



Home Office

NON-TECHNICAL SUMMARY

Tracking salmonids to assess potential impacts of Marine Developments

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

Salmon and sea trout, Acoustic tags, Marine distribution, Marine abstraction, Marine renewables

Animal types	Life stages
Salmon (Salmo salar)	Juvenile
Sea trout (Salmo trutta)	Juvenile, Adult

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?

To better understand Atlantic salmon and sea trout migration pathways in the Bristol Channel and provide data on the potential effect of coastal developments

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?

Fish which migrate into freshwater to spawn, such as Atlantic salmon (*Salmo salar* L.) and sea trout (*Salmo trutta* L.) may have to migrate past coastal developments to complete their life cycle. Developments such as tidal lagoons or major abstractions have the potential to impact on survival of both juvenile and adult stages.

The lack of data on migration patterns of these species, and hence potential impact, has impaired the ability of developers to assess impacts and propose suitable mitigation, compromising marine licence applications and potentially putting the fish populations at risk.

This project will provide specific data for an important coastal development area, and will look to quantify exposure of Atlantic Salmon and sea trout to a planned major marine abstraction and potential tidal range developments, as well as contributing to the development of a wider understanding of migration pathways and survival in the Bristol Channel.

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

1. Evidence quantifying exposure of Atlantic salmon smolts from the River Wye and Severn and sea trout from the River Tywi to a major marine abstraction.
2. Evidence quantifying exposure of Atlantic salmon smolts from the River Wye and Severn and sea trout from the River Tywi to potential tidal range schemes.
3. Qualitative data on coastal distribution and migration paths in a wider area.

Interim reports will be provided to developers and environmental regulators. A final project report will be published and made publicly available. The more important results will be published in peer reviewed journals.

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

Lack of data on key marine species, including migratory fish, is recognised as a strategic information gap by both regulators and industry for assessing potential impacts of marine developments such as marine renewables (see the ORJIP report, 2017). Data for other anadromous species (twait shad, *Alosa fallax*) has demonstrated significant potential risk to multiple populations of twait shad from a new major abstraction (Hinkley point C) and data are needed to understand whether similar risks exist for Atlantic salmon and sea trout migrating through the area.

Developers and regulators will be provided with valuable data as the study progresses; migration data and survival will be analysed and reported regularly and disseminated through conference presentations and publications. Information specific to the area will benefit local regulation and inform evaluation of current and future development proposals. The information will therefore provide both short and long term value. Results describing migration and behaviour patterns in inshore areas will have wider utility and will benefit assessments by regulators elsewhere (Environment agency, Marine Management Organisation, Natural England and Marine Scotland). The value regulators place on this data is reflected in financial commitments (tag and receiver purchase in excess of £0.5m to date) to help support the work.

Local angling associations are keen that evidence is developed to ensure that both the fish population and fishery are protected through the regulatory process for marine developments. They have provided/are providing practical assistance with our fieldwork, including fish capture.

EDF Energy Ltd, the developer of Hinkley point C, are also providing access and assistance and both they and environmental regulators will be provided with relevant evidence to assess the potential impact of their abstraction.

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

Collaborating across multiple organisations and river systems will maximise data value and the potential for novel outcomes.

We are already working closely and collaborating with Natural Resources Wales, Natural England, Environment Agency, and the Devon and Severn IFCA, EDF Energy Ltd, as well as local angling interests and organisations such as Marine Energy Wales and the Game and Wildlife Conservancy Trust.

We expect to produce reports, conference papers and peer reviewed publications.

Species and numbers of animals expected to be used

- Salmon (*Salmo salar*): 300
- Other fish:
 - Sea trout (*Salmo trutta*): 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.

At the current time Atlantic salmon and sea trout populations in many parts of the UK are at historically low levels. Atlantic salmon migrate to sea as smolts. During these migrations they may be killed or their migration success compromised by developments such as abstractions or marine turbines associated with renewables.

Atlantic salmon smolts leaving the rivers Severn, Wye and Usk may be at particular risk during their migrations from a new marine abstraction (the largest in the UK), scheduled to begin operation in 2027, and from the potential development of tidal lagoons for energy generation in the Bristol Channel.

This study aims to look at Atlantic salmon and sea trout migration paths, and will focus on quantifying the potential exposure of smolts and adult sea trout to the developments described above.

This is essential information for regulatory discussions and for managing and protecting salmonid populations.

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

Fish will be captured using rod and line, electrofishing, or nets and traps specifically designed to avoid damage. They will be anaesthetised and tagged with an acoustic tag through an incision approximately 1cm long (or less). The incision will be closed with a dissolvable suture and covered with a suitable covering to provide a waterproofing barrier to protect the wound during the initial stages of healing.

Fish will then be transferred to a well aerated recovery tank and monitored for normal behaviour (holding their position and actively swimming).

Once the fish are recovered from anaesthesia they will be released to continue normal lives.

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

Experience has shown that fish rapidly recover from anaesthesia and surgery and are not expected to suffer any lasting long term harm as a result of the procedures under this protocol being carried out.

