

NOTICE OF PUBLICATION



RESEARCH REPORTS

TITLE XII POND DYNAMICS/AQUACULTURE COLLABORATIVE RESEARCH SUPPORT PROGRAM

Title: Pond history as a source of error in fish culture experiments: A quantitative assessment using covariate analysis

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Date: 1 December 1994

Publication Number: CRSP Research Report 94-74

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

Abstract: Nine successive 5-month experiments, which examined relationships between fertilization strategies (with chicken manure, triple superphosphate and urea), water quality and yields of Nile tilapia (*Oreochromis niloticus*), took place from February 1985 through March 1990 in 16 earthen ponds at the Ayutthaya Freshwater Fisheries Center, Bang Sai, Thailand. Over the course of these experiments, randomization of treatments resulted in all ponds having different fertilization histories. Analysis of covariance was used to quantify the carry-over effects of nutrient inputs from earlier experiments on experimental errors in Experiment 9.

Analyses of variance indicated that the residual (experimental error) accounted for approximately 39% of the total variation of net fish yield (NFY) observed in Experiment 9. Covariate analysis revealed that residuals were most significantly correlated to accumulated chicken manure input from Experiments 5 through 8. Previous pond fertilizations accounted for approximately 49% of total experimental variation in NFY observed in Experiment 9. Multiple linear regression analysis, using treatment inputs and the pond history covariate as the two independent variables to explain NFY, gave an $r^2 = 0.75$ ($P < 0.001$). Pond sediment chemistry data proved to be ineffective as covariates for reducing experimental error and/or predicting NFY.

Reasons for the positive effect of earlier experiments on NFY most likely involved the inverse relationship between the ability of pond sediments to remove soluble phosphorus from overlying water, and the accumulation of organic matter and phosphorus on pond bottoms. Pond management considerations and recommendations for fish culture experiments are given to better account for between-pond variability due to different fertilization histories.

This abstract was excerpted from the original paper, which was published in *Aquaculture* 105:21-36, 1992.

CRSP RESEARCH REPORTS are published as occasional papers by the Program Management Office, Pond Dynamics/Aquaculture Collaborative Research Support Program, Office of International Research and Development, 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.: DAN-4023-G-00-0031-00.