



## Detecting plastic pollution from space

A new study is exploring whether thermal imaging cameras can be used to help detect marine plastic pollution from space. Researchers at North Highland College UHI's Environmental Research Institute in Thurso, part of the University of the Highlands and Islands, have received over £100,000 from the European Space Agency to conduct the 18-month project.

Dr Lonneke Goddijn-Murphy, a Research Fellow at the Institute, is leading the study. She explains: "While satellites have been used to detect marine plastic before, this has relied on optical measures which require daylight. Using thermal imaging to record plastic pollution

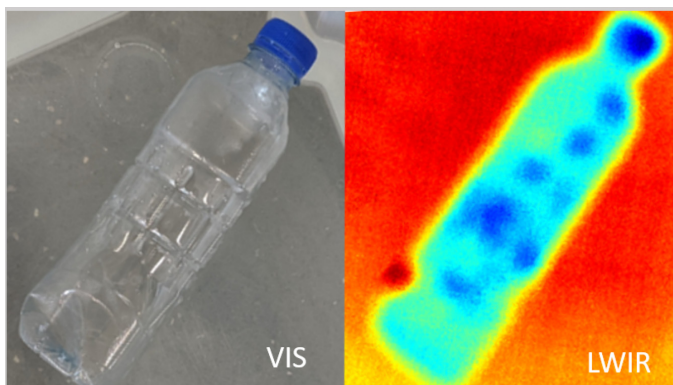
from space is a novel idea which excited the European Space Agency. The concept is based on the idea that plastic can emit different levels of thermal radiation than the water surface."

Dr Goddijn-Murphy has devised a series of experiments to test the technology. She is conducting surveys in the seas around Thurso using drones with thermal imaging cameras. The tests will be run in summer and winter conditions as well as by day and night. A research team at the University of the Aegean in Greece is supporting the study by trialling the technique in a different climate.

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“The test results are looking promising already,” Dr Goddijn-Murphy continues. “If we can show that thermal imaging is an effective way to detect marine plastic pollution, the method could be used alongside other remote measurement techniques. For example, it could be useful in identifying clear plastics which are hard to spot using optical measures. It could be used to help evaluate litter reducing policies and to help locate sources and pathways of marine plastic litter.”

Dr Goddijn-Murphy’s project was funded following a European Space Agency ‘basic activities call’ to prepare for the future and find new ways to detect marine plastic litter. Paolo Corradi, an engineer at the European Space Agency, led the search for ideas. He explains: “We were searching for novel



*(Left ) image of a clear softdrink bottle in the visible spectrum, and (right) the same bottle seen in thermal, long-wave infrared spectrum*

ideas to detect and possibly measure plastic concentrations, improve our understanding of how litter is transported around the world and consequently help to identify plastic sources and sinks. The projects we selected cover different geographical areas, including places like southeast Asia where the problem of marine litter is huge, and, as well as oceans, they touch upon rivers, seas and even land. Every project has the potential to improve our ability to monitor floating plastic from space and thus provide the data necessary to propose appropriate solutions.

“Most of the current research in the optical domain is focusing on the spectral region, from the visible to the short-wave infrared, while we have only started to explore thermal infrared for remote detection of marine plastic. The goal of the project is to assess if thermal remote sensing can provide us with a new technique to monitor plastic pollution in our seas and coasts, and consequently help the European Space Agency in supporting the countermeasures against this global environmental problem.”

For more information contact:  
[lonneke.goddijn-murphy@uhi.ac.uk](mailto:lonneke.goddijn-murphy@uhi.ac.uk)

WITH THE SUPPORT OF



## A new collaboration between UK and Russia

A new programme of research collaboration between universities in the UK and Russia has recently been funded by the British Council. The programme aims to connect the next generation of science leaders by creating partnership and professional development opportunities.

The ERI’s Dr Roxane Andersen is taking part in the programme led by Siberian partner Yugra State University, and will work alongside colleagues from Bristol University in England, Bangor University in Wales, as well as Tyumen University and Nizhnevartovsk State University in Siberia.

