Atlantic salmon (Salmo salar) farming represents one of the most important examples of commercially successful intensive aquaculture in the world. In Europe the main producers are Norway and UK with a respective estimate of 845,000 and 143,000 tons produced in 2009. In spite of this success, viral, bacterial and parasitic pathogens pose a serious threat to the European salmon farming industry and cost millions of euros every year.

The aim

Animals have developed specialized immune responses to viruses, bacteria or parasites. Aeromonas salmonicida, Infectious Pancreatic Necrosis Virus (IPNV) and Gyrodactylus salaris belong to these three categories of pathogens and seriously affect the European Atlantic salmon farming industry. The IMAQUANIM Salmon group has developed valuable tools to monitor and characterize the immune response to the three types of pathogens. Experimental infections were carried out using salmon families showing contrasting levels of resistance to A. salmonicida, animals vaccinated against IPNV and salmon from populations known to be sensitive or resistance to G. salaris.

The outcome

Using molecular technologies such as microarray analysis, Suppression Subtractive Hybridisation (SSH) and real time PCR a collection of novel genes that proved to be involved in the response to parasites, viruses or bacteria were established for Atlantic salmon. Molecules part of the interferon pathway, the main antiviral immune mechanism, such as STAT1 and STAT2 were isolated and used to detect potential viral suppression. Transcription factors such as GATA3 were discovered and can be used as a marker of the Th2 adaptive response. Finally, the precise analysis of genes induced by IPNV in vaccinated fish shed some light on some aspect of viral infection and the importance of proteolysis as a defense mechanism.

What is next?

We still do not know how the host survives or succumbs to a pathogen infection. Traditionally, an experimental infection is monitored by sacrifice at regular intervals after infection of a number of fish. There is no way at present to predict if a fish will die or survive the infection without developing methods for non-lethal sampling and immune response monitoring. The use of the tools developed during IMAQUANIM should now be applied to novel experimental infection designs to answer to the very basic question: What kills the fish? Why do some survive? How can we predict this?


IMPROVED IMMUNITY OF AQUACULTURED ANIMALS