July 2022

Challenger Wave

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

NEWS

Plankton will store more carbon as Earth's climate warms, but storage beyond the end of the century is uncertain

Researchers at the University of Bristol, the National Oceanography Centre (NOC) and other UK institutions predict that the amount of carbon stored by microscopic plankton will increase in the coming century. Using the latest IPCC models (Intergovernmental Panel on Climate Change), the team expects the 'Biological Pump', process where microscopic plants, often called phytoplankton, take up carbon and then die and sink into the deep ocean where carbon is stored for hundreds of years, to account for 5% to 17% of the total increase in carbon uptake by the oceans by 2100. Their findings were published today in the journal PNAS (Proceedings of the National Academy of Sciences), www.pnas.org/doi/full/10.1073/pnas.2204369119.

Lead author, Dr Jamie Wilson, of Bristol School of Earth Sciences, explained: "The Biological Pump stores roughly double the amount of carbon dioxide that is currently in our atmosphere in the deep ocean. Because plankton are sensitive to climate change, this carbon pool is likely to change in size so we set out to understand how this would change in the future in response to climate change by looking at the latest future projections by IPCC models."

Microscopic organisms living in the sun-lit surface of the ocean called plankton use carbon dioxide during photosynthesis. When these plankton die, their remains rapidly sink down through the "Twilight Zone" of the ocean (200 – 1000 m) where environmental factors, such as temperature and oxygen concentration, and ecological factors, such as being eaten by other plankton, control how much reaches the deep ocean where the carbon from their bodies is stored away from the atmosphere for hundreds to thousands of years. Warming of the oceans slows down the circulation, increasing the time that carbon is stored in the deep ocean.

Contributing author Dr Anna Katavouta, who worked alongside early-career scientist Dr Chelsey Baker, both from the National Oceanography Centre, added: "Our research found a consistent increase in the carbon stored in the ocean by the biological carbon pump over the 21st century in the latest IPCC model projections. In contrast, we found a decline in the global export production (the amount of organic matter, such as dead plankton, sinking below the ocean surface) which suggests that export production may not be as accurate a metric for the biological carbon pump than previously thought. We demonstrated that the organic matter flux at 1000 meters is instead a better predictor of long-term carbon sequestration associated with the biological carbon pump This outcome will help us to better understand the processes that control the biological carbon pump and to predict more reliably how much of the carbon released due to human activity will be stored in the ocean in the future."

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However, the IPCC models have no consistent representation of the environmental and ecological processes in the Twilight Zone. This leads to a large uncertainty in how much carbon dioxide originating from the atmosphere the Biological Pump will store beyond the end of the century. In theory, after 2100 carbon storage by the Biological Pump could stall and instead may start acting as a source of carbon dioxide to the atmosphere, which could exacerbate climate change further.

Dr Wilson added: "This research demonstrates the crucial importance of the Twilight Zone region of the ocean for biologically-driven carbon storage in the ocean. This part of the ocean is still poorly understood because it is so hard to observe but it is also just now starting to come under pressures of environmental change, fishing and deep-sea mining. Understanding how the Twilight Zone controls how much carbon is stored by biology in the ocean means we can figure out how to avoid the worst impacts from human practices like fishing and mining." The team will now work towards figuring out which processes in the Twilight Zone are the most important for biologically-driven carbon storage and updating ocean models so they can reliably predict future changes.

New study reveals 'leaky' deep ocean may store less carbon

A study by scientists at the National Oceanography Centre (NOC) has shown that carbon storage in the deep ocean may be considerably less permanent than previously assumed, raising questions about the role the ocean may play as a carbon sink in the future.

Marine life keeps atmospheric carbon dioxide levels 50% lower than they would otherwise be, by transferring and trapping carbon deep in the ocean. However, this paper entitled, 'Biological carbon pump sequestration efficiency in the North Atlantic: a leaky or a long-term sink?', agupubs.onlinelibrary.wiley.com/doi/10.1029/2021GB007286, published in Global Biogeochemical Cycles, found that only 66% of the carbon reaching 1000m depth in the North Atlantic will stay away from the atmosphere for 100 years, a timescale often used as a criterion for carbon storage. The storage of biological carbon, originating from drifting microscopic plants, is typically assumed to be highly efficient once it reaches 1000m. This carbon is assumed to enter deep circulation pathways that keep it away from the surface for centuries or even millennia. As a part of the nationwide CLASS project, projects.noc.ac.uk/class-project, NOC scientists used a global ocean circulation model to simulate the pathways of carbon reaching different depths in the deep ocean to assess how much made its way back to the surface ocean within 100 years.

