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JNCC

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Contents

..... 1

Welcome from our Chief Executive 4
News in brief 5
JNCC and Marine Scotland Science Partnership update: Prawn TV and Cheesy-Bottom Sponges 5
New reports highlight recent work in the Turks and Caicos Islands 5
CITES stakeholder engagement success 6
Tackling Stony Coral Tissue Loss Disease 6
JNCC at COP26 8
So, what did JNCC achieve at COP26 and why was it so important for us? 8
UK Biodiversity Indicators 2021 10
UK reflections on COP26 11
An ocean of solutions to tackle the biodiversity and climate crises 13
Meet the Expert 14
What prompted your interest in the natural environment? 14
How did you get interested in climate change? 14
What does your role involve? 14
What are the biggest challenges you face in your current role? 15
What has been your greatest achievement at JNCC? 15
Using EO to improve disaster resilience in the UK Overseas Territories 16
The role of EO in disaster risk reduction and management (h3) 16
Damage assessment and monitoring 16
Risk Modelling 16
Natural Capital and Opportunity Mapping 16
Looking to the future 17
Ocean acidification and the seabed – detecting early warning signals 18
Using cetacean stranding data to understand the impacts of climate change 20
Monitoring focus 21
Assessing the exposure of UK habitats to climate change 21

SPACE4CLIMATE 23
Landscape Modelling app in the spotlight at COP26 23
Reducing climate risks in supply chains – modelling ecosystem services in agricultural production landscapes 25
Conservation Conversation 26
Species that inspired you as a child? 26
What concerns you most about the natural world? 26
What do you do away from the office? 26
Where is your favourite place? 26
Place you'd most like to visit? 26
If you could dine with any four guests who would they be? 26
Who is your human hero in the natural world? 27
What would you like to achieve in your time at JNCC? 27
If you could choose another job or career, what would it be? 27

Welcome from our Chief Executive

Happy New Year and welcome to the winter edition of *Nature News*, bringing you updates and information on our UK and international work. Looking back at 'Super 2021', a key year for nature, we reflect on our experiences of COP26, working alongside our UK and international partners to build awareness of the need to conserve nature and of nature-based solutions for climate change.

COP26 really showcased how JNCC provides scientific expertise for nature conservation and recovery across the UK and internationally. It was a pleasure to see our experts working alongside our international partners and colleagues from the four UK country nature conservation bodies across numerous of events. This partnership approach is at the heart of JNCC's work and demonstrates how strong we are together.

Ensuring that nature is at the heart of all our thinking is the challenge. As we move through this 'Super Decade' and particularly as we approach the Convention for Biological Diversity, COP15, in China, scheduled for April. Here, new biodiversity targets for the next decade are due to be agreed and will shape our future work.

I was really proud to see that our Senior CITES Policy Adviser Alison Prince was recognised at the UK Wildlife Crime Conference in December. Alison received a lifetime achievement award for her efforts fighting illegal wildlife trade – all done behind the scenes providing analysis, training, expert witness statements and testimony. A well-deserved award.

I hope you enjoy reading about our work, our people and our partnerships.

Dr Gemma Harper, OBE,

Chief Executive, JNCC

News in brief

JNCC and Marine Scotland Science Partnership update: Prawn TV and Cheesy-Bottom Sponges

Throughout 2021, JNCC continued to work closely with Marine Scotland Science (MSS) colleagues to deliver offshore Marine Protected Area (MPA) monitoring.

In September we published a report detailing analysis we carried out using Underwater Television (UWTV) video footage collected by MSS in 2019 and 2020 to assess stocks of the Dublin Bay prawn (*Nephrops norvegicus*) in the northern North Sea. Our reanalysis of the data has allowed us to test whether this footage can be repurposed for monitoring of Central Fladen MPA, which would add value to the stock assessment footage collected by MSS and augment our monitoring of Central Fladen MPA. In November, Joey O'Connor presented the project to Nephrops survey experts at the online annual meeting of the ICES Working Group on Nephrops Surveys.

In September, we embarked on our yearly offshore MPA monitoring survey with MSS colleagues on their *RV Scotia*. This time we focussed our efforts on the deep-sea sponges of the Faroe–Shetland Sponge Belt MPA. The sponges form large aggregations nicknamed 'cheesy-bottoms' by Faroese fishermen due to their appearance. We sampled 187 stations with the drop frame camera, taking over 15,000 photographs of the seabed, and completed 10 camera chariot transects. We also collected water samples and used a probe to collect information about how salinity, temperature, and other properties of the water change with depth. The Faroe-Shetland Channel is a key gateway through the Greenland-Scotland Ridge, an underwater barrier between the Atlantic and Arctic ocean basins. The ocean circulation of the region is critical in the global overturning circulation, where warm, more salty water at the surface flows northwards from the equator, bringing heat and salt to the Arctic region, and at depth, a return flow brings relatively cold and fresh water back into the deep basins of the Atlantic Ocean. Measurements of temperature and salinity have been ongoing since the late 19th century in the Faroe-Shetland Channel and sampling from our survey will contribute to these invaluable datasets and MSS's oceanographic work.

