W) were compared in tropical earthen ponds of surface areas ranging from 200 to 1400 m^2. Mixers were operated during the time of maximum stratification in control ponds (13:00-16:00 h), to standardize test conditions. Performance was assessed as reduction in a pond's stratification energy (SE), contained in the uneven vertical distribution of mass.

Neighboring unmixed ponds showed very similar diel cycles of SE; unmixed ponds also showed similar patterns on successive days, but varied more than neighboring ponds assessed simultaneously. The mixing device of greatest power consumption, a fan-blade aerator-mixer (AM) operated below water surface, reduced stratification energy more quickly than a submersible impeller pump (SP) and an air-lift (AL). The AM and AL were more efficient than the SP, but all were of low efficiency (less than 0·1%). Efficiencies were related to pond size, with perimeter/area ratio being significant but surface/volume not so. Mixing effects propagated rapidly horizontally.

The AM applied sufficient power to exceed the observed daytime rate of increase in stratification energy, i.e. to prevent stratification, in ponds of all sizes except the largest. The AL and SP did not apply power at sufficient rates, and the AM would have been inadequate at other times. It is not necessary, however, to prevent stratification completely for all mixing applications.

This abstract was excerpted from the original paper, which was published in Aquacultural Engineering, 15(5)1996:381-396.

CRSP RESEARCH REPORTS are published as occasional papers by the Program Management Office, Pond Dynamics/Aquaculture Collaborative Research Support Program, Oregon State University, Snell Hall 400, Corvallis, Oregon 97331-1641 USA. The Pond Dynamics/Aquaculture CRSP is supported by the U.S. Agency for International Development under CRSP Grant No.: LAG-4023-G-00-6015-00.