



National
Oceanography
Centre

ANNUAL REVIEW

2019/20



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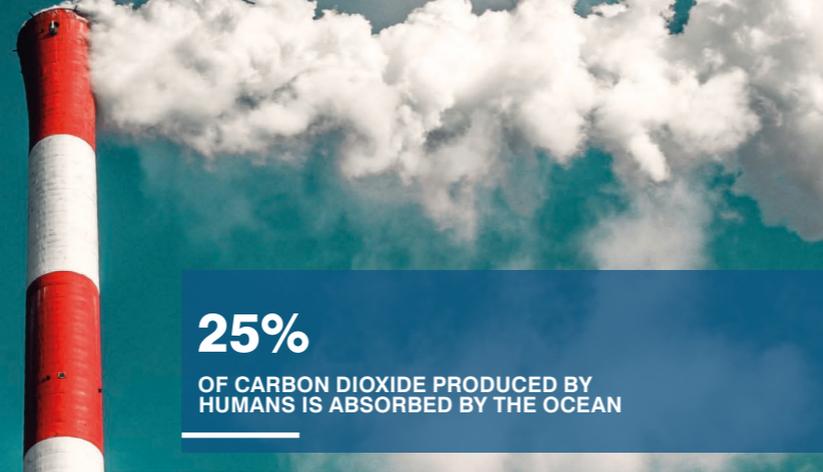
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OCEAN INSIGHTS

50%

OF THE OXYGEN WE BREATHE IS PRODUCED BY THE OCEAN



25%

OF CARBON DIOXIDE PRODUCED BY HUMANS IS ABSORBED BY THE OCEAN



25%

OF OUR ENERGY SUPPLIES COMES FROM THE OCEAN



97%

OF THE EARTH'S WATER IS HELD IN THE OCEAN



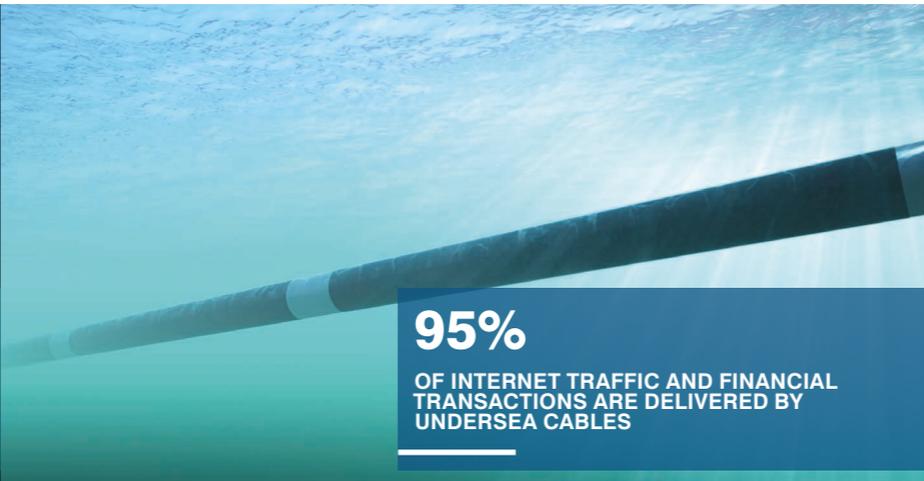
93%

OF EXCESS HEAT GENERATED BY GREENHOUSE WARMING IS ABSORBED BY THE OCEAN



95%

OF THE UK'S IMPORTS AND EXPORTS, INCLUDING NEARLY HALF OF ALL OUR FOOD ARRIVES VIA THE OCEAN



95%

OF INTERNET TRAFFIC AND FINANCIAL TRANSACTIONS ARE DELIVERED BY UNDERSEA CABLES



30%

OF GLOBAL PROTEIN FOR THREE BILLION PEOPLE IS PRODUCED BY THE OCEAN

INTRODUCING OUR BOARD

The Board of Trustees is the governing authority for the National Oceanography Centre (NOC) and are here to help define our strategy, monitor performance, make key decisions, and set the delegations that enable and empower the operation of the organisation.

“It is a great honour to be the first Chairman of the National Oceanography Centre, as it takes its place in the world as an independent charity with an ambitious vision. The NOC is a UK leader and global influencer, but we cannot succeed on our own. We work in partnership with Government, world experts, academia, industry and our own people. During the pandemic we have taken time and space to seize the opportunity to be in control of our own destiny, with all the freedom and responsibility that brings. Together we share a passion: we understand the ocean sustains and nourishes our lives, and we aim to protect it so we can all thrive.”

John Hirst CBE Board Of Trustees Chairman



John Hirst CBE
Board Of Trustees Chairman

John specialises in global business leadership, strategy definition, operational and financial restructuring, international development and growth and performance improvement.

His previous roles included seven years as Chief Executive of the MetOffice, UK Permanent Representative for the World Meteorological Organisation acting as a member of the Executive Council and Chair of the Audit Committee and was Chairman of Hammerson Pension Fund. He was appointed Commander of the Order of the British Empire (CBE) in the 2014 New Year Honours for services to Meteorology.

John holds or has held Non-Executive Director roles with Marsh UK, Ultra Electronics, Anglian Water Services, White Square Chemical, IMIS Global Ltd and is currently a Trustee for Epilepsy Research UK.



David Gee
Audit and Risk Committee Chair

David is a former Chief Finance Officer for ICI and currently Chair of Lockton LLP and the ICI Pension Fund.

David is a strategically orientated senior business manager and finance professional with a focus on value creation with a proven track record of strategic definition and management. He has very wide financial knowledge, expertise and experience, with achievements across a range of businesses, locations and activities, driving strategic and operational improvement. David has strong project and process management skills and experience, both in non-financial and financial areas, and a history driving the management of significant change.



Sarah Kenny OBE
Remuneration Committee Chair

Sarah is the Chief Executive Officer at the BMT Group, a leading international multi-disciplinary engineering, science and technology consultancy offering a broad range of services, particularly in the defence, energy, environment, shipping and ports and logistics sectors. Prior to BMT Sarah was Managing Director at Qinetiq for seven years.

Sarah was appointed Officer of the Order of the British Empire (OBE) in the 2019 Queen's Birthday Honours. The accolade, for services to the Maritime Industry, and Diversity, reflects her long-standing commitment and contribution to supporting and promoting the United Kingdom's maritime industries, in addition to her work on STEM and promoting the importance and value of diversity in the sector.



Dan Hook

Dan is a Naval Architect and Chartered Engineer with over 17 years' experience in the marine industry. Upon graduating from the University of Southampton, Dan worked as a naval architect on the development, testing and trials of a wide range of specialist craft. During this time he recognised the potential within the unmanned vehicle industry and specialised in unmanned platform design.

He was one of the founding members of ASV Global, now known as L3 ASV and held the position of Managing Director as the company grew from two employees to about 150 before selling to L3 Technologies. This company was at the forefront of unmanned surface vehicles and supplied systems around the world for defence, survey, oil and gas and scientific applications.



Professor Sir Ian Boyd

Ian was the Chief Scientific Adviser at the Department of Environment, Food and Rural Affairs. He is currently Professor in Biology at the University of St Andrews. Ian has previously been a Physiological Ecologist at the Institute of Terrestrial Ecology, a Science Programme Director at the British Antarctic Survey and Director at the Sea Mammal Research Unit.

He has received prizes for his research including the Scientific Medal of the Zoological Society of London, the Bruce Medal for Polar Science from the Royal Society of Edinburgh and The Polar Medal awarded by Her Majesty The Queen. Ian received a Knighthood in the Queen's Birthday Honours List 2019 for services to Science and Economics on Food and the Environment.



Dr Sarah McMath

Sarah is the Chief Executive Officer, of Market Operator Services Ltd (MOSL). MOSL allows 1.2 million businesses, public sector bodies, charity and not-for-profit organisations in England to choose who provides their water retails services.

With a doctorate in Environmental Engineering, Sarah worked for Thames Water for 24 years in a wide variety of roles, leading teams of up to 3000 people in both technical and operational areas. She led the development of the company's Business Plan and developed the corporate strategy, including the preparations for competition in the business market. Sarah's most recent role was as the Managing Director of Strategic Planning and Investment, with accountability for all Asset Management, Science, Engineering, Health and Safety and Innovation in Thames Water.



Dr Ruth Boumphrey

Ruth is currently the Director of Research at Lloyd's Register Foundation, where she is responsible for a large portfolio including grants, direct charitable activities and accelerated innovation actions through their international trading arm.

She has research experience in the marine science and technology sector and has previously held roles as the Head of Earth Observation for the UK Space Agency, Head of International at the Natural Environment Research Council and Research Policy and International Division at the Department of Environment, Food and Rural Affairs. Ruth is a Council member at the Welding Institute and Chair of the TWI innovation network. She previously sat as a Council member at Lancaster University.

LEADING CHANGE, OUR WAY

In November 2019 the National Oceanography Centre (NOC) became an independent body, building on our proud 60-year history. Establishing a new organisation is no small task. As well as developing the practicalities, such as systems and processes, the important work has been creating a culture which allows us to innovate and lead in advancing marine science, including developing the measurement technologies on which scientific knowledge and understanding of the ocean depends. Of course, with the COVID-19 pandemic we have had to be flexible, but the science did not stop. The innovation did not stop. By our very nature we found new ways to work. The challenges facing the ocean have not gone away and the next decade will be critical to protecting the health of the ocean upon which our lives and wellbeing so depend. This is why we look forward to engaging strongly in the work of the UN Decade of Ocean Science for Sustainable Development, with its bold vision to undertake the science we need for the ocean we want – clean, healthy, safe, productive, predicted, inspiring, and with information about it transparently accessible to all.

At the NOC we have a shared goal around driving change through innovative thinking, research and technology. Much of this work is about creating new insight, to help us truly understand the impact the ocean has on all our lives. Our passion is exploring the vastness of the ocean, which could be observing it from satellites in space or piloting remotely controlled vehicles through underwater canyons 6000 m deep. We strive to uncover the unknown and create new ways and technologies to help that discovery. All at the NOC have a role to play in this discovery, from those ROV pilots to the coders, the crews on our ships to the support staff on shore. It has been a tough year but we have continued to live by our vision and values, to share our knowledge and expertise to make a real difference to thousands of people. We can all take wonder and pride from our collective achievements this year.

The NOC's key role is enabling science through support of the wider science community with the large research infrastructures and data assets that we operate for UK science. Despite COVID presenting some particular challenges in these areas with ship programmes

being reduced and access to physical sample archives like ocean cores being restricted we have continued to deliver a quality service. The corporate support teams have not only been in the front line or managing the NOC's response to COVID but in establishing NOC's governance and business systems to function as an independent organisation.

