

NON-TECHNICAL SUMMARY

# Fish Movements and Behaviour

### **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

### Key words

Fish movements, Fish behaviour, Fish telemetry, Otolith micro-chemistry

Animal types	Life stages
All other fish	Juvenile, Adult, Pregnant adult, Aged animal
Lobster	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?

To improve knowledge and understanding of the movements, migrations, patterns of distribution and behaviour of fished and bycaught marine fish populations (excluding endangered species listed in Annex 1 of CITES), in relation to their environment. The knowledge and understanding will be used to provide advice in support of rational management and conservation to stakeholders, national and international 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?

Information on all aspects of marine fish migration and distribution in relation to the environment will permit better advice to UK Government in support of national and international commitments to regional management and conservation of marine populations. The advice will be mediated through the Government, but also on behalf of the Government through participation in national and international committees and organisations (such as the EU December Fisheries Council, The Scientific, Technical and Economic Committee for Fisheries, The International Commission for the Conservation of Atlantic Tuna, and The International Council for the Exploration of the Seas), as well as to relevant stakeholders (e.g. commercial and recreational fishing industry and NGO representatives). The information will also contribute to the development of improved methods for assessing marine fish stocks and will help provide a fundamental understanding of the movements, behaviour and distribution of fish in relation to their environment. In turn, this will improve our capability to advise on the likely impacts of commercial and recreational fisheries on fish stocks and enable the design of fisheries management and conservation efforts aimed at optimisation of fishing effort and avoidance of depletion of threatened species.

The work will also inform on the impacts of capture and release, whether deliberate or unintentional, by improving knowledge of post release mortality, or long-term discard survival of commercial and recreational fish species. This will improve advice on e.g. survivability exemptions from the Common Fisheries Policy landing obligation, whereby unwanted fish can be returned to the sea following capture, rather than retained and landed. Additionally, for species such as some species of sharks, skates and rays, long-term post-release survival from commercial and recreational fisheries will inform the Government (and other relevant bodies) on alternative management strategies to reduce fishing mortality.

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

The outputs of the work will include:

1. Data

(i) individual-based data on migration routes, residence times and residence locations, preferred habitats and patterns of behaviour in relation to those habitats;

(ii) individual-level impacts of capture on post-release behaviour and survival

2. Information and knowledge

(i) new understanding of the relationship between biological indicators and behaviour;

(ii) improved understanding of stock and population structure, life history strategies and the individual and population response to environmental drivers

#### 3. Publications

(i) use the data and knowledge gained in peer review 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 likely be felt locally through advice and measures applied to specific regions or fisheries, and help to meet national or regional statutory obligations for rational and sustainable fisheries and environmental conservation. In the medium and longer term, depending on the extent to which the new knowledge is species- or region-specific, the benefits could be felt nationally and internationally and help to meet national and international commitments to fisheries or environmental management. 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 project partners and with a communications team supporting the dissemination of results and major programme highlights.

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

Other fish:
All other fish: 2500

### **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 marine fish of commercial, recreational and/ or conservation concern. The work requires direct empirical evidence of behaviour and responses to environmental or biological drivers. In general, the size of the individuals used will mostly be adult life stages because the instruments available for use to collect the necessary data are on the scale of several cm in size and are therefore only suitable for individuals large enough to carry them without adverse effects.

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

Individuals used in the majority of studies will be captured using modified fishing methods (to reduce adverse effects). Discard survival studies, require that standard fishing methods are replicated from commercial or recreational fisheries. Once caught, fish will be held at the side of the vessel, or in tanks for a short period of time prior to the procedure being undertaken. A suitably sized electronic device will be attached externally or implanted internally using appropriate attachment material or surgical techniques. Individuals may be tagged in the water or on the deck if they are very large, but most will be removed from the water temporarily to facilitate handling. The procedure or afterwards. Small tissue samples, such as blood, muscle, mucus or fin biopsies, may be taken. In some cases, tagging will not be conducted, but tissue samples may be taken. Where feasible, tissue samples collected in this project may be used to help inform stock identification or to assess their fitness for release to the wild, at which point they will be discharged from the Act and returned to the sea.

