

The first Proliferative Kidney Disease tolerant rainbow trout?

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Selective breeding has been utilised for many years in the Atlantic salmon industry, and the results from such schemes have been widely documented. Benefits, such as increased growth rate, reduced food conversion ratio (FCR), improved survival and disease resistance are now traits that salmon breeding companies use to improve the performance of the offspring in each generation. However, in rainbow trout no such selectivity has been utilised and projects to assist farmers in reducing costs, and in turn improve margins, have long been needed. Finally, the trout industry is beginning to utilise the application of selective breeding on strains currently used commercially.

A few years ago, a LINK Aquaculture project on the application of selective breeding to UK rainbow trout took place. The project was a collaboration between the Institute of Aquaculture, the Roslin Institute and the British Trout Association. Together they conducted a survey to identify what farmers thought to be the most important traits relating to commercial production. The general response included, as expected, growth rate, improved FCR, harvesting yield, flesh colour etc. But when asked to identify significant diseases, Proliferative Kidney Disease (PKD) was repeatedly mentioned, especially by farmers located in Southern England, where outbreaks of the disease are renowned to cause mass mortality, or *at best* massive financial burdens.

The current project involves two farms, who provided broodstock to produce 540 genetically related families (Farm A: two strains – 160 families, Farm B: one strain – 380 families). The individuals were reared

communally under commercial conditions and their performance compared. During the growing period there was a severe outbreak of PKD, creating a natural challenge, all families being equally exposed to the causative agent, *Tetracapsuloides bryosalmonae*. At the peak of the infection in September 2004 a sample of 1500 fish was removed and analysed for disease severity using a kidney swelling score (scale 0 – 4; 0 showing no signs of infection, 4 severe infection) and growth parameters. The individuals were identified to the family level using microsatellite markers. The additive genetic variation was calculated and generated significant heritabilities (higher the better).

Farm A = 0.34 ± 0.08
(\pm Standard Error)

Farm B = 0.25 ± 0.06
(\pm Standard Error)

The next stage was to identify the most and least tolerant strains/families by calculating Estimated Breeding Values (EBVs) in kidney units (Lower = better resistance).

Farm A = Min 1.69, Max 2.95, Average 2.33

Farm B = Min 1.54, Max 2.83, Average 2.17

The data also expressed a significant negative correlation of -0.4 between length and weight, and kidney score, suggesting bigger fish appear to be more resistant to the disease. A simple explanation of this correlation would be; healthier fish continue to feed and grow, whilst affected fish become stressed and lose appetite.



A prime rainbow trout

To confirm the calculated values, the siblings of those fish taken for analysis or the original parents (all of which have known EBVs) have been used as breeders to create high and low tolerance families that are currently being assessed under controlled challenge experimental conditions at the Institute of Aquaculture. The controlled challenge will enable the magnitude of the resistance to be measured and, possibly, the resistance mechanism to be determined. The knowledge gained will allow future selections to be made at the farm level that will inevitably improve the tolerance of stocks on sites where PKD is prevalent.

The benefits of undertaking a study of this magnitude and to this level of certainty will not only aid the farms currently involved, but will eventually be a benchmark for the rest of the industry. Selective breeding is a useful tool that should, and will inevitably, be utilised by the entire British rainbow trout farming industry. The advantages can be visualised easily, simply by referring to the genetic gain that has been achieved in other fish species.



Honours for John Tarbit

At November's graduation ceremony, John Tarbit was bestowed an Honorary Doctorate from the University in recognition of his contribution to international development and particularly for his guidance on the Advisory Committee of the Institute of Aquaculture. In his awarding speech, James Muir indicated that this award was also justified for 'his intelligence and

compassion' and 'offering rough and kindly advice to overenthusiastic academics and project staff, and giving canny guidance to Ministers'. John Tarbit was Senior Fisheries Adviser and head of Natural Resources Research at the UK Government Department for International Development.