Home Office

NON-TECHNICAL SUMMARY

# Identifying the factors affecting diadromous and freshwater fish populations

**Project duration**

5 years 0 months

**Project purpose**

- (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**

Fish movements, Fish ecology, Freshwater and marine environments, Anthropogenic effects, Fish conservation

| Animal types | Life stages |
|---|---|
| Brown Trout (Salmo Trutta) | Juvenile, Adult, Pregnant adult, Aged animal |
| Salmon (Salmo salar) | Juvenile, Adult, Pregnant adult, Aged animal |
| All other fish | Juvenile, Adult, Pregnant adult, Aged animal |

## Retrospective assessment

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

# Objectives and benefits

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

**What's the aim of this project?**

The aim of the project is to improve knowledge and understanding of the movements, migrations, patterns of distribution and behaviour of diadromous and freshwater fish populations, in relation to their environment and in particular to anthropogenic pressures. The knowledge and understanding will be used to provide evidence-based advice in support of management and conservation to stakeholders, governments and other national and international organisations.

**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.**

**Why is it important to undertake this work?**

Effective management of freshwater and diadromous fish populations requires reliable information (i.e. supported by research-based evidence) on the status of stocks, their ecology and movements, and the range of natural and anthropogenic factors (e.g. climate change, artificial light at night, water abstraction, fish stocking and non-native species) that can impact fish at different stages of their life cycles. The research proposed under this Project Licence will address aspects of these research priorities, with the ultimate aim of providing evidence-based management and conservation advice to support national government and international bodies which deliver policy relating to management and conservation of fish stocks.

**What outputs do you think you will see at the end of this project?**

The outputs of the work will include:

1. Data: individual-based data on migration routes, residence times and residence locations, preferred habitats and patterns of behaviour, including in response to environmental and anthropogenic factors;

2. Information and knowledge: improved understanding, enabling us to provide better advice on conservation and management, on topics such as monitoring methods, life history strategies and the individual and population responses to environmental drivers;

3. Publications: analysis of the data and knowledge gained for peer-reviewed publications and technical reports to enable knowledge transfer to wider society

**Who or what will benefit from these outputs, and how?**

The short-term benefits will be achieved through advice and measures applied to specific study sites, for example by informing advice about mitigating the effects of in-river obstructions on migrating fish. In the medium and longer term, depending on the extent to which the new knowledge is species- or region-specific, the benefits could be achieved nationally and internationally and help to meet national and international commitments to fisheries or environmental management. The data obtained will help to meet national or regional statutory obligations for rational and sustainable fisheries and environmental conservation. Other benefits from the transfer of knowledge to wider society (other scientific institutions and academics, government and policy makers, civil society) will develop over time as the new insights from the work become integrated with existing knowledge.

**How will you look to maximise the outputs of this work?**

Experimental work will be developed in collaboration with external project partners. Significant new knowledge will be published in peer-reviewed journals or as publicly available reports, with a Communications Team supporting the dissemination of results and major programme highlights through traditional and social media outlets.

**Species and numbers of animals expected to be used**

- Brown Trout (Salmo Trutta): 18,750
- Salmon (Salmo salar): 18,750
- Other fish:
    - All other fish: 21,250

# Predicted harms

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

**Explain why you are using these types of animals and your choice of life stages.**

The aim of the work is to advance our understanding of the movements and behaviour of diadromous and freshwater fishes, and to provide direct empirical evidence of responses to environmental or anthropogenic drivers. Much of the work under this licence will focus on species which have been selected as being of high conservation interest (including Atlantic salmon, brown trout, and European eel), as it is these species for which our work can provide greatest benefits for conservation and management. The life stages used will be selected to answer specific research questions, but in the case of Atlantic salmon and brown trout, many of the knowledge gaps relate to the ecology of juvenile fish and consequently research would be directed at that life stage, whilst ensuring that individuals are large enough to be tagged without adverse effects.

