

Challenger Wave



Monthly newsletter of the Challenger Society for Marine Science (CSMS)

NEWS

NOC data scientist Pauline Weatherall recognised in New Year's Honours

The National Oceanography Centre (NOC) congratulates Pauline Weatherall who works at NOC in Liverpool on the award of an MBE for services to bathymetry (sea bed mapping) in the 2023 New Year's Honours List. Pauline works as the Digital Atlas Manager for the General Bathymetric Chart of the Ocean (GEBCO), www.gebcoset.net, which is the definitive map of the seafloor of the global ocean. For over thirty years her work has involved bringing together digital seabed data from across the world and combining it to update and continually improve the world ocean seabed map. GEBCO aims to provide the most authoritative, publicly available bathymetry data sets for the world's oceans.



More recently, the GEBCO map has become the foundation of the Seabed 2030 project, seabed2030.org, which aims to map the entire

world ocean in detail by 2030. The surfaces of the Moon and Mars have been nearly fully mapped in great detail (250m × 250m resolution) from orbiting space craft. However, although it covers 70% of the Earth's surface, the sea floor has only been mapped from space at 5km × 5km resolution. To get more detailed seafloor maps needs measurements taken from ships (and in future from robotic surface and underwater vehicles) that are painstakingly pieced together to form the GEBCO map. Presently, less than a quarter of the ocean is mapped at even 1km × 1km resolution and only a tiny fraction in the same detail as Mars or the Moon. We take detailed maps on land for granted but they will become increasingly important for the ocean too, for example as ocean-climate simulation models get more detailed and as efforts to create digital twins of the ocean move forward quickly, this basic foundation data will be essential.

Commenting on her award, Pauline said "It is a reflection of all the excellent work that NOC has provided over the years in support of GEBCO and The Nippon Foundation-GEBCO Seabed 2030 Project and a recognition of their continuing importance."

Working for the NOC's British Oceanographic Data Centre (BODC) Pauline has become an internationally recognised expert in bathymetric data and has contributed to many world leading reports, most recently the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization (IOC-UNESCO) pilot "State of the Ocean Report", noc.ac.uk/news/noc-contributes-pilot-un-state-ocean-report.

The report outlines the recent success of Seabed 2030, a collaboration between the Nippon Foundation of Japan and GEBCO. It aims to bring together all available bathymetric data to produce the definitive map of the world ocean

floor by 2030 and make it available to all. The latest figure now stands at 23.4% mapped to a high resolution, noc.ac.uk/news/amount-seafloor-mapped-rises-234, reflecting an increase of 10.1 million square kilometres of new bathymetric data from last year's figure. This increase is equivalent to an area around the size of Europe; and slightly larger than the Sahara, Earth's largest hot desert.

Pauline Weatherall, said about this recent success, "At BODC we act as the Global Center for Seabed 2030 and are responsible for assembling and making available GEBCO's global bathymetric grids. We're proud to work closely with colleagues at the global network of Seabed 2030 Regional Centers and partner organisations to bring together their regional bathymetric compilations into a global, harmonised, data set."

Pauline's contributions to NOC, BODC, GEBCO and Seabed 2030 have enabled international understanding of the depth and shape of the seafloor, fundamental for understanding ocean circulation, tides, tsunami forecasting, fishing resources, sediment transport, environmental change, underwater geo-hazards, infrastructure construction and maintenance, cable and pipeline routing and much more.

New funding allows robot fleet to investigate ocean carbon cycle

The UK is at the forefront of a global shift to using high-tech robots to explore the ocean. The Natural Environment Research Council (NERC) BIO-Carbon programme, bio-carbon.ac.uk/news/bio-carbon-new-funding-opportunity, is investigating how marine life stores carbon dioxide (CO₂). Alongside the ship-based research in 2024 a fleet of autonomous robots, funded via NERC's Net Zero Oceanographic Capability (NZOC) programme, will collect data in a different way that is both low-carbon and novel in its approach to marine science.

Leigh Storey, NZOC lead, commented; "NERC's marine research fleet has a target to be net zero in carbon by 2040.



To achieve that, new technology must be adopted, alongside scientists developing new techniques that can fully exploit all that robots can provide. The BIO-Carbon programme presents an opportunity to show how autonomous platforms might reduce the need for ship-based experiments in the future."

