



## The impact of plastic on seabirds

An estimated 5-12 million tonnes of plastic enters our oceans every year with over 5 trillion pieces currently floating at sea. Marine debris, much of it plastic, has affected 36% of all seabird species through entanglement - either at sea or at the nest. The problem is not confined to our sea, with concern also being raised over freshwater and land birds, with 118 species reported to have become entangled or incorporated plastic into their nest.

After realising how little quantitative data there was for seabirds, the ERI began collating information on nest incorporation of anthropogenic debris by Northern Gannets across the Atlantic.

One colony where no information was available was Mykineshólmur in the Faroes. During June this year Dr Nina O'Hanlon headed to this islet off Mykines, the westernmost island of the Faroes islands, where there are around 2500 breeding gannets. Over two visits, Nina recorded that 74% of gannet nests contained debris, with the vast majority containing thread-like plastic, comprising of rope and packaging straps. This value was higher than at the four Shetland gannetries which Nina visited in May 2018, where around 50% of the nests contained debris.

During fieldwork, over 700 Black-legged kittiwake nests were also checked; however, Nina found only three nests with small sections of thread-like plastic. The data collected on the Faroes will be collated with that from other seabirds across the Atlantic to help us build up a picture of which species are affected by nest incorporation of debris.

Taking this work a step further, a ground-breaking website has been launched as part of the Blue Circular Economy Project (Northern Periphery and Arctic Programme) to enlist the help of the public to gather information about the interaction between birds and debris such as plastics. People from around the globe are being asked to upload details of birds which have become entangled in debris, or which have incorporated it into their nests. While users can upload photos of nests, they are asked not to disturb any birds and to take images from a suitable vantage point.

Researchers will use the information to provide insights into the scale of plastic incorporation into nests and to identify which species are most affected by the issue.

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The ERI's Dr Neil James explains: "While there is much anecdotal evidence about the impact debris such as plastics has on birds, there have been very few studies on entanglement and nest incorporation. We hope that enlisting the help of the public through citizen science will help us to build up a picture of the scale and geographical spread of this issue. We can then use this information to inform policy and future monitoring initiatives."

For more information see [www.birdsanddebris.com](http://www.birdsanddebris.com) or contact: [neil.james@uhi.ac.uk](mailto:neil.james@uhi.ac.uk); [nina.ohanlon@uhi.ac.uk](mailto:nina.ohanlon@uhi.ac.uk)



# Tracking plastic litter at sea

There are still many unknowns about where plastic pollution comes from, where it ends up, and the impact on the natural environment. The total amount of plastic found floating at sea (about 0.25 million tonnes) is only a fraction of the amounts of plastic estimated to enter coastal waters (5-12 million tonnes/year). In addition, despite a growing global plastic production there is little evidence that the amount of plastic at sea has increased. Plastics degrade very slowly and stay in the environment for many years, so, where do all the plastics go?

A new project aims to solve the problem of tracking plastic litter at sea. The Scientific Committee on Oceanic Research (SCOR), an international non-governmental non-profit organization has created FLOTSAM (Floating Litter and its Oceanic Transport Analysis and Modelling) with financial assistance from the National Science Foundation. SCOR-FLOTSAM invited Dr Lonneke Goddijn-Murphy as an expert on the remote sensing of marine litter to their working group in Utrecht, the Netherlands. Remote sensing (RS) is the science of obtaining information about objects or areas from a distance using sensors mounted on platforms, ships, airplanes and satellites. RS has the potential to provide long-term, global monitoring data.

Physical oceanographers of SCOR-FLOTSAM model the transport of floating plastic litter using their knowledge of ocean currents and the characteristics of plastic particles that affect their transport such as size, density and shape. Some models agree on particular aspects, e.g., they all predict the Great Pacific Garbage Patch, but for other locations they can diverge in a major way. One of the explanations for the divergences is the lack of actual plastic litter observations. While some beaches have been surveyed and there are research cruises studying plastic at sea, the ocean is relatively understudied in this respect.

RS offers an alternative means of collecting data, and delegates in Utrecht discussed how RS observations could advance the study of marine plastic litter transport. Some RS observations that could help the models, such as ocean current and sea state data, are routinely available but there is not yet much experience with direct observation of marine plastic litter. However, this inexperience was made up for by the passion of the meeting scientists for solving the problem of tracking plastic litter at sea.

