MASTS-SFC Saltire Emerging Researcher Scheme (MASTS-SERS)

Final Report

MASTS in association with the Scottish Funding Council supported the Saltire Emerging Researcher Scheme, which represented an important and exciting opportunity for Post Graduate Researchers (PGR) and Early Career Researchers (ECR) to engage in substantive collaboration with colleagues from Europe (EA, EEA and EFTA countries).

The scheme aimed to promote mobility between Scotland and European research partners with the aim of strengthening existing, and seeding future, research relationships. Participants are expected to demonstrate the impact of their exchange through the publication of novel research work, the formation of new collaborations and project/ funding submissions, and the dissemination of their results.

As your exchange has now come to a close, we ask that you reflect on the exchanges and provide a report by filling in the form below. The reports will need to demonstrate the potential benefits of the grant for both the recipient and their collaborators. Please return this within four weeks of completing your exchanges to **masts@st-andrews.ac.uk**. When you do so, you are agreeing that your answers may be used to promote the activities of MASTS, including being used on the website and social media channels.

Please note that MASTS may also contact you, the participants, and/or your supervisors to gather additional post-exchange impact information. This information must be provided on request.

Contact information

Participant name	Alejandra Garcia Cabanillas
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Host name	Prof Jose Antonio Juanes De La Peña
University or Institution & Department	Environmental Hydraulics Institute (IH Cantabria) Universidad de Cantabria
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Exchange overview

Title	Modelling productivity and sustainability of future macroalgae farming in the north Atlantic under various climate change scenarios.
Start date	01/02/2022
End date	31/07/2022
Project location(s)	Environmental Hydraulics Institute (IH Cantabria) Universidad de Cantabria c/ Isabel Torres, 15. 39011, Santander. Spain

Abstract (max 300 words)
Provide a brief summary of the exchange using language accessible to a non-specialist. Describe what the exchange objectives were, the activities that were carried out, and the subsequent outcomes. This may be published on the MASTS website.

Motivation for the exchange was bringing together the expertise in marine mathematical modelling at the University of Strathclyde, and macroalgal biology and ecology at IHCantabria, to address issues regarding the emerging industry of seaweed. The main objective was to adapt my PhD dynamic energy budget (DEB) theory model of the kelp species *Laminaria hyperborea* to represent the brown seaweed species *Fucus vesiculosus.*

The activities carried out involved discussions on key morphological difference between *Laminaria hyperborea* and *Fucus vesiculosus* and their impact on uptake of nutrients and photosynthetic rates, and consequent modifications to the DEB model. It turns out that the way in which the fronds of *Fucus* plants grow is radically different from those of *Laminaria*, requiring some novel changes to the underlying theory of the model.

The environmental data needed to drive the *Fucus* model has been obtained from laboratory records at IHCantabria. This includes data on the current and future conditions under various climate change scenarios. Additionally, data on weight and carbon content of *Fucus* plants has been gathered, which wil be invaluable for validating the model.

The outcome of the research has been a new DEB model for *Fucus*, that can be applied to understand the response of individual plants to changing seasonal and climate conditions in wild and aquaculture situations. These predictions wil be of direct economic interest to local communities in Spain where *Fucus* aquaculture is being developed. We can also compare and contrast the responses predicted for *Laminaria* aquaculture situations in Scotland.

Other activities carried out during the exchange involved a series of seminars on R programming language taught by me. Additionally a coding club was established through a virtual platform, which allowed Strathclyde and IHCantabria members to developed their abilities together, in matters such as functional programming.

Impact (max 600 words)
Please demonstrate the impact of your exchange from your perspective, and that of your exchange partner. Describe what the wider benefits of the exchange were to you as participant, your own and host institutions, and the wider community.

The most important impact of my exchange has been increased knowledge for both my partners and me. I have offered my knowledge in programming and more up to date and efficient way of approaching several tasks. Such as functional programming, programmatic reporting, best coding practices, more generally background information, and a reference line about how to approach coding. This has been done though my teaching of a course in R and general personal communications for small tasks.