The BIO-Carbon programme seeks to confront three challenges:

- How does marine life affect the potential for seawater to absorb CO₂? The ability of oceans to absorb carbon dioxide is determined by the alkalinity of the water. Calcium carbonate is the main influence on alkalinity but we are unsure which organisms are producing carbonates and where.
- At what rate does marine life convert CO₂ into organic carbon? Carbon dioxide is removed from the ocean by being converted to organic matter by phytoplankton, microscopic single-cell plants which form the basis of the food chain. Whether global phytoplankton growth will increase or decrease under climate change is unknown.
- How does climate change affect the future storage of carbon in the ocean? The creatures forming the marine ecosystem eventually respire the organic carbon as CO₂. To determine the speed at which this CO₂ is returned to the atmosphere, we need to understand where and when this respiration process occurs in the ocean.

Dr Adrian Martin, the BIO-Carbon Champion from the National Oceanography Centre, added; "The BIO-Carbon NZOC science mission will add considerably to what we can achieve, providing a new set of powerful tools while pioneering a low carbon emissions approach to environmental science. It is great to see the UK leading the way in this responsible approach to research given the UK's drive to net zero carbon emissions."

III Early Career Symposium on Marine Biogeochemical Modelling

15th February 2023 | 1pm-4.30pm (London time) | 10:00-15.30 (Brasilia time); deadline for registration, 14th February 2023, forms.gle/mjg4wqAW4QDCRDU6A. This symposium showcases the final projects from postgraduate students for the AGM5840 module on

mathematical and computational modelling of marine biogeochemical cycles, which is annually offered by INCLINE and IAG-USP. It also features keynote talks given by emerging and world-leading researchers in the field. It is intended to bring together students and researchers interested in theoretical and applied aspects related to ocean biogeochemistry modelling, therefore serving as a forum for the community. Everyone with an interest or curiosity in the subject is welcome to attend regardless their academic background or career stage.

REGISTRATION IS OPEN ONLINE

III EARLY CAREER SYMPOSIUM ON MARINE BIOGEOCHEMICAL MODELLING

15th February 2023
10am – 1.30pm (Brasilia time, GMT -3)
1pm – 4.30pm (London time)

This event showcases **THE FINAL PROJECTS** from postgraduate students for the AGM5840 module on mathematical and computational modelling of **MARINE BIOGEOCHEMICAL CYCLES**, which is annually offered by INCLINE and IAG-USP.

It also features keynote talks given by emerging and world-leading researchers in the field. It aims to bring together students and researchers interested in theoretical and applied aspects related to **OCEAN BIOGEOCHEMISTRY MODELLING**, therefore serving as a forum for the community.

Everyone with an interest or curiosity in the subject is welcome regardless their academic background or career stage.

Keynote speakers:

- Letícia Cotrim da Cunha (UERJ, Brazil)
- Irina Marinov (University of Pennsylvania, USA)
- Sophy Oliver (National Oceanography Centre, UK)
- Ric Williams (University of Liverpool, UK)

Hosted by:

Registration is free of charge (deadline 14th Feb).
Further information: www.incline.iag.usp.br

More information is available at, inclineusp.wixsite.com/iisymposium2023 and on social media:

Twitter: <https://twitter.com/inclineusp>

Instagram: <https://www.instagram.com/inclineusp/>

Facebook: <https://www.facebook.com/inclineusp/>

Atmospheric warming has major implications for ocean circulation in the Mediterranean Sea

Professor Simon Josey, from the Marine Systems Modelling Group at the National Oceanography Centre (NOC), in collaboration

with Dr Katrin Schroeder from the Institution of Marine Science in Italy, has analysed new atmospheric data-models and found that the ocean surface in the North-West Mediterranean (NWMed) has lost less heat than normal in recent decades. This change reduces the movement of water from the upper ocean to the deep layers and has potential consequences for winter storms and summer heat-waves.



The study provides insight into the cause of the changes, showing that a warmer atmosphere is reducing the amount of heat the ocean is losing through its surface. The changes are strongest in the NWMed south of the French coast, which is a key region for the Mediterranean circulation where the upper ocean water normally sinks to deep levels in winter.