We would like to thank all who have contributed to the success of our first year of operation and worked with us in especially unusual circumstances.

Professor Ed Hill CBE
Chief Executive

Professor Angela Hatton
Chief Scientist

Julie Pringle-Stewart
Chief Operating Officer



OUR YEAR IN NUMBERS

ADVANCE

Our internationally excellent research and technology development advanced the frontiers of ocean knowledge

50

NEW PHD STUDENTSHIPS CREATED THROUGH NEW COLLABORATIVE CENTRE FOR DOCTORAL TRAINING

282

ACADEMIC PAPERS PUBLISHED

60

PROJECTS FUNDED FROM NATIONAL, INTERNATIONAL AND COMMERCIAL FUNDING ORGANISATIONS

4

EARLY CAREER RESEARCHER FELLOWSHIPS GRANTED BY NOC-LED RESEARCH PROGRAMME CLASS

15

INTERNATIONAL DEVELOPMENT PROJECTS IN 22 COUNTRIES

SHARE

We continued to create public benefit from all we do

192,845

VISITS TO THE NOC WEBSITE

56

MEDIA BROADCASTS INCLUDING BBC NEWS, SKY TV AND ITV NEWS

16

PUBLIC EVENTS INCLUDING SCHOOL VISITS, TALKS AND LECTURES

102,669

OCEAN VIDEO VIEWS

138

REPRESENTATIVES ON NATIONAL AND INTERNATIONAL BOARDS

INNOVATE

We achieved wider impact by integrating and innovating our world-leading research and technology developments

16

TOTAL PARTNERS NOW COLLABORATING IN THE MARINE ROBOTICS INNOVATION CENTRE

£5.8M

WORTH OF POTENTIAL REVENUE FOR NEW PROJECTS AND CONTRACTS FROM 18 NOC LED BIDS

£57.2M

TOTAL EXPENDITURE ON CHARITABLE ACTIVITY

1443

VIEWS OF THE NEW NOC TECHNOLOGY ROADMAP

MAKING AN IMPACT

We know the ocean is critical to life on earth, yet we are facing a dramatic decline in ocean health, with human activity affecting sea levels, temperature and the millions of species that call the ocean home.

Our ambition to make a positive impact, drive change and bring public benefit in all we do, is measured by these commitments:

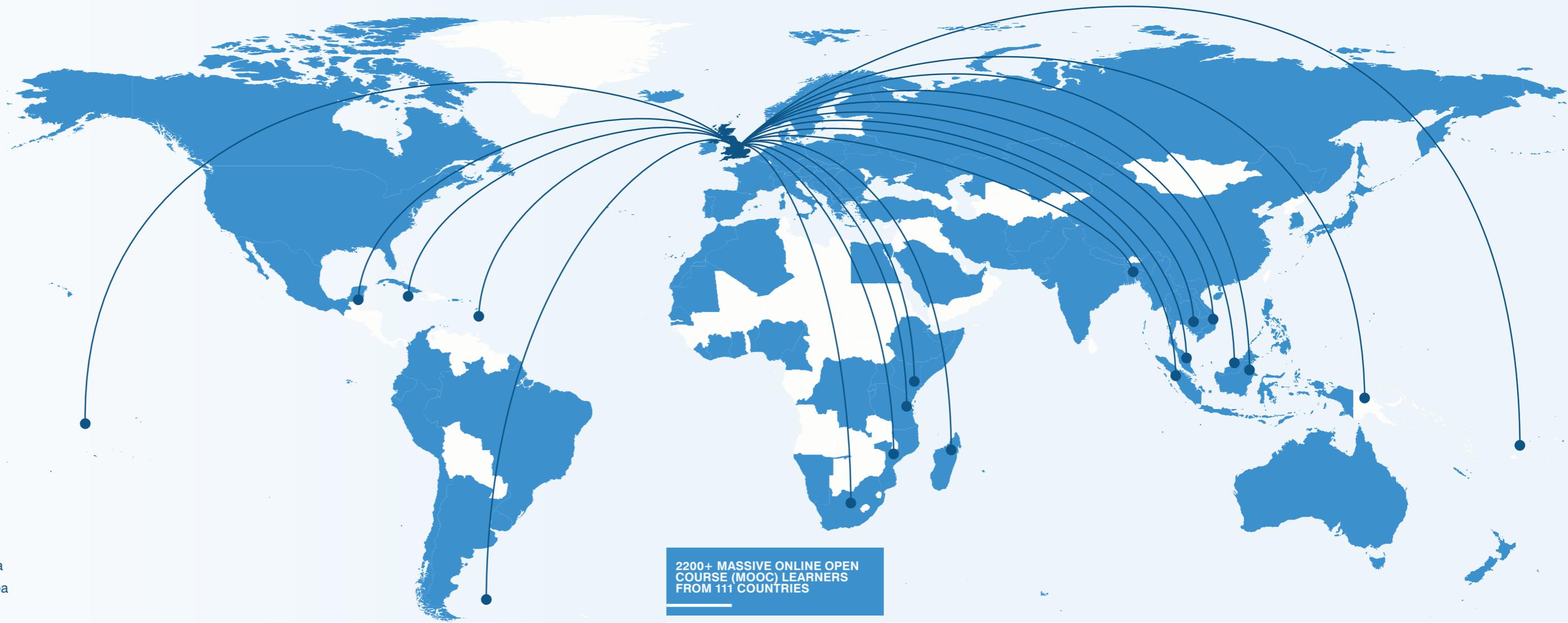
1. Understanding and advising on climate change
2. Reducing pollution of the ocean, by educating and informing
3. Securing & protecting ocean resources and ecosystems which provide food, minerals and clean energy
4. Protecting coastal communities from erosion, extreme weather & flooding
5. Educating people all over the world about ocean issues
6. Supporting overseas nations in growing their ocean science and capability

GLOBAL REACH

Our role at the NOC is to combat this through scientific understanding and education. As a charity we pledge to advance, innovate, enable and share our knowledge with the global community so that together we can take action to protect the ocean we love.

We have undertaken fieldwork and partnerships in countries around the world, including;

- Belize
- Republic of Kiribati
- Dominica
- Jamaica
- St Vincent & the Grenadines
- Grenada
- Mozambique
- South Africa
- Kenya
- Tanzania
- Bangladesh
- Madagascar
- Cambodia
- Indonesia
- Vietnam
- Fiji
- Malaysia
- Kingdom of Tonga
- Papua New Guinea



UNDERSTANDING & ADVISING ON CLIMATE CHANGE

The ocean regulates the global climate; it mediates temperature and drives the weather, determining rainfall, droughts, and floods. Human activities have significantly increased greenhouse gas emissions, but the ocean has moderated the effects, absorbing more than 90% of excess heat and approximately 30% of excess carbon emissions.

Whilst this is sparing us from the extreme impacts we would otherwise experience on land, it is changing marine ecosystems to the detriment of the animals and plants in these systems and the people who rely on them. Without life in the sea, carbon dioxide concentrations in the atmosphere would be 50% higher.

Current climate change research carried out by NOC scientists has highlighted how the increasing ice melt is impacting ocean circulation, and how the changing climate is affecting coastal communities through storm surges and sea level rise. Linked to this we are actively investigating how we may apply technological approaches to mitigate rising CO₂, for instance through carbon capture and storage and farming adaptations, including how we can use advanced modelling methods to study the migration of fluids deep below the ocean floor to increase our ability to monitor storage reservoirs offshore.

DISCOVERY FOR CHRISTMAS

Scientists, engineers and crew from the NOC spent Christmas and New Year sailing through the Southern Ocean on board RRS *Discovery*, on an expedition to understand the role of this notoriously rough part of the ocean in storing carbon from the atmosphere. Their focus was studying the seasonal growth of microscopic marine plants, called phytoplankton.

Phytoplankton live in the light-rich upper layer of the ocean where abundant supplies of light and nutrients allow them to grow. Although smaller than the width of a human hair, phytoplankton play a very important role in how the ocean and climate function. Phytoplankton obtain nutrition by photosynthesising; they convert sunlight energy into chemical energy and they also take up dissolved elements from seawater, including carbon dioxide, to make new cells.

When marine plants die, the carbon held within them moves deeper into the ocean, some in the stomachs of crustaceans and fish that eat them, or by sinking as 'marine snow'. This expedition aimed to address some of the uncertainty around how this process happens. In particular, they were looking at the consequences of phytoplankton

becoming starved of nutrients as their population outstrips supply. This can change the variety and health of species present, affecting how quickly marine snow sinks.

"The movement of carbon into the ocean is particularly important in the Southern Ocean, since it is effectively a 'motorway junction' for ocean currents. Which motorway the carbon enters determines how long it will remain 'locked' away in the ocean. If shallow, maybe a year or less, if deep, possibly hundreds years or longer."

Dr Adrian Martin NOC scientist and CUSTARD project lead

Combining mission data with year-round observations from two NOC gliders, as well as a moored buoy provided by a US Ocean Observatories Initiative, enabled the study of seasonal change, similar to observation of meadows flowering and dying over the year.

This expedition is part of the CUSTARD (Carbon Uptake and Seasonal Traits in Re-mineralisation Depth) project, and part of the NERC ROSES (Role Of the Southern ocean in the Earth System) programme.





JAMES COOK RUNS AMOC

In March the RRS *James Cook* undertook an expedition to measure of one of the world's largest system of ocean currents, the Atlantic Meridional Overturning Circulation (AMOC).

These measurements are used to understand the natural variability of the ocean and climate system and its impact on the weather. This forms part of the National Oceanography Centre led RAPID-AMOC 26N project, which has been collecting data on the AMOC since 2004 in collaboration with the University of Miami and National Oceanic and Atmospheric Administration (NOAA) in the USA.

Currently an array of more than 200 instruments are in the water gathering data on the temperature, salinity and flow rate of the AMOC, which is responsible for the transfer of large volumes of heat from the tropics to northwest Europe, keeping its climate relatively mild. The energy involved in this heat transfer is equivalent to 35,000 times the average rate of electricity consumption in the UK or about one million times the output of an average UK nuclear power station.

“With every recovery of data from the RAPID 26N array of instruments, we learn new things about how the large-scale ocean changes on timescales of days to decades. These observations provide a unique dataset used to validate the numerical models used for weather and climate predictions.”

