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Aquaculture Disruptive Technologies

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Opinion

Aquaculture has a lengthy history and provides a large amount of high-quality proteins to humans. Aquaculture has been the fastest expanding agricultural sector in recent decades. Aquaculture production has surpassed wild fisheries production since 2013. Science applications and the introduction of new technology in aquaculture development have aided the rapid development of aquaculture during the last 50 years. Aquaculture is more diverse than other agricultural industries in terms of species, food, production processes, illnesses, products, corporate structures, and marketing. Almost every area of aquaculture has benefited from scientific and technological improvements. Many technologies have made substantial contributions to aquaculture output. Improved reproductive technologies, for example, have enabled people to close the life cycles of aquaculture species, allowing for species diversification in aquaculture. The use of live feeds in hatcheries, such as microalgae, airtimes, rotifers, brim shrimp, and various copepods, has eliminated a major bottleneck in the culture of some marine species. Selective breeding with the use of quantitative genetics has significantly enhanced commercially important features in over 60 aquaculture species. Mono-sex tilapias, yellow catfish, and river shrimps can now be produced thanks to sex reversal technologies and DNA markers related with sex determination. Intra-family selection in mass-crosses has been enabled by molecular parentage, minimising the risk of inbreeding.

QTL (quantitative trait locus) mapping and marker-assisted selection (MAS) have allowed for the selection of qualities governed by a single or a few main genes. Improved feed formulations based on each fish species' nutritional requirements have improved feed conversion rate (FCR) and lowered feed cost. Disease management technologies have reduced the occurrence of illnesses in aquaculture. Although these early technologies and many others have contributed to remarkable progress in aquaculture, the challenges in aquaculture are daunting in order to fulfil the ever-increasing seafood demands of the world's growing population. More aquaculture products must be produced. The deterioration of environmental conditions, the reduced supply of fish meals and oils, and climate change will have a significant impact on our ability to produce enough aquaculture products to meet the demand for seafood. Aquaculture may be developed in a more sustainable and economic manner. New technologies are constantly being developed and introduced into the aquaculture business.

Emerging and disruptive technologies will increasingly provide novel approaches to improving global fish output and profitability. These technologies include genomic selection (GS), genome editing (GE), information/digital technology, recirculating aquaculture systems (RAS), and solar energy, offshore farming, oral vaccines, novel marketing strategies based on block chain, and the integration of various aquaculture components with the internet of things (IOT), among others. This article summarises and analyses these new and disruptive technologies that have the potential to transform the aquaculture business in order to provide readers with a thorough understanding of these technologies. Genetic enhancement through breeding has been critical to the global aquaculture growth. Conventional breeding programmes have played an important part in driving the global aquaculture industry forward and will continue to do so. The use of molecular technologies into current breeding programmes has hastened the genetic improvement of some aquaculture species. Marker-assisted selection (MAS) has already been used to improve disease resistance in salmon, lymphocystis resistance in Japanese flounder, and the production of all males in tilapia. Other biotechnologies, including as sex control, polyploidization, gynogenesis, androgenise, have significantly improved aquaculture productivity.

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