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Health & Welfare

Statistical modeling of field data can aid shrimp grow-out operations

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Tracking farm area, salinity, stocking density, seedstock source, growth rates and feeds

Evaluation of commercial farm data can identify trends and compare performance.

Aquatec, a leading commercial shrimp hatchery in Brazil, maintains a team of post-sales technical experts who follow up on customer outcomes and offer advice on such matters as shrimp grow-out and disease management. It is part of their job to collect accurate field data from commercial grow-out operations stocked with the company's genetically improved postlarvae as well as animals from competitors.

Data collection, analysis

During the years of 2008 and 2009, field data from over 3,000 shrimp commercial grow-out facilities were collected in the states of Paraíba, Pernambuco, Rio Grande do Norte and Ceará. These field data followed a pre-specified format and included information on farm area, salinity, stocking density, seedstock source, growth rates and feeds. Additional data on management levels and production problems were noted.

After preliminary data checks and different types of validations, accurate field data from 2,768 commercial shrimp grow-outs were subjected to mixed linear model statistical analyses. Random effects of farm and commercial feed brand and type were considered.

Of the commercial grow-outs included in the analyses, 1,943 had been stocked with Aquatec's Speed Line postlarvae (PLs), and the remainder had PLs from other commercial suppliers. The fixed effects of salinity, stocking density and grow-out period – as well as average harvest weight and survival, when appropriate – were fitted as linear, quadratic or higher-order covariates.

Model selection was implemented for the dependent variables: harvest weight and weekly growth, adjusted for survival; grow-out survival; feed-conversion ratio, adjusted for average harvest weight and survival; harvested biomass/ha; number of grow-out days, adjusted for average harvest weight and survival; and incidence of infectious myonecrosis, necrotizing hepatopancreatitis and vibriosis.

For each dependent variable, all the biological functions and relationships included in the statistical model and listed above were thoroughly studied and validated. Some of them are illustrated in Figs. 1 to 4.

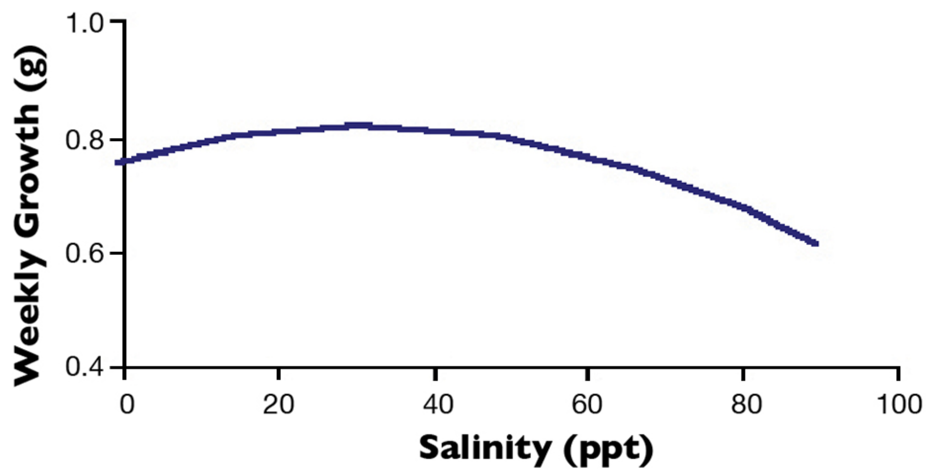

Fig. 1: Relationship between salinity and growth.

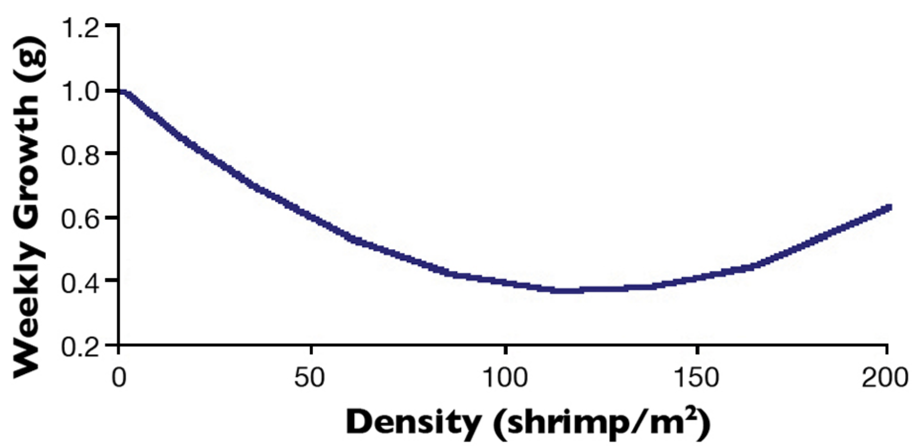

Fig. 2: Relationship between stocking density and growth.

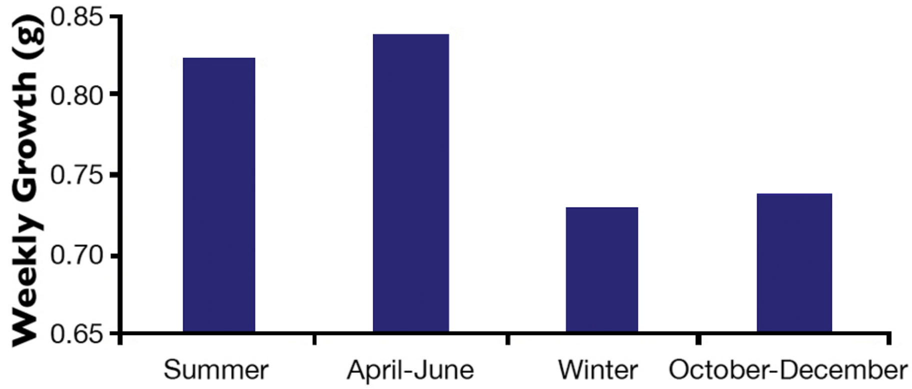

Fig. 3: Impacts of season on shrimp growth.

Fig. 4: Impacts of season on shrimp survival.

Results

The impacts of the management level effect included in the statistical models for the dependent variables are summarized in Table 1.

Rocha, Impacts of management level effects, Table 1

Trait	Average Impact of Poor Management
Harvest weight	-0.45 g
Weekly growth rate	-0.024 g/week
Feed-conversion ratio	0.061
Growout survival	-15.2 %
Harvested biomass	-321.1 kg/ha
Incidence of IMNV	8.6%

Table 1. Impacts of management level effects on different traits (least square means).

Once a given statistical model and its included biological functions and relationships were validated and reached a satisfactory level of biological credence, the authors proceeded to the comparisons of the performances of Aquatec's PL products and those of competitors. Some of these are illustrated in Figs. 5 and 6.

Fig. 5: Growth performance of compared shrimp products.

Fig. 6: Survival of compared shrimp products.

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