The programme will build from successful visits by ERI staff and students to the Siberian Mukhrino field station, managed by Yugra State University, in 2014 and 2019. Over the course of the next three years, the team will develop joint projects involving no less than 24 students to address issues of climate change in peatlands.



For more information contact:  
[roxane.andersen@uhi.ac.uk](mailto:roxane.andersen@uhi.ac.uk)

# Self-sufficient renewable energy for Islands



*The island of Eigeroy, Norway (credit: Frank Emil Moen, Energy Innovation AS)*

Researchers from North Highland College UHI's Environmental Research Institute are excited to be starting work on a new European project that will address issues of energy generation, supply, and greenhouse gas emissions on islands.

ROBINSON brings together 18 partners from 10 countries across Europe including industry, research institutes, universities, and island municipalities, through the 'Decarbonising energy systems of geographical Islands' topic of the Horizon 2020 framework. The project will demonstrate an innovative integrated energy system on the island of Eigeroy in Norway. The system will include both commercially available and novel energy technologies, and also examples of 'industrial symbiosis' where by-products from one industry can be utilised elsewhere in the system such as organic waste, oxygen, and waste heat.

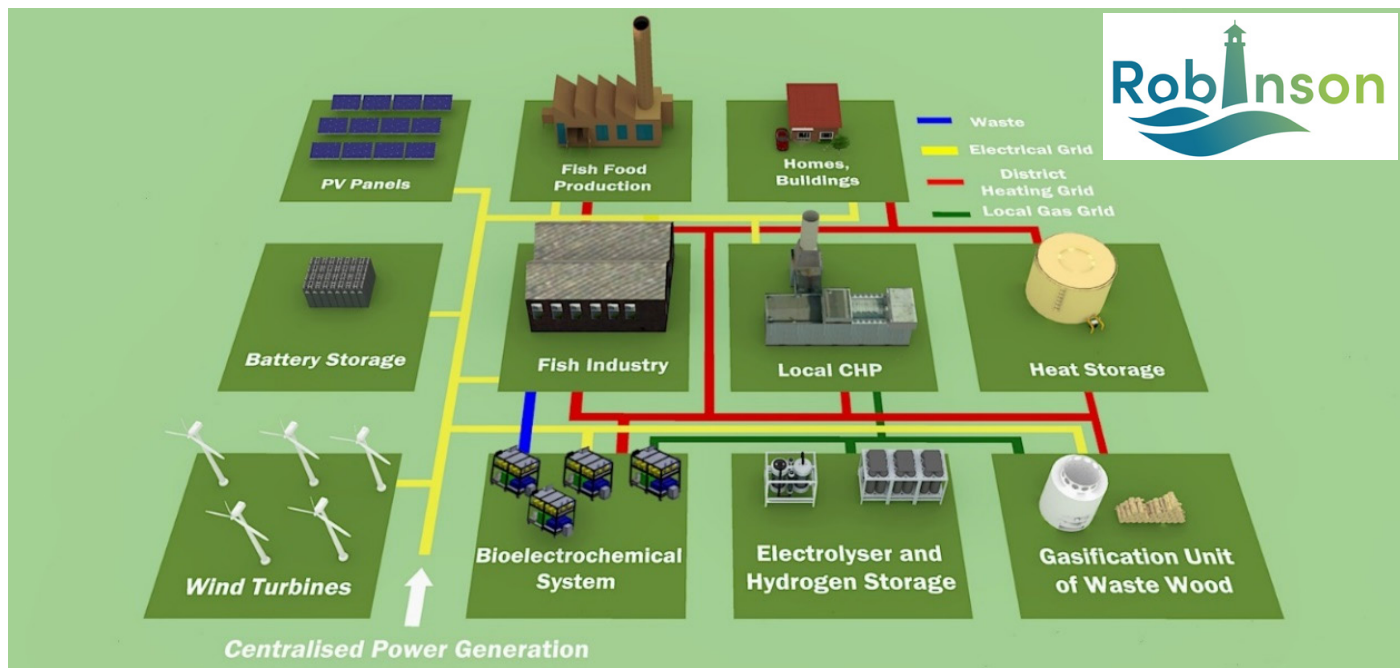
The ambition of ROBINSON is to decrease energy production costs, reduce dependence on mainland power and phase out fossil fuels currently used on Eigeroy within the project timescale. It aims to develop systems that are replicable to help decarbonise island communities worldwide including the Western Isles of Scotland, and the island of Crete. The project will seek to encourage business opportunities for local communities in each setting.

