June 2020

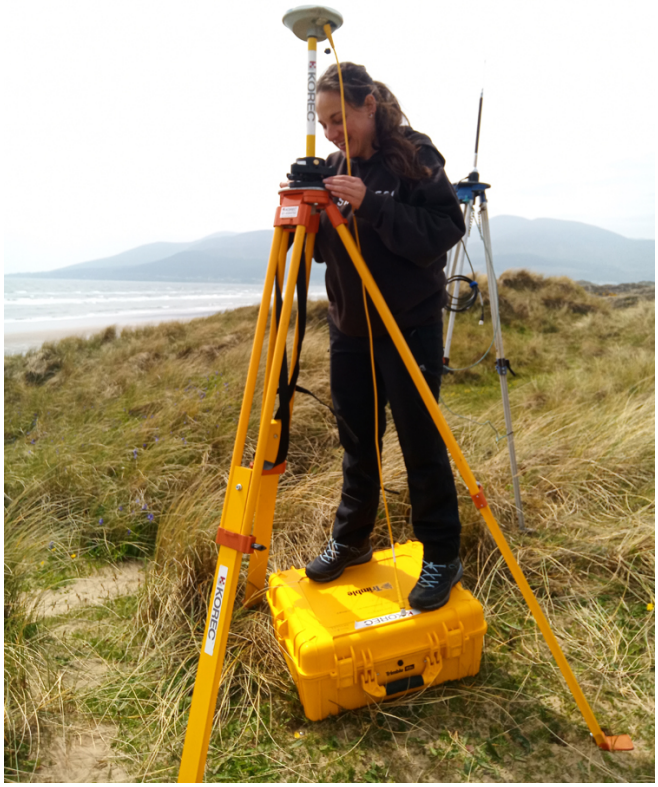
Challenger Wave

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

NEWS

Your beach is changing: Scientists study coastal erosion at Murlough beach

A team of coastal scientists from Ulster University is conducting regular surveys of Co. Down's Newcastle to Dundrum (Murlough Bay) beach system to find out how and why our coastline changes. Their findings will be used to predict future changes to help better plan how we use and also protect our fragile coastal environment. (Watch the scientists in action in our project video, https://youtu.be/ubWRhm9tFmc)



Dr Melanie Biausque of Ulster University is setting up a GPS surveying system as part of a beach monitoring programme at Dundrum Bay.

The work is part of the €6.4 million European environment project MarPAMM (Marine Protected Area Management and Monitoring) that will develop tools and plans to protect vulnerable marine habitats and species in the waters between Scotland and Northern Ireland. The Murlough Bay beach study explores how climate-related processes including sea-level rise and storms, may alter the physical environment that supports protected species and habitats on our coasts.

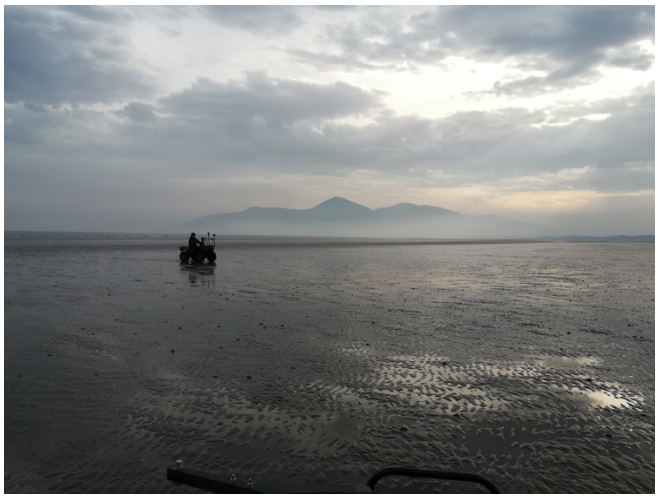
MarPAMM is funded by the European Union's INTERREG VA Programme, managed by the Special EU Programmes Body (SEUPB). Match-funding is provided by the Department of Agriculture, Environment and Rural Affairs in Northern Ireland and the Department of Housing, Planning and Local Government in Ireland.

Lead scientist Professor Derek Jackson from Ulster University's School of Geography and Environmental Sciences, who is leading the coastal processes aspect of the project, explains why the vast sandy beach and dune landscape at the Murlough Special Area of Conservation is an ideal study site: "Naturally, our coasts are constantly and slowly changing. These changes are becoming more apparent when extreme weather events increase and sea levels rise. Using ground based survey technology, we can now study relatively rapid changes in the movements of beach sands on this site. Research to date has shown that the once golden beaches at the promenade at Newcastle have over the past few decades been pushed down the coast towards Ballykinler through wave and tidal action. With increased storm events we are studying how this may present itself in the near future."

Professor Jackson continued, "As well as past and present movements, we are examining future scenarios of how heightened sea levels at the site will alter the coastline dynamics; using Murlough Bay site as a test bed for establishing coastal

monitoring protocols for other sites in the region. These will help advise any future science-led coastal management approaches we may adopt for protecting these vulnerable environments."

Commenting upon the importance of this work Gina McIntyre, CEO of the SEUPB said: "During these challenging times, a stroll along the beach is not yet possible for many of us, however the research that is being carried out by MarPAMM will provide invaluable data to help protect Murlough Bay, for many years to come. Like a number of other EU-funded projects under the INTERREG VA Programme, MarPAMM is continuing to find innovative ways to deliver upon its outputs, during the current crisis. It is one of the key environmental protection projects funded under the programme and will lead to better, more sustainable, marine conservation activities across Northern Ireland, Ireland and Western Scotland."



Ulster University coastal scientists conduct beach surveys at Dundrum Bay to investigate how and why the sand is moving.

In a project video that has just been released, beach scientist Dr Melanie Biausque, who can often be seen surveying the beach at low tide using a quad bike, explains what they do with the data they collect: "We visit the site every month and for the next few years this will help generate a visualisation of surface height changes on the beach, telling us how waves have moved sand around under different wave events. These are incorporated in a computer model that should allow us to see how future storms will react with the underlying sandy seabed and beach."