Joey O'Connor

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New reports highlight recent work in the Turks and Caicos Islands

Two new JNCC reports have recently been published as part of our Darwin Plus funded project in the Turks and Caicos Islands – *Technical assistance programme for effective coastal-marine management in the TCI* (DPLUS119). The aim of the project, which runs until 2023, is to build the evidence base to support assessment and management programmes in the coastal and marine environment of the Islands.

JNCC Report 692 – *Developing an Asset Register for the Turks and Caicos Coastal-Marine Area* – investigates natural capital approaches through a study of the shallow marine coastal areas of the islands, to create a Natural Capital Asset Register for the

TCI for the first time. JNCC Report 693 – *Marine indicators to monitor changes in marine-coastal natural capital: Review of indicators from the literature* – consists of a preliminary literature review, providing an overview of marine ecological indicators and types of data required.

CITES stakeholder engagement success

CITES, the Convention on International Trade in Endangered Species of wild fauna and flora, is an international agreement between countries, aimed at ensuring that international trade in wild species does not endanger their survival. JNCC was appointed by the Secretary of State as the UK CITES Scientific Authority for fauna in 1991 and we celebrated our 30th anniversary of this appointment in 2021.

Throughout the autumn, CITES advisers from our International Advice Team provided support to Defra to undertake a programme of stakeholder engagement. Our experts joined Defra colleagues and representatives from the Animal and Plant Health Agency (APHA) at exhibitions for CITES customers and traders. APHA and Defra act as the UK CITES Management Authority, responsible for the licensing and policy roles respectively. Having a Defra-led stand at these exhibitions enabled traders of CITES-listed specimens to engage with the CITES Authorities, and ask questions about the licensing process since leaving the EU and any wider trade issues.

In October, Becky Austin attended the Aqua Show in Telford, with Sarah Hearn and Luis Oliveira representing JNCC at the International Herpetological Show in November. Both proved a success and enabled us to meet and support traders, raise our profile and help foster a greater understanding of our role in the process of obtaining CITES permits. The last event of 2021 saw Rosina Harris and I attend December's Parrot Society Show.

Following the exhibitions, we have identified several ways we (as part of the Defra team) can increase our impact and enhance the success of future engagement events. We are collaborating closely with Defra, and the JNCC Comms Team, to produce some CITES information leaflets and guidance specifically for distribution at future events. It's always good to have the opportunity to get out of the office and in contact with live animals, including some of the more slippery customers!

Nichola Burnett

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Tackling Stony Coral Tissue Loss Disease

This year we will continue our work with a number of UK Overseas Territories to tackle Stony Coral Tissue Loss Disease (SCTLD) (see also Nature News Summer 2021).

In November 2021, SCTLD training workshops were held in Montserrat and Anguilla, focussing on coral disease ecology and identification, and management and treatment methods. The workshops took place in collaboration with Montserrat Ministry of Agriculture, Lands, Housing and Environment; Anguilla Department of

Natural Resources; Island Solutions Montserrat; JNCC; and JNCC business associate and coral disease expert, Dr Greta Aeby. Beyond direct disease treatment, a reef free from other pressures and environmental stressors will be more likely to naturally recover from disease outbreaks. Coral reef management and healthy coral reef ecosystems play a key role in both the environmental and economic resilience of island states, by providing protection from storm surge, supporting food security and underpinning key economic sectors such as tourism and fisheries.

JNCC at COP26

COP26 of the United Nations Framework Convention on Climate Change was a really important event, and the fact that it was held in the UK made it even more significant for us.

The Conference was held over two weeks and included formal intergovernmental negotiations, with numerous side-events, workshops, seminars, receptions, and presentations. The negotiations resulted in several hugely significant global agreements, notably to limit the destruction of forests, limit methane emissions and commit to enhanced support for developing countries to help them mitigate and adapt to climate change. The mention of the use of coal in a global climate change Agreement was important, and although many delegations wanted a tighter form of wording to phase out the use of coal, having it mentioned in the outcome from the COP is a significant step. Perhaps of key importance, however, was the fact that the various outcomes from the COP keep the possibility of achieving a global target of limiting climate change to 1.5 degrees centigrade alive. This is critical if the worst effects of climate change are to be avoided.

It was really encouraging to see that nature-based solutions were seen as part of the solution to climate change. JNCC and the country nature conservation bodies published a key report some weeks before the COP, outlining how nature can help us mitigate and adapt to climate change whilst enhancing the conservation of nature (*Nature Positive 2030*), and many of the themes in that report were discussed at the COP. This is significant as the twin emergencies of climate change and nature loss can be best tackled together. Indeed, it is unlikely that key targets to reduce the extent and impact of climate change can be achieved without effectively restoring global ecosystems on land and in the marine environment.

So, what did JNCC achieve at COP26 and why was it so important for us?

Firstly, it was excellent to see JNCC and the country nature conservation bodies along with various government departments working so well together. JNCC made important inputs, focussing on the conservation of the marine environment and on Marine Protected Areas in particular. We reported on partnerships and other initiatives we have with France, the USA, Costa Rica, and Chile, amongst others. Importantly the COP gave us the opportunity to discuss our work with senior delegates from these and other countries, including Ministers, Senators and Ambassadors. It was important to hear their views on what had been done and what could be done together in future.