Dr Chelsey Baker, lead author and Ocean Biogeochemical Model Analyst at the National Oceanography Centre, said: "The ocean is an important carbon sink, and the depth to which biological carbon sinks affects how much atmospheric carbon dioxide the ocean stores. In this study, we show that the longevity of carbon storage in the deep ocean may be considerably less than what's generally assumed."

There is considerable scientific interest in how rapidly the ocean is taking up the carbon dioxide (CO_2) human societies are producing, how long this CO2 might remain there, and even whether we can harness the ocean to store CO_2 more efficiently. Consequently, the NOC's findings are of direct relevance to climate change mitigation approaches that aim to use the ocean for long-term carbon storage, such as carbon drawn down by marine carbon dioxide removal schemes.

Dr Chelsey Baker continued, "Our findings could be important because artificially enhanced carbon storage by the ocean is one avenue being explored to help us achieve net zero by 2050. For example, by ocean schemes for carbon dioxide removal, such as iron fertilisation.

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The effectiveness of such nature-based solutions is often dependent on the assumption that carbon reaching the deep ocean will be stored for hundreds of years, something our work suggests may not be so simple." This study also highlights the challenges in monitoring the success of these marine carbon dioxide removal approaches. Essentially, carbon trapped in one location may be lost back to the atmosphere in remote locations tens of years after the carbon dioxide removal was originally undertaken.

This work was undertaken as part of the CLASS project which aims to deliver knowledge of the Atlantic Ocean system that society needs to make evidence-based decisions regarding ocean management. This includes understanding and quantifying key climate regulation and ocean services and predicting how the ocean may evolve as a result of climate change.

Students compete in 2022 European International Submarine Races

Hosted by QinetiQ and the IMarEST, the grand slalom of human-powered submarine racing returned to Gosport, UK, 4th-15th July 2022. Around the world, teams of students have preparing human powered submarines for the return of the European International Submarine Races (eISR). This year's competition, hosted by QinetiQ, is in alignment with the UN Ocean Decade with a new award for the best vision for the decade.

Organised by the Institute of Marine Engineering, Science and Technology (IMarEST), the races form part of the Institute's work to promote the marine sector, support young people and demonstrating to the world that engineering is fun. The unique sporting challenge involves teams of university students using their design and technical skills to invent, build, and race human-powered submarines against the clock on an underwater slalom course.

Race director Professor Megill says of the eISR: "It's a fantastic competition that encourages and creates a community of students who grow into successful career scientists and engineers. The challenge produces well-trained underwater engineers who know how to keep the water out of their machines and have learned how to work as a team under pressure."

This year saw the teams who were preparing their submarines for the postponed 2020 race finally compete. The postponement, due to the COVID 19 pandemic, gave students extra time to work on their designs, Megill explains: "When we had to cancel in 2020, most teams were already honing designs in CAD and in simulation, some had partially completed their hulls, so they're more than ready and keen to get them wet in an actual competition."

As well as daily race winners, there were a total of seventeen awards to compete for, including among others, Best Design Report, Most Unusual Design, Most Dramatic Event, Best Non-Propellor, plus awards for perseverance, exploration, reliability, and individual awards for speed.

For those who were looking to win, Megill said: "The winning teams manufacture their machine to the highest standards, then tune it to the athlete doing the piloting. When they get to the races, they're organised, with each team member well-trained in their role, and they have the flexibility in the team structure with each team member well-trained in their role, and they have the flexibility in the team structure to adapt to the challenges that inevitably appear during the course of the race. Speed is definitely a key factor, but so is control. A fast sub that gets lost or brings the slalom gates with it to the finishing line was not going to do well overall!" Full details, results and pictures can be found at: www.subrace.eu.

It wasn't just HMS *Challenger*

We are approaching the 150th anniversary of the start in December 1872 of HMS Challenger's iconic voyage, but it is less well known that a couple years later, in 1874, that a very similar voyage was undertaken by the then-new Imperial German navy aboard SMS Gazelle. Both voyages ended in 1876. Challenger's science resulted in 50 large volumes (www.biodiversitylibrary.org/bibliography/6513). The Gazelle voyage produced only 5 volumes (of which 4 are available online (www.biodiversitylibrary.org/bibliography/984).

The history special interest group's John Gould has just completed a paper comparing these two voyages, their organisation, objectives and outcomes. John says "Research on Gazelle turned up some revealing insights into the rigours

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of seagoing life in that era. I have also translated the start of the Volume 1 narrative from German to English."