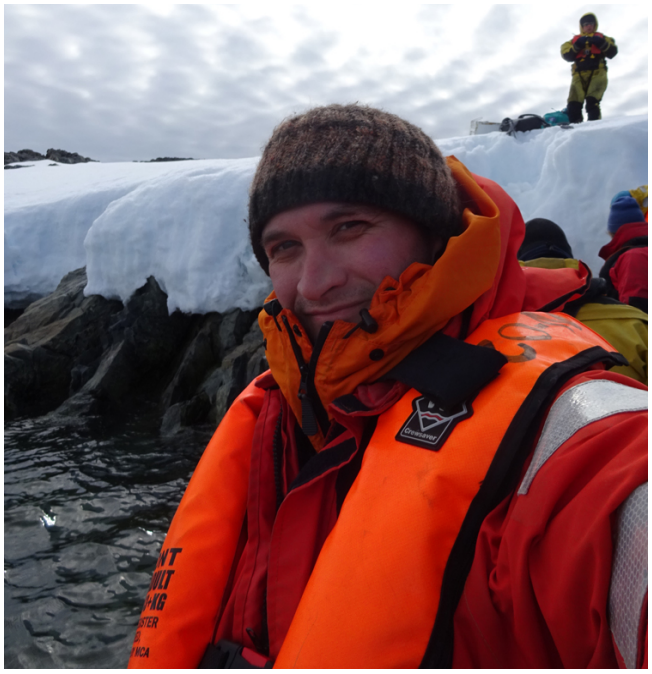
Another Ulster University researcher on the team, Dr Edoardo Grottoli, has also been collating information of past changes of the coastal system in Murlough Bay using historical maps, past aerial photography and historical accounts of storm impact. "Past events will show us to better understand how important patterns of change have unfolded through time and how the coastline is evolving to present and future positions", Dr Grottoli said.

Professor Jackson concluded, "Society needs to understand the movement of the coast and the processes that drive the changes in order to protect our marine environment in the longer term.". The regular sampling at Murlough is currently on hold due to the Corona pandemic and the scientists are instead progressing the computer model.

Antarctica's 'green snow' to spread with global warming

A scientist who led the creation of the first ever large-scale map of microscopic algae on the snow covered Antarctic coastline, so-called 'green snow', has joined the Scottish Association for Marine Science (SAMS) to continue his research. Dr Matt Davey, www.sams.ac.uk/people/researchers/davey-dr-matthew/, comes to the Oban-based institute from the University of Cambridge and has today published findings in the journal Nature Communications, www.nature.com/articles/s41467-020-16018-w, that show the current distribution of the algae and how they are likely to spread as the global temperature increases.

The research team from Cambridge and the British Antarctic Survey combined satellite data with ground observations over two summers in Antarctica to detect and measure the green snow algae. Although each individual alga is microscopic in size, when they grow *en masse* they turn the snow bright green and can be seen from space. Dr Davey said his research could develop further following his move to SAMS, which hosts the Culture Collection of Algae and Protozoa (CCAP), the UK's algal library and one of the most diverse collections in the world. He added: "This research shows that there is still much to discover about the biology of Antarctica and how it might change over the coming decades. Using the latest satellite and spectral imagery technology, combined with simple but essential field work, we were able to produce maps of terrestrial algal blooms in Antarctica for the first time."



Dr Matt Davey has joined the Scottish Association for Marine Science (SAMS) from the University of Cambridge

Blooms of green snow algae are found around the Antarctic coastline, particularly on islands along the west coast of the Antarctic Peninsula. They grow in 'warmer' areas, where average temperatures are just above zero degrees Celsius during the austral summer, the Southern Hemisphere's summer months of November to February. The Peninsula is the part of Antarctica that experienced the most rapid warming in the latter part of the last century.

Dr Matt Davey sampling snow algae at Lagoon Island, Antarctica, 2018. Credit Sarah Vincent

Dr Davey's team found that the distribution of green snow algae is also strongly influenced by marine birds and mammals, whose excrement acts as a highly nutritious natural fertiliser to accelerate algal growth. More than 60 per cent of blooms were found within five kilometres of a penguin colony. Algae were also observed growing near the nesting sites of other birds, including skuas, and areas where seals come ashore. The team used images from the European Space Agency's Sentinel 2 satellite taken between 2017 and 2019, and combined these with measurements made on the ground in Antarctica at Ryder Bay, Adelaide Island, and the Fildes Peninsula, King George Island.

Multi-coloured snow algae on Anchorage Island, Antarctica, 2018. Credit Matt Davey

Snow algae are a key component of the continent's ability to capture carbon dioxide from the atmosphere through photosynthesis. Dr Davey's team identified 1,679 separate blooms of green algae on the snow surface, which would absorb around 479 tonnes of carbon dioxide per year, the equivalent of about 875,000 average petrol car journeys in the UK. The researchers say that the total amount of carbon held in Antarctic snow algae is likely to be much larger because carbon dioxide is also taken up by other red and orange algae, which could not be measured in this study.

Dr Davey, who started at SAMS in May as a new senior lecturer in algal biotechnology, said: "I am looking forward to advancing this and other essential research at SAMS and with other national and international collaborators. SAMS is ideally placed to advance polar algal biology, combining key areas in taxonomy, metabolic science and the space and drone sector. Having CCAP, a global leader in algal culture collections, research and resource provision within the

institute was a key factor in my decision to move to SAMS."

Challenger Society for Marine Science Student Award

The Marine Science Student Award has replaced the former Tripartite Award and was first awarded in 2019. The purpose of the Award is to raise the status of Marine Science education in the U. K., as well as to encourage research among undergraduates in any marine science discipline.

The Society offers an annual award for undergraduate students who have demonstrated excellence in Marine Science research through 3rd year dissertations or projects. University departments in the UK are invited to submit suitable dissertations from final year undergraduate students, with deadlines set usually for the end of July. Students can only be entered by the Convenor of the final year dissertation module from universities located within the UK. Only one submission will be accepted from each department and it should be of outstanding quality. Prizes are awarded after consideration by a panel drawn from the Challenger Society's Council.

Entries are judged on the following criteria:

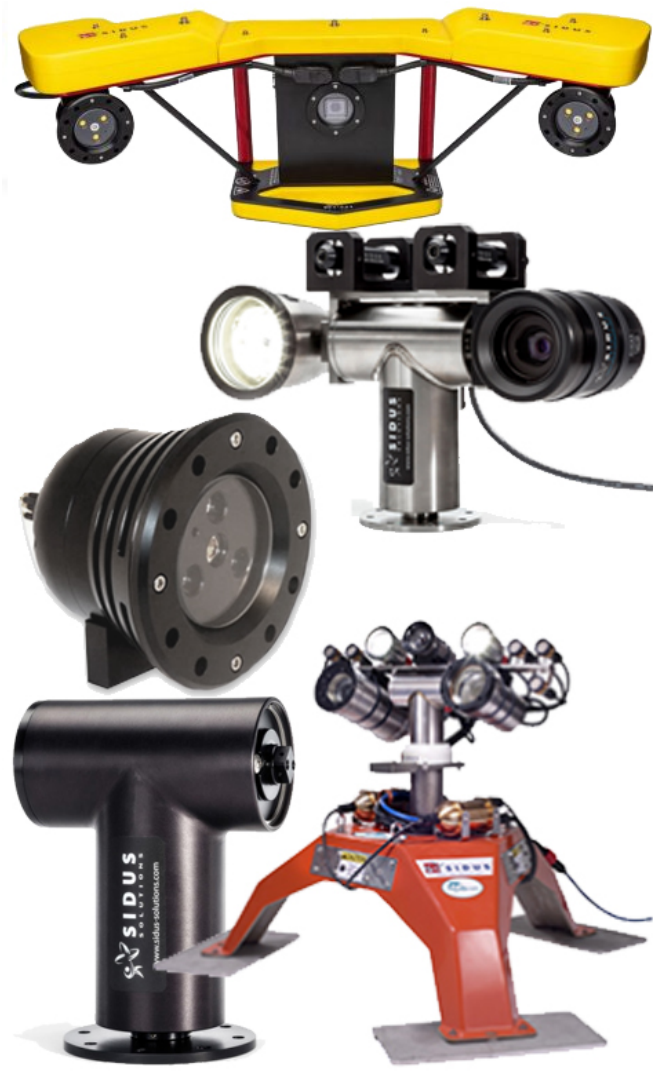
i) Overall excellence of the project.
ii) Originality, or uniqueness of the project.
iii) Relevance to oceanography.
iv) Standard of presentation.

