

Marine Scotland Science projects for SUPER DTP PhDs – to start October 2022

1. Effect of seal presence on farmed salmon welfare

Contact: Kate Brookes, kate.brookes@gov.scot

- There are concerns that the presence of seals around aquaculture pens may cause stress to farmed salmon, but there is very little empirical evidence of this effect
- The project would consider different methods for assessing stress to farmed salmon including their feasibility and the utility of data they may provide. We would expect consideration of both behavioural and physiological responses to stress.
- The project would test the most suitable method or suite of methods to determine whether seals cause measurable stress responses to farmed salmon
- The project will consider the impact of any stress to the farmed salmon and also on the productivity of the aquaculture site.

2. Efficacy of acoustic deterrent devices around aquaculture

Contact: Kate Brookes, kate.brookes@gov.scot

- Acoustic deterrent devices (ADDs) are commonly used around aquaculture sites to reduce the risk of seal predation of farmed fish.
- The evidence for their efficacy is equivocal, but there have been rather few studies, which have all used different metrics to define efficacy. Additionally, there are suggestions that ADDs can work for a period of time but then stop working.
- These devices emit sound into the marine environment and may require EPS licensing due to the potential for them to disturb cetaceans.
- The project would initially consider the most appropriate metrics to assess efficacy of ADDs
- The project would then work alongside producers in the aquaculture industry to measure the efficacy of ADDs under a range of scenarios
- The project would make recommendations about the scenarios in which ADDs are most effective.

3. Drivers of Northern fulmar population declines in Scotland/North-east Atlantic

Contact: Richard.howells@gov.scot and tom.evans@gov.scot

- Scotland supports the majority of the UK population of Northern fulmar, but over recent decades many colonies have declined dramatically. Numerous potential pressures may be driving these declines, including climate change, fisheries impacts and predators, both introduced mammals and native avian predators (e.g. skuas, gulls, eagles). However, the relative contribution of these factors to fulmar population processes and how they vary both spatially and temporally remains poorly understood. Utilising the results of the first comprehensive seabird census conducted in over two decades (Seabirds Count, due to be completed in 2021), this project would investigate the factors driving observed spatial differences in fulmar population trends. Understanding the drivers of fulmar population trends will allow conservation actions and mitigation measures to be identified, along with priority areas, helping inform the Scottish Seabird Conservation Strategy and build resilience to future changes.

4. Understanding biases in seabird tagging studies* (ideally including puffin)

Contact: julie.miller@gov.scot and tom.evans@gov.scot

- Tagging of seabirds using GPS tracking and other devices (e.g. accelerometers and time-depth recorders) is widespread and provides important data for informing management of seabird populations (e.g. foraging ranges and utilization distributions), however it is still poorly understood to what extent the behaviour of tagged individuals is representative of the wider colony (and that of other colonies), how tag effects may manifest themselves in animal behaviour and the implications for assessments.

5. MSS are also interested in supporting projects relating to the effects of offshore renewables (wind, wave, and tidal) on marine bird species in Scotland, and also projects related to seabird conservation in Scotland which can connect to the developing Scottish Seabird Conservation Strategy.
6. MSS are also interested in supporting projects relating to the effects of offshore renewables (wind, wave, and tidal), marine construction and aquaculture on marine mammal species in Scotland. We are also interested in supporting work related to marine mammal conservation in Scotland which can connect to Scottish interests in the developing UK Dolphin and Porpoise Conservation Strategy.
7. **Developing operational spatial models for Scottish fisheries**
Contact: Helen.Dobby@gov.scot and Coby.Needle@gov.scot
 - Spatial measures increasingly used in both inshore and offshore areas to implement fisheries management measures, and to safeguard other environmental zones such as Marine Protected Areas (MPAs) and renewable energy generation.
 - Such spatial measures inevitably impact fishing fleet behaviour and potentially economic returns, for example due to displacement to less profitable fishing grounds or to an overall reduction in fishing opportunities.
 - The aim of the project is to develop an operational spatial model that can be applied to real world fishery management problems, parameterised using available spatial fishery and survey data.
 - Outputs will contribute to the Scottish Government's commitments to ensuring fish stocks are harvested sustainably, and providing a potential basis for specific local fisheries management measures. In addition, the project addresses marine spatial planning issues, linking in particular to managing the co-existence of different marine interests in the same shared space and contributing to a sustainable Blue Economy.
8. **Linking juvenile and adult life history stages of pelagic fish in Scottish waters**
Contact: Neil.Campbell@gov.scot
 - Scottish coastal waters are home to spawning and nursery grounds for commercially significant species of pelagic fish such as herring, mackerel and sprat, while fisheries for these species typically take place further off shore when fish may be mixed with other stocks.
 - Recent studies have focussed on using genetics and morphometrics to split adult herring on the west coast into 6a(N) and 6a(S)7bc spawning components, and this is being fed into the ICES benchmark process for these stocks.
 - Little work has been done to examine the linkages between juveniles in coastal waters and adult populations. This is an area of particular interest to policy colleagues due to the different management regimes in place between the North Sea and waters west of Scotland, and may provide evidence regarding the suitability of these measures.
 - This study would build on recent drift modelling work and advances in genetics to study linkages between juveniles in waters on the east and west coasts of Scotland and their adult populations in neighbouring waters.