Dr Ben Moat RAPID-AMOC 26N project chief scientist

The expedition had to be called home early due to COVID-19 but once able, with robust coronavirus safe working conditions in place for all ship and shore staff, it continued onboard RRS *Discovery*.

This project has continued to evolve by using and supporting innovative technology. Over the last year the on board team recovered water samplers and oxygen measurements to better understand the role of the subtropical North Atlantic in the global carbon cycle.

Based on recent cold winters in the northern North Atlantic, the outcomes of the RAPID-AMOC 26N project predict that the large-scale ocean circulation will have intensified.

BIG SCIENCE NEEDS INNOVATIVE ENGINEERING

The NOC's ambitious programme of scientific research is enabled by its world class engineering and technology capabilities. One project leading the way in innovative thinking is Oceanids, a £16 million Marine Autonomous Systems (MAS) development programme funded by the UK Government's Industrial Strategy Challenge Fund and being delivered and led by the NOC.

The primary aim is to develop enhanced data collection and delivery capability for the UK marine science community, particularly in unexplored and technologically challenging under-ice and deep-ocean environments.

Oceanids is well on its way to delivering two new Autonomous Underwater Vehicle (AUV) classes: three 1500 m depth-rated Autosub Long Range vehicles (ALR1500) that will have longer endurance and greater payload capacity compared to the current vehicles; and a 2000 m depth-rated Autosub capable of carrying high-power sensors and operating under ice (Autosub2KUI). The programme will also deliver enhanced 'command-and-control' (C2) and data

management systems for efficient MAS fleet operations, and a range of new sensors to maximise science output from the new platforms.

This year saw a multidisciplinary team from the NOC visit Loch Ness to conduct trials. Three Autosub Long Range vehicles were unleashed in the Loch in one of the NOC's largest single deployments of Autosubs, to deliver field tests of the new CarCASS and AutoNuts sensor payloads and trial their integration with the subs.

The Loch Ness trials saw a total of 10 new sensors put through their paces. Nine of these were NOC-developed 'lab-on-chip' devices, alongside one third-party electrochemical pH sensor.

Oceanids has received extra funding for the next two years to allow Autosub2KUI and ALR to be fully sea trialled to ensure the new capabilities are ready for science deployments anywhere in the ocean. Once complete they will be delivered into the National Marine Equipment Pool, operated and managed by the NOC on behalf of the wider UK marine science community.



REDUCING POLLUTION OF THE OCEAN

One of the biggest threats to our oceans is anthropogenic pollution. Discarded plastics and other residential waste, discharge from pesticides and industrial chemicals eventually find their way into the ocean with severe consequences for marine life and the habitats they depend on.

Plastics are one of the biggest pollutants in the marine environment with an estimated 10 million tonnes of plastic waste finding its way into our oceans each year.

The harm caused by plastic pollution is wide ranging. It chokes wildlife above and below the waterline. An estimated one million sea birds and an unknown number of sea turtles die each year as a result of plastic debris clogging their digestive tracts, and marine animals of all sorts can become tangled and incapacitated by discarded fishing lines and plastic bags. Fish and other marine life ingest microplastics which in turn can find their way into the human food chain.

The NOC has a dedicated group carrying out cutting-edge research to assess the distribution and transport of plastics to and within the ocean to better understand plastic fate and ecosystem exposure. This is an essential component if we are to understand the effects of plastic contamination on ecosystem health and how this is likely to change in the future.



INVISIBLE PLASTIC FOUND

The mass of ‘invisible’ microplastics found in the upper waters of the Atlantic Ocean is approximately 12–21 million tonnes, according to research published in the journal *Nature Communications*.

Significantly, this figure is only for three of the most common types of plastic litter in a limited size range. Yet, it is comparable in magnitude to estimates of all plastic waste that has entered the Atlantic Ocean over the past 65 years: 17 million tonnes. This suggests that the supply of plastic to the ocean have been substantially underestimated.

“Previously, we couldn’t balance the mass of floating plastic we observed with the mass we thought had entered the ocean since 1950. This is because earlier studies hadn’t been measuring the concentrations of ‘invisible’ microplastic particles beneath the ocean surface. Our research is the first to have done this across the entire Atlantic, from the UK to the Falklands.”

Dr Katsiaryna Pabortsava NOC scientist and lead author

“...if we assume that the concentration of microplastics we measured at around 200 m deep is representative of that in the water mass to

the seafloor below with an average depth of about 3000 m, then the Atlantic Ocean might hold about 200 million tonnes of plastic litter in this limited polymer type and size category.

This is much more than is thought to have been supplied. In order to determine the dangers of plastic contamination to the environment and to humans we need good estimates of the amount and characteristics of this material, how it enters the ocean, how it degrades and then how toxic it is at these concentrations. This paper demonstrates that scientists have had a totally inadequate understanding of even the simplest of these factors, how much is there, and it would seem our estimates of how much is dumped into the ocean has been massively underestimated”.

Professor Richard Lampitt NOC scientist and co-author

This study builds on the NOC’s cutting-edge research into marine plastic contamination, which aims to better understand the magnitude and persistence of exposure to plastics and the potential harms it can cause.

PLASTIC TRANSPORT

NOC research has revealed for the first time how submarine sediment avalanches can transport microplastics from land into the deep ocean. The study also revealed that these flows are responsible for sorting different types of microplastics – burying some, and moving others vast distances across the sea floor.

These findings may help predict the location of future seafloor microplastic hotspots, which in turn could help direct research into the impact of microplastics on marine life.

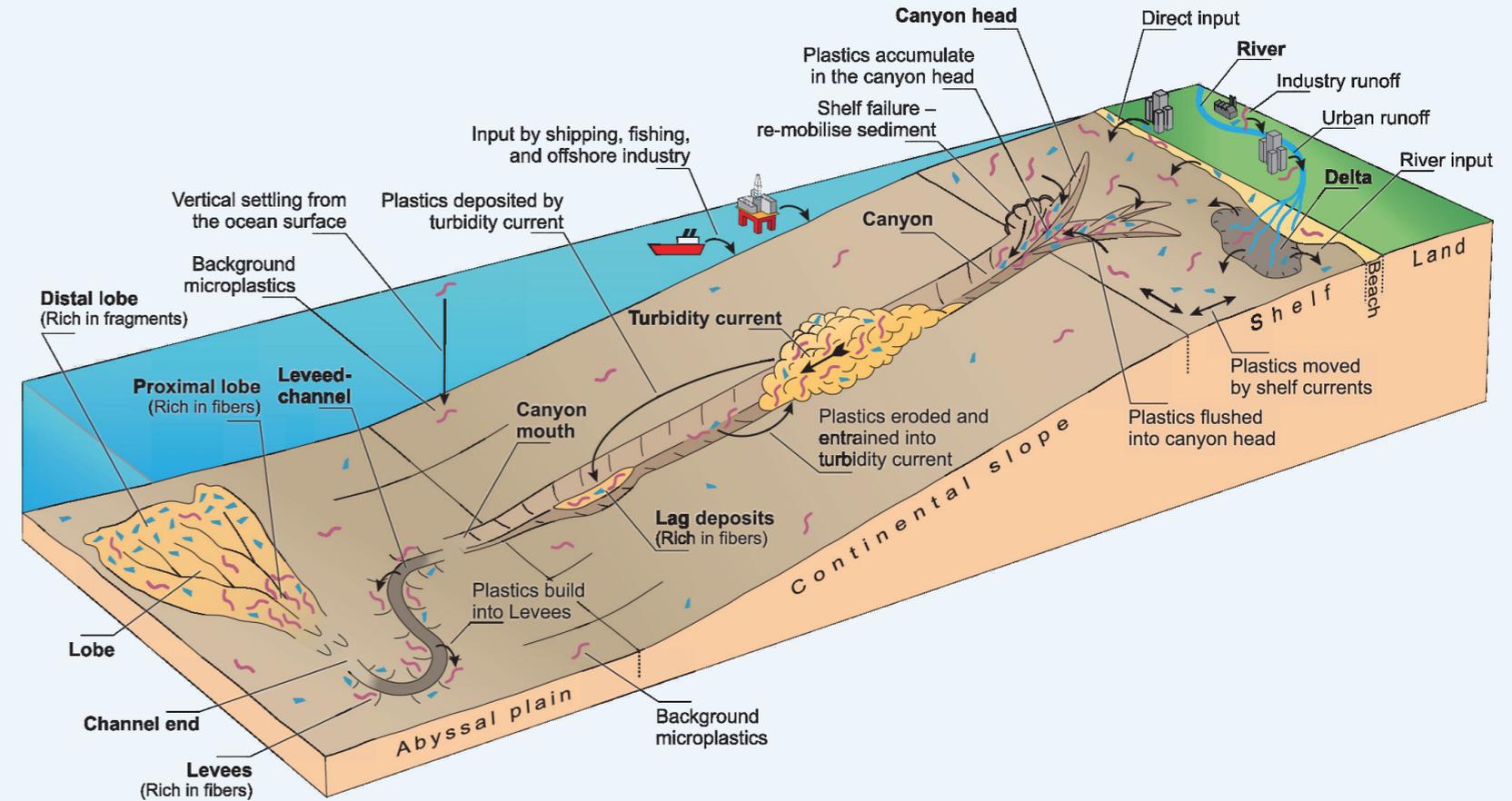
Of the 10 million tons of plastic pollution exported into the oceans each year, it is thought that around 99% of this is stored in the deep sea, often preferentially accumulating in submarine canyons.

However, it was previously not known how plastic pollution gets to the deep sea from land. The new research, published in the journal Environmental Science & Technology, has shown that microplastics can be moved by gravity-driven sediment flows, which can travel thousands of kilometres over the seafloor.

Studying the distribution of different types of plastic on the seafloor is important because the size and type of plastic particle determines how toxins build up the surface, as well as how likely it is the plastic will enter the gut of any animal that eats it, and what animal may eat it.

These experiments show that sediment flows have the potential to transport large quantities of plastic pollution from near shore environments into the deep sea, where they may impact local ecosystems. The next steps for research will involve sampling and monitoring deep-sea submarine canyon, to understand how robustly these experimental findings can be applied to natural systems and the effects on deep-sea ecosystems.

This research forms part of the urgent global endeavour to understand the extent and implications of microplastic pollution on the health of marine ecosystems.



Source: Sci. Technol. 2020, 34, 7, 1160-1169

SECURING & PROTECTING OCEAN RESOURCES AND ECOSYSTEMS

Ocean resources include clean energy, food, and minerals. The ocean is a major food resource, and for over a billion people it is their primary source of animal protein; therefore, understanding how fisheries will be impacted by global environmental change is vital for human life.