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SCOR-FLOTSAM scientists at the second working group meeting at the University of Utrecht, Netherlands



# Great Yellow Bumblebee

It is widely recognised that bumblebees are a keystone species, pollinating numerous wild flowers and cultivated crops across the UK, and their declining numbers in recent years is a serious concern. ERI are currently undertaking survey work for the Bumblebee Conservation Trust (BBCT) in north Sutherland. The aim is to enhance knowledge of the distribution of the Great Yellow Bumblebee (GYB), which has been in decline in the UK over the last century, largely due to changes in habitat availability.



The surveys will build knowledge of where suitable habitat occurs in the region, as well as expanding our records of GYB occurrences. Running between June and September, when this species is active, the focus is on areas where there are previous records, though searches will also be made for other suitable habitat. This is flower rich with red clover, vetches, knapweed, and thistles, with suitable nesting and hibernation sites close by.

If you would like to find out more about the project then have a look at the BBCT website [www.bumblebeeconservation.org/](http://www.bumblebeeconservation.org/).

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Thank you to the Bumblebee Conservation Trust and Nick Owens for the photograph



# Bryden Centre Collaboration

In June, Bryden Centre PhD students and supervisors visited Shetland to explore potential collaborations with Shaun Fraser, Fisheries Scientist at NAFC Marine Centre, thanks to an award from the UHI Energy Innovation Challenge Fund. The focus was to visit Bluemull Sound, situated between the islands of Yell and Unst, to see how this high-energy tidal environment may help answer three main research questions a) how do seabirds use these high-energy environments and is there potential overlap with tidal developments? b) how can seabird monitoring within high-energy environments be improved and standardised (with particular focus upon land-based vantage point surveys)? c) to investigate the fine-scale associations between top predator species and surface hydrodynamics within these high-energy environments.

Nova Innovation has deployed the world's first operational tidal energy array in Bluemull Sound. The trip provided an opportunity to meet Patrick Ross-Smith, Shetland Operational Manager, who kindly gave a guided tour of the onshore facilities at Cullivoe Pier. In addition, the group met Glen Tyler (SNH) and Martha Devine; Martha undertakes vantage point surveys for Nova Innovation's environmental monitoring programme and has an in-depth knowledge of the site. Overall, the trip was a great success and we look forward to future collaborations.

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# Double PhD success

The ERI has recently celebrated two further PhD completions with Yuan Li and Daniel Johnston successfully defending their PhD theses.

Yuan's PhD thesis was entitled "evaluation of biosorbents for the removal of pharmaceuticals and endocrine disrupting compounds from aqueous media", while Daniels PhD thesis was "the ecology of black guillemots in relation to marine renewable developments and marine protected areas".

Both Yuan and Daniel thoroughly impressed their examination panel with the quality of their work and passed with very minor corrections, which was a credit to themselves and their supervisors. Yuan has secured a post at the ERI as analytical chemist, while Daniel is now working for the British Trust for Ornithology in Stirling as a researcher. Many congratulations to both!

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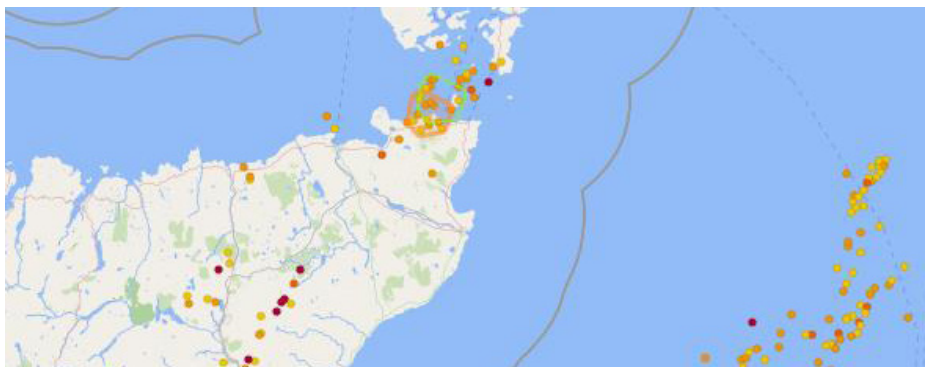
Hydro Nation Scholars Programme

# Lightning Detection Network

There has been increased lightening activity this summer due to warmer than average temperatures. Nowcast ([www.nowcast.de/](http://www.nowcast.de/)) a German lightning specialist have installed a lightning station at the North Highland College (NHC) which forms part of the companies 'LINET' network. The station consists of a field antenna (copper loop, see picture), a GPS sensor and field processor unit. The system measures the electromagnetic waves which lightning strokes emit. The network is capable of measuring

the location, height, strength and polarity of lightning strokes. The first lightning detected near Thurso included a ground strike near the upper river Thurso on 17/06/19 at 4pm with 155000 amps, enough energy to power >50 houses with electricity for a day, or the village of Reay.