The winning student will receive a cheque for £500. In exceptional circumstances the Award may be shared. All winning students will receive one year's complimentary membership of the Society. The deadline for submissions for this year is 31st July 2020. The submission should be by email submission of a nominating letter from the Convenor accompanied by a digital copy of the student's dissertation report. Documents should be submitted to m.green@bangor.ac.uk using "Challenger Society Student Award" in the email subject line. For more information, see www.challenger-society.org.uk/Student_award.

VIEWS

Planet Ocean Ltd is pleased to announce the signing of an exclusive distribution agreement with SIDUS Solutions LLC for the UK and Ireland.

San Diego based SIDUS Solutions LLC., provides undersea situational awareness equipment. Their extensive product offerings include high-definition cameras, electric pan and/or tilt positioning systems, feature rich underwater lighting and projection lasers. The SIDUS product range also includes laser scan video systems and integrated light/strobe/laser systems. More over SIDUS has the full technical capability to undertake bespoke challenges to address emerging problems in automated undersea inspection and visualisation.



Planet Ocean M.D Terry Sloane commented, "Our partnering with SIDUS builds upon our experience of supplying high quality underwater robotics in the form of ROV & AUV technology and we are delighted to once again team with an innovative, industry leader in their field who provides cutting edge equipment with capabilities that push the boundaries.". Planet Ocean will be

providing pre- and post-sales support and first level service from their Camberley Surrey base. For more details about SIDUS Solutions products contact sales@planet-ocean.co.uk or visit: www.sidus-solutions.com.

Welcome to the newly updated Inside Oceanology International (Inside Oi)
Right now, it is more important than ever that we make it easier for companies to share news and connect with the ocean community. With that in mind, the Oceanology International team have been hard at work remodelling and upgrading their blog Inside Oi to be a dynamic, interactive hub for all things Oi.

The new platform includes:

- Access to upcoming webinars from exhibitors and industry experts
- Information on product launches and upcoming projects
- Valuable updates from exhibitors and industry leaders
- Industry insights,

and more, take a looks at: inside.oceanology international.com/.

Updates from members of the History of Oceanography Special Interest Group (SIG)
We thank Chris Hughes for alerting us to some terrific archive programmes about the ocean, now available on YouTube, these include :-

https://www.youtube.com/watch?v=Swe42BT4QiE ; "The Unconquered Ocean Tides" which contains footage of early bottom pressure recorder deployment and lecture material by John Rossiter etc.

https://www.youtube.com/watch?v=-PJ9RNODzM0 ; "Unconquered Ocean Waves" which includes footage of FLIP, Walter Munk etc.

https://www.youtube.com/watch?v=24ctgNIolOE; "Unconquered Ocean Currents" which includes lecture material by John Swallow, Nick Fofonoff etc.
The above all first screened in 1966, apparently.

Also this archive film from 1973 (hence in colour, unlike the above):
https://www.youtube.com/watch?v=XWUSuKZsK4c&fbclid=IwAR1_6IF_e0TWc3DJU7NwbkWFPD-yBM4pHhq_uniPjZZowmeh9jiX-LTxVjU

The first three films were made by the BBC and, because the BBC has no plans to retransmit them, they are now owned officially by the British Film Institute although like most films they end up on Youtube anyway. There were 7 in the series in all: 1. Inner space. 2. Mountains of the deep. 3. Waves 4. Tides 5. Currents 6. Pattern of life 7. A new frontier.

Copies of these three were discovered a few years ago in the NOCL basement along with 6 other films and were converted to digital format by Julie Ledder, made into a DVD, and sent to a few people. We were worried about copyright in doing that, which is how we know that these and the others in the Unconquered Ocean series are BFI property. In the other 6 is the film of David Cartwright's 1973 comparison of bottom pressure recorders, one by Geof Lennon on the 'progression of the tides' made by IOS, and a couple on tide prediction machines. These are shorter and should now all be on the NOC Youtube channel.

There's new material on the Wormley web site (http://www.oceanswormley.org) including:

- An article by Edward Cooper and Gwyn Griffiths describes the development of seagoing navigation systems from the 1950s and 60s up to the present day era of high accuracy GPS. (Under the "Technologies and Infrastructure" page)
- Colin Pelton gives an appreciation of marine geologist John B Wilson, an expert on the carbonate sediments of the NW European shelf, who sadly died in October. (On the "People" page)
- Peter Herring describes the reunions that have taken place of officers and scientists who took part in the International Indian Ocean Expedition aboard the then-new RRS Discovery. (On the "People" page)

Looking for photographs
I have almost completed a table giving summary information about the 19 vessels that have been designated Royal Research Ships. (The number 19 includes the Sir David Attenborough now being built and recognises that RRS Discovery (1962) and RRS Challenger (1971) were altered substantially during major refits). I have not been able to find photographs of RRS Challenger as she looked when she was launched and would like to know if anyone has any. ***:- John Gould, Michael Meredith, and Phil Woodworth***

New Wikipedia Website entry of interest to Oceanographic history

A Wikipedia entry now records the Underwater Association of Malta 1966 as a historical fact, and a notification of its contribution to diving science and marine science generally. It has taken a while to gather information together with correct dates and references, and the entry has now been accepted, after some revision, by the Editorial system of Wikipedia: https://www.google.com/search?q=Wikipedia+Underwater+Association.

The entry is fairly basic, and it would be valuable to add more information where relevant, and especially to add cross-links to other Wikipedia entries, or to primary websites of other organisations. Steve Hall at the SUT (Society for Underwater Technology, is up-dating the SUT website so as to substantiate that paragraph in the Wiki text. Please feel free to add details, dates, pictures, citations, or additional historical information. For example there are other organisations such as the British Society for Underwater Photography which have not been contacted, and CMAS, or diving science groups in South Africa, Australia, NZ and USA. Cross-references to entries or societies concerned with the fundamental research issues of marine science would help to show how the UA had contributed. The site will be most useful if it attracts readers interested in the origins and history of underwater science by diving. ***:- Nic Fleming***

Effective Ballast Water Monitoring in 3 Easy Steps

Our Global Business Development Manager, Matt Kenney, takes the complex issue of Ballast Water Monitoring and distils it in to three bite-sized steps to compliance. The key is to understand the potential pitfalls.