The Conference was also an opportunity to meet UK and Scottish Ministers, and with Ministers from the UK Overseas Territories, who were very complimentary about our work. It was extremely valuable to hear their perspective on climate change and on priorities for the future. In passing, many small island countries now prefer to be called “large ocean states”, given that whilst their land-surface area may be small they have large areas of ocean under their jurisdiction. There is much that we now need to follow up with our colleagues in the Overseas Territories and in other areas in future.

Overall, the Conference allowed us to show what we are doing across the UK, and globally, and to raise our profile more widely. This is important, as we know how valuable our work is, but we need to tell others who are involved in similar work, or who have an interest in it, what we are doing and why. In all the conversations I had, what struck me was the underpinning need for scientifically based advice, data, and information, to inform discussions and to underpin policy and action for the future. This of course is where we come in, and with the increasing awareness of the need to conserve nature and of nature-based solutions for climate change, we can have a key role in shaping how this is delivered in future. Indeed, with the forthcoming Convention on Biological Diversity COP in China scheduled for April 2022, there is a timely opportunity to build on JNCC's reputation and to help inform the global debate in developing nature conservation targets for the next decade and beyond. We now need to work with colleagues in government to maximise the value of our input and to help provide the essential scientific underpinning to these forthcoming negotiations.

Finally, I do want to thank everyone who was involved in making the JNCC input to the Conference so successful. Whilst it was a real team effort, Sarah Harrison, Gwawr Jones, Alison Lee and Beth Flavell and our great Comms Team, along with colleagues from the country nature conservation bodies, really do deserve special mention for dealing with complex logistics, accreditation, travel, and a multitude of other last-minute issues to deliver such a smooth and professional series of events.

Professor Colin Galbraith, Chair, JNCC

UK Biodiversity Indicators 2021

Biodiversity is the variety of all life on Earth: genes, species and ecosystems. It includes all species of animals and plants, and the natural systems that support them. Biodiversity matters because it supports the vital benefits humans get from the natural environment. It contributes to the economy, health and well-being, and it enriches our lives.

The UK Biodiversity Indicators were first published in 2007 and the 14th update was available last October.

Indicators are useful tools for summarising and communicating broad trends. The UK Biodiversity Indicators are dependent on a wide variety of data, provided by government, research bodies, and the voluntary sector – in total nearly 100 organisations are involved.

The UK Biodiversity Indicators set comprises 24 indicators and 52 measures. In the 2021 update, 22 of the 42 measures assessed over the long term show an improvement, compared to 15 of the 39 measures that are assessed over the short term. Fourteen measures show a decline in the long term, and ten a decline in the short term. Measures that improved or deteriorated in the long term have not necessarily continued to improve or deteriorate respectively in the short term.

The UK Biodiversity Indicators were produced to provide a measure for reporting on international goals and targets. The indicators have been published almost annually since 2007. During that time have been refined and revised to ensure they continue to be based on the most robust and reliable available date, and that they remain relevant to changes to the international goals and drivers.

James Williams

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UK reflections on COP26

As we pulled into Glasgow's station, the chatter of languages from around the world came to a crescendo of excited anticipation for the day ahead. The train was filled with people eager to get to COP26, where discussion, events and negotiations would be taking place over the course of two weeks in order for Member States to reach agreement on required actions to tackle climate change.

With the UK hosting COP26 in Glasgow, experts from JNCC and the four UK country nature conservation bodies were involved in a variety of events. Although 6 November was designated as 'Nature Day', biodiversity themes were presented and discussed throughout the COP. Several JNCC staff were co-leading, presenting or moderating events. These provided opportunities to share JNCC's knowledge and experience in relation to nature-based solutions (NbS), assessing habitat condition and local change, and in supporting climate change mitigation and adaptation through Marine Protected Areas.

Colin Galbraith, JNCC's Chair reflected: "COP26 has been a really important event where the twin emergencies of climate change and nature loss have been discussed, and importantly the need for 'nature-based solutions' recognised as part of a wider suite of actions to reduce climate change. It was great to see that JNCC worked seamlessly with the country agencies to make important inputs to numerous events over the two weeks of the COP."

Mike Morecroft, Natural England's Principal Specialist for Climate Change, reflected: "I was fortunate to attend a large part of the COP as part of the Intergovernmental Panel on Climate Change delegation and also contributed to an event on NbS in the UK Pavilion. It was encouraging to see the links between climate change and ecosystems being widely acknowledged: the challenge now is to ensure this leads to increased protection and restoration of natural systems. As conservationists we need to step up and incorporate climate change adaptation and mitigation into all that we do. COP made progress in some key areas, but there is still a long way to go. The challenge now is to implement the actions that have been promised and work to increase commitments on emission reductions and support for the most vulnerable."

NatureScot delivered three exhibits in the Blue Zone: a NbS stand outside the plenary area, a NbS World Leaders garden and biome centrepieces for negotiating rooms. Highlighting NbS at these prime locations attracted a great deal of interest amongst attendees. Debbie Bassett, NatureScot's Climate Change and COP Coordinator, reflected: "We exceeded our expectations for COP26 with engagement in panel discussions, high level meetings and wide-ranging media coverage. We have seen significant increase in traffic to our website and social media platforms reflecting a marked interest in how nature can help address climate change both domestically and internationally. This was a truly exceptional meeting and will help frame our input to the biodiversity COP15 in spring next year."

