# Action Countryside – Assessing Hydropower

Hydropower is seen as a valuable renewable energy source, but Anton Ibbotson asks what are the effects on the freshwater salmon populations

*A popular type of turbine for generating electricity in small-head hydropower schemes is the Archimedes screw turbine, but how fish friendly is it?*

The 2009 Renewable Energy Directive sets a target for the UK to achieve 15 per cent of its energy consumption from renewable sources by 2020, with hydropower seen as one such energy source. The Environment Agency (EA) initially identified 26,000 potential hydropower sites in England and Wales, with 5,000 of these being seen as distinct possibilities for development in around 130 river catchments.

A popular type of turbine for generating electricity in small-head hydropower schemes is the Archimedes screw turbine. These are favoured over other types of turbine because they are thought to be less damaging to fish than other types of hydropower generators. Because of this view, the EA's best practice guidelines for hydropower has no specific requirements for screening that would deflect fish away from the turbine intakes. Instead, only trash screens are recommended to stop large pieces of debris entering the turbine and causing damage. Such screens typically have an aperture of 100mm and therefore do not prevent small fish entering the turbine itself, although the large screens make the turbines more efficient by allowing water to flow unimpeded into the turbine. With the potential for the installation of large numbers of these types of turbines, perhaps with several being set up on any one river, we feel that there is a need to demonstrate and validate

the 'fish friendly' nature of the design. For salmon populations the greatest downstream movement of fish occurs during the spring smolt run when thousands of these small fish start their journey to the sea. Where there are turbines these fish will have to pass through the Archimedes screw and it is important that we have an assessment of the likely effects on the freshwater production of salmon populations. This will provide valuable information for the licensing of future installations and facilitate balanced decision-making where the benefits of renewable energy can be weighed against any ecological cost.

On the River Frome in southern England, we have established facilities for measuring the survival, population size and timing of migration at both juvenile and adult stages in a complete salmon population. Much of this work is based on the individual tagging of more than 10,000 salmon parr every year throughout the River Frome catchment and a wealth of fish counting, trapping and tag-reading equipment is installed in the lower reaches of the river at our Salmon & Trout Research Centre at East Stoke.

> "...an opportunity for evaluating the 'fish-friendly' reputation of these structures"

By chance, in 2010, a low head hydropower plant (Archimedes screw design) was installed approximately four kilometres upstream of our research site. The combination of this installation and the instrumentation of the river at East Stoke, presents an excellent opportunity for evaluating the 'fish friendly' reputation of these structures, not just immediately after passage, but over longer time periods to see whether previously reported superficial damage to fish causes any mortality or population effect later in their life-cycle. Previous studies into the effects of these turbines have tended to focus on damage to fish immediately after they exit the turbine. However, some people have asked whether there is sub-lethal damage (not always obvious immediately below the turbine) that may result in a higher probability of mortality later on during migration through increased vulnerability to predators, changes in behaviour resulting in a longer time of migration and missing the optimum time of entry to saltwater, or a reduction in the ability to adapt to the drastic change from fresh to saltwater.

The installation of the turbine within such a well-monitored river provides a unique opportunity to assess its effect on salmon populations. Although most of the instrumentation is already in place, we will be required to design, build, install and run the fish counting equipment to monitor fish passage through each of the three possible channels around the Archimedes screw installation site. To design and install equipment elsewhere to carry out such an experiment would be extremely expensive.

The proposed three to five year study will be a partnership between the Trust, the Salmon & Trout Association, the Environment Agency, Lulworth Estate and Potential Energy. Lulworth Estate has provided £5,000 and has offered to provide the necessary access to the site, along with the energy supply for running the tag readers. Potential Energy will supply data on the times that the Archimedes screw turbine is running and the quantity of water taken by the turbine and the Salmon & Trout Association have contributed a further £5,000 to the project.

## Action Countryside – Assessing Hydropower

This work aims to provide information that will help us understand the potential impact of individual hydropower applications. It will further provide the building blocks necessary for catchment-wide modelling of the cumulative effects of many hydropower schemes within one catchment.

The NGO Educational Trust wishes to thank the Game & Wildlife Conservation Trust for permitting us to reproduce this article for the benefit of our website users.