It is estimated that by 2030, 10% of the world's minerals, including those vital for low-carbon technologies, could come from the ocean floor but biodiversity is decreasing across the planet including in the oceans, due to habitat loss, pollution, and over-exploitation of resources.

To empower decision makers and the public, to make informed choices about these issues and more, the NOC participates in over 100 international programmes, initiatives and boards. Sharing knowledge and understanding, by working in partnership, is vital for achieving the United Nation's Sustainable Development Goal 14 - conserve and sustainably use the oceans, seas and marine resources.

WORKING IN PARTNERSHIP

By collecting data, undertaking scientific research and delivering state-of-the-art capacity building, the international CME programme supports Commonwealth Small Island Developing States (SIDS) to sustainably manage and use their marine resources.

This fieldwork season saw NOC scientists work alongside colleagues from the Coastal Zone Management Authority and Institute (CZMAI) in Belize, the University of Belize, the Turneffe Atoll Sustainability Association (TASA), and the Belizean Port Authority.

“Belizean coastal environments are some of the most fragile in the world, and are facing a combination of challenges from both human and climate change factors. In collaboration with our Belizean colleagues, we are deploying an array of state-of-the-art sensors that enable real-time monitoring of marine conditions and the stresses being placed upon them, in addition to better characterising the ecosystems at risk.”

Dr Christopher Pearce Programme lead for the NOC

The UK Government-funded CME programme has delivered world leading expertise in marine science since 2016 through a strategic partnership of the NOC, the United Kingdom Hydrographic Office (UKHO), and the Centre for Environment, Fisheries and Aquaculture Science (CEFAS).

Together the NOC worked to map the seafloor and characterise marine habitats around Belize City. We also installed ocean acidification sensors on the coral reef, which is the second longest in the world, as well as quantified the impact of sea-level rise on carbon burial in mangrove forests. In addition, the team characterised how changes in land-use management affect water quality in coastal environments.



CAREER PROFILE

DR DANIEL ROPER

As the Engineering Manager for the NOCs AUV Operations group, I lead a small team of highly skilled engineers, who maintain and operate the NOCs larger Autosub Autonomous Underwater Vehicles (AUVs). My job takes me all over the world, as we help to improve scientific knowledge of the oceans. I also get to work with exciting technologies, and explore innovative ways to apply them.

Growing up, I was always very interested in solving puzzles and figuring out how things work. When I left school this led me to study mathematics at University. Whilst there are many areas of mathematics, I was always particularly interested in applied mathematics.

After my first degree, I decided that I wanted to travel and see the world, so I joined the Merchant Navy as an Engineering Officer Cadet. I studied Marine Engineering and Management, and I travelled around the world as a ship's engineer, learning the particular challenges of engineering at sea.

In 2010, I was given the chance to undertake a PhD, applying mathematics to the control of a robot fish. I was finally able to connect

the dots between my love of mathematics and marine engineering. After my PhD I joined the Marine Autonomous Robotic Systems (MARS) group at the NOC, where I have worked with a number of AUVs including Autosub 6000, Autosub 2KUI, Autosub Long Range and of course Boaty McBoatface.

It never ceases to amaze me that in some ways exploration of the depths of the Oceans is more challenging than exploration of the wider reaches of the solar system. Whilst space exploration has its own challenges, radio waves travel through space with great ease, so more often than not the operators of space probes know not only where their probe is, but can send instructions, and retrieve information.

The Ocean on the other hand does not allow radio waves to travel any significant distance. The Ocean also quickly stops the passage of light, while in space we can see light from objects millions of miles away, under the sea even with the brightest lights we can only see for a few tens of metres.

In this strange world where we can only observe what is immediately around us, exploration is extremely challenging. Sound is our main tool for communication and feeling out of shapes. But this too is limited in detail and range.

Like space it is often more practical to send an unmanned probe to do our exploring for us, we can send them places that would be far too inhospitable or dangerous to send a person.

Because of the limits in underwater communication our probes can't rely on us to tell them where they are or what to do, they must be self-reliant (Autonomous). By applying recent advances in technology we are able to finally peek behind the veil of the ocean and see what secrets lie beneath.



PROTECTING COASTAL COMMUNITIES



Sea levels rising is one effect of climate change, mostly due to a combination of meltwater from glaciers and ice sheets and thermal expansion of seawater as it warms.

The Intergovernmental Panel on Climate Change (IPCC) concluded that between 1901 and 2010 global average sea-level increased by 19 cm. By the year 2100 it is likely that global-average sea-level will rise by a further 20 to 80 cm, and possibly more, if there is further collapse of certain parts of the Antarctic Ice Sheet.

It's predicted that low-lying coastal regions all over the world will be subject to ever more frequent extreme coastal flooding. In the UK, coastal flooding from storm surges is the single biggest natural disaster risk, impacting over four million people.

The NOC develops computer models of tides and storm surges to deliver improved forecasting systems for coastal flooding and sea-level extreme events. Our science and scientists directly contribute to assessments such as that of the IPCC.



REAL TIME FLOOD RISK

A one metre sea level rise is almost certain in the next century and it is estimated that 20% of England's coastal defences could fail under just half this rise. Ambitious climate mitigation and adaptation plans may protect 400,000 – 500,000 people, but flood and coastal erosion risks cannot be fully eliminated – we cannot build infinitely high sea walls.

Better ways to measure, forecast, warn of and respond to coastal flooding are required to protect people, property and infrastructure.

The National Oceanography Centre's WireWall project set out to dramatically improve real-time monitoring to optimise existing forecast services and information accessibility in the UK. Working in partnership with other leading national and global experts the team developed a novel field instrument able to measure the speed and volume of individual waves as they over-topped a sea wall. Their success secured new funding from the UKRI's Strategic Priorities Fund to use cutting-edge digital technology to advance environmental outcomes.

The new project, 'Coastal REsistance: Alerts and Monitoring Technologies', will demonstrate a point-of-impact flood hazard nowcasting system to meet national coastal management needs.

"Our team of collaborators are thrilled to have the opportunity to benefit local communities by developing this innovative real-time flood hazard observation system, with the potential for integration into navigation systems diverting people away from flood hazard. We will also be engaging the local community in coastal hazard monitoring through the development of a self-guided coastal walk accompanied by an Augmented Reality phone app that will allow people to visualise storms during calm conditions."

Dr Jenny Brown NOC Coastal Oceanographer and Coastal REsistance: Alerts and Monitoring Technologies (CreamT) lead

CAREER PROFILE

DR JENNY BROWN

Dr Jenny Brown is a Coastal Oceanographer within the Marine Physics and Ocean Climate group at the National Oceanography Centre in Liverpool. Her expertise are in coastal flood and erosion risk assessment to inform shoreline management strategies.

Growing up on the Isle of Wight Dr Brown had one goal in life – to live near and work with the sea. She studied Physical Oceanography with Maths at Bangor University and continued to do a PhD modelling sediment transport. She continued as a shelf seas modeller starting work in 2007 at the Proudman Oceanographic Institute, which in 2010 became the National Oceanography Centre. Dr Brown has worked on many different projects modelling shelf sea and estuarine processes as well as coastal impacts, such as beach response, shoreline evolution and flood inundation.

In 2018 new opportunities allowed Jenny to take part in fieldwork and learn new skills in observational oceanography. So far her career has enabled her to live the dream of living by and studying the sea.

A Coastal Oceanographer progresses the NOC's modelling capabilities to explore sensitivities to human intervention and natural change within the coastal system. The team then use this data to provide decision support to coastal policy makers and work with the Marine Data Products team to transfer scientific understanding into business opportunities. She is also the lead on several projects including WireWall and CreamT (Coastal REsistance: Alerts and Monitoring Technologies) developing innovative modelling and monitoring approaches.

"The diversity of working in research means every project is different and I'm always learning new skills and working with new people ."

Dr Jenny Brown

To support equality and diversity, Dr Brown often takes part in school outreach and public engagement activities promoting STEM (Science, Technology, Engineering, and Mathematics) activities to the next generation. As well as mentoring a number of students and staff.





NATURE-BASED COASTAL DEFENCES

The Pearl River Delta in the South China Sea is densely populated and fast-developing, home to 67 million people it is the most urbanised delta in the world. As it is very low-lying, cities here, like Guangzhou, are the most vulnerable to sea level rise. Nature-based coastal defence solutions have increasingly been recognized as more sustainable alternatives to conventional hard engineering approaches against climate change.

Project ANCODE is aiming to understand the potential for the re-introduction of nature-based coastal defences, namely mangroves and oyster reefs, into such an environment. Using wetlands, mangroves, coral and oyster reefs as a buffer zone, which can attenuate waves and, in a regime of moderate sea level rise, the sediment trapping in such zones can keep pace with sea level.

Through this project we are developing process-based understanding and predictive models of ecosystem size requirements and how to create ecosystems for coastal defence, using the world's largest urban area, the Pearl River Delta as a model system. The project was short-listed for the Newton Prize 2019.



EDUCATING THE WORLD ABOUT OCEAN ISSUES

As a charity, we recognise we need to do more outside the science and political communities that have been our home. We have been making every effort to organise more public engagement activities, so people in our communities understand more about the ocean.

We also aim to inspire young people to become more involved in ocean issues, as aspiring oceanographers of the future. In the last year, we attended 16 science festivals and school events, and increased our digital engagement to broaden our reach to new audiences.

When our research ships are overseas, we invite local groups to come and see our amazing facilities. This year we were able to visit Canada and Chile before going into lockdown.



MONSTERS OF THE DEEP

The National Maritime Museum Cornwall in Falmouth opened a major new exhibition 'Monsters of the Deep: Science Fact and Fiction' which features over 500 samples from the NOC Discovery Collections as well as a model of everyone's favourite yellow submarine; Autosub Long Range, better known as Boaty McBoatface.

"We are proud to be part of this immersive exhibition that shines a light into the abundant but mysterious deep sea world. It is exciting to share not only the unique specimens from the Discovery Collections but the innovative engineering that allows us to explore and better understand this hostile environment. As the ocean profoundly impacts human society I hope this exhibition brings enjoyment and wonder to many people and inspires future generations into ocean focused careers."

Professor Ed Hill CBE Chief Executive

The exhibition, guest curated by the NOC's Dr Tammy Horton, takes visitors on an immersive tour through the world of deep-sea monsters, both real and imagined. From Medieval folklore, to the

cryptozoologists and monster-hunters of the 20th century, the exhibition examines the enduring fascination with the creatures that live in the depths of the ocean, bringing together rarely seen specimens, artefacts and artworks from world class collections, including the NOC, Royal Museums Greenwich, the British Museum, the Science Museum, and Cambridge University Library.