The procedures carried out in these protocols will be done under general anaesthetic and therefore fish will be subjected to no more than mild stress as a result of capture and handling. There may be some mild post-operative discomfort, but experience of staff carrying out the work will ensure fish are only released once they are behaving in a normal manner within the release tank, when they are able to swim upstream against the flow.

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)?

We expect the severity to be moderate for all fish tagged. The tagging approach is intended to minimise discomfort or damage to the fish.

What will happen to animals used in this project?

- Set free

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 project aims are to look at the behaviour and distribution of Atlantic salmon (*Salmo salar* L.) and sea trout in the wild in order to gain information to manage and protect the species in the context of specific development areas. There are no practical alternatives to generate this data.

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

Theoretical modelling and expert opinion has already been utilised to look at potential distribution and movement in the study areas. Comparison of predictions using these methods and actual data already collected on twaite shad has demonstrated that, in the absence of real data, expert opinion and modelling approaches may produce highly misleading and inaccurate results.

Specific empirical data for salmonid migration to validate opinions and models are therefore essential to underpin environmental impact assessments and regulatory decision making.

Why were they not suitable?

See above. In the absence of migration studies and actual movement data for Atlantic salmon and sea trout in the Bristol Channel there is no basis to validate these models and their predictions. Data from similar studies of twaite shad has demonstrated that expert predictions in the absence of real data were very wrong.

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?

We need to use sufficient fish to provide quantifiable estimates of detection rates in each of the development areas, which can be compared with the number of tagged fish successfully emigrating from each river, to enable calculation of the proportion of the population exposed to risk. The actual numbers required will be determined by emigration success, and by the proportion of tagged fish entering the development areas, which are currently unknown. Proposed sample sizes (up to 300 salmon smolts and 250 sea trout smolts and adults) have been informed by results from emigration success and detection rates from and our other studies of Atlantic Salmon and sea trout (river Tawe) and twaite shad (rivers Severn, Wye and Tywi) as well as initial Atlantic salmon smolt tagging under this licence,

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

Proposed sample sizes have been informed by results from emigration success and detection rates from our other studies of Atlantic Salmon and sea trout smolts (river Tawe) and twaite shad (rivers Severn, Wye and Tywi). The first year of tagging of Atlantic salmon smolts on the river Wye has been completed and results show that a second year of tracking is required to confirm conclusions and increase the confidence in the dataset.

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

Ongoing review of data, developing computer models which can be used in subsequent studies to reduce requirements for similar work.

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.

The capture and tagging methods we are using with acoustic tags are well established, with the tags specifically designed for the purpose, and the smallest that will provide the necessary output and battery life required for the study. The methods we are using are designed to allow the fish to return as rapidly as possible to normal behaviour with minimal long term effects.

Why can't you use animals that are less sentient?

Our objective is to understand observe behaviour and distribution of Atlantic salmon smolts under natural conditions, including at sea. This cannot be achieved by other means.

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

Capture method

Depending on site availability we will use one or a combination of trapping (rotary screw traps (RST), fyke nets modified to minimise damage, electrofishing (for adult sea trout) or rod and line (for adult sea trout). All of these methods have been demonstrated to provide fish in good condition for tagging.

Choice of tags

We are using the smallest tags available consistent with the objectives of the project, including tag life and acoustic output needed for tracking in the marine environment. The tags we are using are specifically designed by the supplier for work with the species and life stages we are using. They are tough and smooth to minimise any issues if ingested by a predator.

Tagging and recovery procedures

The anaesthesia technique we are using ensures water circulation across the gills throughout the procedure.

When tagging during dark hours light will be kept to a minimum to reduce stress. Aseptic surgery techniques and single use scalpel blades and suture needles will minimise risk of infections.

Each incision will be covered with a suitable temporary wound barrier to provide a waterproofing barrier to protect the wound in the initial stages of healing. Sutures will be checked prior to transfer into recovery and holding tanks.

Smolts will be monitored and only be released in groups when exhibiting normal swimming behaviours.

All procedures will only be performed by suitable trained and qualified individuals (ie PIL holder; training and competency record kept by NTCO)

Smolts will be released in groups to maintain shoaling behaviour.

Humane end-points and limits of severity

If internal damage to organs were to occur during surgery, the fish would not be allowed to recover and would be euthanized by a schedule 1 method.

Adults will be recovered by holding them in the river against the current with water flowing over the gills until they are able to swim away unaided.

If fish fail to recover from anaesthesia they will be euthanized by a schedule 1 method

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

There are a number of published studies using these tags and techniques. However methods evolve continuously and we have taken best practice advice from various partners and Universities, all of whom are undertaking current licenced work with these species, and our approach and protocols seek to take the best from each, consistent with our objectives.

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

We will continually review the literature. We will continue to attend conferences, such as recent SAMARCH, Unlocking the Severn and IFM workshops, which bring together salmonid tracking researchers. As well as learning ourselves, we will present data at these events to share it with others. We will continue to network with others to share and learn from further developments, both as research understanding of the field develops and to improve our tagging methods to minimise any potential adverse effects. Where appropriate we will update our protocols and methods.