The International Convention for the Control and Management of Ships' Ballast Water and Sediments (2004), herein referred to as the 'BW Convention', is now an integrated part of operating a modern shipping fleet. Since 2017, all compliant ships have been employing a certified ballast water management plan, and any applicable vessels not yet fitted with a suitable ballast water treatment system should now be scheduled to install one before the next International Oil Pollution Prevention (IOPP) survey. By 2024, every vessel engaged on international voyages and fitted with a sea water ballast system should be in compliance with the 'D-2' standard for Ballast Water treatment, relegating the 'D-1' standard for ballast water exchange to a contingency measure, should the ship's treatment plant become inoperative.

Of course, such regulations require enforcement, and in the case of the BW Convention, that is dealt with, in part, in Article 9, Inspection of Ships. However, this is where problems may be encountered by ship operators. The article states that inspectors can conduct: *"a sampling of the ship's ballast water, carried out in accordance with the guidelines to be developed by the organization"*

This ambiguity holds significant implications for vessel operators and port state control inspectors who need to understand a new testing regime that will be applied to their vessels. Accordingly, the IMO 'G2' guidelines have been produced for the Sampling of Ships' Ballast Water, and while these do seek to address the issue, the technical and procedural guidance lacks significant detail. More fundamentally, there remains a disconnect between the high-level aims of policing the discharge limits set out in the D-2 standard, and the practical methods of sampling that can be employed during an inspection.

Arguably, the sampling regimes that will be employed during ship surveys should aim to:

i. Ensure the ship is compliant with the BW convention and relevant territorial legislation and is not posing a threat to the marine environment by acting as a vector for invasive species and bacteria.

ii. Conduct sampling using practical and realistic methods with equipment suitable for use aboard ship.

iii. In accordance with article 9 on the BW convention; carry out accurate sampling and analysis that does not unduly delay the operation, movement or departure of the ship.

The lack of an agreed standard and methodology for the sampling of ships' ballast water creates uncertainty for ship owners and technical operators. It is for this reason that Chelsea works closely with the IMO and other organizations on the development of equitable and workable solutions.

So, here are three steps responsible ship operators could take today to ensure their fleet is

ready for the development of the global ballast water survey and inspection regime:

1. Seek advice on responsibilities. Most maritime state legislatures have made provisions intended to hold ship owners or operators accountable for 'knowing' or 'negligent' pollutant discharges in territorial waters. In the US, for example, there are a number of articles of state and federal legislation that render ship operators prosecutable for non-compliant ballast water discharge – even if a treatment system is in use. While investing in a quality, type-approved treatment system is a good idea, relying on a type approval certificate and subsequently assuming that all ballast water discharges are compliant, is a potentially troublesome strategy.

2. Take a proactive approach to ballast water discharge monitoring. Once a treatment system is installed, being able to provide evidence of an ongoing water quality monitoring program not only provides an ability to check the performance of treatment systems over time, but potentially helps safeguard against prosecution. The efficacy of treatment systems, many of which were installed at considerable cost, should be periodically monitored to understand the health of the system and provide peace of mind that discharges are compliant. Think of it as doing chart corrections or swinging the compass. While most good treatment systems provide self-monitoring of basic system functionality (as is required by the regulations), this monitoring does not include measuring the quality of the resultant outflow, thus cross-checking its compliance.

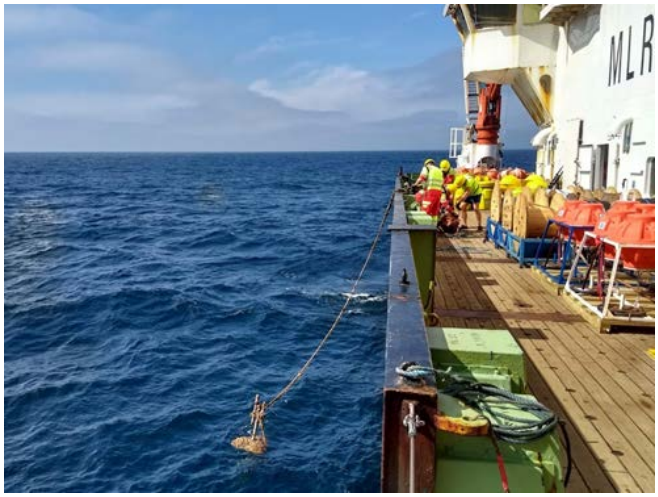
3. Understand what inspectors will test and measure in ballast water. Every ship survey is imbued with a degree of risk to the ship operator and while this is an accepted reality of ship operating, the commercial landscape in shipping today favors operators who take a pragmatic approach to rounding-off their risk registers. By taking steps to perform indicative compliance-level checks on ballast water discharge flows, problems can be foreseen before environmental damage occurs or prosecutions, delays and fines are issued by an enforcement authority.

Chelsea Technologies' patented FastBallast Compliance Monitor, is a small, lightweight and rapid ballast water testing instrument, designed to provide a lab-accurate assessment of ship's ballast water discharge against key elements of the D-2 Standard. The instrument integrates a sophisticated measurement technique with a convenient, easy-to-use interface. The patented Single-Turnover Active Fluorometry (STAF) technology only requires a capfull of ballast water to test automatically in under 8 minutes. For more information please contact our Maritime Sales Manager Emma Johnson by emailing ejohnson@chelsea.co.uk. ***:- Matt Kenney***

SALTS

The Last Ship

Cast your mind back to a time when things were 'normal', the second weekend of March 2020. A time before lockdowns and social distancing; when pubs still opened, international travel was easy and live sports were a thing. This story starts in a bar in Tenerife, where a group of scientists, sailors and technicians were enjoying the sun and relishing in the sporting prowess of the England rugby team, as they stormed to victory over the Welsh. We were enjoying our last taste of normal, for what we thought would be a short six weeks. The team was about to embark on a voyage of discovery across the Atlantic, solving some of the many mysteries of the Atlantic Meridional Overturning Circulation (AMOC).

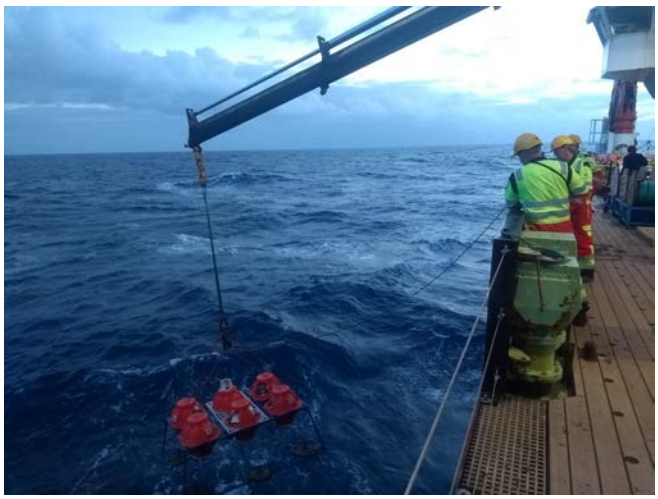


Once a mooring is released from the seabed, grappling and retrieving to deck is a rather manual process. Credit: Matt Clark.

