Developing Nutritional Models for Aquaculture: Integrating Existing Knowledge, Addressing Real Issues, and Setting Directions for Research

Dominique P. Bureau and Katheline Hua

UG/OMNR Fish Nutrition Research Laboratory
Dept. of Animal and Poultry Science
University of Guelph, Ontario, Canada
Tel.: 1-519-824-4120 ext. 53668; Mobile: 1-519-241-5533
Email: dbureau@uoguelph.ca

The aquaculture industry is a complex sector that offers challenges largely unknown to other traditional livestock agriculture operations. Hundreds of species are cultivated on a commercial scale using a wide variety of production systems. Rearing animals in an aquatic environment greatly complicates monitoring of growth, standing biomass, feed delivery, and waste outputs. Feed delivered but not consumed by the animals cannot be recovered or even appropriately quantified. The nutritional composition of fish feeds varies considerably which complicates comparison of feed efficiency values amongst operations and even, to some extent, between production cycles. Wastes produced by fish culture operations are often difficult to contain and may, potentially, contribute to environmental degradation of fragile aquatic ecosystems.

In this time of increasing competition, high cost of commodities (e.g., feed ingredients, energy), and stagnant or decreasing product prices, most aquaculture operations are more than ever faced with the significant challenge of improving or maintaining their profitability. In parallel, increasing pressure and actions by various NGOs and environmental groups, competing resource user groups, and different levels of government are also challenging aquaculture operations to become more environmentally sustainable. In this context, aquaculture operations must be pro-active and adopt strategies to improve their production efficiency and product quality, and to reduce their release of wastes and potential environmental impacts. Having access to simple and accurate management tools to monitor and forecast production and product yield, optimize feed delivery and utilization, and manage waste outputs would be very valuable for many aquaculture operations. Production management and benchmarking models have allowed dairy and swine herd managers and professional advisors (veterinarians and nutritionists) around the world to record, analyze, and compare productivity of dairy and swine herds and achieve tremendous improvement in productivity of these agricultural operations over the past 60 years. It is reasonable to believe that aquaculture operations could benefit very significantly from the use of adequate mathematical models.

A large amount of information is generated each year by the aquaculture operations themselves and by the vigorous research programs on the growth, nutrition, and feeding of cultivated aquatic organisms carried out by hundreds of research teams around the world. Our knowledge base is expanding rapidly but it is very difficult to keep up with progress, integrate and use new knowledge, and identify gaps in our understanding. Mathematical modelling stands as a useful tool to meet many of these challenges. The presentation will therefore focus on three areas where aquaculture operations (and fish feed manufacturers) could greater benefit from the use of robust yet simple mathematical models:

1) Prediction and analysis of production and feed requirement
2) Estimation and management of waste outputs
3) Integration of knowledge base in the context of feed formulation