The paper is now available as a preprint and open to peer review at hgss.copernicus.org/preprints/hgss-2022-7/. John would be pleased to hear any comments, corrections or suggestions for improvement. Remember to visit the Challenger website for more information if you are interested in joining either this or any other SIG.

Climate Linked Atlantic Sector Science, CLASS, project opportunities

Berths available on CLASS expeditions

The sustained observation expeditions have berths available for students and early career researchers (ECRs) to join them and make measurements or collect samples for projects in collaboration with CLASS researchers. Students and ECRs will receive support in collecting their data and samples at sea, gain experience in a range of seagoing activities and benefit from working closely with CLASS researchers.

ECRs can apply for a berth on a CLASS research cruise through one of three options:

a) A berth funded by the ECR's own project, to collect data and/or samples to carry out research that will enhance CLASS objectives.

b) A berth associated with a CLASS ECR Fellowship (see below) or a PhD with a CLASS Principal Investigator

c) A berth as a volunteer for the core science team. Some, but not all, CLASS cruises need volunteers for their core team of people who take samples and process data.

Details of CLASS cruises and deadlines for applications can be found in the Application Form on the CLASS website. ECRs considering applying for a berth on a CLASS cruise should contact the Principal Investigator (PI) to discuss their ideas and plans first. More information, including contact details for the PI, what you need to know, and where to send your form, is given in the Application Form, projects.noc.ac.uk/class-project/academic-engagement. Applications can be submitted at any time.

CLASS Fellowships for Early Career Researchers

CLASS has an ECR Fellowship scheme to support extended visits by graduate students or postdocs to NOC and SAMS. The purpose of CLASS ECR Fellowships is to support the career development of ECRs by enabling collaborative working with CLASS researchers, as well as access to CLASS facilities, data sets, model output and tools, and berths on CLASS cruises.

The research carried out by the ECR during the Fellowship should enhance the CLASS objectives and build on the project's observations and/or modelling and/or technology development. Applications are invited for CLASS Fellowships at NOC and SAMS. The deadlines are given at projects.noc.ac.uk/class-project/academic-engagement.

Call for UN Ocean Decade Actions No. 03/2022 runs until August 2022

Coinciding with the International Year of Artisanal Fisheries and Aquaculture, the scope of the Call for Decade Actions No. 03/2022 for Decade Programmes is Challenge 3, Sustainable Blue Food, and Challenge 4, Sustainable Ocean Economy. Building on the impact of the Ocean Decade since its launch in January 2021, the call aims to continue addressing thematic and regional gaps and to encourage transformative science to achieve the outcomes identified for the next ten years.

The ocean is the foundation for future global economic development, human health and well-being, it provides food security and livelihoods for hundreds of millions of the world's poorest people. But to achieve the vision of a sustainable and productive ocean, knowledge and tools to support the recovery of wild fish stocks, and the deployment of sustainable fisheries management and aquaculture practices are needed. Innovation, technological developments and decision support tools to minimize risk, avoid

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lasting harm and optimize the contribution of economic sectors to the development of a sustainable ocean economy are essential. Providing governments and industrial decision-makers with tailored information and ocean management frameworks such as sustainable ocean planning that build resilience, recognize thresholds and avoid ecological tipping points, are required to guide the development of sustainable ocean economies and promote marine sectors.

The two selected Ocean Decade Challenges, www.oceandecade.org/challenges/, are closely interlinked. The term 'sustainable ocean economy' has numerous facets across different sectors, including elements related to energy, fisheries and aquaculture, shipping, tourism, etc. For the Call for Decade Actions No. 03/2022, now 17 endorsed Decade Programmes are also inviting Project submissions. These "umbrella" Decade Programmes include various thematic orientations, some focusing on marine life and ocean observations, others on regional action such as in the Mediterranean Sea. Among them, Marine Life 2030, https://oceandecade.us15.list-manage.com/track/click?u=75c69bf185fb2be069850f6ee&id=ce576e3164&e=7e66fb83d6, aims to establish a globally coordinated system to deliver actionable, transdisciplinary knowledge of ocean life to those who need it, promoting human well-being, sustainable development, and ocean conservation. Access the Call documentation and submit your Action on the Ocean Decade Global Stakeholder Forum, forum.oceandecade.org/page/call-for-decade-actions.

From a regional perspective, the Call for Decade Action No. 03/2022 seeks to target Projects focused on Africa and Pacific Small Island Developing States (SIDS). To date, the Ocean Decade has worked hard to mobilise resources around the world, but these regions continue to be underfunded compared to regions such as Europe and North America.

