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## RESEARCH REPORTS

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SUSTAINABLE AQUACULTURE FOR A SECURE FUTURE

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**Title:** AquaFarm: Simulation and decision support for aquaculture facility design and management planning

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**Abstract:** Development and application of a software product for aquaculture facility design and management planning are described (AquaFarm, Oregon State University©). AquaFarm provides: (1) simulation of physical, chemical, and biological unit processes; (2) simulation of facility and fish culture management; (3) compilation of facility resource and enterprise budgets; and (4) a graphical user interface and data management capabilities. These analytical tools are combined into an interactive, decision support system for the simulation, analysis, and evaluation of alternative design and management strategies. The quantitative methods and models used in AquaFarm are primarily adapted from the aquaculture science and engineering literature and mechanistic in nature. In addition, new methods have been developed and empirically based simplifications implemented as required to construct a comprehensive, practically oriented, system level, aquaculture simulator. In the use of AquaFarm, aquaculture production facilities can be of any design and management intensity, for purposes of broodfish maturation, egg incubation, and/or growout of finfish or crustaceans in cage, single pass, serial reuse, water recirculation, or solar-algae pond systems. The user has total control over all facility and management specifications, including site climate and water supplies, components and configurations of fish culture systems, fish and facility management strategies, unit costs of budget items, and production species and objectives (target fish weights/states and numbers at given future dates). In addition, parameters of unit process models are accessible to the user, including species-specific parameters of fish performance models. Based on these given specifications, aquaculture

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facilities are simulated, resource requirements and enterprise budgets compiled, and operation and management schedules determined so that fish production objectives are achieved. When facility requirements or production objectives are found to be operationally or economically unacceptable, desired results are obtained through iterative design refinement. Facility performance is reported to the user as management schedules, summary reports, enterprise budgets, and tabular and graphical compilations of time-series data for unit process, fish, and water quality variables. Application of AquaFarm to various types of aquaculture systems is demonstrated. AquaFarm is applicable to a range of aquaculture interests, including education, development, and production.

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