

## Introduction

Profitability in the shrimp industry depends on growth and survival. Nevertheless, the genetic studies in the Pacific white shrimp (*Penaeus (Litopenaeus) vannamei*) have focused in growth traits with only one dedicated to survival<sup>4</sup>. Survival in aquatic species varies with environmental factors, mainly with water quality, sanitation, food availability, and management system, but it also has genetic components. It has been observed that in Mexican commercial conditions, shrimp survival rates vary from 40 to 85% depending on production system, geographical region, season, year or productive cycle, as well as weather conditions.

## Objectives

This study was aimed to estimate the heritability for survival between 70 to 135 days of age in *P. vannamei*.

## Data and Methods

Data from 2 selection experiments realized in 2 units of a Mexican hatchery during 2004 and 2005 (108 full- and paternal half-sib families each year) were used for quantitative genetic analysis. Animals were descendants of selected shrimp using BLUP methods<sup>1</sup>. A total of 450 shrimp per family were tagged each year at 70 days of age, and shrimp of every family was placed in 4 (2004) and 3 (2005) different production environments where density varied from 10/m<sup>2</sup> to 180/m<sup>2</sup>. Shrimp were harvested and weighed at 135 days of age. A code identification number was assigned to dead animals, and final data consisted of 63,601 records. (binary trait)

Animal models were used to analyze data within year, within location, and for the complete data set, with ASREML software<sup>3</sup>. Models included the fixed effects of year, location, and density, the random animal additive genetic effect, and the random effect common to full sibs containing the effect of tank environment, non additive genetic effects and maternal effects, and the residual. Heritability was estimated as  $h^2 = \sigma^2_u / (\sigma^2_u + \sigma^2_c + \sigma^2_e)$ . The proportion of the effects common to full sibs was estimated as  $c^2 = \sigma^2_c / (\sigma^2_u + \sigma^2_c + \sigma^2_e)$ .



## Results

Survival varied from 61.2 to 75.3%, and its heritability averaged 0.07 with models that considered common effects to full-sibs, and 0.14 when such effect was excluded from the models. Heritability was similar across years and environments. Although  $c^2$  was small (0.01 to 0.04), its inclusion is important to avoid survival heritability overestimation. Although relatively small, the observed heritability for survival allows its inclusion in breeding programs.

## Discussion

Heritability estimates were similar to those observed by Gitterle et al. (2005)<sup>4</sup>, who estimated it varying from 0.02 to 0.12 (0.07 in average). These low estimates are consistent with findings in other productive species<sup>2,5,6,7</sup> revealing that the main factors affecting survival are related to environment, particularly with those associated with management practices related to feeding, water quality and sanitary conditions.

Since there were small differences in the age across families (up to 14 days), and age was not included in the model, family and age effects were partially confounded. This might have caused heritability estimates to be biased upwards.

## Conclusions

Based on the heritability estimates for survival, and given its economic importance for the shrimp industry, this trait can be included in breeding programs. Nevertheless, the optimal inclusion of this trait will depend on its relative economic value and its complex association with growth traits. Research in this area of study is needed.

Although survival can be improved through genetic selection, this trait can and must be improved with better management practices designed to provide better environments and sanitary conditions.

## References

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