Natural Resources Wales' involvement in COP26 centred around several events delivered in partnership. Clive Walmsley, NRW's Lead Specialist Advisor for Climate Change & Decarbonisation, highlighted the UK Inter-Agency Climate Change Group's showcase of NbS case studies. Located in the Green Zone this stand illustrated approaches to delivering NbS at scale across an array of habitats. In collaboration with Welsh Government, NRW also hosted an event in the Multilevel

Action Pavilion demonstrating the importance of sub-national governments in acting on climate change. This event also promoted key messages from the *Nature Positive 2030* report, produced jointly by the UK's statutory nature conservation bodies. Clive commented: "It was positive to see such a strong focus on nature being part of the solution to climate change, but especially the agreement among so many countries to halt deforestation by 2030."

The Northern Ireland Environment Agency welcomed the recognition that COP26 placed on the importance of working with nature to provide benefits and solutions to help tackle climate change and biodiversity loss. Mark Hammond, Head of Natural Environment Operations, stated: "Our staff were enthused by the sessions promoting NbS and the recovery of our natural habitats. We were also encouraged by the positive commitments made by world leaders to end deforestation and support sustainable land use, and to the conservation, protection, sustainable management and restoration of forests and other terrestrial ecosystems."

As I returned home to Edinburgh by train, I shared conversation with three attendees from United Arab Emirates who excitedly photographed the hills, woodlands and fields that we passed by throughout the journey. Seeing Scotland's landscapes afresh through their eyes reminded me of the huge variety of ecosystems around the globe and yet the climate crisis faces them all. Mark summed up the shared sense of purpose at COP26: "There is now a responsibility on us all to meet these climate and biodiversity challenges and to take urgent action to deliver a low-carbon high-nature future. We look forward to working with all stakeholders to deliver this vision for the benefit of our society and biodiversity." And as Mike said: "There is no time to lose!"

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With contributions from:

Clive Walmsley, Lead Specialist Advisor: Climate Change & Decarbonisation, Natural Resources Wales

Colin Galbraith, Chair, JNCC

Debbie Bassett, Climate Change and CoP Coordinator, NatureScot

Mark Hammond, Head of Natural Environment Operations, Northern Ireland Environment Agency

Mike Morecroft, Principal Specialist – Climate Change, Natural England

An ocean of solutions to tackle the biodiversity and climate crises

The International Partnership on MPAs, Biodiversity and Climate Change – an alliance of government agencies and organsiations from across the globe – is working together to progress the evidence base about the role of Marine Protected Areas (MPAs) and biodiversity in tackling climate change.

The Partnership's vision is for global decision-makers to implement MPA networks as nature-based solutions for biodiversity conservation and climate change mitigation, adaptation and resilience.

The Partnership was in the spotlight at COP26, with two high-profile events to raise awareness and promote our collective ambition, featuring high-profile speakers, including Ministers, from around the world. Recordings of both events are available on the International Partnership website www.mpabioclimate.org.

The seeds of the International Partnership were sown at COP25 in 2019, where our marine experts worked with colleagues from the Ministry of Environment in Chile to organise two events that explored the role of MPAs in tackling climate change. With a range of answers provided, the event contributors committed to working together to address common evidence gaps and to exchange knowledge and expertise. Framed around a shared vision and common objectives, the International Partnership on MPAs, Biodiversity and Climate Change was formally launched in 2021.

As co-leads of the Partnership, JNCC has been at the forefront of building momentum for the Partnership, helping to shape its development and leading on the delivery of priority actions. We are working closely with the founding membership – Chile's Ministry of the Environment, Costa Rica's Ministry of Environment and Energy, the French Biodiversity Agency and the United States' NOAA Office of National Marine Sanctuaries – with scientific support from representatives of the International Union for Conservation of Nature and the Marine Alliance for Science and Technology for Scotland. Discussions with additional countries and organisations who have expressed interest in joining the Partnership are underway and we look forward to welcoming new partners to share knowledge, experience and evidence in the future.

Alongside the Steering Committee, two technical groups have been created to bring scientific expertise from partner countries:

Technical group 1 focuses on building the evidence base around the role of MPAs as nature-based Solutions (NbS) for climate change and biodiversity and communicating this evidence internationally.

Technical group 2 looks at building the capacity of MPA managers to understand and implement climate change planning in the adaptive management of MPAs.

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Meet the Expert

In this issue we meet Cristina Vina-Herbon who jointly leads JNCC's Marine Ecosystems team. Cristina plays a key role in the marine indicators and climate change work programme.

What prompted your interest in the natural environment?

Since early childhood I have always been captivated by the ocean. I have an early memory of walking around the fishing ports with family, watching the catch of the day being loaded into boxes as ice was being poured all over the fish, an image I found inherently compelling. I became interested in anything I could find when swimming or strolling on the beach. Whenever I could, I collected shells, amassing boxes, literally filling my room, grouped by colour and shape. I also collected algae, pressed in paper, as you do with flowers. Unfortunately, being easily distracted, I once forgot that I left some algae samples in my bucket in my room, which unfortunately was left undiscovered for a number of days. As you can imagine the bucket started to reek as the algae decomposed, permeating the house. After a family search and much anguish – everyone thought it was a dead mouse – the bucket was found and disposed of. Needless to say, after that I was encouraged to collect only shells! As my father said '*algae are whales' and fishes' food, if I keep picking them up, they will go hungry ….* ', I found this a good reason and from then I left algae well alone.