The ERI team will characterise the ecological impacts of the demonstration system on Eigeroy throughout its lifecycle and extend this learning to plans for both the Western Isles and Crete. They will also study the potential socioeconomic benefits of on-island energy generation on the Western Isles, and lead a working group to engage closely with other EU networks and initiatives with parallel aims such as the Clean Energy for EU Islands Initiative and European Islands Facility.

Dr Mark Walker, part of the ERI ROBINSON team, said "Island communities often get a rough deal when it comes to energy cost, even where renewable energy resources such as wind, solar, biomass and others are plentiful. We hope the ROBINSON project can help to resolve this whilst delivering multiple benefits to local communities and avoiding damage to the environment. Through UHI's strong links with Scottish Islands and their communities we hope that this project can have direct beneficial impacts and help Scotland transition to a low carbon future."

For more information contact:  
[mark.walker@uhi.ac.uk](mailto:mark.walker@uhi.ac.uk)  
[benjamin.williamson@uhi.ac.uk](mailto:benjamin.williamson@uhi.ac.uk)

*This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 957752.*



Schematic of the Robinson integrated energy system to be installed on Eigeroy

## Damage and regeneration of vegetation post fire

Jacqueline Johnstone, a final year UHI BSc Environmental Science student carried out her dissertation project looking at the extent of damage and regeneration of peatland vegetation post fire, with the ERIs Roxane Andersen, Chris Marshall and Paula Fernandez. This project focussed on the fire that occurred in May 2019 near Strathy, Sutherland, where twenty-two square miles of blanket bog were affected. The WWF claim that up to 700 000 tonnes of CO<sub>2</sub> was released into the atmosphere as a result of the fire.

Jacqueline's project focused on the heather biomass loss during the fire; regeneration post-fire in high and medium burn areas and how much bare peat was present in each burn severity. She also recorded which plants regrew after the fire.

A key element of the research was to estimate heather biomass in unburnt plots and develop a method to determine the heather biomass that might have been present before the fire. A common approach to do that would have been to harvest unburnt plots, dry the biomass and weigh it, but due to Covid-19 restrictions this was not possible. However, an alternative approach was found, where biomass could be predicted using a non-destructive method. Regression equations were used to work out old, young and total biomass in unburnt plots. Further allometric equations were successfully developed to predict biomass based on remaining stems in burnt plots. For the final steps, Jackie will use the estimated

biomass as well as the vegetation surveys to compare the high and medium burn severity areas. This work feeds into the wider FireBlanket project led by Roxane Andersen.

For more information contact:  
[roxane.andersen@uhi.ac.uk](mailto:roxane.andersen@uhi.ac.uk),  
 17001790@uhi.ac.uk (Jacqueline Johnstone)



# Regional partnership ‘Highly Commended’ by British Medical Journal

An innovative Highland partnership has been ‘highly commended’ for their work at the 2020 British Medical Journal Healthcare Awards Ceremony. The ‘One Health Breakthrough Partnership’ involving NHS Highland, the Environmental Research Institute, Scottish Environmental Protection Agency, Scottish Water, HIE and the James Hutton Institute, received the recognition in the highly contested Environmental Sustainability and Climate Action category.

The OHBP is tackling the environmental impact of healthcare activities including the risk to water pollution from the use of pharmaceuticals (medicines). Even though medicines do much good, their administration, excretion and progression through wastewater systems has led to their detection in rivers and other natural waters. Here they can exert biological effects on aquatic life and contribute to antimicrobial resistance.

