



Home Office

NON-TECHNICAL SUMMARY

Tracking Salmonid Smolts and adults to establish in river survival rates and coastal movements

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

Sea trout, Salmon, Acoustic tags, Marine distribution, Survival

Animal types

Life stages

Other fish species

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 salmon and sea trout migration and provide data on in river and marine movements, including the potential and actual effect of man made structures in coastal and river environments

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 salmonids, may have to migrate past coastal and in-river developments to complete their life cycle. Developments such as weirs, barrages, tidal lagoons or major abstractions have the potential to impact on survival of both juvenile and adult stages.

This can be particularly important for species such as sea trout (*Salmo trutta L.*) or shad (*Alosa fallax*), which spawn multiple times and may therefore be subject to cumulative impacts. 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 track up to 300 sea trout smolts, up to 200 sea trout adults, and up to 250 salmon smolts tagged with acoustic tags. The tags regularly emit a coded acoustic pulse which can be detected and decoded by fixed passive receivers, enabling individual movements to be followed. Fish will be tagged in freshwater, and their migration to sea followed, to develop quantitative survival, migration and availability data for a specific coastal location. It will also look at the impact of a major in river structure at head of tide. The project will provide specific data for an important coastal development area, and contribute to the development of a wider understanding of in river survival, coastal and marine phase movements, and distribution of sea trout. Tissue samples will also be collected from salmon smolts for a wider study aiming to correlate genetic characteristics with post tagging survival.

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

1. Quantitative data on distribution and residence times of salmon and sea trout in the immediate study area.
2. Qualitative data on coastal distribution and migration paths in a wider area.

3. River and sea survival / return data for sea trout

4. Evidence describing migration past a structure at the tidal interface (some limited data exists already at this site, but this study will significantly improve knowledge).

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 (see the ORJIP report, 2017).

Developers and regulators will be provided with valuable data as the study progresses; migration data and survival would be analysed and reported on an annual basis. Information specific to the area will benefit local regulation (Natural Resources Wales) 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 UK regulators (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) 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.

Understanding genetic factors linked to survival could inform knowledge of wider factors causing current low salmon stock levels.

We would also expect to provide information regularly during the course of the project to the wider scientific community through conference papers and publications.

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

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

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

Finclips will be supplied to a research consortium including other universities and the Atlantic Salmon Trust. Collaborating across multiple organisations and river systems will maximise data and potential for novel outcomes.

Species and numbers of animals expected to be used

- Other fish species: Up to 750 fish

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.

Sea trout migrate to sea as smolts, returning to spawn as adults. During these migrations they may be killed or their migration success compromised by various natural and human activities, including natural factors such as predation and disease, and man made problems such as the presence of barriers (weirs and barrages), pollution, marine and in-river developments.

In the natural state, sea trout normally spawn multiple times, unlike salmon, where only a small percentage survive spawning. As such the impact of human activities can be multiplied through their lives, as losses may compound with each migratory phase.

At the current time sea trout populations in many parts of the UK are at historically low levels. However much less is known about sea trout than salmon, particularly their movements in the marine environment. This study aims to look at sea trout survival rates at different life stages, and will focus on the impact of specific man made developments and development proposals. This is important information for managing and protecting sea trout populations.

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

Fish will be captured using nets or 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 initially prevent the wound from infection during initial healing. Option: adipose fin clips may be taken from some salmon smolts to enable genetic analysis. This work will be undertaken collaboratively with Hull University who are working under project PD6C17B56.

Juvenile fish will then be transferred to a well aerated recovery tank and monitored for normal behaviour (holding their position and actively swimming). Adult fish will be held facing into the water stream until they are able to hold position and actively swim upstream.

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 that

juvenile fish are only released once they are behaving in a normal manner within the release tank, or for adults, 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 sea trout (*Salmo trutta L.*) and Atlantic salmon (*Salmo salar L.*) 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 has already been utilised to look at potential distribution and movement in the study area. This has identified the species most at risk from developments and these are the subject of these studies.

Why were they not suitable?

In the absence of migration studies and actual movement data for sea trout in the Bristol Channel there is no basis to validate these models and their predictions.

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 robust estimates of survival at different life stages to inform models which can then be used to predict impacts without the requirement for further experiments using live fish. Sea trout life cycles are more complex with multiple spawning returns common and a sea complex age structure. For this reason we aim to tag more sea trout (up to 500 in total). For salmon, where we are tagging smolts and looking at emigration through Swansea Bay only, we would aim to tag up to 250 fish, over two years. Our initial estimate is therefore that this *could* require tagging up to 750 fish to generate robust data.

In practice the key factor in determining the number of fish required will be survival at different life stages. The numbers given above are maximum numbers and design and actual numbers will be set on a 'pilot study' basis and informed by past results as the project evolves.

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

We have undertaken two years of tagging for sea trout (the initial year was under a separate project licence) and one year of tagging for Atlantic salmon. Numbers have been reviewed after each season to look at survival and return rates and this request is intended to allow a second comparative year of data for both species.

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.

Both salmon and sea trout are economically important for recreational fisheries; they are also important conservation species, widely recognised as a measure of the health of river systems. Marine developments are routinely required to demonstrate that they will not impact salmonids, yet the data to

do this are highly limited. For Swansea bay lagoon developments modelling has demonstrated that sea trout are a particular concern.

The capture and tagging of methods we are using with acoustic and radio tags are well established. 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 sea trout and salmon 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

The trap we are using for adults has a large holding area and will be fished at least twice a day. For smolts the Fyke nets we are using are an NRW design with a large soft meshed cod end designed to minimise damage to the fish. We will remove smolts from the nets at regular intervals during the night.

Choice of tags

We are using the smallest tags available consistent with the objectives of the project, including tag life and tracking in the marine environment. The tags we are using are specifically designed by the supplier (VEMCO) 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 for both smolts and adults ensures water circulation throughout the procedure.

When tagging during dark hours (smolts) 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 temporary barrier, reducing discomfort and providing protection from infection. 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. Adults will only be released when they are able to swim upstream and maintain position against the flow, and will be released into a quiet deep pool where they can shelter in lower flows until ready to swim away.

Where salmon are being adipose clipped, the potential adverse effects of fin clipping are most likely to occur during the procedure, such as unintentionally damaging the fish. This will be controlled by ensuring the fish is anaesthetised, holding the fin up with forceps and ensuring scissors are sharp.

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.

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 NRW studies (via our NVS), from Hull International Fisheries Institute, from the Atlantic Salmon Trust, and from the Game Conservancy Trust. All the above 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 attend conferences, such as the recent SAMARCH workshop, which brought together salmonid tracking researchers. 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.