The expedition was part of the RAPID project (www.rapid.ac.uk/rapidmoc/) which has been continuously monitoring the AMOC since 2004. The backbone of the project is the RAPID array of around 20 or so moorings. These are situated along the 26.5 °N parallel, stretching from the Canary Islands in the East and the Bahamas in

the West. The moorings are concentrated off the West coast of Morocco, the mid-Atlantic ridge, and to the East of the Bahamas. They're a real feat of engineering, with some more than 5 km tall. Dotted along the length of the moorings' anchor wires are MicroCAT (CTD) instruments measuring conductivity, temperature, and pressure, which with geostrophic balance can be used to estimate the strength of the ocean circulation. There's also a host of more exotic instruments such as current meters, oxygen sensors, remote autonomous samplers and others.

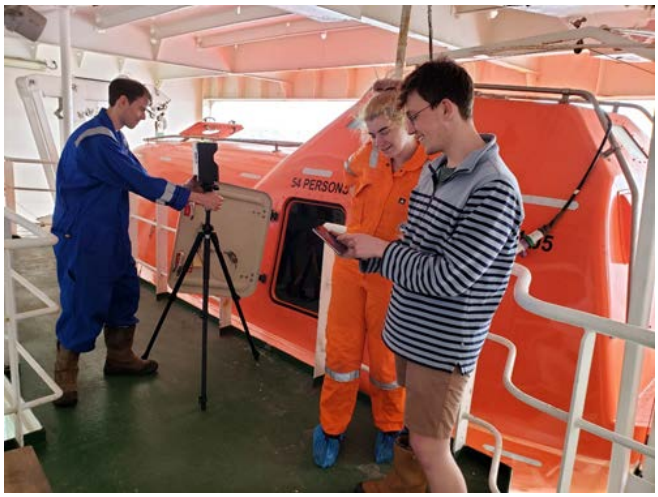
Back to our story, the crew had been tasked with recovering, servicing and redeploying these moorings. Within a day or so we were well on our way and getting stuck into the laborious process of hunting down and laying out moorings. Thankfully (for variety is the spice of life) there were more than just moorings to keep us occupied. Back in Tenerife we had been joined by scientists from NOAA who had entrusted us with a precious cargo -- a set of 12 glass spheres containing pressure inverted echo-sounders. These 'PIES', as they are affectionately known, may one day become ubiquitous in the global ocean monitoring system. It is hoped that they will be able to replicate some of the functionality of a mooring, but at a fraction of the cost.



Deploying one of two PIES arrays. Credit: Matt Clark

The PIES are lowered (read: lowered to the surface then dropped for a descent of several thousand metres) to the bottom of the ocean where they remain for a year, measuring the properties of the water column above them. When they're done measuring they then release their anchor and float up to the surface, beaming back their data to satellites. Though the system has undergone extensive testing, this is the first time they have been deployed in anger; as their data comes in, it will be fascinating to see how successful their deployment has been.

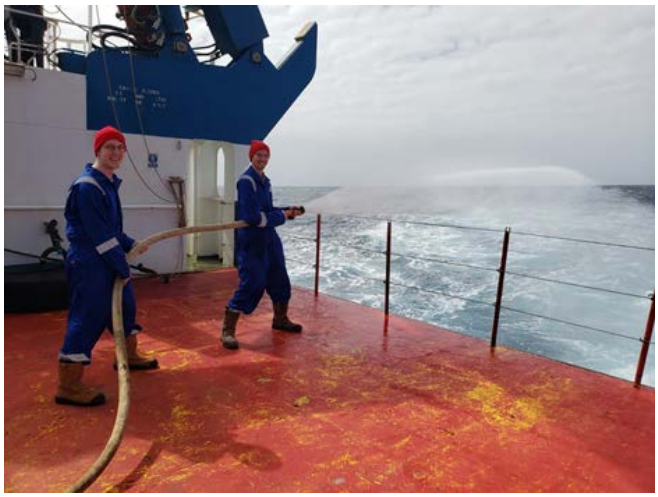
Having completed the servicing of the Eastern section of the array we embarked on a 4 day steam to the mid-Atlantic ridge, with a brief pause to deploy an Argo float (www.argo.ucsd.edu/). Around half way through the passage, a meeting of all the ships company was called. The ship had received a message informing us we were to turn around and steam back to Southampton. It must be said that this wasn't unexpected. When we left the Canaries, we were aware of the coronavirus and its increasingly rapid spread. It was strange at sea watching the situation unfold, being so very isolated from everything going on back at home. We saw first the toilet roll shortages, then, as the days went on, it became clear things were becoming serious and the virus was causing a huge amount of suffering. Within three days of the decision to turn back having been made, the UK went into lockdown; it was clear heading home was the right decision. It was to be a long and slow steam back, but we were safe and there were still many other things to keep us occupied.



Matt (L) and Fraser (R) map the starboard lifeboat under the watchful gaze of cadet Lisa (Centre). Credit: Eleanor Frajka-Williams/RAPID Twitter.

Our 10-day voyage to Southampton gave us ample time to complete our cruise report sections, as standard for all research cruises. We also had enough time to complete some more unusual tasks such as 3D mapping the ship, using a special 3D imaging camera kindly lent to us by colleagues at BAS (British Antarctic Survey). Whilst the mapping began back in Tenerife, the additional no-science days allowed us to

complete the project. It was an amazing opportunity to enter areas that us scientists wouldn't normally work in: crawling (literally) around the engine room, workshops and thruster room. It was also an opportunity to chat to the engineers who keep the ship running. We also managed to map one of the two lifeboats. The completed scans will be used in future public outreach activities.



Fire hose practice requires teamwork! Credit: Eleanor Frajka-Williams/RAPID Twitter.

The return journey also gave the captain the perfect excuse to hold another muster and fire drill for the crew. Whilst the crew were busy extracting a simulated "casualty" from the engine room in full breathing apparatus and fire-proof suits, we were given the much less stressful task of "boundary cooling the fire" from the aft deck. In reality, this meant aiming the hoses overboard and seeing how far you could propel the water.

Dolphins escort us across the Bay of Biscay. Credit: Matt Clark.

We may not be marine biologists, but we were delighted to see many dolphins keeping us company on our return journey, with a brief glimpse of a whale. Other non-science cruise highlights were the amazing sunsets we experienced almost every evening. It was a real treat to spend many an evening on the bridge and Forecastle Deck stargazing under the clearest skies we're likely to come across. From conversations with the very friendly and knowledgeable bridge crew, we gained more insight into the operation of the ship too. Some of us also got steering lessons !