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**Pictured left:**  
17/06/19 lightning strikes around Thurso

**Pictured right:**  
Lightning antenna on NHC roof

# Staff Awards

The Highlands and Islands Students Association (HISA) of the University of the Highlands and Islands offer awards to students and staff alike for their roles within the university. This year the ERI's Magnus Davidson and Desislava Todorova along with North Highland college UHI lecturer Jane Clark received highly commended awards for their teaching contribution as voted for by their students. It is great

to see that UHI students appreciate the dedication and expertise of our staff. Well done to all!

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# Out and About with the ERI

'One environment, one health and sustainable societies' was the theme of this year's Society of Environmental Toxicology and Chemistry (SETAC) conference in Helsinki, Finland - one of the largest international events for scientists to meet and discuss environmental contamination, regulation of natural resources and novel research.

At the event the ERI's Dr Szabolcs Pap presented two posters, one on phosphate recovery and re-use (North West Europe Programme:Phos4You) the other on pharmaceutical removal from water using biochar; while Dr Yuan Li gave a platform presentation on how to use low-cost natural waste to remove pharmaceuticals from water. Meanwhile PhD student Lydia Niemi highlighted how pharmaceuticals are emitted by hospitals and not removed by rural wastewater treatment plants. The presentations and posters initiated lively discussion. All abstracts and presentations are publicly available at <https://helsinki.setac.org/>



Meanwhile, ERI researchers Dr Pete Gilbert and Dr Paul Gaffney were invited to present on "the journey and role of organic matter in river systems" at The Highland Environment Forum. This is a meeting of enthusiasts, stakeholders and practitioners who are actively involved in nature conservation activities within the highland region.

Pete discussed how peatlands are stores of soil organic matter (carbon) and consequently why Flow Country rivers are some of the most important in the UK for organic matter transport (e.g. LOCATE project), while Paul presented results from his PhD research on the effects of forest-to-bog restoration on organic matter transport in streams.

Other presentations included work on environmental DNA by the Rivers and Lochs Institute, UHI, the conservation of freshwater eels, hydromorphological restoration on the Spey catchment and the management of invasive (plant) species. Overall, the day was filled with networking, good discussion and plentiful questions from a very enthusiastic audience. Highland Environment Forum events are open to all, and details of future events can be found at <http://www.highlandenvironmentforum.info/>.

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## Peatland restoration climate cooling effects

Research documenting the effect of forest-to-bog restoration on greenhouse gas emissions and aquatic carbon export undertaken in the Flow Country underpinned an April 2019 policy brief. It was published by ClimateXChange, Scotland's centre of expertise connecting climate change research and policy. This research brings together outputs from three interlinked PhD projects involving ERI, and a Scottish Government (RESAS) project from the current Strategic Research Programme (2016-2021).

The key message which emerged was that integrated research demonstrates the general benefits of habitat restoration on the carbon balance of peatlands. It extends existing knowledge of hydrological drivers of greenhouse gases in these systems to the specific case of forestry on deep peats. It shows for the first time that short-term disturbance effects of the restoration

management, associated with net increases of greenhouse gas fluxes, are compensated by long-term carbon sequestration and net climate cooling.

Shortly after the publication of this policy brief the Scottish Government announced an additional £11M to fund peatland restoration management, on top of the £3M that has already been committed to a number of projects, including in the Flow Country. The policy brief also recommends continued monitoring to inform cost-effectiveness of new restoration approaches.

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# Ohio students visit ERI

A visit from Sinclair College (North Highland College's sister college in Ohio) for a science summer school proved a great success. Nine students, accompanied by two staff, arrived in mid-May as Caithness was warmed by some early summer sun. After a welcome meal on the Monday night, they were taken to visit the RSPB Forsinard reserve, a tour of the Castle of Mey followed and the day completed with a barbeque.

The following day started with some water and soil sampling in Thurso and Halkirk, allowing for lab analyses to follow, introducing them to a wide range

of techniques and instruments. A tour of CfEE allowed them to discover more about our REE theme, and some of the remote sensing work carried out, and they spent some time in the microscope lab looking at samples under dissecting microscopes and the scanning electron microscope. We look forward to more exchanges in the future.