**Typically, what will be done to an animal used in your project?**

An animal used in this project will typically be captured using electric fishing or in a net or trap (with the most appropriate method selected to minimise adverse effects). Once caught, the fitness and well-being of the fish will be assessed to ensure that it is fit to undergo the protocols. The fish will then typically be transferred to a holding tank containing an anaesthetic, and then maintained under sedation or anaesthesia while protocols are conducted. This will typically involve the fish being measured and weighed. Optionally, a small number of scales may be collected (to enable ageing, or for genetic or isotope studies), and/or a small amount of tissue (a fin clip) or mucus may be collected (typically for genetic analysis). A small blood sample may optionally also be taken at this point. The fish would then typically be tagged, with the tag type dependent on the study question. Some tag types, particularly electronic tags, need to be placed inside the coelom and therefore require surgery, whereas others such as Passive Integrated Transponders require a less invasive process. Fish will then be placed in a recovery tank under observation to assess their fitness for release, at which point they will be discharged from the Act and returned to the wild.

A smaller number of fish may also be subjected to an additional protocol, stomach or colonic flushing, to gain data on their diet. These fish would also be captured from the wild and anaesthetised, and may also undergo biological sampling prior to the flushing, which involves the insertion of a tube into the stomach and flushing out of stomach/colon contents using distilled water or saline solution. The fish would then be allowed to recover, and after passing an assessment for fitness they would be released to the wild.

**What are the expected impacts and/or adverse effects for the animals during your project?**

The procedures are assessed as being of Mild or Moderate severity. Possible adverse effects include:

1. **Pain or distress during the tagging or sampling procedure.** If necessary and beneficial, as for example during surgical tagging, anaesthesia or sedation will be used to minimise this risk. Whether or not anaesthesia and/or analgesia is used, fish will be handled carefully to minimise handling stress, and kept out of water for the minimum time necessary to undertake the procedure. Careful monitoring by experienced operatives will take place throughout the procedure, and until the fish is fully recovered and released.

2. **Infection of tagging wounds or skin (as a result of handling or capture damage).** Risk of infection will be minimised by creating aseptic conditions for tagging.

3. **Loss of weight or condition due to handling or tissue sampling.** This risk is considered small because handling and sampling protocols have been carefully designed to minimise impact to the fish on the basis of previous practice and experience. Tissue samples would be scaled appropriately to the size of the individual, and taken from areas of the body where the risk of damage, pain or post-procedural deterioration was minimised.

**Expected severity categories and the proportion of animals in each category, per species.**

**What are the expected severities and the proportion of animals in each category (per animal type)?**

The expected severities of the Protocols are 'Mild' and 'Moderate'.

In work on salmon and brown trout, 96% of animals under this Project Licence would experience 'Mild' severity, and 4% would experience 'Moderate' severity.

In work on other fish species, 96.8% of animals under this Project Licence would experience 'Mild' severity, and 3.2% would experience 'Moderate' severity.

**What will happen to animals used in this project?**

- Set free
- Killed
- Kept alive at a licensed establishment for non-regulated purposes or possible reuse

# Replacement

**State what non-animal alternatives are available in this field, which alternatives you have considered and why they cannot be used for this purpose.**

**Why do you need to use animals to achieve the aim of your project?**

The principal aim of the work is to describe the ecology and behaviour of wild fish in relation to changes in their aquatic environment, to support their conservation and management. Therefore, there is no alternative to the use of living animals.

The data which will be gained from this project will fill knowledge gaps which hinder our ability to effectively manage these species, and will typically be species-specific (which drives our selection of particular species to work on).

**Which non-animal alternatives did you consider for use in this project?**

Procedures will only be undertaken for fish species where gaps in knowledge cannot be filled with non-animal alternatives. Work will only be initiated after a review of literature to ensure that this project is not duplicating previous studies which can already provide the required data.

Environmental DNA sampling is an emerging new tool which can be used as a non-invasive method for determining presence or absence of fish in water bodies, and we will use this method where appropriate. However, it cannot provide the detail on fish biology, movements and habitat use for which the Protocols in this Project are better suited.

**Why were they not suitable?**

To monitor the movements and behaviour of diadromous and freshwater fishes to the required level of detail for conservation management, there is no viable alternative to tagging protocols. Similarly, stomach flushing is the only effective way to achieve data on fish diets from living fish.