Professor Josey said: “Air temperature has warmed more rapidly than ocean temperature which effectively puts an ‘extra blanket’ over the ocean stopping it from getting as cold as it used to and reducing the ability of waters to sink to the deeper layers. It is also possible that the reduced ocean heat loss will have a knock-on effect on the atmosphere, modifying weather patterns in the region and the occurrence of extreme events including severe winter storms.”

The study discovered that the air has warmed more quickly than the sea surface in the last 70 years in the NWMed but not in the Aegean Sea pointing to regional differences in the way in which ocean-atmosphere interaction is changing. As a result, the NWMed is not losing as much heat as it used to, and the normal ocean circulation there has now become threatened. A further study is planned to explore the implications of this and to assess the impact it will have on overall weather and climate for people living in this region, including France, Italy, Spain and north Africa. This area has already become known as a climate change hotspot as witnessed by the major heat-wave in

the summer of 2022, which saw June temperatures of 40–43 °C in parts of Europe, with France experiencing multiple heat breaking records.

Professor Josey continued: “We found that surface ocean heat loss has weakened, and that winter sinking is now occurring only about half as often as it did 40 years ago, indicating that the normal flow of water between the upper and deep ocean has been disrupted. This may well have consequences for the wider ocean circulation, and it is imperative that we investigate this further with a climate model-based study to determine the impacts and possible feedbacks on the atmosphere including winter storms and summer heat-waves.” To read the full paper, visit iopscience.iop.org/article/10.1088/1748-9326/aca9e4.

Uniting on ocean acidification: a radical new approach to monitoring OA impacts at global scale

Around one quarter of the CO₂ emitted from human activities annually is absorbed by the ocean. This has been shown to affect the chemistry of the seawater, causing a drop in pH which has major implications for many marine species and ecosystems. Despite the threat that ocean acidification (OA) poses, there is currently no global framework for monitoring its biological impacts, and this is hampering efforts to fully assess the rate and scale of the issue. As such, a team of ocean acidification experts, including scientists from Plymouth Marine Laboratory (PML), have created a new methodology designed to ensure best practice in future OA monitoring and improve globally-coordinated efforts to understand and mitigate its effects.

Drawing on a wealth of data from previous experiments and observations, the publication "Unifying biological field observations to detect and compare ocean acidification impacts across marine species and ecosystems: What to monitor and why", doi.org/10.5194/os-19-101-2023, proposes five broad classes of biological indicators that, when coupled with environmental observations including carbonate chemistry, would create a far more advanced understanding of the rate and severity of the biological changes taking place due to ocean acidification globally.

Lead author, PML's Director of Science and Co-Chair of the Global Ocean Acidification

Observing Network (GOA-ON), Professor Steve Widdicombe explains, “The chemical effects of ocean acidification are well-documented but we still need much better, more detailed and more consistent real-world data on its biological effects. Over the past two decades, lab experiments and other studies and analyses



have shown that ocean acidification can have profound effects on species such as corals, crabs and other shellfish and marine organisms. Higher CO₂ levels in seawater make it difficult for shellfish to build their shells

and for corals to form their reefs, as these are made of carbonate compounds. This is hugely significant for ecosystems, the wider marine food web and indeed, our own food security. By establishing a universal methodology we hope to be able to effectively evaluate the rate of change and the various mechanisms that affect ocean acidification across a diverse range of ocean environments. It's a very ambitious and innovative step forward but also something that requires rapid and widespread adoption.”

The framework itself presents an approach which considers five fundamental ecosystem traits, all of which span across different marine ecosystems and which have been previously identified as potentially sensitive to ocean acidification. Designed to enable a comparison of the relationships between rates of chemical and biological change under different circumstances, and across regional and global scales, the framework will, in turn, contribute towards UN Sustainable Development Goal 14.3 'Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels'.

Crucially, it will also support work towards the achievement of the UN Convention on Biological Diversity (UN CBD) goal to minimise the impacts of ocean acidification (as set out in the Kunming-Montreal Global Biodiversity Framework, adopted in December 2022 at COP15 in Montreal). Professor Widdicombe adds, “An improved and inclusive monitoring framework,

enabling the combination of chemical and biological data, is vital in terms of how we understand ocean acidification and the impacts it is having, and will have in future, across marine species and ecosystems. Ultimately, this new approach should help enable the scientific community to contribute even more effectively to the achievement of the UN Decade of Ocean Science vision, 'the science we need for the ocean we want'. This includes empowering countries and regions with emerging OA science capacity".