After 20 days at sea, on Saturday 28th March we arrived at the Port of Southampton and tied up alongside the National Oceanography Centre. All our equipment was put into cages and lifted onto the quayside. Of course this was all done with social distancing in mind, with quayside staff not allowed to come aboard to assist for fear of infecting us. Once the majority of this was done, all scientists and technicians signed off and went home to sit out the lockdown and discover what this "new normal" is all about. In some sense we were very lucky: many commercial seafarers are still stranded offshore with no end in sight to their ordeal. We had also been at sea for the panic buying stage of the pandemic and supermarket stock levels had mostly recovered !. Despite our cruise being cut short, the 3 weeks we spent at sea certainly taught us a great deal about time series data collection and was a valuable experience. Of course, we would like to thank chief scientist Ben Moat for inviting us to come aboard, and to all scientists, technicians and crew who made the cruise an enjoyable success. ***:- Matt Clark*** *is a SPITFIRE DTP PhD Student at the University of Southampton, National Oceanography Centre Southampton. You can follow Matt on Twitter: @Ocean_MattC* ***Fraser Goldsworth*** *is a PhD student with the Oxford DTP in Environmental Research, University of Oxford. You can follow Fraser on Twitter: @FraserOcean*

CALENDAR

7th - 9th October 2020: Marine Alliance for Science and Technology for Scotland 10th Annual Science Meeting (ASM)
Glasgow, Scotland
Join us at the Technology and Innovation Centre, Glagow. We will look back at the signiificant progress made by our partners and collaborators,

and look forward to 2021, which sees the start of the decade of ocean science for sustainable development. We will examine the modern challenges that face our marine waters, and identify ways and means to conserve and sustainably use the oceans, seas and marine resources for sustainable development.

This cross-disciplinary meeting brings together members of the marine science community, with the aim of promoting and communicating research excellence and forging new scientific collaborations. The cross-disciplinary nature of the event as well as the high calibre of the selected talks means that scientists can broaden their knowledge in marine science as well as benefit from expertise and ideas gained in a range of fields other than their own. Science presentations and e-poster sessions will take place on the first two days, together with Plenary Speakers and opportunities to network.

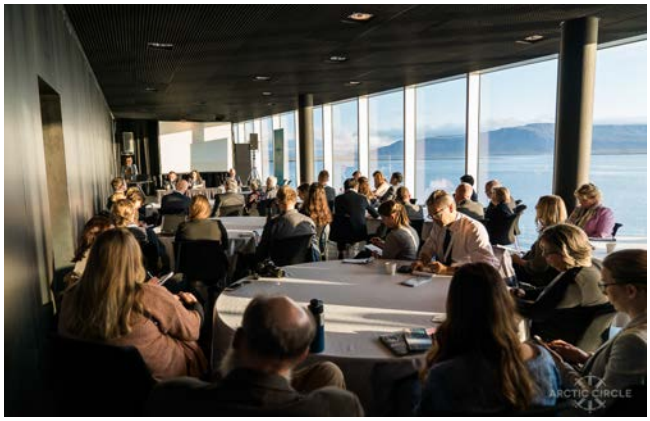
We are delighted that IMarEST is sponsoring the student prizes for the 2020 ASM. Best Presentation - £200 first prize and a £100 second prize and Best Poster - £130 first prize and a £70 second prize. Winners of the Best Presentation and Poster will be invited to attend the IMarEST Scottish Branch evening lecture to obtain their certificate and prize (travel cost to be reimbursed by IMarEST). You must be a student member of IMarESt to be eligible for these prizes, www.imarest.org/membership/membership-registration/upgrade-your-membership/student-member-simarest. The E-poster submission deadline is 16.00 on Monday **28th September 2020**.

On the third day the venue will host a number of meetings and workshops: If you are interested in hosting one of these, or if you are interested in **exhibiting** at the 2020 event, or anyone wishing to showcase or demonstrate a piece of kit/equipment please email Dr Emma Defew, ecd2@st-andrews.ac.uk. For further general information, please visit, www.masts.ac.uk/annual-science-meeting/.

8th – 11th October 2020: Eighth Arctic Circle Assembly

Reykjavík, Iceland

The Arctic Circle has received over 200 Session Proposals for the eighth Arctic Circle Assembly. In addition to the record number of Proposals, hundreds of speakers have already been confirmed. The Session Proposals come from a great number of institutions from different parts of the world, focusing on a wide variety of Arctic issues.



Session Proposals are currently under review. Session organizers will be notified in the coming days whether their Session has been accepted. Sessions at the Arctic Circle Assembly are held in auditoriums, lecture halls, board rooms, and open spaces throughout Harpa and nearby venues. Sessions are organized by governments, institutions, organizations, universities, think tanks, companies and others. In addition, the Arctic Circle itself organizes Plenary Sessions at the Assemblies.

During these pandemic times Arctic Circle will continue its mission of enhancing and facilitating Arctic and Global dialogue. Arctic Circle social media channels will share updates on Arctic and Global issues and highlight important information from previous Assemblies and Forums. For Information, visit www.arcticcircle.org.

21st – 23rd November 2020: Arctic Circle Japan Forum

Tokyo, Japan

The Forum will be organized in coordination with the Third Arctic Science Ministerial Meeting,

which is co-hosted by the Icelandic Ministry of Education, Science and Culture, and the Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT). The Arctic Circle is collaborating with the Sasakawa Peace Foundation in organizing the Forum.

Governments, universities, companies, research institutions, organizations, associations and other partners are invited to submit proposals for Sessions to the Arctic Circle Secretariat. Guidelines will be published soon.

30th November – 2nd December 2020: Evolving and Sustaining Ocean Best Practices Workshop IV
Maryland, USA
We are pleased to inform you that this annual OBP event will be held in suburban Maryland. The agenda and more details will be circulated next month. We look forward to you joining us for another productive workshop. Please mark the dates on your calendar.

If you have any questions, please email jay.pearlman@ieee.org. On behalf of the Steering Group for the Ocean Best Practices System, Jay Pearlman and Johannes Karstensen, SG Co-Chairs. Submit your Best Practices in Ocean Observing for peer-review: www.frontiersin.org/research-topics/7173/best-practices-in-ocean-observing

1st – 3rd December 2020: Oceanology International
London, UK
Celebrate the world's largest ocean technology exhibition and conference. Oceanology International is turning 50, and you are invited to the celebration. The event brings the industry together, from businesses to government and thought leaders from different sectors, to offer the latest information and technology that are moving our oceans.

Dramatic progress in ocean surveying is unlocking previously unimaginable opportunity across the ocean tech community. The 50th Anniversary Oi expo looks ahead to the next half century of surveying and services, bringing together 500 companies in 17,000 m^2 of exhibition space designed to inspire. Survey and services are key dimensions of the current ocean tech revolution, enabling new kinds of insight into the ocean floor, aquatic life and ongoing change in our oceans.

Progress in automation is unlocking previously unimaginable opportunity across the ocean tech community. It's a unique chance to meet the teams behind the innovations and see the technology in action. From subsea controls to autonomous survey boats, aerial drones to independent sample collectors, unmanned systems will streamline operations and deliver new depth in detail and data.

