How Selective Breeding Contributes to Sustainable Aquaculture

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ABSTRACT:

Aquaculture provides increasingly significant global seafood production. Based on FAO, global aquaculture production in 2017 was 80.1 million t which accounts for 46% of the total production. However, an increase in demand for farmed fish due to growing population may present environmental impacts, i.e., pollution, overuse of antibiotics, and interbreeding when not practicing sustainably. According to World Bank, sustainable aquaculture requires 3 key components, i.e., environmental sustainability, economic sustainability, and social and community sustainability. For the environmental sustainability, minimizing aquaculture footprints can be practiced through farming technologies, such as rearing systems, less marine based feeding, vaccination, as well as selective breeding. By exploiting variation of the heritable genetic effects on production traits, e.g. growth and resistance to diseases, it has been possible to shorten rearing period to a market size, leading to lower water footprints, amount of feed (major costs in aquaculture) and less antibiotics. Genetic gains have been documented for growth (7.0-18.9% per generation) and resistance to diseases (4.0 – 19.0%), and ranged from moderate to very high. For Norwegian Atlantic salmon 37 years ago, to achieve 4 kg, grow out period was approximately 22 months at sea while, with selective breeding, the grow out period reduced to about 13 months in 2014. Fast growing fish resulted in feed reduction by 0.5 million t/year and lower production cost by NOK 5 billion (Gjedrem, personal communication, 2016). Yet, aquaculture productions are from only 12% of selectively bred stocks. Hence, fish producers should consider farming more selectively bred stocks to enhance global farmed fish production sustainably. On the other hand, responsible aquaculture is important to prevent farmed escapees which may interbreed to wild stocks, causing genetic introgression and subsequently alter genetic integrity of the wild stocks. The farmed escapees have been prevented and relevant regulation has been set in Norway even though the impact of genetic introgression on genetic diversity requires further investigation and documentation. The awareness of genetic introgression is still inadequate in Thailand. For instance, hybrid catfish (*Clarias gariepinus* x *Clarias macrocephalus*) has escaped to natural rivers and has interbred with *C. macrocephalus* (native species), resulted in declining pure breed wild stocks of *C. macrocephalus* substantially and may lead to extinction ultimately. Policy makers should urgently raise awareness and promote responsible aquaculture by preventing escapees in practice. In conclusion, farming selectively bred stocks can contribute to sustainable aquaculture however, farmed escapee should be prevented so that genetic resources can be preserved and be utilized sustainably.

KEYWORDS:

Environmental footprints, farmed escapees, genetic gain, interbreeding, responsible aquaculture, selective breeding