Her Royal Highness, The Princess Royal, undertook an official visit of the exhibition in September and met with Dr Tammy Horton and the NOC's Chief Executive Professor Ed Hill CBE. They introduced The Princess Royal to a section called 'Meet the Real Monsters of the Deep' which features over 500 deep sea specimens and samples from the NOC's Discovery Collection, a globally important research collection that enables scientists and oceanographers to expand understanding of the deepest parts of the ocean.

The National Maritime Museum Cornwall's 'Monsters of the Deep: Science Fact and Fiction' is open until January 2022. Visit nmmc.co.uk for more information.



CAREER PROFILE

DR TAMMY HORTON

Dr Tammy Horton is a researcher on a variety of deep-sea biodiversity projects at the National Oceanography Centre in Southampton. Dr Horton is also the curator and manager of the NOC's Discovery Collections – a unique collection of 70,000 benthic and pelagic samples from many areas of the world's oceans. It is the only collection consisting solely of deep-sea and open-ocean invertebrates in the UK and provides vital insight into the species that live at extreme ocean depths.

Dr Horton's research is focused on the taxonomy, biogeography and biodiversity of deep-sea amphipods. As a taxonomist she has a keen interest in the advances in modern methods of taxonomic databasing, interactive web-based keys and digital illustration. She is also interested in fish parasitology and in particular studies of Cymothoid isopods following her PhD studying the taxonomy, ecology and pathology of cymothoid isopods in both wild and farmed fish.

She is well known for her taxonomic work, which has resulted in the descriptions of numerous new species of deep-sea amphipods, and

her contributions to the understanding of the diversity and ecology of deep-sea ecosystems.

Dr Horton is the Chair of the Steering Committee of the World Register of Marine Species (WoRMS), a database that captures the names of all marine species globally, and she coordinates the World Amphipoda Database (WAD) and the World Register of Deep-Sea Species (WoRDSS) which aims to capture the names of all species living deeper than 500 m.

Having begun her academic career working at the Natural History Museum, London she is an expert in the use and care of marine invertebrate specimen collections. She also teaches invertebrate zoology and parasitology and supervises research students at the University of Southampton.

With her extensive expertise and experience Dr Horton was selected as a Guest Curator for the National Maritime Museum Cornwall's Monsters of the Deep exhibition.



GROWING OCEAN SCIENCE CAPABILITY OVERSEAS

The NOC maintains and develops strong and lasting international collaborations in order to tackle the most challenging scientific questions, globally. Many of our partnerships support food and energy security, sustainable marine economies, and resilience to climate change for developing countries.

We are currently working on 15 different projects in 22 countries, with Official Development Assistance (ODA) funding provided predominantly via National Capability (NC-ODA), the Global Challenges Research Fund (GCRF), European Space Agency (ESA) and directly from UK Government. The primary aim of this work is to promote the economic development and welfare of our overseas partners.

Our international partnerships provide new knowledge, outcomes, and capacity building that support partner countries' abilities to address local, national, regional and international initiatives, such as the UN Sustainable Development Goals, in particular SDG14 and the UN Decade of Ocean Science for Sustainable Development (2021-2030), in parallel ensuring alignment with the UK Aid Strategy, in particular to strengthening resilience and response to crises, and tackling extreme poverty and helping the world's most vulnerable.



HOSTING A GLOBAL CLASSROOM

Over 100 million people in the Western Indian Ocean (WIO) region live within 100km of the coast, with over 1 million working in the fisheries sector. The WIO is highly dependent on the ocean for economic stability, food security, and social cohesion. In recent years, the region has seen dramatic and often poorly understood reductions in key fisheries, due to the combined effects of climate change, natural ecosystem variability, overfishing and degradation of key marine habitats.

SOLSTICE-WIO is a four-year collaborative project that brings together recent advances in marine technologies, local knowledge and research expertise to address challenges facing the Western Indian Ocean region in a cost-effective way via state-of-the-art technology transfer, collaborative environmental and socio-economic research and hands-on training.

A new Massive Open Online Course was launched by the NOC on Future Learn in October and has already welcomed over 2200 learners from 111 countries in its first semester. This free online course, Ocean Science in Action: Addressing Marine Ecosystems and

Food Security, introduces learners to innovative marine technologies and their applications used to tackle the challenges of the sustainable management of marine ecosystems.

It features over 30 video lectures including footage of fieldwork, numerical ocean model animations and visualisations of the Remote Sensing data. Learners will explore how new technologies can form the basis for environmental research and monitoring programs to deliver decision support for marine policy development and resource management. Using case studies based in the Western Indian Ocean, learners will see how marine science could be applied to the sustainable management of local marine ecosystems, and how this may contribute to global efforts to meet the UN Sustainable Development Goals.

The course is an output from the SOLSTICE-WIO project funded by the UK Global Challenges Research Fund (GCRF).

'Ocean Science in Action: Addressing Marine Ecosystems and Food Security' is available on FutureLearn. Visit solstice-wio.org for more information.





CAREER PROFILE

PROFESSOR ANGELA HATTON

I am the Director of Science and Technology at the National Oceanography Centre in Southampton. This means I oversee all of the NOC's oceanography research, from measuring how the oceans influence climate and the UK's weather, to identifying new marine species and understanding the mystery of deep sea. I get to work with the most amazing and innovative people, who transform the way we see the oceans, and my job is to have a strategic view of what is needed and to enable the researchers to achieve it.

What do you love most about the work you do?

I started as a sea-going oceanographer and am truly passionate about the oceans. What I love most is working with like-minded people who share my love of the oceans and knowing that what we do can make a real difference. Whether it's addressing direct issues like coastal flooding, how we manage marine protected areas or creating new understanding about how the oceans work, I love that I get to do something that matters.

What is it like being a woman in science – and what has changed since you started?

It's been brilliant and challenging. When I started there were times that I was the only woman on board a ship and like many women, I felt I had to work harder than everyone else to prove myself. Fortunately, a lot has changed. There are now often times when 50% of the scientists on research expeditions are female and there are a lot of examples of successful women in science nowadays. In fact, nearly 30% of our researchers at the NOC are now women and almost 45% of our technical experts and specialists are female – numbers I hope we can continue growing. Mostly I realised a lot about myself. I didn't need to be something I wasn't to succeed, I just needed to do my best, figure out my own strengths and weaknesses and realise that it didn't matter how other people saw me. That way I not only did my job well, but I got to enjoy doing it too.

What advice would you give to any young girl or woman looking to get into the field?

Don't be afraid to go out there and do something you care about, the biggest limitation can come from our own doubts and lack of confidence. I didn't worry about where I would get to in my career, I just did my best, took opportunities when they came and tried to enjoy it. Remember our working life is quite a long time (40+ years) and so be open to opportunities, don't be afraid of failure – it's actually one of the best ways to learn and it's good to be adaptable. I have loved being a researcher, I love being a Director in a position to enable others and I loved being a mum. I think you can have it all, you just can't have it all at the same time; but that's okay as there is plenty of time with a career ahead of you.



ENABLING OCEAN SCIENCE

In our first year operating as an independent charity, we have continued our legacy of world leading oceanographic science, research, engineering and innovation. Our National Capability role has enabled the UK community to explore from our coasts to the remotest, deepest and most hostile parts of the ocean. We also have worked in global partnerships to advance ocean science and education. Together, we have delivered a greater understanding of issues that affect our environment, our landscapes, our health and our prosperity.



OUR NATIONAL CAPABILITY

TWO WORLD CLASS RESEARCH VESSELS
RSS JAMES COOK & RSS DISCOVERY



BRITISH OCEAN SEDIMENT CORE
RESEARCH FACILITY (BOSCORF)

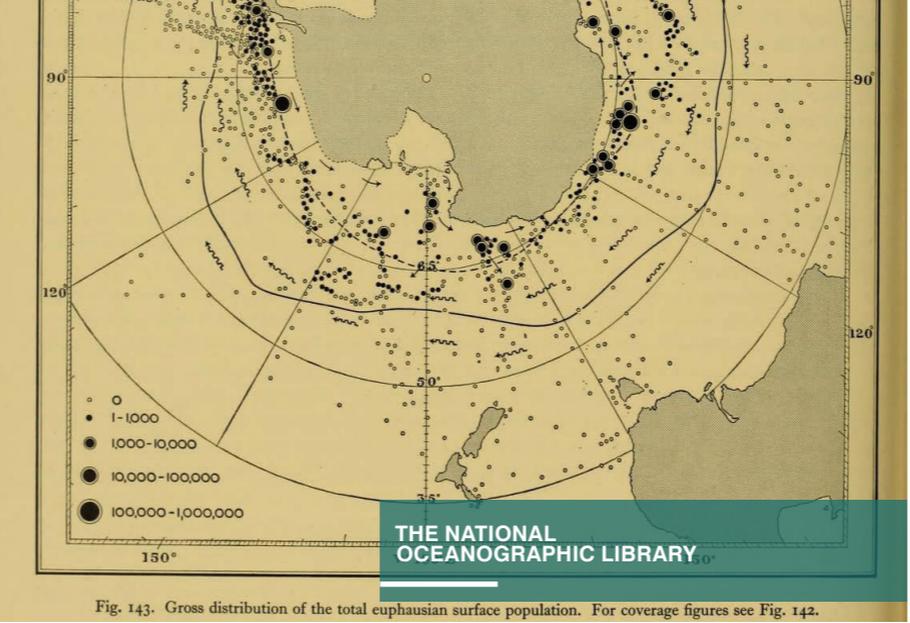


Fig. 143. Gross distribution of the total euphausiid surface population. For coverage figures see Fig. 142.