# Reduction

**Explain how the numbers of animals for this project were determined. Describe steps that have been taken to reduce animal numbers, and principles used to design studies. Describe practices that are used throughout the project to minimise numbers consistent with scientific objectives, if any. These may include e.g. pilot studies, computer modelling, sharing of tissue and reuse.**

**How have you estimated the numbers of animals you will use?**

The estimate for numbers of animals used in each protocol are based on previous research experience and but will be re-assessed prior to any project being implemented (using support from in-house statisticians and information from peer-reviewed scientific literature). All experimental work will use advice from professional statisticians to ensure that the minimum number of animals are used that will permit a robust and meaningful statistical analysis of the results. These statisticians will provide statistical support to all aspects of the research, from designing the experimental approach to conducting and reporting the analyses.

**What steps did you take during the experimental design phase to reduce the number of animals being used in this project?**

All experimental methods and numbers of animals used will be based on published literature and previous experience and research by the Project Licence holder and colleagues (including the use of statistical power analysis to assess appropriate numbers for the study aims). As part of our internal Animal Welfare and Ethical Review Process, each programme of study is considered by senior staff from our in-house scientific and statistical teams and their sign-off is required before any study is undertaken.

**What measures, apart from good experimental design, will you use to optimise the number of animals you plan to use in your project?**

Studies will be undertaken using as few individuals as possible for the required aims. Information collected in previous studies (including where appropriate, from other species), will be taken into account when designing experiments, to ensure that animal numbers are optimised. Recent studies have included the use of statistical power analysis to identify appropriate numbers to include in the study. Data collected from these studies (including tissue samples and electronic tag data) will be used in partnership with other institutes and organisations to help optimise animal use to achieve study aims.

# Refinement

**Give examples of the specific measures (e.g., increased monitoring, post-operative care, pain management, training of animals) to be taken, in relation to the procedures, to minimise welfare**

**costs (harms) to the animals. Describe the mechanisms in place to take up emerging refinement techniques during the lifetime of the project.**

**Which animal models and methods will you use during this project? Explain why these models and methods cause the least pain, suffering, distress, or lasting harm to the animals.**

A range of species including Atlantic salmon, brown trout, European eel and other diadromous and freshwater species need to be studied in order to provide relevant and meaningful data to support policy and management decisions. The animal models and methods chosen will be those deemed most likely to provide valuable evidence to support conservation and management advice, based on previous experience and research (by ourselves and by other researchers). No endangered species, as defined in Annex A of Council Regulation 338/97, will be used on this project.

Best practice methods in fish capture, handling and regulated procedures will be followed to ensure that we minimise animal suffering. Where fish undergo a procedure and recovery, they will be monitored for a suitable period of time in order to assess any adverse impacts and ensure a minimum of suffering.

**Why can’t you use animals that are less sentient?**

The aim of the work, to advance our understanding of the movements and behaviour of diadromous or freshwater fish in their natural environment, inherently precludes the use of terminally anaesthetised animals or less sentient species. The research questions addressed by this project would be specific to both species and life stages, which will determine the choice of study animal.

**How will you refine the procedures you're using to minimise the welfare costs (harms) for the animals?**

Where appropriate, anaesthesia and analgesia will be administered to provide pain relief. All animals will have a post-procedural assessment to ensure their fitness for release to the wild (in addition to an assessment prior to starting the procedure).

**What published best practice guidance will you follow to ensure experiments are conducted in the most refined way?**

Best practice guidelines for fish tagging and sampling were documented at a Workshop on Mark Identification Tagging (WKTAG) in January 2024 and will be used as a basis for continually improving effective methods. Tag attachment/implantation methods will be continually updated, and reviewed alongside tag technology developments to ensure that they are humane and that they minimise the effects on the fish’s behaviour, welfare and survival. Published studies on refinement of techniques will be used to help refine protocols and methods. Personal Licence holders and the Project Licence holder will contribute to working groups and studies to help inform others of best practice that arises from this study.

**How will you stay informed about advances in the 3Rs, and implement these advances effectively, during the project?**

The Project Licence holder will stay informed about advances via continual review of peer-reviewed literature and regular discussion with the AWERB team. Literature review will focus on advances in replacement (e.g. use of non-invasive technologies such as environmental DNA sampling), reduction (e.g. looking at numbers of fish used in any similar studies, or looking for new studies which fill the knowledge gap that our planned work is intended to do) or refinement (e.g. improved methods of fish capture or handling, or advances in tagging methodology). Any advances in these areas during the lifetime of the Project licence will be discussed with the AWERB team and incorporated into the project.