Environment Agency Chair says collaboration needed to protect local economies and nature on the coast

A concerted effort is needed to better protect our coastal communities and economies whilst enhancing our marine environment, said Environment Agency Chair Alan Lovell on the 26th of January, as the EA launched its latest 'State of the Environment: Coast and Marine report', assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1130743/State_of_the_environment_-_the_coastal_and_marine_environment_-_report.pdf. With over a third of the UK population living within 5 km of the coastline, more work is needed to ensure the protection, recovery and restoration of our coastal and marine environment, and to enable coastal populations to thrive.

Speaking at the Coastal Future's Conference, Alan Lovell said "England's national story is a story about our relationship with the coast and a century of air travel has not totally eroded our reliance on ports and estuaries to deliver the things we need. Yet, coastal towns are now among the most deprived in the country. We need to work together with coastal communities to identify the best possible way to keep them safe and prosperous. We need a concerted effort to better protect coastal communities and economies while enhancing the marine environment."

The report, produced by the EA's Chief Scientist's Group, draws attention to the many consequences of climate change, with 85% of England's salt marshes, which store the carbon equivalent of nearly 40 million people's annual domestic emissions, estimated to have been lost since the 1800s, as well as up to 50% of seagrass meadows and 95% of our native oyster

population. Meanwhile over 100,000 people are estimated to be at risk from significant coastal flooding, a figure likely to increase by 300% this century, even if global warming is kept to 2 degrees. However, the report also shows important progress towards tackling these threats to our marine and coastal environment, including salt marsh restoration, helping fish populations recover and improving water quality in designated bathing waters.

Alan Lovell also said "Continued action must be taken to curb the threat of climate change, through evidence based, collaborative approaches spanning from large-scale projects, local on-the-ground restoration and working alongside coastal communities to identify the best possible approach to coastal management. The EA continues to invest in a healthy coastline through many outlets including our National Flood and Coastal Erosion Risk Management



strategy and our Restoring Meadow Marsh and Reef initiative. Although some progress has been made, there is a great deal more to be done and I hope that what we learn from innovative projects such as these will encourage others

to join us and invest in ways that champion coastal resilience and help in the fight against climate change."

The EA's Restoring Meadow Marsh and Reef initiative, ecsa.international/reach/restoring-meadow-marsh-and-reef-rememare, is just one of the programmes taking action to tackle climate change, and aims to restore at least 15% of priority estuarine and coastal habitats by 2043. Additionally, the EA's £120m Habitat Compensation and Restoration Programme, funded through Flood and Coastal Risk Management, has created over 1200 hectare of salt marsh and mudflat since 2005 to keep pace with protected habitat lost as a result of managing risk to people and property. The latest mapped extent of salt marsh in England shows an overall increase of 7% compared with 2006 to 2009 figures, nearly half of which is as a result of habitat creation in this programme. The

restoration initiative aims to build on this experience for salt marsh and help to build an accelerated programme for this and other inshore habitats.

The Environment Agency will continue to invest in innovation, partner collaboration and local on-the-ground restoration to ensure a coordinated approach to manage our coastal and marine environment, combat the effects of climate change, and mitigate the damage that has already been done.

Volunteers for Special Interest Group coordination roles

The Challenger Society for Marine Science currently supports a number of Special Interest Groups (SIGs). These are community focused and led groups that enable those working in a particular field to easily maintain contact and meet up, often at side events associated with the biennial Challenger Conference. The Society offers financial support to allow these meetings to run e.g. to provide catering. We can also help to advertise your activities on our website and via our social media channels.

We currently have vacancies for coordinators/leads of the following Special Interest Groups. Please click on the hyperlinks or contact us directly for more information.

Marine Science and Policy, www.challenger-society.org.uk/marine_science_policy.

Sea Ice, www.challenger-society.org.uk/Sea_Ice.

Sea Level, www.challenger-society.org.uk/Sea_Level.

Coastal and Shelf Seas, www.challenger-society.org.uk/Coastal_and_Shelf_Seas.

If you are interested in volunteering to take on one of these roles, either as Lead or Deputy, please reply to Cecilia Liszka, ceclis56@bas.ac.uk, for further information or to express your interest. We are particularly keen to hear from those in early career stages but anyone is welcome to put themselves forward.