THE NATIONAL OCEANOGRAPHIC LIBRARY



THE MARINE ROBOTICS INNOVATION CENTRE



NATIONAL MARINE EQUIPMENT POOL
AND SEAGOING TECHNICAL SUPPORT



BRITISH OCEANOGRAPHIC
DATA CENTRE (BODC)



PERMANENT SERVICE FOR MEAN SEA LEVEL &
THE NATIONAL TIDAL AND SEA-LEVEL FACILITY



THE DISCOVERY COLLECTIONS

OUR YEAR IN NUMBERS

ENABLE

Our internationally excellent research and technology development advanced the frontiers of ocean knowledge

483

DATASETS PROCESSED BY THE BRITISH OCEANOGRAPHIC DATA CENTRE (BODC)

235

DATA DEPOSITS RECEIVED BY BODC

9481

EMERGENCY ESCAPE
ARGO DATASETS SENT TO MET OFFICE BY BODC

6.2M

DOWNLOADS FROM THE NERC VOCABULARY SERVICE (NVS) MANAGED BY BODC

850m

OF SEDIMENT CORE WAS IMAGED BY THE BRITISH OCEAN SEDIMENT CORE RESEARCH FACILITY

670m

OF SEDIMENT CORE WAS PHOTOGRAPHED BY BOSCORF'S IMAGING SYSTEM

6083

INDIVIDUAL SUBSAMPLES TAKEN BY BOSCORF FROM FIFTY EIGHT SEDIMENT CORES

230m

OF SEDIMENT CORE WERE DEPOSITED INTO BOSCORF FROM RRS JAMES COOK EXPEDITION

100%

OF DATA TRANSFERRED TO PRINCIPAL INVESTIGATOR WITHIN ONE WEEK OF SHIPS RETURN

RAPID EXPEDITION ON RRS DISCOVERY EXPLORED THE ROLE OF THE SOUTHERN OCEAN IN THE EARTH SYSTEM

ORCHESTRA EXPEDITION ON RRS DISCOVERY EXPLORED THE SOUTHERN OCEAN AND ITS ROLE IN THE GLOBAL CLIMATE

88%

OF MARINE AUTONOMOUS ROBOTIC SYSTEMS (MARS) IN A READY-TO-GO STATE

50

OCEAN-GOING TECHNICIANS MAINTAIN THE NATIONAL MARINE EQUIPMENT POOL - EUROPE'S LARGEST

71%

OF SCIENTIFIC ENGINEERING CAPABILITIES IN A READY-TO-GO STATE

75%

OF TECHNICIANS TIER ONE QUALIFIED



ARGO AND THE NERC VOCABULARY SERVER

A huge underwater network of robotic Argo floats have the critical job of continuously observing the ocean interior to enable scientists to understand more about its invisible properties. All Argo floats contribute to the Core Argo mission of measuring pressure, temperature and salinity to 2000 m. Some floats contribute to the Deep Argo mission by extending these measurements down to a depth of 6000 m. Others contribute to the Biogeochemical Argo mission by also measuring oxygen, pH, irradiance, chlorophyll fluorescence, particle backscatter and nitrate to 2000 m. At regular intervals, the floats return to the surface to transmit their data to specialist centres, such as the NOC's British Oceanographic Data Centre (BODC).

The wealth of data comes with rich and diverse information about the floats, their sensors, the variables measured and their quality – the concepts needed to consistently capture this information are managed centrally in the NERC Vocabulary Server (NVS) operated by BODC. Over the past 15 years BODC have used their data expertise and innovative thinking to develop the NVS to support a wide variety of ocean data management applications.

This year the NVS experienced six million downloads, two million more than last year, proving an invaluable resource to its growing global community of users. The powerful capability of the NVS is now being deployed to support the Argo data system as part of the EU Horizons 2020 project ENVRI-FAIR, which aims to improve the findability, accessibility, interoperability and reusability of environmental data. The NVS helps Argo data managers to maintain and improve the consistency of Argo metadata.

Now that the Argo data system is underpinned by the NVS, data users can make better use of this powerful dataset. The NVS will facilitate the development of new tools and services to help explore the rich information about Argo, and support its links with other ocean observing networks. This development will pave the way towards greater use of controlled vocabularies in support of global ocean observations and provide an example for other observing systems to follow.

CAREER PROFILE

JULIE PRINGLE-STEWART

Julie Pringle Stewart is the Chief Operating Officer, Director of Finance and Operations and Company Secretary at the National Oceanography Centre. Julie studied for a BA in Commerce at Napier University in Edinburgh and is a Fellow of the Association of Chartered Certified Accountants (ACCA). She began her career in the financial sector before moving into the research environment over 25 years ago, initially commercialising the British Geological Survey's portfolio.

Following a period as Deputy Director Finance at NERC (Natural Environment Research Council) Head Office Julie went on to work at the NERC Research Ship Unit, heading the Finance and Operation team. In 2013 Julie joined the NOC and, as Chief Operating Officer, led the organisation through a successful transition from a government arm's length body to an independent charity.

An inspiring leader, Julie is a mentor and role model to many, and is a tireless champion of equality, diversity and inclusion at the NOC.

A recent highlight for Julie has been her involvement in the Oceanids project, where she is the Senior Responsible Owner. Oceanids is a £16 million Marine Autonomous Systems development programme that will enhance capability for the UK marine science community.

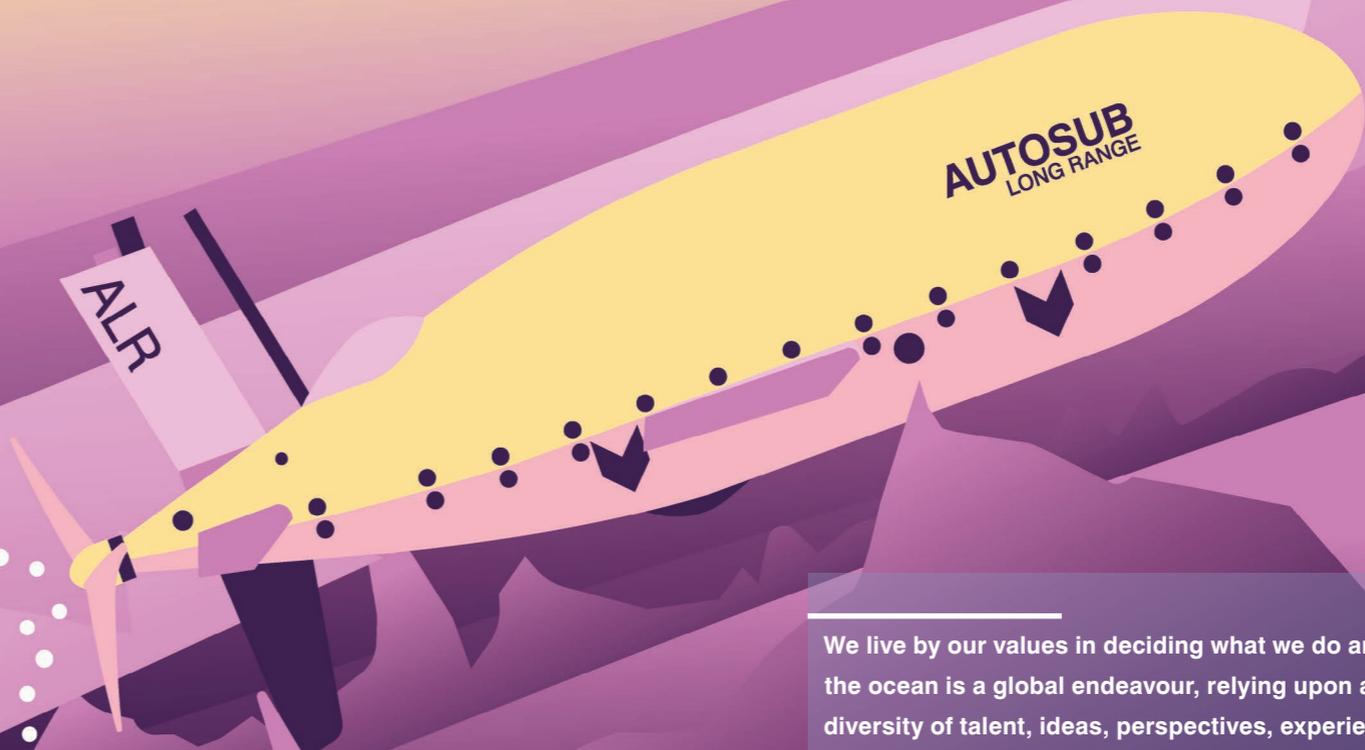
"The NOC will be seeking to add value by ensuring the funding for this disruptive technology innovation is translated into industry, by working in partnership through our existing Innovation Centre partners and associates and wider."

Oceanids will help us strengthen academia-industry-government stakeholder engagement through funding initiatives, such as the enhanced control room in the Innovation Centre, and will build on previous investment to enable greater autonomy and smarter operation of new and existing platforms, for example through enhanced command and control."

Julie Pringle Stewart Oceanids Senior Responsible Owner



LIVING OUR VALUES



We live by our values in deciding what we do and how we do it. Investigating the ocean is a global endeavour, relying upon and fully embracing our diversity of talent, ideas, perspectives, experiences, backgrounds and skills.

OUR VALUES

“Our people are our greatest asset, and our shared values underpin all that we do in realising our vision and delivering our mission. I would like to thank all our staff who have embraced our change in organisational status, and responded with resilience and compassion to the disruptions caused by COVID-19. We have had to be flexible, but the science did not stop. The innovation did not stop. By our very nature we found new ways to work.”

Professor Ed Hill CBE Chief Executive



EXCELLENCE

WE VALUE EXCELLENCE AS THE FOUNDATION ON WHICH THE NATIONAL OCEANOGRAPHY CENTRE IS BUILT



EMPOWERMENT

WE VALUE PEOPLE AND TEAMS AS THE NATIONAL OCEANOGRAPHY CENTRE'S MOST IMPORTANT ASSETS



INTEGRITY

WE VALUE INDEPENDENCE AND INTEGRITY AND TREAT EACH OTHER WITH RESPECT AND TRUST



INNOVATIVE THINKING

WE VALUE CONSIDERING DIFFERENT APPROACHES, FINDING DIFFERENT WAYS OF DOING THINGS AND SEEKING CREATIVE SOLUTIONS



ENVIRONMENTAL RESPONSIBILITY

WE VALUE THE OCEAN, RECOGNISING OUR RELIANCE ON IT, AND CONSIDER OUR ENVIRONMENTAL IMPACT IN EVERYTHING WE DO



WORKING IN PARTNERSHIP

WE VALUE THE BENEFITS OF WORKING TOGETHER AND ACTIVELY SEEK TO EXCHANGE KNOWLEDGE, SKILLS AND RESOURCES



WORK PACKAGE 1
FUTURE SCIENCE NEED



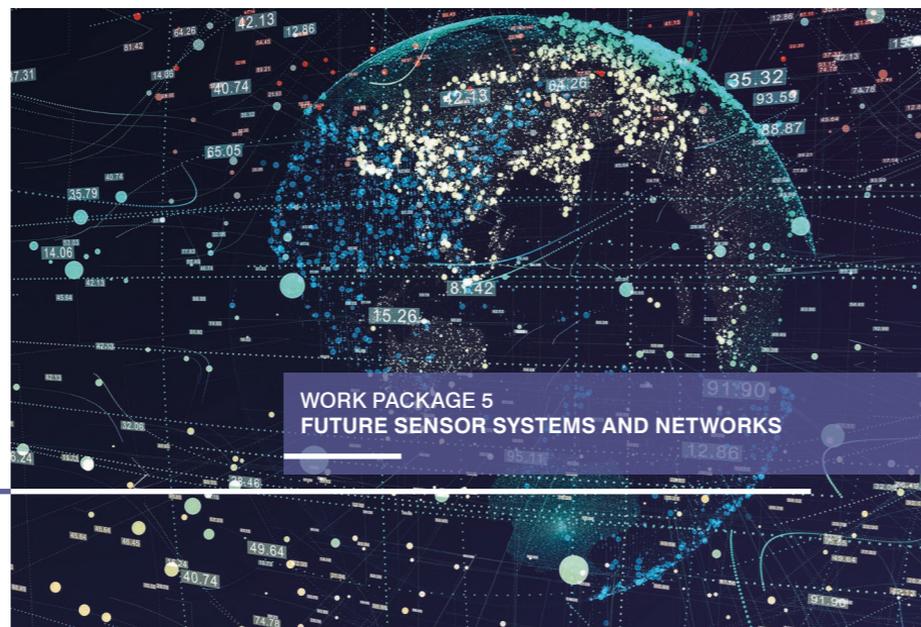
WORK PACKAGE 2
FUTURE POLICY AND REGULATION