The OHBP partners recognised that pharmaceutical pollution is an emerging problem and that

no single agency could address this challenge in isolation. The partners identified joint and multi-disciplinary approaches on upstream interventions and technological solutions to improve water stewardship. This included conducting research, linking with other HEIs, waste surveys, “greening” formularies, developing guidance for prescribers and the public, producing a video on antimicrobial resistance and working with NHS Estates department to achieve the Alliance for Water Stewardship standard.

Sharon Pflieger, Consultant in Pharmaceutical Public Health, NHS Highland said “we are really proud to have had our work highly commended at the BMJ Awards. We are working hard to improve the NHS’s social responsibility around water and the environment, reducing the impact of pharmaceuticals on the environment whilst improving the health of our population. Eventually we hope to spread our work across the world to help heal our planet as well.”

Stuart Gibb, UHI Vice Principal and Director of its Environmental Research Institute said “this recognition underlines the value of partnership working toward addressing complex issues that cut across organisational and disciplinary boundaries. It also has given us confidence that good healthcare and environmental stewardship can be practiced and promoted together”.

Further good news is that the partnership has just secured funding from the Water Industry Division of the Scottish Government to ensure that it can further develop work in seeking to reduce the environmental impact of pharmaceuticals.

For more information contact:  
[stuart.gibb@uhi.ac.uk](mailto:stuart.gibb@uhi.ac.uk)  
[lydia.niemi@uhi.ac.uk](mailto:lydia.niemi@uhi.ac.uk)



*Jeane Freeman, Cabinet Secretary for Health and Sport, with members from NHS and ERI involved in securing the AWS*

## What is the One Health Breakthrough Partnership?

Vision  
**A “non-toxic environment”**

Mission  
 To improve healthcare & the environment, inform legislation, drive research & innovation

### Founding members



# ERI Public Seminar Series

Having been unable to host seminars at our Castle Street building since the start of lockdown in March, we have now made it back onto the seminar scene with our first virtual seminars, and have spread our wings to the international stage! In September, ERI's Dr Chris Marshall spoke about 'Bog Breathing' - the seasonal movement up and down of the bog surface, explaining how this motion can be interpreted to understand the health of the peatland. In October, David Agombar, director of Hookpod Ltd. presented

the development of the Hookpod - an ingenious device designed to reduce seabird bycatch in longline fishing; this type of fishing is estimated to be responsible for the deaths of up to 100,000 albatross a year.

ERI are currently organising public seminars for the coming months. If you would like to receive the link to our future online seminars and are not on our mailing list, please contact: [eriseminars@uhi.ac.uk](mailto:eriseminars@uhi.ac.uk)

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## Study of tidal turbines effects on seabirds

Scotland is committed to increased electricity production via marine renewable energy, including tidal turbines. However, concerns remain regarding the effects of underwater turbines on the environment and marine wildlife, including seabirds. In order to address these concerns, researchers at ERI are investigating seabird use of areas where turbines are operational. One such site is Bluemull Sound in Shetland, where tidal energy developer Nova Innovation has grid-connected turbines which have been running since 2016. Less than 1 km from the turbines lies a roost of European shags, a species noted to be highly vulnerable to negative effects from turbines due to the risk of underwater collision, as well as habitat displacement. In order to study how the shags use the channel, ERI PhD researcher Natalie Isaksson teamed up with Dr.

Shaun Fraser at NAFC Marine Centre, Shetland back in 2019.

In September 2020 with UHI MESE funding, Natalie was able to spend 2 weeks in Shetland working on this project. The visit included shag diet sample analysis, maintenance of trail cameras overlooking the tidal channel, and knowledge exchange with NAFC researchers. The data gathered through this collaboration will help determine the real risk to shags from the tidal turbines at this site. The busy weeks were capped off with a long-anticipated visit to Hermaness, a stunning nature reserve warmly recommended to any visitor to Shetland!