In addition, if your marine science community is not represented by the range of SIGs we currently support, please feel free to propose a new one. This should be a 1-2 page proposal providing some brief background and scientific justification for the need for the SIG, the remit it would cover, and any activities you propose to

run over the next couple of years. It does not need to be hugely extensive and should not be longer than 2 pages. Any questions, please again email Cecilia Liszka, ceclis56@bas.ac.uk.

NOC Association of Marine Science National Capability Beneficiaries (NOCA) Annual General Meeting; Registration now open

The National Oceanography Centre (NOC) Association of Marine Science National Capability Beneficiaries (NOCA) is the main vehicle for NOC's engagement with the beneficiaries of NOC-led marine science National Capability (NC). NC comprises: science, large-scale research infrastructure, small-scale NC-services, facilities and data and National and Public Good.



Registration for the 12th Annual General Meeting of the NOCA is now open. The (virtual) meeting will take place via Zoom during the mornings of Wednesday 7th and Thursday 8th June 2023. This year's agenda will include items on the UK Sustained Scientific Ocean Observation Priorities Consultation, updates on the Upscaling Autonomy Working Group, the Climate Linked Atlantic Sector Science programme, artificial intelligence and digital twins, and accessibility to ship-based research. For enquiries, please email NOCA Secretary: Jackie Pearson jfpea@noc.ac.uk. You are warmly invited to participate by completing the registration link for this free event, noc-events.co.uk/noc-association-2023-registration.

VIEWES

Scaling up Marine Autonomy: Marine research community consultation

A recommendation of the landmark Net Zero Oceanographic Capability (NZOC) report, noc.ac.uk/files/documents/nzoc_summary_report.pdf, was that "NERC should expect to double

the size of the autonomous fleet it supports every five years." In response, the NOC Association of Marine Science National Capability Beneficiaries (NOCA), noc.ac.uk/partnerships/our-national-role/coordinating-uk-marine-science/noc-association, and the Challenger Society for Marine Science have formed the joint Upscaling Autonomy Working Group (UAWG). The UAWG is running a series of information webinars, followed by a consultation, on the future shape of upscaling of marine autonomy in the UK. For further details and to register, please see the event flyer which can be found on the NOCA web page, noc.ac.uk/partnerships/our-national-role/coordinating-uk-marine-science/noc-association.

New Seabed 2030 partnership strengthens autonomous ocean mapping in support of a complete map of the entire seafloor

The Nippon Foundation-GEBCO Seabed 2030 Project, www.seabed2030.org, has entered into a memorandum of understanding with ecoSUB Robotics, a division of Planet Ocean, which designs and builds innovative autonomous underwater vehicles (AUVs) for ocean research. The collaboration will greatly support the realisation of a complete map of the ocean floor as ecoSUB AUVs are able to navigate areas which are inaccessible to scientists and divers for safety or other reasons.

Established in 2004, Planet Ocean, www.planet-ocean.co.uk, provides instrumentation to the oceanographic research community, as well as the defence sector. In 2015 the company, together with the Marine Autonomous Robotic Systems group based at the National Oceanography Centre (NOC), developed a groundbreaking micro AUV which led to the creation of ecoSUB Robotics, www.ecosub.uk, based at the Marine Robotics Innovation Centre of NOC. Since then ecoSUB Robotics have developed the system to include a comprehensive and growing range of AUV's incorporating advanced navigation techniques and the highest resolution side scan sonar systems available along with cameras and acoustic communications. The portability and affordability of ecoSUB enables new and existing users of AUV's to explore new opportunities offered by compact autonomous systems for survey, science, defence and exploration.

Seabed 2030 is a collaborative project between The Nippon Foundation and GEBCO to inspire

the complete mapping of the world's ocean by 2030, and to compile all bathymetric data into the freely available GEBCO Ocean Map. GEBCO is a joint programme of the International Hydrographic Organization (IHO) and the Intergovernmental Oceanographic Commission (IOC) and is the only organisation with a mandate to map the entire ocean floor. Seabed 2030 is formally endorsed as a Decade Action of the UN Decade of Ocean Science for Sustainable Development.

"At ecoSUB Robotics we're committed to increasing accessibility to AUVs and making this groundbreaking technology available to all," commented Terry Sloane, Managing Director of Planet Ocean. "Advancing oceanographic research will benefit the entire population and AUVs play an invaluable role in progressing this field of ocean science. We look forward to supporting the global effort in pursuit of a complete ocean map led by Seabed 2030 through the development of our advanced, yet affordable, AUV technology."