How did you get interested in climate change?

After finishing my PhD, I was appointed to set up a marine lab in Shetland, to monitor and assess the environmental impact of fish farming and other activities. People there are very friendly, and although the population is small, there is a constant flow of visiting scientists from across the world. One reason for this activity is the geographic position of the Shetland islands, as they are a perfect location to observe and measure natural variations of the oceanic currents, ecosystems and biodiversity. We measured species composition associated with pelagic habitats, particularly the increase in occurrence of some taxa, such as siphonophores, colonial organisms indicative of climatic change. Later, I started working for the Environment Agency in England. There I was involved with proposals for managed realignment and the restoration of saltmarsh habitats. This aims at working with nature to mitigate the effects of increased wave and sea-level rise, using natural defences to absorb and dissipate the effects of flooding, instead of hard fabricated structures. This gave me an understanding of the importance of including societal and economic factors alongside ecological and environmental analysis to promote long term sustainable, nature-based solutions.

What does your role involve?

Currently, I'm the joint head of the Marine Ecosystems Team, focussing on expanding R&D and scientific capabilities of the team. I'm responsible for the strategic direction and the overall quality of scientific products produced by the team to measure the effects of human activities and natural factors on benthic ecosystems. There is clear evidence that the ocean is under pressure from the increased atmospheric carbon dioxide which is affecting trophic flows, biodiversity and ocean acidification. My work in the past two years has been to evaluate and

improve the analytical tools and models we have developed, exploring the use of available data to measure climate change drivers, and possible trends.

What are the biggest challenges you face in your current role?

Certainly, one of the biggest problems we are facing at present is to measure accurately the combined effects of climate change effects with anthropogenic pressures and provide solutions for mitigation and adaptation for both. For example, subtidal soft sediments are natural stores of carbon (blue carbon). Disturbance of those sediments by human activities can result in the remineralisation of the organic carbon stored within sediments, reducing the capacity of habitats to store and sequester carbon, potentially leading to an increase in ocean acidification. We are looking at how we can best measure the consequences of this disturbance of biodiversity and carbon storage and flows from offshore soft sediments, exploring options for mitigation which could be used to minimise the effects of human impacts.

What has been your greatest achievement at JNCC?

As a team leader, my team is what I'm proudest of. In the past few years, our team has been increasing our scientific capability in data analysis and modelling to improve the methods and type of results and evidence products we are able to produce. We have highly positive and enthusiastic staff members who are very committed and passionate about the work we are delivering.

Aside from my team management, one of the scientific work areas I'm most pleased about is the ongoing collaboration between the UK and North East Atlantic European experts on the assessments of marine ecosystems, evaluating changes driven by human activities and environmental data, recently also including climatic data. We jointly produce evidence and advice for conservation and recovery of seabed habitats and ecosystems in the North East Atlantic waters. As an expert, I put a large amount of effort into building and maintaining trust. This takes time, but is critical in order to maintain ongoing collaboration and engagement between scientists, policy, and decision-makers for the protection of the marine environment.

Using EO to improve disaster resilience in the UK Overseas Territories

Hurricanes and tropical storms pose a major threat to Small Island Developing States (SIDS), including many of the UK Overseas Territories. Tropical storms are likely to increase in frequency and intensity in the coming years due to climate change, increasing the severity of the threats to communities, economies and the environment. These risks were a prominent topic at COP26, with a number of high-profile events focussing specifically on how to improve disaster resilience in SIDS. JNCC was proud to support the UK Overseas Territories in their participation in these events, helping to amplify their voices and spotlight the many creative solutions being developed on these islands.

JNCC has been working with a number of the UK Overseas Territories to build on-island stakeholder capacity to mitigate disaster risk since 2016. This work programme helps a diverse range of communities build resilience against contextually relevant disasters using natural capital management and habitat conservation approaches.

The role of EO in disaster risk reduction and management (h3)

Earth Observation (EO) plays a key role in mapping priority natural capital assets and monitoring changes over time. EO techniques have been instrumental in the creation of valuable tools to support development and land-use decision-making in the UK Overseas Territories. Satellite data can be used to model disaster risks and identify the most impactful locations for nature-based solutions. This information can be integrated into planning and policymaking, helping decision-makers target the most efficient and effective solutions for each unique context.

Damage assessment and monitoring

JNCC used EO satellite imagery to assess the impact of Hurricanes Irma and Maria along the coast of the British Virgin Islands (BVI). Using this type of data, decision-makers had a detailed, wide-scale view of the extent of the damage to Paraquita Bay, one of the largest natural harbours in the BVI with a natural sea barrier of coral rock flanked by mangroves. The satellite images showed the extent of the displacement of boats in the harbour and the damage to the surrounding natural environment.

Risk Modelling

Using EO satellite data, we modelled the risk from storm surges in Anguilla. The risk zones identified can be used to plan evacuation strategies and target key areas for effective disaster response. These data can also be used to advise on development, making investors aware of the risks and enabling them to plan suitable mitigation strategies. Likewise, they can feed into decision-making about natural capital and can help identify optimal areas to invest in nature-based solutions, such as mangrove restoration.