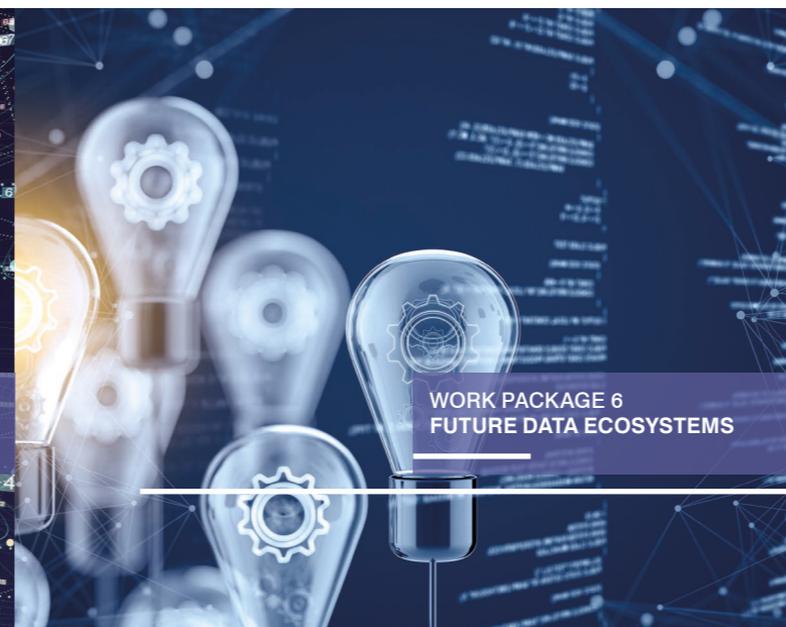
WORK PACKAGE 3
FUTURE SHIP TECHNOLOGIES



WORK PACKAGE 4
FUTURE MARINE AUTONOMOUS SYSTEMS



WORK PACKAGE 5
FUTURE SENSOR SYSTEMS AND NETWORKS



WORK PACKAGE 6
FUTURE DATA ECOSYSTEMS

THE FUTURE IS NET-ZERO

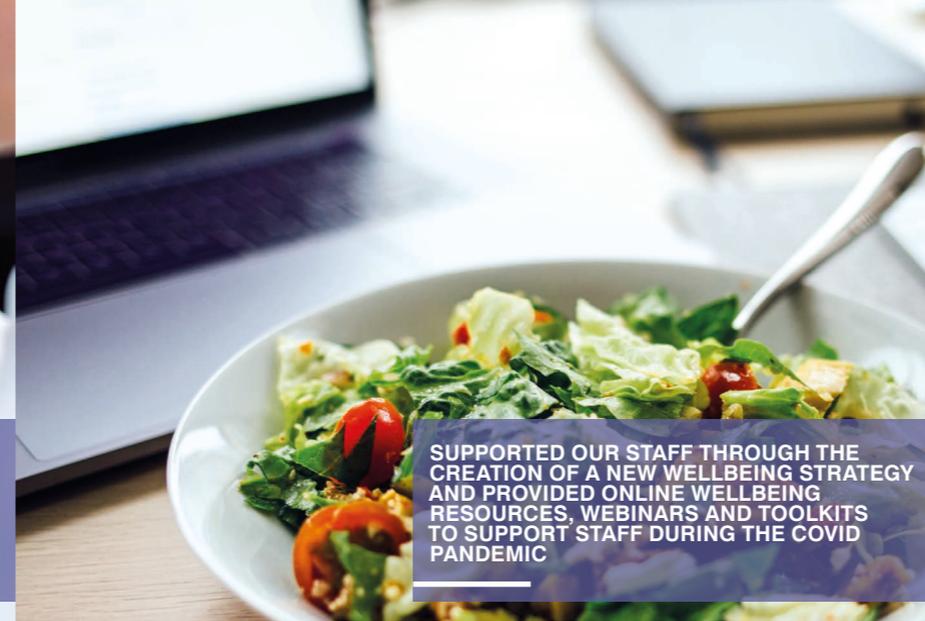
The Natural Environment Research Council (part of UK Research and Innovation) kicked off the Net-Zero Oceanographic Capability (NZOC) project at the very end of 2019-20. It will scope out ways they can maintain and enhance its research infrastructure in the future whilst adhering to their objective of becoming a 'net-zero' organisation by 2040.

As the UK's centre of excellence for oceanographic research, the NOC are leading this £250k project with support from the University of Bristol, the Defence Science and Technology Laboratory (DSTL), the University of Portsmouth, the Royal Navy, Royal Holloway University (RHUL, UoL), the Met Office, and Plymouth Marine Laboratory (PML). We will engage the marine science community and key stakeholders through digital workshops and digital surveys to carefully consider both current and future marine research, including drivers of change, enabling novel technologies such as autonomy and sensors, and constraining factors and risks.

SUSTAINABILITY AND SOCIAL RESPONSIBILITY



DEVELOPED AND PUT INTO PRACTICE NEW RESEARCH INTEGRITY AND SAFEGUARDING POLICIES THAT ALSO PROMOTE AND SUPPORT SCIENTIFIC QUALITY AND ASSURANCE



SUPPORTED OUR STAFF THROUGH THE CREATION OF A NEW WELLBEING STRATEGY AND PROVIDED ONLINE WELLBEING RESOURCES, WEBINARS AND TOOLKITS TO SUPPORT STAFF DURING THE COVID PANDEMIC



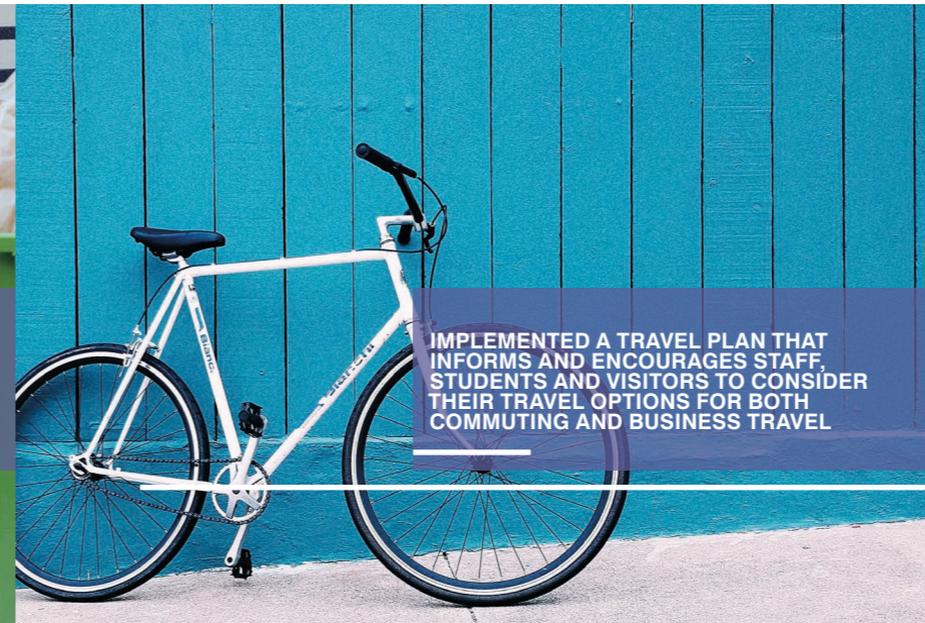
DEVELOPED OUR NEW EQUALITY, DIVERSITY AND INCLUSION (EDI) STATEMENT AND CREATED A TASK FORCE TO DELIVER THE EDI ENGAGEMENT ROADMAP



COMMITTED TO OPERATING OUR VESSELS TO A SHIP ENERGY EFFICIENCY MANAGEMENT PLAN, IN LINE WITH IMO GUIDELINES



SUCCESSFULLY RETAINED OUR ISO 14001 ACCREDITATION FOR ENVIRONMENTAL MANAGEMENT



IMPLEMENTED A TRAVEL PLAN THAT INFORMS AND ENCOURAGES STAFF, STUDENTS AND VISITORS TO CONSIDER THEIR TRAVEL OPTIONS FOR BOTH COMMUTING AND BUSINESS TRAVEL



WE IMPROVED OUR SOLAR ARRAY IN SOUTHAMPTON BY SERVICING 544 EXISTING PANELS AND ADDING 244 NEW PANELS. OUR SELF-GENERATED SOLAR ENERGY IS EXPECTED TO PROVIDE AROUND 3.9% OF OUR TOTAL ANNUAL ENERGY CONSUMPTION (PREVIOUSLY 2.5% IN 2019) FROM SEPT 2020



EQUALITY, DIVERSITY AND INCLUSION

We recognise that we cannot successfully achieve true public benefit for all without a strong and shared commitment to equality, diversity and inclusion.

At the NOC we value individual differences and the rich diversity that this brings. We want to ensure that no-one is at a disadvantage or feels excluded because of who they are, what they believe in or the experiences that they bring. We have a moral responsibility to recognise and change behaviours within the NOC, our community and the wider world, to support this vision. We still have far to go, but together we are committed to do the hard work and bring about genuine institutional change.

