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The Search for Genetic Markers Associated with Disease Resistance in Two Strains of Arctic Charr

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Icy Waters Ltd. is a privately owned Canadian company and a world leader in Arctic charr (*Salvelinus alpinus*) aquaculture. It is committed to the belief that Arctic char are one of the finest freshwater finfish available in the marketplace today. Located in Whitehorse, Yukon Territory, Icy Waters Ltd. is a fully integrated operation that includes a certified broodstock facility, hatchery, tank farm and processing plant. Since its establishment in 1986, a strong broodstock development program has been a cornerstone for Icy Water's success. In 2001, Icy Waters aspired to broaden their breeding program to include new technologies in molecular genetics. In collaboration with Simon Fraser University and with funding from Canada's National Research Council Industrial Research Assistance Program (NRC-IRAP), the Icy Waters Arctic Char Broodstock Enhancement Project was started. Over the past six years, the goal of this project has been to discover genetic markers that can be used to increase the efficiency of breeding strategies through the implementation of marker-assisted selection (MAS). Some of the benefits to come out of this program include the ability to identify sex, estimate the relatedness of potential mates, establish pedigrees, monitor genetic variability and select for improved growth rates. More recently, the company's interests have turned towards the discovery of genetic markers that are associated with disease resistance, in particular, resistance to furunculosis.

In this study, several backcross lines, each consisting of ten full sibling families, were subjected to a furunculosis challenge. Each line was generated by crossing hybrids of the Nauyuk Lake and Tree River strains with one of the respective purebred lines. Tissue samples were collected from sensitive and resistant individuals to search for genetic markers associated with furunculosis resistance. DNA fingerprinting and pedigree analysis were used to separate a selected population into full sibling families. Two of the families were selected for linkage analysis and genome wide scans using amplified fragment length polymorphisms (AFLPs) and microsatellite markers. Several linkage groups with associations for furunculocus resistance were identified. Although markers were predominantly AFLPs, comparative analysis with other genetic maps for Arctic char provided several new microsatellite markers with the potential to identify furunculocus resistance in the Icy Waters populations. Last fall, genetic markers believed to be associated with growth rate and disease resistance were used in marker-assisted selection trials. The products of this selection are currently being tested to see if a genetic improvement in furunculosis resistance was achieved.