Call for Papers deadline extended to 26th August 2022: DSR-II Special Issue on IMBeR West Pacific Symposium

The IMBeR West Pacific Symposium, 'Changing West Pacific Ocean: Science and Sustainability', was held between 22nd-25th November 2021 in Shanghai. This online event drew more than 900 participants and more than 160 presentations to provide new scientific observation results and perspectives on the changing marine biosphere in the West Pacific Ocean and its neighboring Indian and Southern oceans. It also brought many notable success stories about how scientific research activities empower us to cope with changing oceans due to global warming and harness the ocean's wealth sustainably. The symposium topics covered coastal blue carbon, coral reefs, dried small fish, ecosystem-social interactions in the coastal sea, marine biogeochemistry and biodiversity in the Indo-Pacific Region, marine-extreme events, oceanic top predators, tropical ocean ecosystem, and ocean interventions. It forged a camaraderie amongst the scientists and stakeholders interested in the West Pacific and its neighboring oceans from more than 70 countries.

We are delighted to announce that the Deep-Sea Research II special issue, two volumes, stemming from the IMBeR West Pacific Symposium are under development. All presenters at the symposium are kindly entitled to submit manuscripts for the special issue. The manuscripts generated through/by/from/during the West Pacific Symposium are all welcomed according to the IMBeR publication policy. If you have developed manuscripts that fit into the Symposium over the course of time and are interested in submitting ones, please follow the submission guidelines here, imber.info/wp-content/uploads/2022/03/Special-Issue-guidelines-for-IMBeR-WPS-V2.pdf, or contact IMBeR IPO-China (imber@ecnu.edu.cn); new deadline 26th August 2022.

VIEWS

Ocean Explorer Magazine, Issue 42, Spring/Summer 2022

If you are following the right social media groups then you'll have seen the memes about algae and the lament of their lowly profile in the public consciousness: 'When you produce half the world's oxygen, but trees get all the credit' is the message that accompanies some cartoon algae with disgruntled expressions.

Well, in this issue we're #AllAboutAlgae. It's high time everyone knew the value of these wonderful organisms, not just to our planet's life system but also in the prospect of new and sustainable products and environmental solutions.

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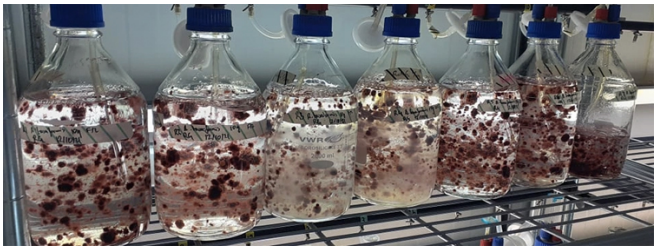

Red Seaweed - SAMS

As ever, we are highlighting some of the amazing work at SAMS. We look at how seaweed is the next big industry for UK coastal communities and why algae may aid space exploration. And, does red seaweed really make cow flatulence more environmentally friendly ?: for more, visit https://samsmagazine.com/.

Challenger Society clothing store on Teemill
Please visit challengersociety.teemill.com/ where you can browse, and even purchase items if you like. Please feel free to provide feedback in the help section.

SALTS

Four state-of-the-art Biogeochemistry (BGC) floats deployed
In May and June, four new BGC floats were deployed in the framework of the ERC REFINE project, erc-refine.eu/. The LOV team, lov.imev-mer.fr/web/, deployed four new Provor CTS5 'Jumbo' floats in the Labrador Sea on board the R/V *Celtic Explorer* (Marine Institute, Galway, Ireland), through a campaign conducted as part of the North-West Atlantic Biological Carbon Pump (NWA-BCP) project, nwa-bcp.ocean.dal.ca/. They are dedicated to explore the Ocean Twilight Zone and address the key processes driving the Biological Carbon Pump.

For the first time, these four new BGC floats were equipped with the following innovative technologies:

- an attenuation sensor (CRover), a sensor typically used to measure the attenuation of light, is used here to measure the attenuation due to trapped sediments in order to calculate the rate of deposition of these sediments. This sensor is associated for the first time with a multi-parking option at 200m, 500m and 1000m depth (the sensor is cleaned using a pump after each of these three steps),
- the Underwater Vision Profiler (UVP6) embarking AI-based zooplankton recognition capabilities, according to pre-registered patterns for detected zooplankton specimens,
- two hyperspectral Ramses radiometers from Trios to measure the downwelling and upwelling light fluxes (Ed / Lu) to determine reflectance.

