Fully Funded (3.5 years) PhD project available

Title: Assessing the Resilience of Scotland’s Blue Carbon Sediment Stores

Funding: Marine Scotland with additional funding from Scottish Natural Heritage, and University of St Andrews

Supervisors: Professor William Austin (University of St Andrews), Dr Tobias Borger (University of St Andrews), Prof John Baxter (Scottish Natural Heritage) and Dr Ian Davies (Marine Scotland)

Eligibility and funding amount: Successful candidates will receive an annual stipend in line with RC-UK rates, and payment of their (UK/EU) tuition fees. UK/EU students are eligible to apply for full funding. Applicants from Commonwealth countries are welcome to apply but should note that the scholarship does not cover the full overseas fee, which for 2018/19 is £19,790; Commonwealth country applicants will be required to fund the difference per year. Studentships will be awarded on the basis of academic quality and research promise.

Application deadline: 31 January 2018.

Rationale: Significant coastal stores of Carbon (C) have recently been identified from the seabed sediments along Scotland’s west coast (e.g. Smeaton et al., 2016). These sediment C stores and their role in the long-term sequestration of atmospheric Carbon Dioxide represent an extremely important, yet poorly quantified component of Scotland’s natural capital. While there is therefore growing interest in the potential of these marine sediments to host C that would otherwise contribute to Scotland’s Green House Gas emissions, the stability and resilience of these sedimentary C stores under increasing Anthropogenic pressure is poorly understood. This PhD project will examine and quantify the potential impacts of management practices, particularly the impacts of mobile benthic fishing gear, on the long-term stability of Scotland’s marine sedimentary C stores.
**Background:** The OSPAR Quality Status Report (QSR 2010) highlighted a range of human activities with physical impacts on benthic habitats. A particular focus has been the impact of benthic fishing on seabed habitats and associated benthic communities, where the extent of the physical damage to these habitats has been assessed (figure 1). OSPAR’s strategic objective with respect to biodiversity and ecosystems is to halt and prevent by 2020 further loss of biodiversity in the OSPAR Maritime Area, to protect and conserve ecosystems and to restore, where practicable, marine areas which have been adversely affected. **Currently, the role of these benthic habitats in sequestering (and indeed cycling) C has not been fully considered and represents an important knowledge gap.**

Regional-scale assessments of physical disturbance from bottom contacting fishing since the QSR 2010 is now possible through region-wide annual mapping of fishing pressure since 2013. These data can be combined with region-wide information on the distribution and sensitivity of benthic habitats and an opportunity has therefore emerged to address C sequestration/storage potential (figure 2). The existing approach uses a combination of semi-quantitative and categorical methods to assess the pressure/impact relationship between habitats and fishing; **this same approach could be adopted in order to develop a semi-quantitative assessment of the fishing impact on C storage/recycling in Scottish coastal waters.**

**Figure 1** the distribution of surface abrasion caused by vessels >12 m in length fishing with bottom contacting gears, aggregated for the years 2010 to 2015. Areas with high levels of variability will be at different stages of recoverability and impact (source: OSPAR).

**Figure 2.** Benthic habitats affected by bottom fisheries (source: OSPAR)
**Aims of the PhD:** The PhD student will work in collaboration with Marine Scotland to design and deliver a field- and laboratory-based experimental study of the impacts of mobile benthic fishing gear on the C sequestration/storage potential of Scottish marine sediments. For example, this PhD project could readily be linked to the Marine Scotland MRV *Scotia* annual *Nephrops* survey if berths and suitable seabed sampling opportunities were available. The large-scale regional sampling programmes of the MRV *Scotia* (**figure 3**) would also provide an excellent opportunity for the student to integrate field and laboratory analyses of sediments with well-constrained benthic ecosystem and fishing (commercial trawl) intensity surveys. Laboratory studies would focus on characterising sediment properties and particularly on the quantification of C contents and sources. Novel experimental work on the settling velocities of different sediment size fractions would be undertaken and, if resources allowed, some incubation studies would be undertaken to understand how re-suspended sediments (linked to benthic impacts) contribute to an enhanced C cycling (and hence reduced C sequestration potential) at the sea floor. It should, however, be noted that intensive and repeated benthic impacts may impoverish benthic ecosystems to the extent that they become less efficient at recycling organic matter at the seafloor (and enhance net C sequestration). Results would be integrated into a semi-quantitative framework, as described above (**figure 2**), providing large-scale predictive capability of the fishing impact on C storage/recycling in Scottish coastal waters.

**Deliverables of the PhD:** (i) an improved assessment of the marine sediment C stores associated with key regions of benthic fishing impact/intensity in Scottish waters; (ii) improved spatial up-scaling estimates of surface sediment C content over large areas of fishing activity/intensity; (iii) an assessment of the age and long-term C storage history of these sediments; (iv) a field- and laboratory-based assessment of the role of benthic fishing impact on sediment resuspension and C cycling; and (v) to address the primary research question – how resilient are Scotland’s sedimentary C stores to benthic disturbance and, specifically, to what extent do bottom contacting fisheries impact Scotland’s Blue Carbon resource?

**Application Enquiries:** For informal enquiries, please contact Professor Bill Austin, University of St Andrews (wena@st-andrews.ac.uk) or visit [http://www.st-andrews.ac.uk/gsd/opportunities/pg/](http://www.st-andrews.ac.uk/gsd/opportunities/pg/)

**Application Process:** Please complete our online [PhD Application](http://www.st-andrews.ac.uk/gsd/opportunities/pg/) and ensure that you do the following:

- Apply to the “School of Geography and Sustainable Development”.
- Apply to the programme “PhD Geography (Science)”.  
- Note on the application that you are applying for a project funded by Marine Scotland with additional funding from Scottish Natural Heritage, and University of St Andrews.
- Note that the title of the project is “Assessing the Resilience of Scotland’s Blue Carbon Sediment Stores”.
- Name your principal supervisor as William Austin.
- Please upload a sample of academic writing (minimum of 500 words).