Seabed 2030 Project Director Jamie McMichael-Phillips said "Not only do AUVs enable us to access hazardous areas, but they also provide a solution to the mapping of remote and uncharted areas. Collaborative working is essential to Seabed 2030 and it's through partnerships, such as this with ecoSUB Robotics, that we're able to ensure our strategy remains forward-looking, and that our efforts are well-positioned to make use of innovative technologies as they become available to progress our goal."

All data collected and shared with the Seabed 2030 project is included in the GEBCO global grid, which is free and publicly available. Planet Ocean and ecoSUB Robotics will be exhibiting at Ocean Business in Southampton, in April this year, www.oceanbusiness.com.

European Geophysical Union meeting EGU 23, session ITS3.6/BG8.5, Nature Based Carbon Cycle Management Solutions: the role of oceanic, terrestrial and geological systems (NBCCMS)

Come and visit the exciting PICO (Presenting Interactive Content) session, meetingorganizer.copernicus.org/EGU23/session/46870, on the afternoon of Tuesday the 25th April, in Vienna.

Empowering the natural primary production capacity of the Earth System Carbon Cycle, without the risks of engineering the composition of the environment itself, to remove excess atmospheric CO₂, is the subject of this Session. Activities and mechanisms that decrease CO₂, without increasing acidification, and which, importantly, allow the economies of the world to continue to grow and prosper are encouraged; particularly global Nature Based Carbon Cycle Management Solutions (NBCCMS) effecting an efficiency gain in the natural capture and storage of carbon, enabling the control and regulation of CO₂ levels in the atmosphere via natural mechanisms. NBCCMS should provide no mechanism for a preferential pressure on naturally determined biodiversity.

The Earth has a carbon cycle, where carbohydrate and hydrocarbon structures produce carbon dioxide (CO₂), through respiration and combustion just below or at the Earth's surface. The CO₂ released into the atmosphere is then taken up by biological primary production, through photosynthesis, and converted back into carbohydrates and hydrocarbons. Traditionally, forests are known to play a key role in the carbon cycle; from an EU perspective alone, offsetting about 10% of total European GHG emissions, with a net carbon sink of 400 Mt CO₂ eq/yr (EEA, 2020), mainly in forest lands and to a less extent in Harvested Wood Products (HWP). More recently, other terrestrial ecosystems and also oceanic ecosystems have been shown to play equally key roles in the Earth's carbon cycle from a global perspective. Now, to reach global targets for climate neutrality by 2050, further boosting the role of NBCCMS in increasing the permanence of carbon stored in natural ecosystems as well as in harvested products is needed.

We have become so accustomed to being instructed that there is no 'silver bullet' to the anthropogenic climate crisis that most of us have begun to accept it as an irrefutable fact. However, there are no published papers demonstrating this, if indeed it is something that could be demonstrated. In a more simple thought process having worked out how to supercharge the combustion side of the Earth's carbon cycle, during the unprecedented innovation of the industrial revolution, it doesn't seem too far fetched to imagine that there are NBCCMSs for supercharging the photosynthetic side of this

natural cycle and rebalancing the system. – **your Wave Editor is one of the convenors of this session**

SALTS

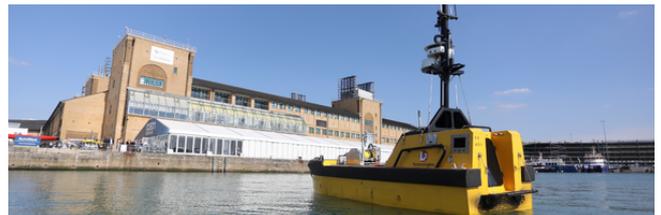
No news from sea this month I'm afraid

I know that this is a favourite section for many readers, where we get the inside information about life at sea, its thrills and spills. So please the next time you are at sea or carrying out any fieldwork, please remember that a simple paragraph or two will get you published here. – **Ed**

CALENDAR

18th-20th April 2023: Ocean Business 2023

Ocean Business returns to the National Oceanography Centre, Southampton UK. Register for your free ticket, www.oceanbusiness.com/, to see, in person, the scientific and technological developments from the industry. Connect with thousands of the industry's brightest minds, and share ideas to help define the future of ocean technology.