The BGC floats were first tested at sea in March by the LOV team. © Thomas Jessin/LOV

The REFINE project aims to implement a breakthrough in in-situ robotic process studies based on a new generation of highly instrumented 'jumboized' profiling floats. These deployments are the starting point of an expectedly long series of BGC Argo-based robotic process studies in nine key regions representative of the diversity of global oceanic biogeochemical conditions and their responses to climate change; so stay tuned.

CALENDAR

27th–29th August 2022: Arctic Circle Greenland Forum
Nuuk, Greenland
Greenland in the global Arctic, climate and prosperity, geopolitics and progress, organised in association with Naalakkersuisut, the Government of Greenland.

The programme for in excess of 50 sessions is now available from the website. Participants are also invited to book special tours for August 29th by visiting www.arcticcircle.org/fiord-adventure.

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The Forum will be held at the Katuaq Cultural Centre in Nuuk, and will bring together Governments, universities, research institutions, organizations, associations, companies and other partners. For more information, visit www.arcticcircle.org.

29th August – 2nd September 2022: SWOT-AdAC & CLIVAR conference on submesoscale (fine scale) ocean dynamics
Paris, France, Providence, USA Hobart, Tasmania and Qingdao, China
The Earth system has complex dynamics, characterized by feedbacks among biophysical processes occurring at a wide range of spatiotemporal scales. Disentangling these complex feedbacks is at the core of our capacity to predict climate change scenarios at high accuracy. This knowledge forms also the base for planning effective adaptation and mitigation strategies, as well as sustainable environmental policies, in particular over the decadal timescale. Due to their size, the fine scales (i.e. mesoscale and smaller, spatial scales of 1–100 km) are not resolved in most Earth System Models and provide a major challenge for global observing systems. Nevertheless, they play a pivotal role in climate dynamics, by storing and directing the flow of energy across the ocean scales, and by strongly modulating the ocean biogeochemical cycles as well as air-sea and ice-sea interactions. The fine scales affect the distribution and behavior of marine biota, forming the skeleton of the open ocean seascape where major conservation programs are planned in the incoming years under international initiatives like “Biodiversity Beyond National Jurisdiction” and “High Ambition Coalition”. Understanding these dynamics is also critically important in the early phase of marine pollution accidents, during which the fate of the pollutants is controlled by horizontal stirring.

The workshop “From filaments to climate change: recent advancements and future challenges in finescale ocean dynamics” aims at understanding the role of fine scale ocean dynamics on feedbacks among biophysical processes, increasing accuracy of climate predictions, assisting in improving Earth System Models, and discussing how knowledge of the finescale can be integrated in management and conservation efforts. The workshop will bring together scientists from different disciplines in oceanography; geophysical fluid dynamics, biophysical interactions, model parameterization, observational oceanography, climate modelling, and societal applications. Special emphasis will be given to the synergies between models and observations, with a focus on emerging inversion/assimilation techniques, Lagrangian methods, and on the opportunities opened by next-generation in situ and remote sensing finescale platforms, like the forthcoming SWOT satellite mission. For more information, follow the workshop website at finescales2022.sciencesconf.org/.

5th-8th September 2022: ECSA 59: Using the best scientific knowledge for the sustainable management of estuaries and coastal seas
San Sebastian, Spain
ECSA 59 will bring together a global multi-disciplinary community of researchers, educators and practitioners to address issues of outstanding importance in the science (both natural and social) and management of estuaries and coastal seas in this rapidly changing world.

Main topics include:
Changing physical settings and processes

Biogeochemical processes and fluxes at the land sea interface

Shifting ecosystem structures and functions

The human dimension: impact, management, governance

For our full list of topics and special sessions please visit the website at www.estuarinecoastalconference.com/submit-abstract.asp.

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5th-9th September 2022: Challenger Society Biennial Meeting – celebrating the 150th anniversary of the Challenger Expedition

London, UK

The Challenger Society is delighted to announce that the Challenger 150 Conference 2022 registration and abstract submission is now open. This is a once in a lifetime opportunity to have dinner in the spectacular surroundings of the Natural History Museum Hintze Hall, underneath 'Hope' the Blue Whale. Guests will be allowed to circulate the galleries including a new display of Challenger art and specimens in the Images of Nature gallery prior to the dinner.

Conference: 6th-8th September 2022
Side events: 5th and 9th September 2022

Hosted by the Natural History Museum and Imperial College, London, UK, the Challenger Society Conference will mark the 150th anniversary of HMS Challenger setting off on her round the world voyage. The meeting will be held in person at the Royal Geographical Society, Natural History Museum and Imperial College in South Kensington, London.