This is a unique chance to find out what's possible, meet the teams and see the technology in action. Register online now to attend Oi 2020: www.oceanologyinternational. com/.

Visit the show to:

- Have access to a free and interactive educational programme that will inspire and inform you on key industry topics.
- Meet experts and do business – the show offers more than 500 exhibitors, global suppliers of cutting-edge technology.
- Stay up to date with regulations and policies to make more effective decisions for your business and projects.
- Explore features such as the Ocean ICT Zone, focused on marine and ocean IT, communications, satellite and data solutions.

Here are some of the exciting developments for 2020:

- Expanded Dockside Demonstrations - we doubled the number of companies demonstrating technology at the dockside

so you have even more options for an immersive experience.
- New tracks at this year's conference - Asset Integrity and Monitoring, Coastal Zone and Shallow Water, Data Interpretation and AI, and much more. Full programme coming soon.
- Expanded Ocean ICT Zone – More exhibitors and technology at the area dedicated to the latest IT and Communication Technologies for the Ocean Space.

To succeed in your future ocean strategies, you need to be where the people shaping them are. Register now to Oceanology International 2020 and celebrate our 50th anniversary where the industry is.

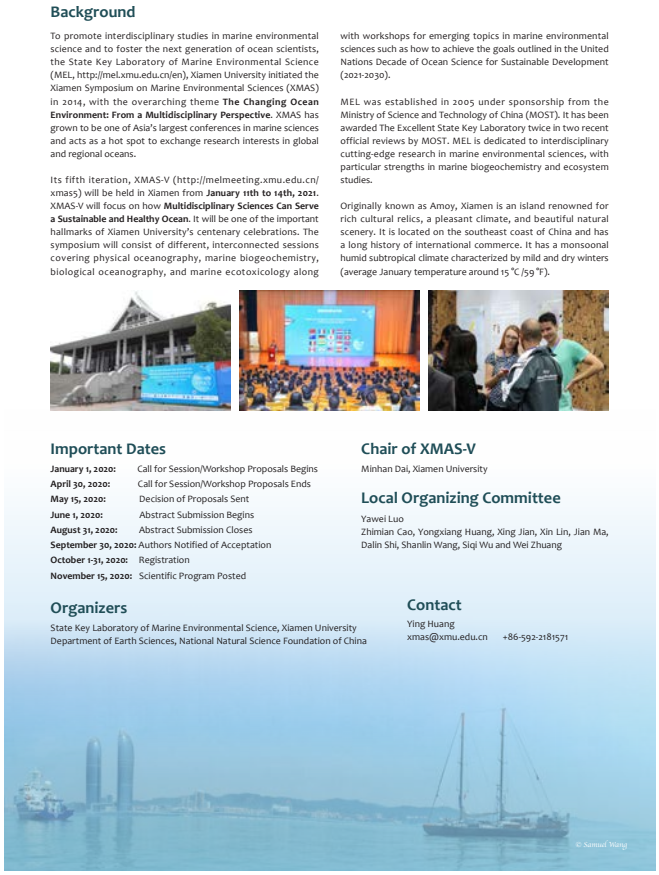
Our technical sessions unpack the latest developments and insights on essential topics, including:

- offshore energy development
- asset monitoring
- navigation and positioning
- hydrography, geophysics and geotechnics
- environmental stressors
- data interpretation and AI

It's shaping up to be a sensational show and an occasion no one in the Ocean tech community can afford to miss.

In its 50 years, Oi has consistently advanced with the community involved in exploring, monitoring, developing or protecting the world's oceans by providing networking across different sectors, knowledge exchange from various disciplines and valuable business opportunities. That reflects on the developments of the show programme year by year and the new benefits for attendees.

11th – 14th January 2021: The Fifth Xiamen Symposium on Marine Environmental Sciences
Xiamen, China



Background

To promote interdisciplinary studies in marine environmental science and to foster the next generation of ocean scientists, the State Key Laboratory of Marine Environmental Science (MEL, http://mel.xmu.edu.cn/en), Xiamen University initiated the Xiamen Symposium on Marine Environmental Sciences (XMAS) in 2014, with the overarching theme **The Changing Ocean Environment: From a Multidisciplinary Perspective**. XMAS has grown to be one of Asia's largest conferences in marine sciences and acts as a hot spot to exchange research interests in global and regional oceans.

Its fifth iteration, XMAS-V (http://melmeeting.xmu.edu.cn/xmas5) will be held in Xiamen from **January 11th to 14th, 2021**. XMAS-V will focus on how **Multidisciplinary Sciences Can Serve a Sustainable and Healthy Ocean**. It will be one of the important hallmarks of Xiamen University's centenary celebrations. The symposium will consist of different, interconnected sessions covering physical oceanography, marine biogeochemistry, biological oceanography, and marine ecotoxicology along with workshops for emerging topics in marine environmental sciences such as how to achieve the goals outlined in the United Nations Decade of Ocean Science for Sustainable Development (2021-2030).

MEL was established in 2005 under sponsorship from the Ministry of Science and Technology of China (MOST). It has been awarded The Excellent State Key Laboratory twice in two recent official reviews by MOST. MEL is dedicated to interdisciplinary cutting-edge research in marine environmental sciences, with particular strengths in marine biogeochemistry and ecosystem studies.

Originally known as Amoy, Xiamen is an island renowned for rich cultural relics, a pleasant climate, and beautiful natural scenery. It is located on the southeast coast of China and has a long history of international commerce. It has a monsoonal humid subtropical climate characterized by mild and dry winters (average January temperature around 15 °C /59 °F).

Important Dates

January 1, 2020: Call for Session/Workshop Proposals Begins
April 30, 2020: Call for Session/Workshop Proposals Ends
May 15, 2020: Decision of Proposals Sent
June 1, 2020: Abstract Submission Begins
August 31, 2020: Abstract Submission Closes
September 30, 2020: Authors Notified of Acceptation
October 1-31, 2020: Registration
November 15, 2020: Scientific Program Posted

Chair of XMAS-V
Minhan Dai, Xiamen University

Local Organizing Committee
Yawei Luo
Zhimian Cao, Yongxiang Huang, Xing Jian, Xin Lin, Jian Ma, Dalin Shi, Shanlin Wang, Siqi Wu and Wei Zhuang

Organizers
State Key Laboratory of Marine Environmental Science, Xiamen University
Department of Earth Sciences, National Natural Science Foundation of China

