Triploid Trout:

I was recently very surprised to learn that Triploid Trout can develop gonads. What exactly is Triploid Trout or Salmonids then and what are the benefits of using them in aquaculture production systems?

Triploid trout are also known as 3N or sterile trout. Triploids are infertile and thus remove the risk of genetic interaction with wild stocks in waters where they are introduced for recreation purposes. Male triploids may still develop functional gonad tissue and may participate in spawning behavior, which could interfere with reproduction of wild stock. Female triploids do not develop mature gonads and do not exhibit spawning behavior. This reduces the potential for harmful interaction with spawning wild fish, and increases somatic growth and over-winter survival. Female triploids in an aquaculture production system will have better flesh quality, for instance color at harvesting, as compared to diploids.

You can produce triploid trout by fertilizing the normal green trout eggs with normal sperm and then heat shocking the eggs to induce polar body retention. Triploid fish contain three sets of chromosomes. One-half of the fish will be XXY, or triploid males, and one-half will be XXX, or triploid females. Both males and females should be sterile. To produce triploid fish simply fertilize the eggs with normal sperm, wait 10 minutes, and then heat shock the eggs, either at 29 °C for 10 minutes or at 26 °C for 20 minutes. Triploid males will probably show more gonadal development than triploid females. Gonads from a mature triploid male may appear similar to those of a normal fish except they will be smaller and will not produce sperm. Gonadal development should be inhibited in triploid females. Triploid females should have string like gonads. Gonads of both triploid males and females can be compared to those of normal males if they are sexed at around six months of age. All Female Triploids are normally produced to limit any form of gonad development. Development rates appear very similar, until the onset of sexual maturity in All Female/diploid trout. It is difficult to differentiate visually between triploids and diploids, particularly when both are immature. Diploids will develop spawning coloration, and the males develop kypes, when they mature whereas triploids will maintain their non-mature appearance.

You might be concerned about whether triploids are “genetically modified organisms”. No, they are not because no genes were introduced at all. A genetically modified organism (GMO) or genetically engineered organism (GEO) is an organism whose genetic material has been altered using genetic engineering techniques. These techniques, generally known as recombinant DNA technology, use DNA molecules from different sources, which are combined into one molecule to create a new set of genes. This DNA is then transferred into an organism, giving it modified or novel genes. Genetically modified organisms thus have had specific changes introduced into their DNA by genetic engineering techniques. These techniques are much more precise than mutagenesis (mutation breeding) where an organism is exposed to radiation or chemicals to create a non-specific but stable change. Other techniques by which humans modify food organisms include selective breeding (plant breeding and animal breeding). Triploid individuals should have one-third more DNA in their cells because they have three sets of chromosomes, compared with two sets in normal diploid animals. You can buy expensive equipment that can measure the amount of DNA in an individual’s blood cells, but the easiest way to verify that triploid animals have been produced is to sex them by dissection after they’re six months old

and see whether all the fish have similar male like gonads. Hybrid triploids can also be produced by fertilizing eggs with sperm from closely related species.

Some of the benefits of utilizing triploid trout in your stocking program include:

- Fish are suitable for release without genetic impact, as they cannot breed with native populations.
- Better growth to large sizes as all energy is transferred to growth rather than reproduction.
- Better flesh quality as compared to diploids.

The hydrostatic pressure chamber is also used to produce sterile triploids for rainbow trout and for several other salmonid species. Pressure-treated eggs appear to have higher survival and more consistent triploidy rates than heat-shocked eggs. It is likely that this technology will replace the heat-shock bath in large-scale triploid production in the future.

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