Harnessing Genomics to Optimize Aquaculture Breeding Strategies

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Resumen

Aquaculture plays an increasingly important role in food and social security, helping to supply the growing demand of high-quality protein for human consumption and to improve the livelihood of local communities. However, the sector faces important challenges associated with the effects of climate change, disease outbreaks, sustainable growth, among others. Widespread adoption of selective breeding is a key strategy to overcome the main challenges faced by aquaculture, and to increase the sustainability and efficiency of the sector. In this presentation, we will discuss the core characteristics of aquaculture selective breeding programs (SBPs) for key aquatic species, providing examples of their overall structure and main applied breeding strategies and tools. Focus will be given on applications of genomic technologies that have allowed to enhance the efficiency of SBPs as, for example, the use of genomic information to optimize the management of genetic diversity, improve the genetic progress of hard to measure traits, better explore genotype by environment interaction and non-additive genetic effects, among other applications. Difficulties to implement SBPs posed by peculiarities of sex determination and reproduction control of some species will also be discussed, emphasizing the importance of genomic tools to overcome some of those difficulties. More practical benefits of the adoption of genomic technologies, such as early communal rearing and commercial multipliers production, will also be presented. Alternatives to mitigate genotyping costs will be discussed with emphasis on DNA pooling strategies. Finally, future genomic opportunities applied in combination with other biotechnological innovations (e.g. genome editing, surrogate broodstock) will be explored, highlighting their potential to support the sustainable growth of aquaculture.