Don't forget to start taking your pictures for the Photo Competition, to be judged at the Challenger Society Conference. This time, the subject is to be 'Ocean Challenges': more details coming soon. The Conference web site is, www.nhm.ac.uk/our-science/science-events/the-challenger-society-conference-2022-in-london.html. If you have any questions regarding the conference please email challenger150@nhm.ac.uk.

19th-23rd September 2022: Open Science Conference on Eastern Boundary Upwelling Systems (EBUS): Past, Present and Future and the Second International Conference on the Humboldt Current System

Lima, Peru

The meeting will bring together PhD students, early career scientists and world experts to understand, review, and synthesize what is known about dynamics, sensitivity, vulnerability and resilience of Eastern Boundary Upwelling Systems and their living resources to climate variability, change and extreme events. For more information, visit www.ebus-lima2022.com/.

25th September-2nd October 2022: Ramon Margalef Colloquium 2022, Past, present and future of a living ocean

Barcelona. Spain

A workshop hosted by the Institut de Ciències del Mar (ICM-CSIC). We have a limited understanding of the long physicochemical and biological evolution of the ocean. In a context of climate change, it is crucial to better understand the paleo-ocean and how it has evolved into the present ocean. That information would allow us to generate better predictions of the future ocean.

Thus, the main aim of this workshop is to bring together scientists from different disciplines, paleoceanographers, biogeochemists, conservation biologists, microbial ecologists, ecosystem modellers, geologists and physical oceanographers, in order to develop improved perspectives on the future ocean, based on knowledge from the past and present.

The RMSC2022 will promote synergies and dialogues between different disciplines as well as networking and knowledge exchange between senior, junior and next-generation researchers from different disciplines. Registration is now open and all information can be found at ramonmargalefcolloquia.com.

5th-19th October 2022: Ocean Best Practices System (OBPS) Workshop VI

Virtual

The OBPS announces that the Ocean Practices Workshop VI will take place virtually with plenaries on the 5th (opening plenary 1A), 6th

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(opening plenary 1B), and 19th (closing plenary) of October 2022 (each three hours long). Working Group sessions will meet in between, at times of their own choosing.

The Workshop will cover a broad range of topics proposed and selected by session leads and the workshop coordinators. For the plenaries, there are two general themes: 1) Guiding technology evolution and use, and 2) Capacity development and sharing, with an emphasis on developing countries. Let us know if you are interested in participating, or in proposing a theme or session for a Working Group, by filling out the Interest to Participate short form at docs.google.com/forms/d/e/1FAIpQLSc5MEiuWVNa5JXah47qoIdhKrDopmcY2bEzBcVu2MLrAATHJQ/viewform.

Please circulate this invitation to colleagues who may be interested in focused discussions; those who may want to learn more about developing, curating and sharing Ocean Practices; and to help plan the next three to five years of OBPS and its Ocean Decade programme: "OceanPractices". Should you have any questions, please e-mail us at info@oceanbestpractices.org. We look forward to hearing from you, Frank Muller-Karger, Chair, OBPS Workshop VI; On Behalf of the Ocean Best Practices System Steering Group

11th-13th October 2022: 7th Argo Science Workshop
Brussels, Belgium

We are pleased to announce that the call for abstracts is open for the 7th Argo Science Workshop.

This international workshop is hosted by Euro-Argo and will take place in the Royal Belgian Institute of Natural Sciences, Brussels, as a hybrid event with in-person and virtual attendance options. You will find further information on the workshop webpage, www.euro-argo.eu/News-Meetings/Meetings/Others/7th-Argo-Science-Workshop-October-2022.

13th-16th October 2022: Arctic Circle Assembly
Reykjavik, Iceland
Arctic Circle, www.arcticcircle.org, provides an open, democratic platform for discussion and cooperation on Arctic Affairs, for Governments, universities, research institutions, organizations, associations, companies and other partners.

Attended by more than 2000 participants from over 60 countries, the Assembly is the largest international gathering on the Arctic. Every year, participants can attend over 150 Sessions, receptions, art exhibitions, film screenings and more with various networking opportunities provided throughout the Assembly days.

8th-10th November 2022: 12th MASTS Annual Science Meeting: Supporting the Blue Economy Vision
Glasgow, Scotland
Scotland's blue economy includes the marine, coastal and the inter-linked freshwater environment of Scotland, the different marine and maritime sectors it supports, and the people connected to it. It also encapsulates the legislation, policies, programmes and international commitments that determine its management, as well as the under-pinning scientific research that provides data and information for evidence-informed policy development and is used to evaluate our success.