Natural Capital and Opportunity Mapping

A recent EO analysis has shown that the natural coral reef barrier in BVI provides US$74.3 million worth of protection against hurricanes and other disasters annually. We used EO data to map and value natural capital in the BVI and fed them into the

BVI Flood Resilience Modelling tool to model flood risk from storm events under a range of natural capital scenarios, as shown below. This tool enables decision-makers to compare a variety of scenarios to the baseline risk model and identify opportunities to enhance natural capital and disaster resilience. Thanks to its user-friendly interface, the tool is useful for engaging a wide range of stakeholders and communicating the value of nature-based solutions.

Looking to the future

With funding from the Conflict, Security and Stability Fund, JNCC is continuing to work with the UK Overseas Territories to identify opportunities for nature-based solutions to protect communities and economies in the face of climate change. We are working closely with local experts to create and improve the available EO solutions, like risk models, with new datasets that deliver higher-resolution data. By learning from past experience and collaborating with a variety of local stakeholders, we are identifying evidence gaps and opportunities to incorporate the use of nature-based solutions into planning and decision-making.

Alyssa Fischer

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Ocean acidification and the seabed – detecting early warning signals

Ocean acidification is the reduction in the pH of the ocean caused by uptake of excess carbon dioxide (CO_2) from the atmosphere. This is a natural process, but the accelerated release of anthropogenically produced CO_2 into the atmosphere is happening too fast for the natural system to keep pace.

The effects of ocean acidification on marine species and habitats are not well understood. Marine species with calcium carbonate shells and skeletons, such as corals, lobsters and mussels, are likely to be particularly vulnerable. Often species are exposed and affected by ocean acidification across their life cycle, including their early development and larval stages. Thus, ocean acidification may affect not only established populations, but also reduce the likelihood of successful reproduction to maintain these populations. Understanding the extent and magnitude of those impacts is important because it could result in reductions in sensitive habitats and species and continued declines in biodiversity. This can have knock-on effects on the food web (e.g. prey availability) and the ecosystem services provided (e.g. commercial fishing, carbon storage).

JNCC, working with others, has delivered a project which takes a first step towards including ocean acidification in future climate change evidence and mitigation measures. This work has focussed on identifying the seabed species and habitats, and their larval stages, that are most sensitive to ocean acidification and identifying areas most likely to experience the largest changes in pH.

Marine species and habitats sensitive to ocean acidification were selected based on a literature review and availability of existing monitoring data. We used projections of changes in pH from the Copernicus Climate Change Service to identify areas in UK waters that are expected to become more acidic under different CO_2 emission scenarios. Results showed that, regardless of the emissions' scenario, we can expect significant changes in ocean pH within the next three decades. Changes are likely to be more pronounced in certain areas such as the northern North Sea, the eastern English Channel and the Irish Sea. The seabed species examined are primarily clustered around the UK coastline and thus might have adapted to fluctuations in pH. However, some of the species were also present offshore such as oysters and lobsters in the eastern English Channel, sea urchins in the Irish Sea and both sea urchins and cold-water corals in the northern North Sea. Species are likely to be affected by a suite of environmental parameters such as increased temperature, in addition to changes in pH. Better knowledge of other factors affecting ocean acidification, such as changes in temperature and ocean currents, is required to really be able to understand how our marine species and habitats are going to be affected.

The full report, which will be published soon, identified several knowledge gaps surrounding best selection processes for species' datasets and identified areas for improvement. The report provides recommendations, including those from the Global Ocean Acidification Observing Network (GOA-ON), for future monitoring and assessment, which potentially would allow for some of the effects of ocean acidification to be mitigated, particularly when the information and evidence is considered alongside, or in combination with, effects from human activities on marine ecosystems.

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Using cetacean stranding data to understand the impacts of climate change

By exploring new applications for existing data we can maximise the value of monitoring and survey efforts to answer new questions and gain better understanding. For decades, the UK has been taking the opportunity to gain information from cetaceans stranding around our coast to learn more about their life history and monitor the impacts of pressures and emerging threats these species face. But what else can this fascinating long-term dataset tell us about the natural marine environment around us?

JNCC initiated a collaborative project with the Natural Environment Research Council (NERC) researchers and experts from strandings schemes to investigate whether cetacean strandings data can help us understand impacts of climate change on the marine environment. Cetaceans are likely to face direct and indirect impacts of climate change, such as loss/change of habitat and changes in prey abundance and distribution. In turn, these changes may lead to shifts in cetacean distribution.

This new analysis is based on nearly 30 years' data from the UK Cetacean Strandings Investigation Programme database, exploring whether trends in stranded cetaceans could act as 'sentinels' or indicators of change in live populations resulting from changes in climate and associated impacts. Four species which could be impacted by changing ocean temperatures were included in the analysis, chosen due to their historic distribution and apparent limited distribution overlap: Atlantic white-sided dolphin (*Lagenorhynchus acutus*), common dolphin (*Delphinus delphis*), striped dolphin (*Stenella coeruleoalba*) and white-beaked dolphin (*Lagenorhynchus albirostris*). By modelling the strandings' records of these four species, totalling 3,596 individual strandings' events in the UK between 1990 and 2018, it was noted that the proportion of the two warmer water adapted species (striped dolphin and common dolphin) has increased over time. This increase was more pronounced in northern regions than in the southern regions, suggesting the edge range of warm-water adapted species has moved north. The change in proportion of strandings of the warm- and cold-water adapted species correlates with observed increase in mean annual sea surface temperature, suggesting changing ocean conditions may be resulting in more of the warm-water adapted species ranging further north. However, the definitive drivers of these changes require further investigations to shed greater light on these findings.