For more information contact: [natalie.isaksson@uhi.ac.uk](mailto:natalie.isaksson@uhi.ac.uk)



# ERI conference round up

Although in-person attendance is not currently feasible, many conferences have been organized as virtual events and thus networking and presentation of ERI's research has continued through a fully digital platform. The ERI team has continued presenting their work to a range of audiences – here are some of the recent highlights:

Dr Elizabeth Masden presented her research on “When speed matters: the importance of flight speed in avian collision risk models” at the Marine Alliance for Science and Technology Scotland (MASTS) Annual Science Meeting 2020. ERI PhD researcher Natalie Isaksson also presented at this meeting and received second prize for her electronic poster entitled “Assessing the effects of tidal stream marine renewable energy on seabirds: A conceptual framework”. This followed from Natalie's earlier success in receiving second prize at the PRIMaRE (The Partnership for Research in Marine Renewable Energy) conference, for her presentation on “Exploring potential environmental effects of tidal stream marine renewables using bio-tracked seabird data”.

The ERI also hosted an online webinar as part of the FireBlanket project, entitled ‘How does land management influence fire resilience and carbon fate in blanket bogs?’. This webinar featured speakers from the NERC funded FireBlanket & FireRecover projects, including the ERI's Dr Roxane Andersen, and was supported by Peatland Action. There were 50 attendees at the webinar who engaged in a lively post-presentation discussion on results and future ideas.

For more information contact:  
[elizabeth.masden@uhi.ac.uk](mailto:elizabeth.masden@uhi.ac.uk),  
[natalie.isaksson@uhi.ac.uk](mailto:natalie.isaksson@uhi.ac.uk),  
[roxane.andersen@uhi.ac.uk](mailto:roxane.andersen@uhi.ac.uk)



## New faces @ ERI

### John King PhD Researcher



Hello, my name is John King and I've just joined the ERI to start a PhD investigating the fluxes of dissolved organic carbon in peat pools and lochans. The project is funded through the SUPER DTP initiative and I'll be working with Peter Gilbert, Roxane Anderson, Amy Pickard (CEH) and Daniel Mayor (NOC).

I recently graduated with a Masters in Sustainable Mountain Development from the UHI's

Centre for Mountain Studies and have also been working as a mountain leader for the last few years. Previously I spent a couple of years living in Helmsdale where I got to introduced to the wonders of the Flow County. I'm looking forward to moving back up to the north and getting stuck into the project!

For more information contact:  
[john.king@uhi.ac.uk](mailto:john.king@uhi.ac.uk)

### Ilgaz Çakın PhD Researcher



Hello, my name is Ilgaz Çakın and I have recently started a PhD within the 'Environmental Contamination and Ecological Health' research group at ERI as part of Scotland's Hydro Nation Scholars Programme. Originally from Turkey, I completed my master's degree at Newcastle University in Industrial Biotechnology. Over the next four years, I will be looking at reedbed based water treatment from an entirely new perspective, helping whisky distilleries optimise their systems. I will do this by

examining the biotic communities in reedbeds using “metagenomics” alongside considering water quality/geochemistry, reedbed environment (climate, altitude, exposure), and plants used. In this way, we will define a diagnostically useful method to assess reedbed performance for use both within and outside the Scotch whisky sector.

For more information contact:  
[ilgaz.cakin@uhi.ac.uk](mailto:ilgaz.cakin@uhi.ac.uk)

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## New faces @ ERI

### Nicholas Petzinna PhD Researcher



Hi everyone. My name is Nicholas Petzinna and I joined ERI in the beginning of October 2020 to begin my PhD. Before coming to ERI I studied at the Scottish Association for Marine Science (SAMS) and graduated with a Bachelor in Oceanography and Robotics. My interest is to uncover and describe the behavioural reaction of animals towards human made structures in the ocean. My PhD is funded by the SUPER DTP initiative and is about

using multibeam sonar to record and explain possible changes of animal behaviour around marine renewables aiding future installation projects and policy makers.