Join us as we celebrate our twelfth annual conference and discuss how to support the blue economy vision. The MASTS Annual Science Meeting is a cross-disciplinary event that brings

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together members of the marine science community, with the aim of promoting and communicating research excellence and forging new scientific collaborations. After hosting the ASM online for the past two years, **Early bird registration will open in August.**

The first two days will bring together expert plenary speakers and contributed talks, panel sessions and e-posters outlining the latest research and management practices that address key topics related to marine science and management in the face of global climate change. Alongside our general science sessions, the event will include special topic sessions, and plenty of opportunity to enjoy networking with your peers and making new contacts.

The third day will be devoted to workshops. Confirmed workshops to date include Scottish marine invasive non-native species workshop; and Improving Diversity & Inclusivity in Aquaculture. MASTS also look forward to co-hosting with the SUT, their annual "Decommissioning & Wreck Removal" workshop. This workshop will be open to all, and will take place on Thursday 10th November. However, there are more workshops in development, so more details will be coming soon.

Abstracts for talks and e-posters are now invited for our general science sessions or one of our four special sessions. Talks will be followed by a live group Q&A session within which all the speakers will be panel members. All presenters are encouraged to not solely focus on past and current research but reflect on gaps of knowledge and future research directions. Talks should be accessible to other disciplines, by avoiding jargon and keeping technical details simple.

Abstracts are invited to sessions on:

1 General Science sessions (any field of study related to marine science and supporting the blue economy vision, www.gov.scot/publications/blue-economy-vision-scotland/)
2 Multiple Aquatic Stressors
3 Artificial Intelligence
4 Marine policy and management- linking current and future research to policy and impact,
5 The influence of large scale offshore renewable developments on bottom-up ecosystem processes

The deadline for abstract submission is 16.00 on **Friday 19th August 2022**. For further details about the sessions and the abstract submission template, please visit our dedicated webpage at masts.ac.uk/annual-science-meeting/.

We are delighted that IMarEST have kindly agreed to sponsor the student prizes for the 2022 ASM. Don't forget to stay up to date on the ASM by following us on Twitter or LinkedIn #MASTSasm2022. If you would like to get involved or have a query about the ASM, please drop us an email, masts@st-andrews.ac.uk. We would love to hear from you if you would like an exhibit space at the ASM.

27th–30th November 2022: 2nd Springer MedGU Annual Meeting 2022

Marrakech, Morocco

The Mediterranean Geosciences Union, association.medgu.org/, in collaboration with Springer and Ibn Tofail University (Morocco) organizes the 2nd MedGU. Visit our website (www.medgu.org) to learn more about the event.

On this occasion, we are pleased to invite you to take part in the conference (in-person or virtually) and share/discuss your latest research findings. The MedGU Annual Meeting is one of the largest international geoscience meetings (200 attended in-person the MedGU-21 in Istanbul and 250 online). The MedGU Annual Meeting aims to provide a forum where geoscientists, especially early career researchers, can present and discuss their findings with experts in all fields of geosciences. It will feature talks and panels covering a diverse range of geoscience and geoscience-society topics.

The MedGU-22 encourages submissions of research works from all regions of the world. The MedGU-22 Proceedings will be published in Springer ASTI Series (indexed in Scopus & SCImago). Contact us, if you need more information, contact@medgu.org.

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

Tokyo, Japan

The Arctic Circle is collaborating with the Sasakawa Peace Foundation in organizing the

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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 info@challenger-society.org.uk. Contributions for next month's edition of Challenger Wave should be sent to: john@vectisenvironmental.com by the 29th July.

JOBS and OPPORTUNITIES

Ocean Engineering Technician – National Oceanography Centre

As a member of the Ocean Engineering group, you will work within a team of technicians and be accountable for provisioning the safe, efficient and effective operation and maintenance of marine science capabilities; working on the maintenance and preparation of equipment to allow scientists to operate at sea. These include winches, liquid nitrogen systems and lab containers, to name a few.

You will have completed a recognised apprenticeship or equivalent qualification in mechanical engineering or have knowledge and experience of working within a mechanical engineering field. You will be a self-motivated individual and can manage your personal workload efficiently. You'll have a high degree of initiative and a disciplined approach to problem solving and task prioritisation.

Closing date: 2 August 2022.

