A Fresh look at Progress and Perspective of Genomic Selection in Aquaculture:From Functional Genomics to Phenome Networks

Sadr A.S.[1*]; Javanmard A.[2]; Nazemroaya S.[1]; Shirali M.[3,4]

1-Aquaculture Research Center-South of Iran, Iranian Fisheries Science Research Institute, Agricultural Research Education and Extension Organization (AREEO), Ahvaz, Iran.
2-Department of Animal Science, Faculty of Agriculture, University of Tabriz, East Azerbaijan, Iran.
3-Agri-Food and Biosciences Institute, Hillsborough, BT26 6DR, UK.
4-School of Biological Sciences, Queen's University Belfast, Belfast, BT9 5AJ, UK.
*Corresponding author's email: a.sadr@areeo.ac.ir

Abstract:

Aquaculture breeders aim to enhance the sustainability and efficiency of production to meet current and future demands. Based on this goal, the marriage between quantitative and molecular biology brings new insights into the fish genome. Currently, genomic selection (GS) is the conceptual framework for the improvement of broodstock performance. In general, GS uses phenotype and genotype information of the reference population to define the best model for the estimation of genomic breeding values (GBV) by capturing the total additive genetic variance. Finally, GS enables breeders to select candidate fish offspring based on their GBV as the parents of the following generation, without the requirement of phenotypic records in the training populations. Utilizing estimated GBV in breeding programs can further increase the genetic gain in the modern aquaculture industry. The primary challenge in GS is to accurately understand the genotype-to-phenotype relationship. To address this challenge, it requires to translate the connection between the population's genetic structure (genome) and all the animal phenotypes (Phenome). This review aims to bring up-to-date knowledge about the current statue of research on GS with emphasis on its application in aquaculture breeding and help the aquaculture breeders to understand the application, limitations and opportunities of the current sophisticated tool in the provided snapshot.

Keywords: Aquaculture, genomic selection, breeding, phenome