I am a big fan of the outdoors and I am looking forward to exploring the northern tip of Scotland.

For more information contact: [nicholas.petzinna@uhi.ac.uk](mailto:nicholas.petzinna@uhi.ac.uk)

### Manuel-Thomas Valdivia PhD researcher



Hi! My name is Manuel-Thomas Valdivia and I am a PhD student in the Division for Biomedical Sciences, Inverness.

I am investigating novel applied nanomaterial and photonic solutions to tackle pharmaceutical pollution at key entry points within the water cycle, e.g., at hospitals. My research will bring together several stakeholders and involve both the Environmental Research Institute (with Mark Taggart and Szabolcs Pap as supervisors)

and the Division for Biomedical Sciences.

I am optimistic that throughout my research I will be able to show proof of principle or even design an applied solution for pharmaceutical removal and contribute with my work to protect the environment and ultimately human health.

For more information contact: [manuelthomas.valdivia@uhi.ac.uk](mailto:manuelthomas.valdivia@uhi.ac.uk)

### Juulia Meller Masters by research



Hi, my name is Juulia Meller and I started my masters by research at the University of the Highlands and Islands at the start of October. I will be mainly based in Inverness but will be carrying out part of my laboratory work at the ERI, under the supervision of Mark Taggart.

I will be doing work as part of the Transport Scotland A9 academy, looking at the release of saltwater run-off from the application of

road salts and its impact on water quality and macroinvertebrate communities. I will be utilising eDNA metabarcoding for the macroinvertebrate community assessment. I am excited to be back at the UHI and looking forward to continuing my studies.

For more information contact: [anna.juulia.meller.ic@uhi.ac.uk](mailto:anna.juulia.meller.ic@uhi.ac.uk)

## Publications

Benjamins, S., Masden, E., & Collu, M. (2020). Integrating wind turbines and fish farms: An evaluation of potential risks to marine and coastal bird species. *Journal of Marine Science and Engineering*, 8(6), [jmse-805737]. <https://doi.org/10.3390/jmse8060414>

Bienida, A., Daté, V., Andersen, R., Nwaishi, F., Price, J., Mahmood, M. S., & Strack, M. (2020). Methane emissions from fens in Alberta's boreal region: reference data for functional evaluation of restoration outcomes. *Wetlands Ecology and Management*, 28, 559-575. <https://doi.org/10.1007/s11273-020-09715-2>

Bond, A. L., & Jones, I. L. (2020). Relationships between mercury burden, sex, and sexually selected feather ornaments in crested auklet (*Aethia cristatella*). *Environmental Science and Pollution Research*, 1-6. <https://doi.org/10.1007/s11356-020-08219-z>

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**Braidwood, D. W., Taggart, M. A.,** Smith, M., Morgan, G., & **Andersen, R.** (2020). Small-scale field trials identify optimal habitat restoration options on enclosed nuclear sites. *Ecological Engineering*, 156, 1-14. [105976]. <https://doi.org/10.1016/j.ecoleng.2020.105976>

**Gaffney, P.P.J.,** Hancock, M.H., **Taggart, M.A., Andersen, R.** (2020) Restoration of afforested peatland: immediate effects on aquatic carbon loss. *Science of the Total Environment*, 742, 140594 <https://doi.org/10.1016/j.scitotenv.2020.140594>

Hays, G.C., Koldeway, H.J., **Williamson, B.J.,** & Others. (2020). A review of a decade of lessons from one of the world's largest MPAs: conservation gains and key challenges. *Marine Biology*, 167, [159]. <https://doi.org/10.1007/s00227-020-03776-w>

Herrero-villar, M., Velarde, R., Camarero, P. R., **Taggart, M. A.,** Bandeira, V., Fonseca, C., Marco, I., & Mateo, R. (2020). NSAIDs detected in Iberian avian scavengers and carrion after diclofenac registration for veterinary use in Spain. *Environmental Pollution*, 266, 115157. <https://doi.org/10.1016/j.envpol.2020.115157>