The modelling methods trialled in this study could be further explored as evidence of climate change, adding further value to the ongoing strandings monitoring programme in the UK.

This research was conducted in collaboration with Kings College London, Institute of Zoology/ Cetacean Strandings Investigation Programme and the Scottish Marine Animal Strandings Scheme.

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Monitoring focus

Assessing the exposure of UK habitats to climate change

JNCC places a high priority on biodiversity surveillance schemes because knowing how biodiversity is faring helps us to understand human impacts on the natural world and to guide conservation action. The National Plant Monitoring Scheme (NPMS) partnership is supporting a new analytical role to explore NPMS data. We are pleased to welcome Oliver Wilson to his new post, which will have an initial focus on climate change. Oli explains…

“Much research assessing the impacts of climate change on nature involves peering into uncertain futures and predicting what might happen. But we can too easily forget that we’re already living in a world whose climate has been profoundly and rapidly altered. While COP26 renewed the focus on whether the planet will be 1.5°C (the safest achievable), 2°C (extremely damaging) or 2.5–3°C (current commitments) warmer on average in 2100 than before the industrial revolution, about 1°C of that warming has already happened.

It’s important, then, to think about the natural world’s responses to climate change over recent centuries, as well as for the coming decades. Working with more concrete data on past changes has some advantages over more speculative future projections, but truly long-term observational datasets are globally rare. The UK has some of the best datasets globally: Met Office data stretches from 19th century weather station networks to some of the world’s most advanced future climate projections.

In my new role, I’m integrating these datasets to assess the exposure of UK habitats to 20th and 21st century climate changes. Some parts of the country have experienced and/or will experience disproportionate climatic changes, which – depending on the capacity of their ecological communities to respond – could translate to greater impacts on biodiversity. Do historic and future climate changes affect different habitats? Or will the future pile yet more pressure on the same ecosystems? This research will help us to learn more.

By comparing sites in the UK’s habitat monitoring network (NPMS, Countryside Survey, etc.) against these gradients of climate change exposure, we will show whether survey plots are focussed in more or less changeable locations, helping us to better interpret the results of our monitoring schemes. Integrating data on climate change exposure and long-term habitat monitoring will help evaluate where, when and how ecological communities are resisting or responding to changing conditions. Ultimately, this research should provide important context for understanding how the intertwined global climate and biodiversity crises are playing out in the UK.”

You can learn more about Oli’s work and the National Plant Monitoring Scheme at www.npms.org.uk

The National Plant Monitoring Scheme (NPMS) is organised and funded by the UK Centre for Ecology & Hydrology, Botanical Society of Britain & Ireland, Plantlife, JNCC, and

The Department of Agriculture, Environment and Rural Affairs for Northern Ireland. The NPMS is indebted to all volunteers who contribute data to the scheme.

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SPACE4CLIMATE

Landscape Modelling app in the spotlight at COP26

Delivering climate-focussed strategies and policies such as net zero requires that we change the way we use landscapes. Detecting land cover or

land-use change is critical to understanding the role of the environment in responding to the climate emergency. The ability to monitor landscape change on an almost daily basis could contribute significantly to informing climate change adaptation and mitigation measures and monitoring outcomes. Satellite data can play a key role in providing the information required to produce evidence-led policies that will deliver on net zero and other policies with wider environmental and economic benefits.

While mapping the landscape from Earth Observation (EO) is becoming well established, evidence on habitat condition and change over time is lacking. JNCC has been working with satellite data to detect large-scale landscape change as well as more subtle or gradual changes in habitat condition. The work can also aid delivery of nature-based solutions by targeting restoration sites, particularly in peatlands.

Building on earlier proof-of-concept work, our experts developed a web-delivered Landscape Monitoring app which provides automated analysis of satellite data, enabling users to track change over time at selected sites and highlight changed areas on a map. A multi-year time-series of data from the Copernicus Sentinel-1 (radar) and Sentinel-2 (optical) satellite missions was used to generate indices to quantify vegetation productivity, plant moisture content, vegetation structure, and surface water. These indices were combined with habitat maps to highlight land parcels whose index values deviate from average values for that habitat, potentially indicating a change in state or condition.

The app successfully detected a wide range of landscape changes such as tree felling, flooding and upland burning, as well as subtle changes such as drought-induced vegetation stress or the impact of management activities. Stakeholders who participated in user testing of the app agreed that this type of decision-support tool has potential to reduce costs and improve environmental policy delivery through more effective targeting of survey and management resources.

At COP26, the app was showcased as a poster on Earth Information Day, and as a case study in the Space4Climate area in the Green Zone, which is where members of the public could engage. There was an equivalent interactive display at the UK Pavilion in the Blue Zone.

Work is continuing in this area where we're hoping to scale up the capability from site-based to regional and eventually national scales, as well as integrating field data with satellite data to provide valuable insight. These advances will enable users to assess change and condition at a land parcel level with whole country coverage, bringing us closer to the ability to make landscape-level decisions to inform adaptation and mitigation measures.