Meet over 360 world-leading manufacturers and service providers to demo the latest tools and see products live in action. From cutting-edge surveying innovation to the latest marine autonomous systems, you'll find hundreds of solutions to transform your business in 2023 and beyond. See the full demo programme here, www.oceanbusiness.com/training-and-demonstrations-programme-day-1/. It's free to attend so register for your ticket, we can't wait to see you in April.

23rd-28th April 2023: EGU General Assembly 2023

Vienna, Austria

The EGU General Assembly 2023 will bring back many of the features the EGU community

enjoyed before the pandemic, including: orals, posters, and, PICO sessions, in a new hybrid format, as well as a wide variety of networking opportunities. At the same time, we are very keen to improve the experience for our virtual attendees, and are working hard to connect the virtual and on-site experiences as much as possible. Learn more about the planned format for EGU23 on our website, egu23.eu/about/meeting_format.html.

4th-9th June 2023: ASLO Aquatic Sciences Meeting 2023, Resilience and Recovery in Aquatic Systems

Palma de Mallorca, Spain

Concepts of resilience and recovery do not only apply to aquatic ecosystems but also to societies when faced with disruptions and crises. Past events have shown that adaptability and decisiveness are important keys to resilience and recovery. Disruptions are opportune moments for setting up strategies for management and recovery. Faced with the COVID-19 pandemic, ASLO meetings have adapted by transforming the ASM 2021 Palma meeting to virtual with a positive attitude that in 2023 we will recover and meet in-person. Positivity is also an important factor. We do not dwell on problems, but we try to look for solutions and get united for whatever crisis we face.

We will incorporate the theme of resilience and recovery in aquatic systems into the plenary sessions and encourage submissions that examine these topics and invite you to contribute special sessions on topics relevant to freshwater and marine ecosystems. We look forward to having a dynamic meeting. This will be an in-person meeting, beginning on Sunday with an opening plenary and reception, then conclude on Friday, with the scientific program scheduled Monday through Friday. There will be a small virtual component for those unable to travel to Spain. The programme, registration and abstract submission information are available at www.aslo.org/palma-2023/, and the abstract deadline is 23rd February.

26th–30th June 2023: MARE Conference People & the Sea XII, Blue Fear, navigating ecological, social and existential anxieties during the Anthropocene

Amsterdam, Netherlands

In addition to regular paper-based panels, we encourage panel proposals with innovative

formats that stimulate interaction and dynamism. These include formats such as roundtables, workshops, brainstorm sessions, debates, artistic interventions, exhibition (virtual excursion), documentary film (photo essay/story) screenings with discussion, meet the author sessions, book presentations etcetera. We strongly encourage the submission of pre-arranged panels. If you have an idea for a panel but only a partial list of presenters, please submit and we will help connect you to others. For more regular panels, we encourage thorough discussion of presented papers, for example by including discussants or peer reviewing. We also welcome the submission of individual abstracts (max 300 words) for oral presentation. Please note that sessions will be 1.5 hours long and that participants may submit only one lead-authored paper proposal, although they may initiate or be second author in other kinds of proposals.

To present a paper in the MARE conference, the participant must be physically present in Amsterdam. Online participants can observe all conference sessions, but will not be able to present themselves. Please, regularly visit this page, <https://marecentre.nl/>, for updates and important information about the 12th MARE People and the Sea conference. Please, note that the deadline for the submission of panel and paper abstracts has been extend to Wednesday, **February 15th at midnight (CET)**.

9th-14th July 2023: Goldschmidt Conference
Lyon, France

Let's Talk about #DEI @goldschmidt2023. Tell us about obstacles that contribute to the under-representation of marginalized groups in geochemistry. Suggest best practices and innovative ideas to remove those obstacles. Submit your free additional abstract to Session 14e by the abstract deadline on 1st March advertising the edi session at the forthcoming goldschmidt conference this year, conf.goldschmidt.info/goldschmidt/2023/cfp.cgi.

4th–6th November 2023: Arctic Circle Japan Forum

Tokyo, Japan

With more than 100 speakers over 50 sessions, the programme is now published; to register and see the programme visit <https://cp-entry.com/acfj2023-en/>. The Arctic Circle is collaborating with the Sasakawa Peace Foundation in organizing the Forum.