**Li, Y., Taggart, M. A.,** Mckenzie, C., Zhang, Z., Lu, Y., **Pap, S., & Gibb, S. W.** (2021). A SPE-HPLC-MS/MS method for the simultaneous determination of prioritised pharmaceuticals and EDCs with high environmental risk potential in freshwater. *Journal of Environmental Sciences*, 100, 18-27. <https://doi.org/10.1016/j.jes.2020.07.013>

**Niemi, N., Taggart, M., Boyd, K.,** Zhang, Z., **Gaffney, P.P.J.,** Pflieger, S., **Gibb, S.** (2020) Assessing hospital impact on pharmaceutical levels in a rural 'source-to-sink' water system. *Science of the Total Environment*, 737, 139618. <https://doi.org/10.1016/j.scitotenv.2020.139618>

**Isaksson, N., Masden, E.A., Williamson, B.J., Costagliola-Ray, M.M., Slingsby, J.,** Houghton, J.D.R., Wilson, J., (2020). Assessing the effects of tidal stream marine renewable energy on seabirds: A conceptual framework. *Marine Pollution Bulletin* 157. <https://doi.org/10.1016/j.marpolbul.2020.111314>

**Pap, S., Taggart, M. A., Shearer, L., Li, Y.,** Radovic, S., & Turk Sekulic, M. (2021). Removal behaviour of NSAIDs from wastewater using a P-functionalised microporous carbon. *Chemosphere*, 264(Part 1), [128439]. <https://doi.org/10.1016/j.chemosphere.2020.128439>

**Pap, S., Kirk, C., Bremner, B.,** Turk Sekulic, M., Shearer, L., Gibb, S. W., & Taggart, M. A. (2020). Reply to comments on "Low-cost chitosan-calcite adsorbent development for potential phosphate removal and recovery from wastewater effluent" by Pap et al. [Water research 173 (2020) 115573]. *Water Research*, 179, [115828]. <https://doi.org/10.1016/j.watres.2020.115828>

**Taggart, M. A.,** Shore, R. F., Pain, D. J., Peniche, G., Martinez-haro, M., Mateo, R., Homann, J., Raab, A., Feldmann, J., Lawlor, A. J., Potter, E. D., Walker, L. A., **Braidwood, D. W.,** French, A. S., Parry-jones, J., Swift, J. A., & Green, R. E. (2020). Concentration and origin of lead (Pb) in liver and bone of Eurasian buzzards (*Buteo buteo*) in the United Kingdom. *Environmental Pollution*, 267, [115629]. <https://doi.org/10.1016/j.envpol.2020.115629>

Watson, A. J., Schuster, U., Shutler, J. D., Holding, T., Ashton, I. G. C., Landschützer, P., Woolf, D. K., & **Goddijn-Murphy, L.** (2020). Revised estimates of ocean-atmosphere CO2 flux are consistent with ocean carbon inventory. *Nature Communications*, 11(1), [4422]. <https://doi.org/10.1038/s41467-020-18203-3>

## Dedication

We dedicate this edition of ERI elements to the memory of our friend and colleague Dr Colin Mckenzie, who sadly passed away earlier this year. Colin worked at the ERI for several years, generously assisting on many projects. We are very grateful for Colin's contribution and for the time, effort and care that he gave to us all.

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Castle Street,  
Thurso,  
Caithness, KW14 7JD, Scotland  
Tel: +44 (0) 1847 889589  
Fax: +44 (0) 1847 890014  
Email: [eri-info@thurso.uhi.ac.uk](mailto:eri-info@thurso.uhi.ac.uk)

environmental research from a new perspective

Centre for Energy & Environment,  
North Highland College UHI, Thurso, Caithness,  
KW14 7EE, Scotland  
Tel: +44 (0) 1847 889000  
Fax: +44 (0) 1847 889001  
Web: [www.eri.ac.uk](http://www.eri.ac.uk)