Given my presence here, I have been able to very easily access the environmental data necessary for including a model of the brown al;ga Fucus vesiculosus in my PhD. Additionally I have had the opportunity to understand how to work with new data types, how databases are managed and how GIS relevant data is gathered and used in biological research. I have also had the opportunity to get more familiar with the best practices required for interdisciplinary collaborations to function. Together with the requirements that are a requisite in government, reports and that will then be used to advise policy. Not only have I learnt what is needed but I have also been able to provide my host institution with a new method to produce routine reports with repeated measures in a manner that saves them a significant amount of time and simultaneously reduces the likelihood of user errors.

I have benefitted by being able to participate in data gathering and experimental work. Additionally I have benefited by being part of conversation regarding laboratory and field experiment setups, making me further appreciate the difficulties of acquiring the data that is required to run the mathematical models that are the basis of my work. This has also greatly increased my personal knowledge in subjects such as species identification and morphological variations between populations and individuals.

I have also being able to provide assistance with English to Spanish translations, for publications, lessons and other miscellaneous tasks. This has benefited my hosts by being able to not hire external non-scientist to carry out the translations. By doing them myself, a discussion about terminology and general language differences is possible. This not only reduces the likelihood of information being misunderstood by being translated by someone from outside of the field, but it also reduces the time that it will take the paper to get reviews, as any language concern has being addressed beforehand.

For the wider community here at IHCantabria the main benefit has been the chance to learn about the differences and similarities between Scotland and Spain marine research and policies.

Outputs (max 300 words)
Has this exchange resulted in clear outputs, such as the generation of a proposal, research results, or publication? Please provide brief details here. Do any of these outputs have relevance to larger programmes such as the UN SDGs, Blue Economy Action Plan etc?[1]

The main and clearer output of this exchange has been the development of a new DEB model for *Fucus* spp, which has not been previously done with this approach. This model has applications to understand how this species will be affected by climate change in regards to their biomass, and therefore have applications to understand the economical impact of growth under stress inducing conditions.

Another clear output has been the setting up of an internship for further application of my programming knowledge in R, specifically the use of Rstudio projects and Rmarkdown, to optimize the current methodology and streamline the report writing process here at IHCantabria.

Plans for another PhD student here to carry out her own exchange in Oban are also been developed, as the main focus of the research group here is red algae. After multiple discussion about the similarities and differences between red and brown seaweed, it has been decided that it would be beneficial for this student to get a closer look at different more northerly seaweeds. Especially as she is also studying the effects of temperature on several species of economical interest.

The Future (max 300 words)
How do you plan to ensure a sustainable collaboration in the longer-term and maximise opportunities and impact in the future? How will you carry forward the benefits now the exchange has been completed? Please outline five concrete plans for future collaboration as a result of your exchange.

To ensure sustainable collaboration the first step is the joint undertaking of the publication of a paper on the, methodology and results obtained and developed here. The new methodology developed here is a result of joint mathematical knowledge provided by Strathclyde and field knowledge provided by my colleagues at IHCantabria. Additionally, all the environmental data required to run the model was provided by the team here.

Another plan to continue cementing this collaboration will be the joint attendance to the 8th European Phycological Congress, by myself and other members of both research institutions.

Further support regarding R will also be provided by mean of personal communications through Microsoft Teams.

I will be carrying out an internship to update the reports here to programmatic reporting. This will also support the collaboration by maintaining continuous communications.

Any further comments (max 500 words)

Please use this space to provide any additional comments. These may include, but are not limited to; what you would do differently if you could take the exchange again; what contingency measures you had to use (if any); details of any unexpected benefits or problems; any significant variations in costs;

I would like highlight the main unexpected benefit that I gained during my exchange being new first hand knowledge on red seaweed, such as *Gelidium corneum* and *Asparagopsis spp*, which I had not previously worked with. Specifically, knowledge on their morphology, economical importance, environmental preferences and ecological niches.

Additionally I have been able to attend several thesis progress committees (which are open to everyone here) and a thesis defense; this allowed me to think about different way to measure my own progress in a more efficient way. It also provided me with the opportunity to see how a thesis defense is carried out, as they are private in the UK, therefore increasing my confidence on how I will carry my own.

Final expense report

Item Number	Description	Cost per Unit	Number of Units	Total Amount (£)
1	PhD student Stipend	1300	6	7800
2	Travel Cost	98.98	1	98.98
3				
4				
Add more rows if needed				
Total				7898.98
In-kind contributions	Bench fees	512.00	6	3072
In-cash contributions				
Grand Total (Total requested from scheme + In-kind + Cash)				10970.98