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

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

1. Pain or distress during the tagging or sampling procedure. If necessary and beneficial, anaesthesia and/or analgesia will be used to minimise this risk. Whether anaesthesia and/or analgesia is used or not, fish will be handled carefully to minimise handling stress and their response to it, and will be placed onto surfaces that will minimise accidental movement. Careful monitoring of the fish will be undertaken throughout the procedure, and until the fish is fully recovered.

2. Infection of tagging wounds or skin (as a result of handling or capture damage). Risk of infection will be minimised by conducting appropriate antiseptic and disinfection procedures and techniques to create aseptic conditions for tagging. Where appropriate, analgesia will be applied to the tagging site to reduce likely pain.

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 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)?

Expected severities are 76% Mild and 24% Moderate.

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

- Killed
- 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 aim of the work is to use electronic telemetry methods (acoustic tags, data storage tags, or pop-up satellite archival tags) together with (where appropriate) otolith microchemistry (stable isotope research) and biological sampling (including genetic analyses and physiological assessment), to advance our understanding of the movements and behaviour of marine fish of commercial, recreational and / or conservation concern (excluding endangered species listed in Annex 1 of CITES). The knowledge being pursued does not exist and is typically species-specific. For this type of investigation there is no appropriate alternative to the use of conscious wild fish (i.e. there is not a non-protected animal alternative).

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

Procedures will only be undertaken for species and areas where there are gaps in knowledge that cannot be filled with non-animal alternatives. For example, where there is information available on the movement, behaviour or discard survival for the species and area of interest - this information will be used first of all. For example, a non-animal alternative that could be considered to help fill data gaps includes passive acoustics, which can help to quantify seasonal changes in the abundance and biomass of marine species.

### Why were they not suitable?

Passive acoustics can be used to understand hotspots for marine species abundance, but it is very difficult or impossible to identify single individuals to species level. Even so, for migratory species, this only provides a discreet period of monitoring in areas where there is acoustics with validation tows. To monitor the behaviour of mobile marine species, at present there is no appropriate alternative to the use of telemetry on conscious wild fish to achieve the aims and objectives.

### 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 experimental methods and numbers of animals used are based on previous experience and research and will be assessed prior to any project being implemented (including support from Cefas statisticians).

## 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 at Cefas (including the use of statistical power analysis to assess appropriate numbers for the study aims). As part of Cefas' 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. The use of electronic tags, rather than simple ID tags, enables the collection of high-quality data on individuals at liberty for up to several years, which provides far greater insight than the information gained from the recapture of ID-tagged fish alone. Depending on the aims of the study (and on individual variability), this can help to reduce the number of individuals required in the study. Where possible, the use of methods that enable remote transmission of data will be used so that the recovery of data is not dependent upon recapture of the fish and the data recovery: animal use ratio is maximised.

## 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 sea bass (*Dicentrarchus labrax*), spurdog (*Squalus acanthias*), common blue skate (*Dipturus batis*), common flapper skate (*Dipturus intermedius*), porbeagle shark (*Lamna nasus*), Atlantic bluefin tuna (*Thunnus thynnus*) etc. need to be studied to achieve the aims and objectives of the project. The methods chosen are based on previous experience and research that has been shown to provide evidence that is valuable in formulating advice on factors that may affect fish populations and possible mitigation.

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

The aim of the work is to advance our understanding of the movements and behaviour of marine fish of commercial, recreational and/ or conservation concern in relation to their environment. The study is therefore dependent on collecting species-specific information.

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

Where appropriate, anaesthesia and/or 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.

## 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 developing effective methods. Tag attachment/implantation methods will be continually updated, reviewed and evidencebased alongside tag technology developments to ensure that they are humane and that they minimise the effects on the fish's behaviour, long-term welfare and survival. Published studies on refinement of techniques will be used to help refine protocols and methods. PILh and the PPLh 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?

With tag technology continually improving, electronic tags become smaller, with increasingly benign attachment/implantation approaches. Tag attachment/implantation methods will be continually updated, reviewed and evidence based alongside tag technology developments to ensure that they are humane and that they minimise the effects on the fish's behaviour, long-term welfare and survival.