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Recent Trends in Applied Zoology

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Chapter 19

Preservation of ancestral DNA of salmon and other aquatic species with the aid of biotechnology.

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Abstract

The best method for preserving aquatic genetic variety appears to be the use of gene editing to establish genetic barriers between domesticated and wild aquatic species. Salmon's condition is not an unusual one. An increasing problem is preserving the genetic heritage of the numerous aquatic species that are now being produced for the food supply through aquaculture. Breeding initiatives improve features of commercial value while lowering genetic diversity. But as the oceans are altered by a rising climate and rivers and coastal regions are reshaped, the genetic variety reserves in wild aquatic populations become more and more important to their survival and adaptation. Here, we contend that employing gene editing to establish genetic barriers between farmed animals and integrating aquatic wild animals is proving to be the most successful strategy for maintaining aquatic genetic diversity. It merits the strong backing of the conservation community as a result.

Key words: Ancestral DNA,

Origin of salmon

Although more recently the word has been used to refer to similar fishes of the same family (Salmonidae), mainly the Pacific salmon, which constitutes the genus Oncorhynchus, salmon, originally, the enormous fish now commonly known as the Atlantic salmon (Salmo salar). The following are the six species of Pacific salmon (Oncorhynchus): the coho or silver salmon (O. kisutch), which ranges from the Bering Sea to Japan and the Salinas River of Monterey Bay; the chum or dog salmon (O. keta), which ranges from the Mackenzie and Lena rivers in the southern Arctic southward to Japan and the Rogue River; the king, spring, or chinook salmon (O. the pink or humpback salmon (O. gorbuscha), which is found from the Arctic to Japan and the Klamath River; the cherry salmon (O. masu), which is located off Japan; and the salmon that is found in the Yukon River, China, and the Sacramento .River. The rivers on both sides of the North Atlantic are home to the Atlantic salmon. Exocoetus volitans, a tropical two-winged flying fish. Tropical two-wing flying fish, tropical two-wing flying fish, tropical fish, fishes, and animals, beloniformes, ichthyology, fish plates, and marine biology.

Aquaculture and biotechnology

A subset of the biologically based technologies included by the word "biotechnology" or the more contemporary phrase "synthetic biology" is the improvement of agricultural organisms by changing certain properties through genetic modification techniques. Despite being widely used in aquatic organism research, gene transfer technology has not yet been incorporated into commercial breeding programmes for aquatic animals.

The sole example, an Atlantic salmon strain with an additional growth hormone gene, highlights both the advantages and challenges of commercialization. Salmon under the brand name "AquAdvantage" was created by a Canadian team more than 30 years ago (12) and licenced to AquaBounty Farms, Inc. (now AquaBounty Technologies, https://aquabounty.com) shortly after. Finally, AquAdvantage salmon entered the market for sale in Canada will enter the market in 2016, and the US will follow in 2021 (13).

A gene construct containing an extra copy of a growth hormone gene from a different salmon species, Chinook salmon (Oncorhynchus tshawhytscha), is added to Atlantic salmon (Salmo salar), creating AquAdvantage salmon (Salmo salar). By placing a promoter sequence from a gene that produces an antifreeze protein in the ocean pout, Macrozoarces americanus, the additional gene's expression is further altered. In contrast to wild salmon, which only generate growth hormone periodically, genetically modified (GM) fish produce more growth hormone continually (12). their untamed equivalents (12). They also consume up to 25% less feed than traditional Atlantic salmon and are more effective at converting feed to biomass (14).

They can be raised in top-notch, entirely land-based RAS facilities thanks to their qualities. By being close to inland markets, these facilities can cut transportation costs and enhance market freshness. Because of the numerous physical and biological barriers that separate AquAdvantage salmon from their wild counterparts, they do not represent a threat to wild salmon.

The production facilities use recirculated water and are on terrain remote from habitats for wild salmon. Through the adoption of only sterile triploid females, such physical containment is further strengthened by reproductive containment (15). However, AquAdvantage salmon's trip through the enforced regulatory requirements From the initial regulatory inquiries submitted to the US Food and Drug Administration (FDA) in 1995 to the US and Canadian regulatory approvals for consumption in 2015 and 2016, respectively, on genetically modified organisms (GMOs) has spanned two decades (16). Salmon from AquAdvantage has had a protracted and challenging road to market, but it has received positive reviews from food critics and will soon be more readily accessible in the United States (17).

Biotech and Biological Restrictions

The sterile animal production methods and conventional, albeit high-quality, RAS are what keep wild salmon populations apart from AquAdvantage salmon, which has been genetically manipulated to meet economic goals. To date, discussions and research in the context of aquatic conservation have centred on employing biotechnology to stop the spread of transgenic characteristics. wild relatives of farmed species or, more recently, to get rid of invasive species (18, 19). The foundation for employing biotechnology to build considerably more effective biological barriers between farmed and wild populations is being laid by advances in our understanding of the reproductive physiology of aquatic creatures.

For instance, CRISPR/Cas gene-editing studies in Atlantic salmon have shown that deletion of the dead end (dnd) germ cell-specific gene leads in sterile animals that do not produce gametes or sex hormones but nonetheless grow properly (20, 21). It is currently feasible and, in fact, moving quickly to develop a novel technique for mass-producing genetically sterile animals (22).

Actively putting up impediments to reproduction is another possible strategy. It is known that centromeres can move. is thought to be crucial for speciation and to interfere with meiosis (23). By altering or moving centromeres, it should be possible to prove hybrid incompatibility between farmed and wild aquatic strains as these speciation mechanisms are better known (24). Breeders will, of course, need to make sure that such animals' behaviour does not affect the ability of their wild counterparts to reproduce (25).

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