

Research at the Institute of Aquaculture



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# Vaccine could play key role in PKD control

PROLIFERATIVE kidney disease (PKD) is an economically significant parasitic condition, costing the UK trout industry over £2.5 million per annum. Although primarily regarded as affecting first season rainbow trout, other salmonids can become infected during freshwater stages with varying levels of severity. The name PKD was first devised in 1974, although reports of a similar syndrome affecting trout date back at least 50 years previously. The disease is endemic in large areas of Europe and North America, but has not been recognised in the Southern hemisphere to date. Water temperature has a profound effect upon the progress of the disease, with high levels of mortality seen on endemic farms during the summer months.

For many years the causative agent responsible was unidentified. In 1999, however, this was shown to be a myxozoan parasite (named *Tetracapsuloides bryosalmonae*) that developed within freshwater bryozoans (invertebrates known colloquially as “moss animals”), releasing 20 µm spores that could infect salmonids by entry through the skin and gills. Typically, on affected farms, most if not all stock exposed to infected water develop the disease. However, mortality levels vary from 20-100% depending upon secondary factors, such as temperature, stress levels and the presence of other diseases. Those fish that recover from clinical disease display resistance to future challenge with the pathogen: this being crucially important in the development of a prospective vaccine.

As with many other parasitic diseases, there are currently no licensed prevention or treatment protocols for PKD. Previously, the use of malachite green in salmonid husbandry



**Above: Male brown trout: a possible target for *T. bryosalmonae***

**Insert: Confocal microscopy representation of a *T. bryosalmonae* spore**



**Left: Part of a bryozoan colony of *Fredericella sultana*, an alternate host for *T. bryosalmonae***

seemed to mitigate the severity of the disease, but its withdrawal has led to farmers employing alternative management systems with limited success. The Institute of Aquaculture (IoA) has played a pivotal role in PKD research for the last 25 years, liaising closely with partners within the UK and the rest of the world during that time.

A NERC funded research project within the Aquatic Vaccine Unit of the IoA focused on the laboratory culture of bryozoans alongside development of control methods. The establishment of an invertebrate laboratory culture system allowed in depth study of the development of the parasite within this host, including the use of confocal microscopy to determine the 3D structure of the infective spore. It was established that exposure to a single spore of *T. bryosalmonae* was sufficient to lead to full-blown PKD in rainbow trout, thus explaining the high morbidity levels witnessed on farms. Drug trials were conducted using in-feed medications and experimental vaccine preparations developed from infected bryozoan material, but neither was found to be sufficiently effective to justify commercial refinement.

A current vaccine development project funded by Defra and Schering-Plough Aquaculture aims to overcome some of the shortcomings encountered using conventional technology. A protective component of the parasite has been identified and purified. Using its DNA sequence, large quantities of the antigen could be produced and used for the vaccination of fish. The prospective vaccine would play a key role in the control of this highly damaging disease on farms and limiting the spread in wild populations of native salmonids.