“We embrace diversity, which runs through all of our Values and is integral to our vision for innovation. We will be working to embed this further in all we do, and I will personally be establishing and leading a new taskforce that will focus on making sure we remain inclusive and celebrate difference.”

Professor Ed Hill CBE Chief Executive



ON THE HORIZON



ENVIRONMENTAL SOLUTIONS

With the focus on the Oceans and climate: Decade of the Ocean, COP26, the UK Net Zero Pledge, we need to be supporting the idea that the ocean can part of environmental solution to anthropic global issues. Sustainable resource management of marine systems, be it for coastal resilience, mineral extraction for essential metals for the green economy, or using depleted oil and gas reservoirs to store carbon dioxide away to reduce global warming, requires knowledge that minimises the impacts that these activities have on marine systems. The NOC will be actively working in these sectors in the coming year, sure in the knowledge that our expertise is amongst the best in the world.



HEALTHY AND PRODUCTIVE SEAS

Studies into the impact that man's activities have on the marine environment are essential to develop policies that can protect this delicate ecosystem. Better understanding of the pressures on marine systems from contaminants such as plastics; nutrients, herbicides and pesticides, and the impacts of land use changes such as deforestation and wetland drainage programmes, is urgently needed.



INTERNATIONAL COOPERATION

In 2021 we will have the G7 presidency and aim to exert great influence over the G7 Future of the Seas Initiative. The year also sees the UK hosting the COP26 UN Climate Change Conference in Glasgow, a real opportunity to get ocean issues firmly near the top of the climate agenda.

2021 is also the launch year of the UN Decade of Ocean Science for Sustainable Development. At the NOC, we are planning to make the most of the next 10 years in raising the profile of the ocean and working with world leading scientists to tackle the issues that are important to us all.



PUBLIC ENGAGEMENT AND FUNDRAISING

We will be supporting Southampton in its bid to become City of Culture in 2025, working in partnership with our community. We also plan to increase our public engagement events helping us to educate and inspire people.

As a newly independent organisation we will be looking at new ways to diversify our income, including fundraising. Individuals, companies and charitable foundations have an important role to play in understanding our changing ocean, so as a collective we can play our part in helping to restore it.

MONEY MATTERS

INCOME

£44,925,000
NERC / UKRI - GRANTS

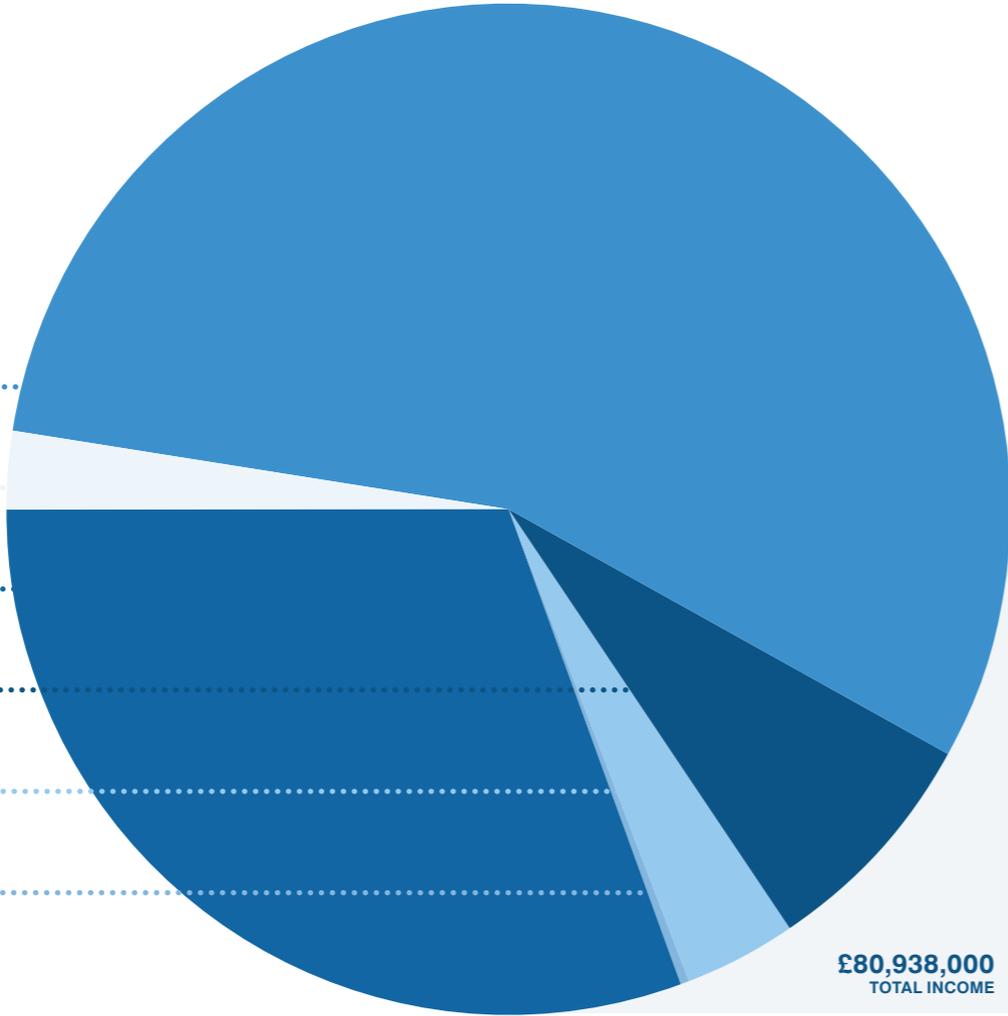
£2,000,000
DONATIONS

£24,667,000
GRANTS TO PURCHASE ASSETS

£5,996,000
UKRI - OTHER GRANTS

£2,959,000
TRADING ACTIVITIES - CHARITY

£26,000
INVESTMENT INCOME



£80,938,000
TOTAL INCOME

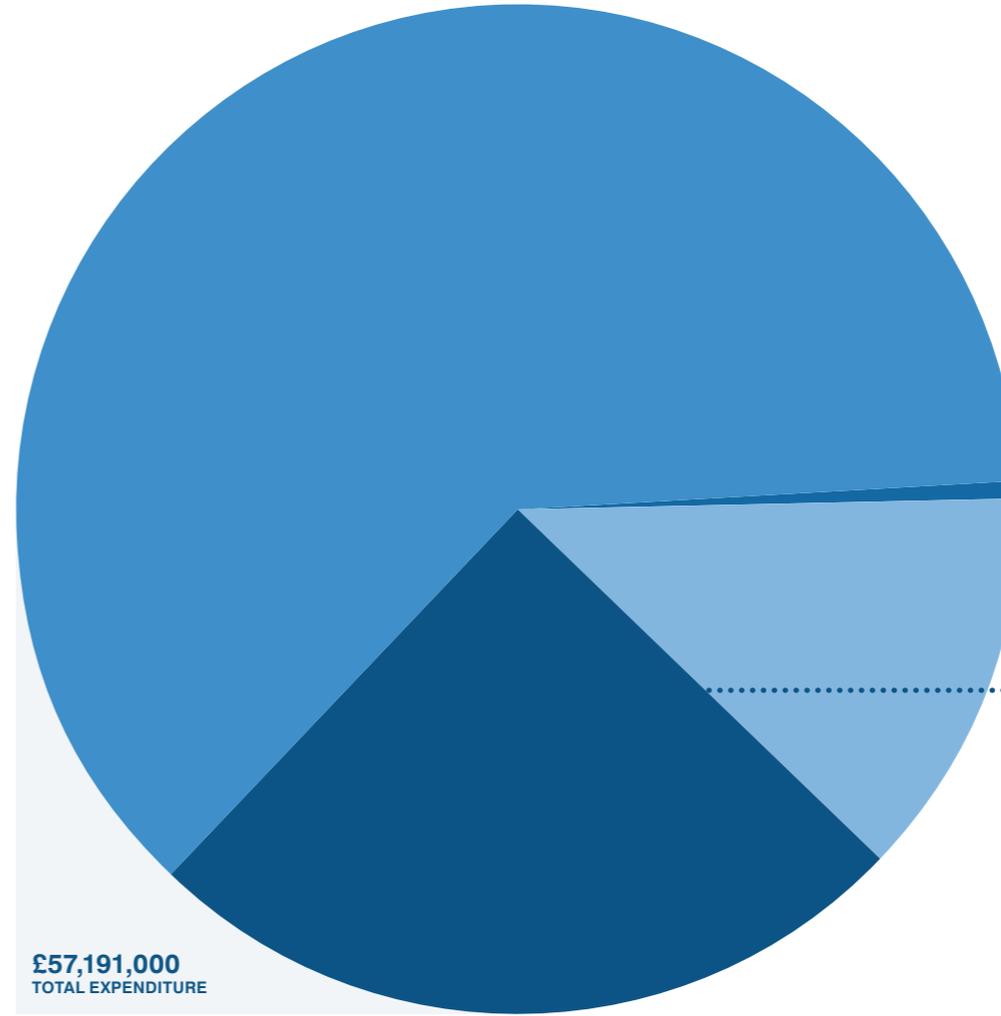
EXPENDITURE

£35,585,000
SCIENTIFIC RESEARCH

£255,000
GOVERNANCE

£7,105,000
DEPRECIATION

£14,246,000
OPERATIONS, MANAGEMENT AND SCIENTIFIC FACILITIES



£57,191,000
TOTAL EXPENDITURE

KEEPING IN TOUCH

The NOC is the UK's centre of excellence for research and technology development in marine science.

To get bitesized updates on our Science and Technology, Latest News, Public Events, Career Opportunities and Educational Resources, subscribe to **NOCMail** via our website or follow us on social media;

 noc.ac.uk

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 [National-Oceanography-Centre](https://www.linkedin.com/company/National-Oceanography-Centre)

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SUPPORTING OUR OCEAN RESEARCH & INNOVATION

Whether your passion is combating climate change, conserving and protecting ocean life or equipping the next generation of marine scientists, supporting the National Oceanography Centre allows you to have a direct impact on world leading ocean research and innovation and helps ensure we continue to make global impact from the coast to the deepest ocean.

We are a world leader in oceanographic science, research and innovation. Working in some of the remotest, deepest and most hostile parts of the ocean our scientists bring a greater understanding of issues that affect our environment, our landscapes, our health and our prosperity.

With your support our scientists and engineers can continue to push the boundaries of knowledge and exploration to protect our oceans, our planet and our futures.

Find out more at noc.ac.uk