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Reducing climate risks in supply chains – modelling ecosystem services in agricultural production landscapes

Combining Earth Observation (EO) data with local knowledge can assess the ecosystem services that contribute to making agricultural production systems more resilient to the impacts of a changing climate. The EO4cultivar project sustainable livelihoods work package, showcased at COP26, includes two important case studies from Colombia and Peru.

The project modelled the ability of the land to moderate surface water runoff, helping to regulate overland flow and mitigate flooding, as well as identify areas contributing to aquifer recharge to mitigate drought. Both of these climatic variables are linked to the El Niño-Southern Oscillation (ENSO) which Colombian partners perceived to be more unpredictable and extreme with a changing climate.

The project mapped opportunity areas within one of the main basins of the Río Frío 'Cold River' catchment. The model highlights existing areas of grassland and agricultural areas that could be strategically converted to more dense vegetation landcover types (i.e. reforested) as part of a climate-driven water risk management strategy (i.e. nature-based solutions). Project partners are using these models to conduct assessments on where best to reforest riparian areas to manage water-related climate risk in their agricultural production zones.

Project partners in Peru had identified soil erosion and the accompanying sedimentation effects as a serious concern in terms of impact of infrastructure and slope stability. The case study focussed upon the large commercial production areas of La Libertad in central Peru. Here the increased intensity of the ENSO has led to flooding and the mass movement of soil and geological material that blocks and damages the irrigation channels that are vital to the vast production areas of asparagus and avocado.

Maps of soil erosion risk helped regional actors to identify areas of high risk of mass movements, enabling foresight into where mitigation measures should be considered to counter effects of extreme precipitation events. As in Colombia, the project created maps to show where it should be possible to restore or create new habitat to strengthen the existing wetland or woodland ecological networks to enhance biodiversity, while simultaneously enhancing the level of surface water regulation.

The outputs produced are designed to improve understanding of how adopting an integrated approach to land management can increase ecosystem resilience. The ecosystem service maps and accompanying management guides indicate how natural functions and processes can be considered in land-use planning, and where nature-based solutions can be considered to ensure natural systems are able to continue to support human activities under a changing climate.

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Conservation Conversation

In this issue we meet Manaswita (Mansi) Konar, Director of Economic Analysis and Evidence at JNCC. Prior to her JNCC role, Mansi worked as the lead ocean economist at the World Resources Institute, where she provided economic advice to the Ocean Panel which consisted of 14 world leaders transitioning to a Sustainable Ocean Economy. She has also worked as a Senior Economist and Strategist in the UK Civil Service on a range of high- profile international and domestic policy issues.

Species that inspired you as a child?

I grew up in Kolkata and like every Kolkatan I have had a deep relationship with fish. Bengal, situated within the Ganges delta region, is criss-crossed by numerous rivers and has countless ponds and lakes teeming with a wide variety of fish like Rui, Katla, Pabda, Tangra, koi, Hilsa, pomfret, and Bhetki. Fish is also more than food, it features in Bengali literature, sculptures, and paintings as historically fishing was one of the primary occupations of the people of Bengal. The sight of fish is also considered auspicious in my culture. For example, I remember as a child going to weddings where the Bengali bride is welcomed in the groom's family by showing a live fish.

What concerns you most about the natural world?

The alarming rate at which plant and animal species are disappearing. This should not only concern us from a societal existence perspective, as reduced biodiversity will threaten our food and water supply, but also from a moral and ethical perspective, as I believe these species that we share the planet with have the same right to exist as humans.

What do you do away from the office?

I love going for walks in and around London with my daughter who just turned one. We also love spending time looking at the magnificent tiny beasts in London Zoo – from underwater corals and the aquatic wildlife they support, to industrious leafcutter ants, spiders and beetles. And we love seeing the birds in Richmond Park and also the deer!

Where is your favourite place?

It will be hard to pick one so I will cheat and name three locations that have contributed to my well-being and resilience – banks of the River Hooghly in Kolkata, Pacific Coast in California and my running route in Regent's Park.

Place you'd most like to visit?

The mountain ranges in Kyrgyzstan.

If you could dine with any four guests who would they be?

David Attenborough to hear about remote corners of the world that I have not visited and the life on the

planet I have never seen; Medha Patkar to learn more about how her social activism journey has played an instrumental role in changing the Indian environmental processes; Shobha Mudgal as no dinner is complete without music and as an amateur Indian classical vocalist I have been inspired by her range and depth of

voice; Alex Honnold, to hear about the best places to rock climb and camp in the wilderness.

Who is your human hero in the natural world?

I think what the youth today is doing is heroic – standing up for their future and raising their voices to save their planet.

What would you like to achieve in your time at JNCC?

There is lots to do and I feel a sense of excitement and optimism about it. I really want to develop and build the organisation's expertise in economics and finance. There is a need for more investment in nature-based solutions and creating the right market incentives will be key to attracting private investments. With JNCC's scientific expertise, it can play a key role to help direct private investments towards credible nature-based solutions. I am also keen to be an ambassador for the organisation, showcasing its incredible work and talent. Finally, I want to ensure that JNCC continues to be a great place to work – caring about the well-being of its people and investing in their development.

If you could choose another job or career, what would it be?

Veterinary surgeon.