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## New faces @ ERI

### Samual Stewart visiting student



Hi, I'm Sam from Aberdeen University, where I am doing an MSc in Analytical Chemistry. I came to ERI in May for a research placement, as the basis for my master's thesis.

My project marries chemistry with archeology looking at the dietary habits of seaweed-eating sheep from the past, which can be inferred from their skeletons. My research will determine the barium/strontium

ratio in vegetation and soils which were consumed by the sheep (using ICP-AES), which should then be reflected in their bones and teeth. I am very excited for the new experiences this internship will give me, including an opportunity to do sampling (on Orkney) and lots of lab experience.

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### Jackie Johnstone placement student



Hello! I am a 3rd year BSc (Hons) Environmental Science student at North Highland College UHI. This summer I am doing a placement with Paul Gaffney conducting laboratory experiments to investigate the effect of peat, conifer brush and needles on surface water chemistry.

During this placement I will learn about peatland fieldwork and analytical techniques for water

chemistry including nutrients, metals and carbon analysis. With learning about hydrochemistry I will have a better understanding of the key elements of water, which are the life force of all aquatic and marine species.

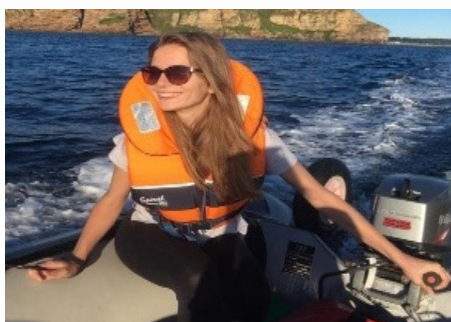
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## Sanja Radovic, Erasmus+ student



Co-funded by the  
Erasmus+ Programme  
of the European Union



Hello, my name is Sanja and I am a student of the Erasmus+ mobility programme, working on my PhD thesis about low-cost hybrid systems for water treatment.

I have finished my bachelors and masters studies at the University of Novi Sad, Serbia, where I was researching the occurrence of pharmaceuticals in drinking water and the best ways to reduce them through low-cost treatment. Now, my aim is to investigate

the possibility of combining low-cost coagulants with low-cost adsorbents in order to reduce levels of pharmaceuticals and metals in water.

I am really grateful for this unique and special opportunity to do my research at ERI, and also to meet people from various countries and improve my language skills.

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## Milyana Lukic, Erasmus+ student



Co-funded by the  
Erasmus+ Programme  
of the European Union



Hi, I am Milyana from the University of Novi Sad in Serbia. I am here for three months as part of the Erasmus+ programme. I am currently completing a masters degree in Environmental Engineering.

At the ERI, I am working with PhD student Lisa Shearer on pharmaceutical removal from water using low cost materials such as

crab and mussel shells and spent grain from whisky distilleries.

I am excited to be in Scotland and am looking forward to getting to know the region and it's people and culture!

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## Marion Yanez visiting student



I joined the ERI for a 5-month placement as part of my Energy and Environmental Engineering studies at the Engineering School INSA (National Institute of Applied Sciences) in Lyon.

At ERI, I am working with Dr Benjamin Williamson and PhD student James Slingsby to develop the detection of seabirds and hydrodynamic features in tidal

sites using an Unmanned Aerial Vehicle (UAV, or drone). We are also exploring the use of a thermal camera.

My placement goal was to encounter a totally different environment from Lyon and its peculiarities.

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## Molly Goodyer visiting student



Hi, I'm Molly and I'm going into my third year of undergraduate Biochemistry at the University of Bristol. This summer I'm completing a placement with Uthman Badmus looking at increasing the bioavailability of Selenium in Seaweed.

Selenium is a micronutrient essential for many processes in humans, including the functioning of proteins involved in removing reactive oxygen species, and in

thyroid hormone metabolism. We are trying to enrich the Seaweed with selenium before performing analysis to see whether it has been converted to an organic form capable of being absorbed by humans. I find the topic really interesting and I'm hoping this experience will give me more direction for life after graduation.

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# Publications

- Andersen, R.**, Taylor, R., Cowie, N.R., Svobodova, D. and **Youngson, A.** Assessing the effects of forest-to-bog restoration in the hyporheic zone at known Atlantic salmon (*Salmo salar*) spawning sites. **2018**. *Mires and Peat*, 23, 1, p. 1–11
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