Home Office

NON-TECHNICAL SUMMARY

MITIGATING IMPACTS OF RIVER ENGINEERING ON FISH

Project duration

5 years 0 months

Project purpose

- (a) Basic research
- (d) Protection of the natural environment in the interests of the health or welfare of man or animals.
- (e) Research aimed at preserving the species of animal subjected to regulated procedures as part of the programme of work.

Key words

Dams, hydropower, acoustics, telemetry, electricity

Retrospective assessment

> The Secretary of State has determined that a retrospective assessment of this licence is not required.

Objectives and benefits

Description of the project's objectives, for example the scientific unknowns or clinical or scientific needs it's addressing.

What's the aim of this project?

The project aims to: (1) quantify the impact of river infrastructure (e.g. hydroelectric turbine intakes and pumping stations) on fish; and 2) develop environmental impact mitigation technology, such as behavioural deterrents (e.g. using acoustic/electric fields), to protect fish.

Potential benefits likely to derive from the project, for example how science might be advanced or how humans, animals or the environment might benefit - these could be short-term benefits within the duration of the project or long-term benefits that accrue after the project has finished.

What are the potential benefits that will derive from this project?

Information obtained will provide evidence of negative impact of man-made river structures on fish distribution, movement, and survival to help develop and prioritise conservation actions. This will help regulators ascertain whether current methods to protect fish (e.g. fish ladders and screens) are effective for the species of conservation concern, and highlight areas where improvements can be made. Identification and quantification of secondary impacts associated with river structures and their operation, such as the sounds created, will be achieved so that alternative protective measures can be developed.

Species and numbers of animals expected to be used

What types and approximate numbers of animals will you use over the course of this project?

Fish.

The total number depends on the number of sites selected by the Environment Agency for monitoring. Total maximum number = 23,600 over 5 years.

Predicted harms

Typical procedures done to animals, for example injections or surgical procedures, including duration of the experiment and number of procedures.

In the context of what you propose to do to the animals, what are the expected adverse effects and the likely/expected level of severity? What will happen to the animals at the end?

The adverse effect of this study will related to the marking of fish (e.g. use of elastomer tags, fin clips, and PIT tags) which will require minor procedures involving a hypodermic syringe, tagging of fish which will involve surgery and suturing, and stress associated with exposing fish to sound and electric fields. These will include minor discomfort and elevated stress during the use of anaesthetic and marking /tagging procedure, associated with insertion of hypodermic needles (e.g. to implant visual markers) and surgery associated with implanting a transmitter into the body cavity of the fish. When

encountering electric fields likely adverse effects are likely to be minor and relate to those common for sedation and anaesthesia, primarily that motion and breathing is reduced accompanied by a partial loss of equilibrium, but remaining reactive to touch stimuli. The likely/expected levels of severity will range from mild (all protocols except tagging studies involving surgery) to moderate (use of surgery to tag fish). Risk of mortality will be low (less than 1:1000) and any fish exhibiting stress or suffering as indicated by abnormal behaviours and increased rates of gill ventilation as a result of the procedure will be humanely killed with a lethal dose of anaesthetic. In most cases fish will be returned to the wild after completing the procedures.

Replacement

State why you need to use animals and why you cannot use non-animal alternatives.

It is currently impossible to model movement behaviour of many species of fish in response to conditions encountered at river structures. Live animals must be used to obtain the information necessary to facilitate greater understanding of this so that models may eventually be developed. This project will provide information needed to develop deeper understanding of fish behaviour on which conservation efforts can be based. The approach proposed will use the minimal amount of animals to obtain the information necessary.

Reduction

Explain how you will assure the use of minimum numbers of animals.

Statistical tests will be used to estimate the numbers of fish that should be used to obtain valid results. Through a process of continuous re-evaluation and adaptation of the research methodology, the numbers of fish required will be constantly refined by updating the estimates the number of fish needed while still achieving scientifically valid results. Statistical tests will be used on data collected to inform estimates of numbers used in subsequent phases of the research. This way the number of fish required to ensure meaningful conclusions will be minimized.

Refinement

Explain the choice of species and why the animal model(s) you will use are the most refined, having regard to the objectives. Explain the general measures you will take to minimise welfare costs (harms) to the animals.

It is essential that the animals used are the same species for which this research is intended to benefit by developing the most appropriate management strategies based on real world observations. The species selected represent those that of high conservation and/ or economic value as defined by national and international legislation, yet maintain populations that are relatively stable and healthy in the study rivers selected. The selected species also provide representatives of fish with a range of different body morphologies, swimming capabilities, behaviours, and life history traits. All surgical

techniques will use well developed and widely used protocols to minimize handling and associated stress. Effects of the techniques will be monitored to reduce probability of causing pain and suffering during future phases. Behavioural traits will be monitored to indicate humane endpoints i.e. the earliest indicator in an animal experiment of severe pain, distress, suffering, or impeding death. Post-surgery behaviour will be closely monitored over the period of recovery to assess deviation from the pre-surgery condition. The data will be regularly reviewed to assess whether behavioural measures can be refined to enhance the efficiency of identification of humane endpoints based on a relationship between exhibition of aberrant behaviour and resulting deterioration in condition.