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## RESEARCH REPORTS

Sustainable Aquaculture for a Secure Future

**Title:** Calculation of pH in Fresh and Sea Water Aquaculture Systems

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**Abstract:** A procedure for the calculation of pH in fresh and salt waters has been developed. The method is based on a fourth-order polynomial relationship between hydrogen ion concentration and other (conservative) water quality parameters. The method avoids trial and error estimations and results in a direct calculation procedure that can be implemented in models developed in various modeling environments, such as spread-sheets, conventional programming languages (BASIC, C, FORTRAN, PASCAL, etc.) or specialized modeling languages (Extend™, Stella™).

The method developed is based on the solution of the full alkalinity-pH equation. Because of the need for simplification of the equations to yield explicitly solvable polynomial equations, the accuracy of the solutions depends on the simplification made and varies with water properties. Three simplifications are tested based on a second-, a third- and a fourth-order polynomial equation for hydrogen ion concentrations. The equations have been tested for salinities ranging from 0 to 35‰ (fresh to sea water), for temperatures ranging from 0 to 35°C, for total carbonate carbon concentrations of 0.1 and 5.0 mmol/liter, and for total ammonia nitrogen concentrations of 0 and 10 mg/liter. Approximations are most accurate in waters of high total carbonate carbon and low ammonia concentrations, where the fourth-order approximation yields results that are within 0.05 pH units for the full range of pH values tested (5-10).

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