Environment Agency

Evidence

Understanding eel and fish behaviour to improve protection and passage at river structures

Project summary SC120061

This project studied the behaviour of fish and eels to find better ways to protect them at flood control structures, weirs, hydropower sites and other intakes. The study showed significant impacts of some river structures on migrating eels, but also that understanding eel behaviour at such structures and intakes in relation to flow could help improve their passage.

The findings show how designs and location of eel passes could be improved to increase the survival and passage of eels during their migration up and down rivers. This evidence will help to inform guidance for provision of eel passes and operational changes at river structures at critical times of the year for migrating eels and other fish species. The study also showed that trap and transport of mature eels from landlocked reservoirs is an option to increase numbers of eels undertaking their spawning migration.

Eel migration

The European eel is now classified as endangered. Its complex life cycle makes this species vulnerable to man-made river structures that hinder its migration. Mature adult eels (known as silver eels) migrate down rivers and travel 4,800km to spawn in the Sargasso Sea (an area of the Atlantic Ocean). The larvae return across the Atlantic Ocean to Europe to migrate up rivers as glass eels and elvers. The provision of eel passes at in-river structures and the screening of intakes where water is abstracted is required by law.

Results from field trials on rivers

Using sonar cameras and acoustic telemetry systems to track fish and eels, researchers monitored their movement past river structures and investigated the effects of changing flows on passage and the effects of a hydropower installation on coarse fish and eel behaviour and movements

For upstream migration of eels, field trials showed that introducing a plunging flow at the entrance of eel passes (see Figure 1) improved passage by two-fold for immature life stages. Plunging flow is water cascaded to the entrance of the pass which assists eels in locating the pass. The position of the pass also influenced catches; smaller eels (<121mm) favoured bankside passes and larger eels mainly used passes in the centre of the river.

Figure 1: Trials with plunging flow aimed at the base of eel passes which helps young eels find the pass to migrate upstream

Tracking of silver eels on their spawning migration in one river showed that a single abstraction intake was the main cause of mortality, while several structures were associated with delays in movement of up to 68 days.

Detailed tracking of silver eels at a complex of 5 structures found that they rarely took a direct route and did not follow the expected route of greatest flow. Changes in water velocity at one of the structures revealed that at high velocities eels tended to swim rapidly back upstream away from the structure, whereas at low velocities the eels explored the structure (see Figure 2).

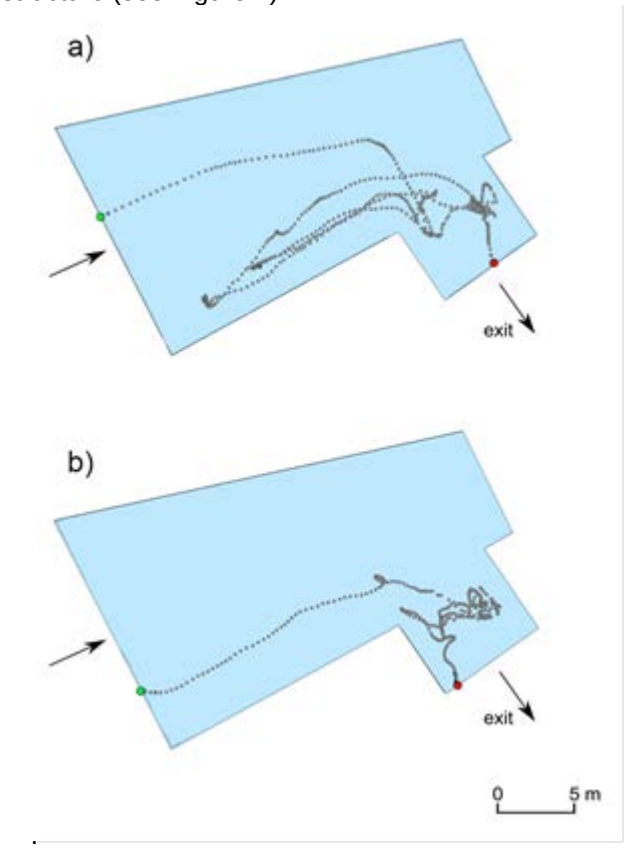

Figure 2: Trajectories of acoustically tagged downstream migrating adult eel through the forebay of a redundant hydropower facility. Tracks show (a) rejection in the intake channel under constricted flow (high velocity acceleration) and (b) exploratory behaviour under unconstricted flow (low velocity acceleration). Green and red circles denote the start and end of tracks, respectively.

Helping eels in landlocked waters to migrate

The research also looked at the problem of eels in landlocked still waters which may not be able to undertake their spawning migration. 'Trap and transport' has been suggested as a means to overcome this, but it was not known if eels transported from such water bodies would migrate successfully.

The project captured 80 reservoir eels which were acoustically tagged, released into a river and tracked, alongside 30 migrating silver eels from the same river. The results showed that 88% of the reservoir eels and 90% of the river eels migrated through the 25km study reach and into the sea, suggesting that trap and transport could be a way of boosting the number of silver eels able to migrate.

This summary relates to information from project, SC120061:

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