Governments, universities, companies, research institutions, organizations, associations and other partners were invited to submit proposals for Sessions. For more information visit www.arcticcircle.org/forums/arctic-circle-japan-forum.



The CSMS email address is challenger.society@gmail.com. Contributions for next month's edition of Challenger Wave should be sent to: john@vectisenvironmental.com by the 28th February.

JOBS and OPPORTUNITIES

Two positions available at the NOC, Southampton.

The National Oceanography Centre (NOC) is the UK's centre of excellence for oceanographic sciences. We are a national research organisation, delivering integrated marine science and technology from the coast to the deep ocean.

1: Marine/Carbonate Chemist: Autonomous Sensor Development

<https://careers.noc.ac.uk/vacancy/marine-carbonate-chemist-autonomous-sensor-development-509947.html>

2. Research Engineer (Sensors for the Ocean Carbonate System)

<https://careers.noc.ac.uk/vacancy/research-engineer-sensors-for-the-ocean-carbonate-system-509954.html>

Informal enquiries to Dr Socratis Loucaides, Principal Scientist, Ocean Technology and Engineering, s.loucaides@noc.ac.uk

EGS International Ltd hiring Head of Geosciences

EGS are looking for a dynamic motivated individual to manage the day to day running of the Geosciences Department. You will head up a dedicated team working on complex projects across a broad spectrum of market sectors.

Visit www.oceanbusiness.com/job-posts/job-advert-egs-international-ltd-hiring-head-of-geosciences/ to find out how to submit your application.

There are jobs on the IMBER web site

<http://www.imber.info>

Integrated Marine Biosphere Research

Jobs and opportunities

New

- 2023 Open call: NF-POGO Visiting fellowships for shipboard training. 3 February - 30 November. Apply **now**
- Executive Director: Scientific Committee on Oceanic Research (SCOR), University of Delaware, USA. Apply by: **17 February**
- Call for Expressions of Interest: Schulich Fellowship 2023/24: Marine & Environmental Law. Apply by **17 February**
- PhD/Postdoc: Ocean coupled physical-biogeochemical modelling. Liège University, Belgium. Apply **now** – open until filled
- PhD/Postdoc: Suspended particulate matter modelling. Liège University, Belgium. Apply **now** – open until filled
- Climate & Ecosystems Coordinator: NERACOOS, Portsmouth, NH, USA. Apply **now**. Open until filled
- Postdoc: Biogeochemical Oceanography, Princeton University, NJ, USA. Apply **now**. Open until filled
- Short-term position: Project Researcher for online mapping of concepts and methods. Work remotely. Apply by **10 March**
- Short-term position: Digital/animation artist with web design & basic programming abilities. Work remotely. Apply by **10 March**
- Call for Proposals: International Teams in Space and Earth Sciences. Submit by **16 March**
- PhD: Predictive modelling for management. University of Tasmania, Hobart, Tasmania, Australia. Apply by **27 March**
- Science Director: International Science Council (ISC), Paris, France. Apply by **31 March**
- Associate/Assistant/Full Researcher: Oceans and Atmosphere, Scripps, California, USA. Apply by **1 May**
- 2023 Call for SCOR Working Group proposals. Submit by **12 May**
- Call for Nominations: Bina Agarwal Prize for Young Scholars in Ecological Economics. Submit by **15 May**

In case you missed it...

- Postdoc: Ecosystem Modeling and Fisheries Science: Climate Change, Nutrient, and Contaminant Impacts on the Salish Sea, University of Washington Tacoma, USA. Apply now, open until filled
- Research Manager: Bazaruto Centre for Scientific Studies, Benguerra Island, Mozambique. Apply by **16 February**
- CBD Call for nomination of experts for ad hoc technical expert group on indicators for the Kunming-Montreal Global Biodiversity Framework. Submission deadline: **23 February**
- Director: WCRP RIfS International Project Office, Montreal, Canada. Apply by **23 February**
- Postdoc fellow: Mercury Biogeochemistry, Stellenbosch University, SAWS, MIO, Stellenbosch, South Africa. Apply by **28 February**
- Oceanographer: Fugro, Wallingford or Portchester, UK. Apply by **28 February**
- Science Director, International Science Council, Paris, France. Apply by **31 March**

imber@imr.no