For more information visit careers.noc.ac.uk/vacancy/ocean-engineering-technician-488466.html

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Recruiting at Planet Ocean

Planet Ocean ecoSUB Robotics Division are seeking two talented individuals to join our small team to develop our capabilities at this next crucial growth phase of the technology. Our ecoSUB Division is based within the Marine Robotics Innovation Centre within the National Oceanography Centre Southampton. ecoSUB Autonomous Underwater Vehicles (AUVs) are robotic platforms at the leading edge of subsea technology development. They are affordable, intelligently designed and extremely disruptive to the market, markedly increasing accessibility to a wide range of users in research, offshore energy, and defence markets. Following the release of production systems, the ecoSUB division is in the process of growing a strong team of talented engineers to advance the system and achieve the growth plan.

Senior Robotics & Embedded Software Engineer
This position will primarily be responsible for software development for the ecoSUB AUV. The embedded software is very much at the heart of the AUV system and as such is the lead engineering role. This role involves working closely with mechanical and electronics development to ensure complete system functionality and cohesive operation. The role is primarily R&D focused with aspects of existing system support. The Senior Robotics & Embedded Software Engineer role will involve supporting colleagues and will benefit from career development opportunities and excellent compensation. The role will involve fieldwork and travel, with time spent at sea guaranteed. Required offshore training will be provided.

Production, Procurement & Test Manager
ecoSUB AUVs are self-contained electro-mechanical systems produced in small batches. The Production, Procurement & Test Manager role is responsible for production and testing of the ecoSUB AUV and associated products. This role involves working closely with R&D engineers across software, mechanical and electronics to ensure complete system functionality and cohesive operation. The role is primarily associated with the procurement of materials, system build and testing, liaison with sub-contractors and suppliers, documentation, and quality control. This is a new role within the ecoSUB team and requires the successful candidate to grow the ecoSUB teams' capability to efficiently build and deliver production systems as well as supporting R&D's test requirements. The role will involve future recruitment and development of a wider team to deliver the capacity and services required by the division. The role will involve fieldwork and travel, with time spent at sea guaranteed. Required offshore training will be provided.

Please contact carole@planet-ocean.co.uk for further information and visit www.ecosub.uk.

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There are jobs on the IMBER web site

http://www.imber.info

IMBeR Integrated Marine Biosphere Research

Jobs and opportunities

New

- Internship: Marine Debris & Administration Coordinator, Fishing Gear Coalition of Atlantic Canada, remote, anywhere in Canada. No deadline given; **apply now**
- Predoctoral contract: Genetic adaptability of marine species in natural gradients analogous to the oceans of the future, IRBio, Spain. Open until filled; **apply now**
- Postgraduate opportunities on the Marbibi-SA project, South Africa. Various deadlines; **apply now**
- PhD scholarships: Marine ecosystems modelling, University of Trieste, Italy. Open until filled; **apply now**
- Postdoc: Ocean biogeochemical perturbations by plasticizers, University of Vienna, Austria. Open until filled; **apply now**
- Associate editor(s) Environmental Development journal: Send CV and biographical information to Neville Sweijd, subject: "EnvDev Associate Editor" nsweijd@access.ac.za. No deadline given; **apply now**
- Fisheries Officer (Fisheries Management), FOA, Rome, Italy. Apply by **22 July**
- Communications Officer, European Marine Biological Resource Centre, France. Apply by **1 August**
- Assistant Prof: Ocean solutions and carbon, Utrecht University, Utrecht, The Netherlands. Apply by **15 August**
- Multiple postdocs (pool), Helmholtz Institute for Functional Marine Biodiversity, University of Oldenburg, Germany. Apply by **15 August**
- Assistant Prof: Earth System and Climate Sciences, Utrecht University, Utrecht, The Netherlands. Apply by **15 August**
- 3 postdoc grants: Pathways for sustainability, Future Earth's Pathways Initiative. Submit interest by **11 September**
- Funding: ITOPF R&D Award, funding support for projects that have the potential to improve knowledge and understanding of issues related to accidental marine pollution form ships. Learn more and apply by **2 December**

In case you missed it...

- Multiple PhD position in modelling, Dynamics of Ecosystems and Computational Oceanography research group of Oceanography and applied geophysics in collaboration with the University of Trieste, Italy. **Apply now**
- Project Scientist/Specialist: North Pacific climate and oceanography, NOAA Southwest Fisheries Science Center, Monterey CA, USA. Open until filled; **apply now**
- Knowledge Exchange Associate, One Ocean Hub. Apply by **24 July**
- Postdoc: Trace metal biogeochemistry, GEOMAR Helmholtz Centre for Ocean research, Keil, Germany. Apply by **25 July**

imber@imr.no

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