Next-generation fish breeding by combination of developmental biotechnology and genomic selection

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Summary :

Selective breeding is a key technology used for producing high-quality aquaculture fish. However, relatively long intervals between generations in aquaculture species limit rates of genetic improvements. To overcome this challenge, we will develop a novel generation time acceleration technique comprising two remarkable technologies; that is, surrogate broodstock technology and advanced puberty onset. Integration of the generation time acceleration techniques and multi-trait genomic selection would facilitate the establishment of a unique fish breeding scheme where genetic improvements can be obtained in multiple traits rapidly and simultaneously.

We also focus on developing a novel "genetic lock" method, which facilitates the mass production of genetically sterile fish from surrogate broodstock to preclude the piracy of improved breeds. In addition, we will establish a germ cell bank of the improved breeds by means of germ cell cryopreservation to store the genetic resources permanently. The germ cells could be revived using the surrogate broodstock technology, and seedlings of the targeted breeds could be reproduced anytime without any genetic deterioration.

Through the above technologies, we present "next-generation selective breeding," which is heralded as a gold standard for selective breeding in aquaculture.

Integration of developmental biotechnology and genomic selection

Accelerated generation × Multi-traits genomic selection

Genetic improvements in multiple traits rapidly and simultaneously

Next-generation fish breeding Program
+Sterilization by genome editing

Mass-production of sterile fish — "Genetic lock" against piracy

Cryo-bank of germ cells — Store and revive selected breeds

Gold standard for the selective breeding in aquaculture