Contact
Ying Huang
xmas@xmu.edu.cn +86-592-2181571

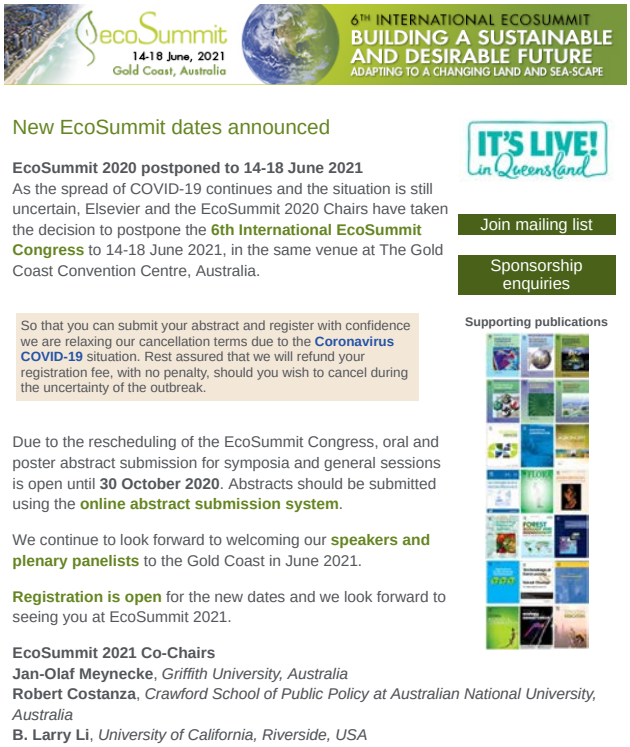
The State Key Lab of Marine Environmental Science (MEL), Xiamen University and the Earth Science Division of the National Natural Science Foundation of China (NSFC) are going to hold the fifth bi-annual meeting XMAS-V. The theme of XMAS-V is **Multidisciplinary Sciences Serving a Sustainable and Healthy Ocean.** More information about the meeting can be found at http://melmeeting.xmu.edu.cn/xmas5/.

14th-18th June 2021: EMODnet Open Conference and Jamboree
Ostend, Belgium
Due to the outbreak of the COVID-19 virus, the second EMODnet Open Conference and Jamboree which was initially scheduled to take place in September 2020 has been postponed. Save the date for this event, which will bring together the extended EMODnet family in Ostend (Belgium) to set goals for the next phase of EMODnet to 2030. More information will follow, www.emodnet.eu/conference2021.

14th-18th June 2021: the postponed EcoSummit 2020
Gold Coast, Australia
As a result of the spread of COVID-19, Elsevier and the EcoSummit 2020 Chairs took the

decision to postpone the 6th International EcoSummit Congress to 2021,to be held in the same venue at The Gold Coast Convention Centre, Australia.

Due to this rescheduling, oral and poster abstract submission for symposia and general sessions is open until 30 October 2020. Abstracts should be submitted using the online abstract submission system, ecosummitcongress.com/submit-abstract.asp. We continue to look forward to welcoming our speakers and plenary panelists to the Gold Coast in June 2021.



Registration is open for the new dates, ecosummitcongress.com/conference-register.asp, and we look forward to seeing you at EcoSummit 2021. So that you can submit your abstract and register with confidence we are relaxing our cancellation terms due to the Coronavirus COVID-19 situation. Rest assured that we will refund your registration fee, with no penalty, should you wish to cancel during the uncertainty of the outbreak.

EcoSummit 2021 Co-Chairs:
Jan-Olaf Meynecke, Griffith University, Australia
Robert Costanza, Crawford School of Public Policy at Australian National University, Australia
B. Larry Li, University of California, Riverside, USA

16th - 18th June 2021: 9th International Workshop on Marine Technology - MARTECH 2020
Vigo, Spain

The organising Campus de Excelencia Campus do Mar (University of Vigo, Spain) and the Universitat Politècnica de Catalunya (UPC, Spain) will call for papers for MARTECH 2021, www.martech-workshop.org.

The main objective of the MARTECH Workshop is to show latest investigations and exchange of information and points of view on current research in MARine TECHnology. The Program Committee cordially invites you to participate and submit your contribution in one of the proposed topics:

- Operational Oceanography
- Instrumentation, Metrology, Signal processing
- Seafloor observatories and sensor networks
- Observatories, remote sensing
- Marine Robotics: ROVs, AUVs, ASVs, Gliders
- Underwater imaging and communication
- Seafloor and Water Column characterization
- Technology for Marine Biologyand Aquaculture
- Renewable energies
- Coastal, regional, and offshore research vessels and platforms
- Marine Geophysics technology and solutions
- Marine Data Interoperability and data flow
- Technologies for a sustainable dredging
- 2021 as a point between the past and the future

Yours sincerely, Dr. Ana Bernabeu, General Chair and Dr. Joaquin del Rio, Steering Committee Chair

9th – 13th August 2021: IMBeR ClimEco7 summer school
Vancouver, Canada

Unfortunately, due to the restrictions that we are currently all dealing with, and the uncertainty as to how things will be in August when we were planning to hold ClimEco7, IMBeR has taken the decision to postpone the summer school for a year.

All the applications that we received for ClimEco7 this year will be carried over to 2021. Results of the selection process will be made known during March 2021.

New dates for ClimEco7 are 9-13 August 2021

UBC, Vancouver, Canada

imber@dal.ca

6th - 10th September 2021: Postponed Challenger Society Biennial Meeting
Oban, Scotland
The biennial Challenger conference attracts around 300 leading UK marine scientists, science managers and early career scientists. As well as showcasing cutting edge marine science and technology, the conference is noted for its training of young scientists and networking events, including a public lecture by an eminent authority on relevant societal marine issues.

Once again the call is out for sponsors and exhibitors wishing to participate in next year's conference. The conference is a great place to be if you are recruiting marine science graduates.

For the only the third time, the conference will be held at SAMS (Scottish Association for Marine Science in beautiful OBAN. SAMS hosted the first post war conference back in 1946 and since then only once more since in 2006.

20th – 22nd September 2021: Oceanology International Middle East
Abu Dhabi, UAE
Whilst it is hugely disappointing to postpone the launch, and not a decision we have taken lightly, we believe it is the best course of action for all involved. In the last couple of months, we have been speaking to customers, partners and supporters to understand their views and to ensure we make the best decision - in such challenging circumstances - for the ocean communities we serve.

We trust that postponing Oceanology International Middle East will enable us to deliver the true value of this world-leading brand next year. Amid these challenging times, we would like to reiterate our commitment in creating new opportunities and connections for our industry. Over the next several months, we will offer our support to the global community by hosting various digital activities that will connect our exhibitors with their targeted clients. In advance, we thank you for your understanding and support. If you require any further clarification or information regarding this situation, please feel free to email us at info@oceanologyinternationalmiddleeast.com.

5th - 9th September 2022: Challenger Society Biennial Meeting – celebrating the 150th anniversary of the Challenger Expedition
London, UK
To be hosted by the National History Museum, just a 'date for the diary', stayed tuned.

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 30th June.

We continue to send printed copies of Challenger Wave to members of the CSMS without email addresses. However it is in everybody's interest to send your email address to Jennifer Jones, jxj@noc.ac.uk, as soon as possible

JOBS

There are jobs on the IMBER web site

http://www.imber.info