Hybridization and fitness traits in sturgeon

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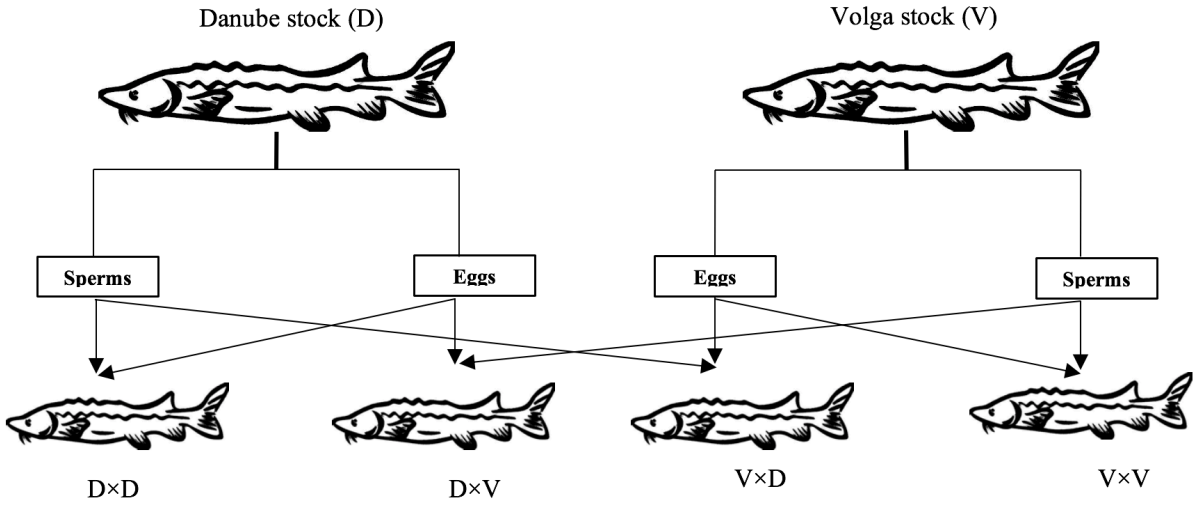
Sturgeon are one of the most ancient fish species and have been around the Triassic period. Although they are among the most endangered fish species in the world the progress in artificial propagation technology has accelerated development of sturgeon aquaculture.

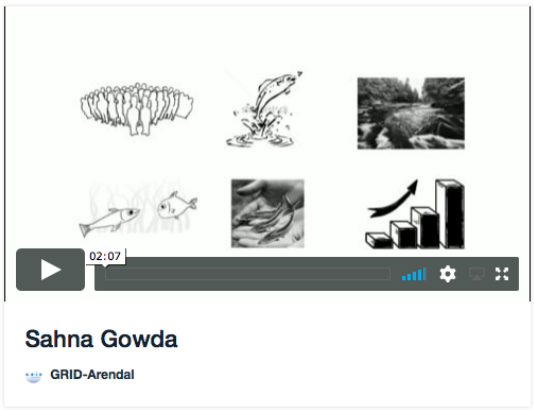
The main driving force promoting the development of sturgeon aquaculture is the drastic decline in natural populations and the huge profits in the sturgeon farming worldwide. Essentially, reproduction of brood stocks through hybridization and other breeding programmes is often done mainly for aquaculture and also used in restocking purposes. Human-induced hybridization is increasing nowadays, often with unpredictable outcomes with respect to species persistence. However, hybridization has a significant impact on fitness in the first couple of generations and long-lasting neutral genetic effects.

Hybridization can be either a potent tool or significant challenge, although it is often ignored in the conservation and restoration management of endangered populations. The hybridization types may have different impacts on future generations. Hybridization within species often produces viable and fertile individuals, but the fitness of offspring and their reproductive success and survival can be higher (heterosis) or lower (outbreeding depression) than their parental populations. Since heterosis is not having any detrimental effects on conservation efforts, the focus of selecting parental populations is to combat outbreeding depression. Therefore, in our project, we aim to study the effects of inter-population hybridization on the offspring's fitness and possible genetic incompatibilities (if there are any). This can be potentially helpful when we use non-native stock for restocking programs.



For our project, we used sterlet (*Acipenser ruthenus*) stocks from Danube and Volga river basins to produce purebred and hybrid families. Sterlet are a relatively small sturgeon species which is often used as model species in research on sturgeon biology and culture due to its early maturation. We chose Danube and Volga stocks considering them having low genetic divergence from one another as well as similar local adaptations which could avoid the onset of outbreeding depression.

The crucial step was to find the candidate parents which could be distinguished individually among the two populations. In order to achieve this goal, we used microsatellite markers. In order to establish hybrid and purebred crosses, 12 males and 12 females were artificially propagated from each population. We produced reciprocal hybrid crosses and purebred crosses. Reciprocal crossing was also adopted to produce hybrid crosses to study the parental effect on genetic polymorphism and physiological fitness between reciprocal hybrids.



Simpleshow video - https://vimeo.com/271433828

We observed the highest fertilization followed by hatching rate in Danube (♀) × Volga (♂) cross. The produced crosses were checked for growth traits every two months. After 10 months of rearing, the highest growth rate was noted in in Danube (♀) × Volga (♂) cross and highest survival was observed in Volga purebred cross. Likewise, the lowest growth rate was found in the Volga (♀) × Danube (♂) cross whereas purebred crosses performed in between the reciprocal hybrids. We also assessed the critical swimming capacity of the crosses after 2 months of hatching and no difference in swimming performance was observed.

Moving on to the genetic parameters, the level of genetic polymorphism was high in the hybrids which is the probable cause for novel adaptation and heterosis, allowing higher fitness in changing environment. We observed that the produced intraspecific hybrids performed better than the purebreds. We also noticed the significant differences in the growth performance between the reciprocal hybrid crosses. This suggests us that it's not only the hybrids but it is always necessary to take the position of the individual population in a hybridization matrix. Results of our project will broaden the limited knowledge on genetic features and fitness of sturgeon hybrids (with reciprocal parental inputs) and purebreds.