

Challenger Wave



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

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NEWS

Fisheries Technology for Resource Management

The UK alone has 6,400 fishing vessels, with total landings of fish catch equating to £770.3 million (627,000 tonnes) in 2012. Despite warnings of a slowdown in the marine catch in the 1970's and 80's, the fishing industry increased fishing efforts

with more powerful boats as well as superior technology, allowing the tracking of fish populations with sonar devices and larger nets to increase catch size. In addition, the international commercial fishing industry is double the size necessary to meet current requirements and overcapacity is now a global norm. The European Union itself is in 40% overcapacity, resulting in fierce competition and difficulties in mitigating impacts with higher percentages found around the globe.



Although overexploitation of fishing resources is the main issue, wasteful practises which resort in by-catch or discard is an area necessitating much focus by resource management schemes. By-catch has long been recognized as a widespread issue, with around 25% of total catch being discarded back into the sea dead due to little or no commercial value. This equates to approximately 27million tons, the equivalent of 600 fully-laden Titanics.

The impact of by-catch to the ocean ecosystems is not only colossal but often irreversible. The different types of commercial fishing practices result in variations of species and quantities being killed as by-catch: nets kill cetaceans, long-line fishing kills birds, and bottom trawling can devastate marine benthic ecosystems. Shrimp fisheries are renowned to be inefficient and ecologically damaging, with often over 80 per cent of a catch comprising marine species other than shrimp which gets discarded. Bottom-trawling and beam-trawling, removes up to 20% of the seafloor fauna and flora in a single trawl, in addition to by-catch of commercially unattractive animals.

By-catch occurs due to fishing gears inability to adequately select target species, the problem worsened by economic pressures resulting from overexploitation. A large majority of by-catch is discarded due to fishing quotas minimising landings (size of catch) and when regulatory restrictions prohibit retention of particular attributes (size, species, sex). Therefore, some by-catch occurs in commercial fisheries, however, higher rates are found in fisheries with less selective fishing methods and practices.

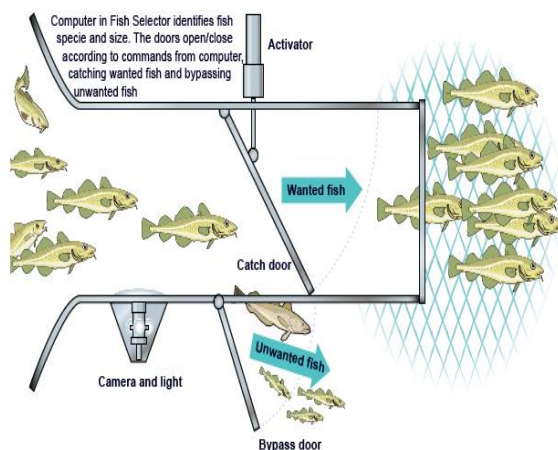
Mitigating the environmental impact of commercial fishing by avoiding, minimizing and compensating for adverse effects, is fundamental for fisheries management authorities worldwide. The

complex interplay of ecological, economic, and social considerations has often resulted in by-catch management being reactive, confrontational and costly. Some by-catch species, including fish, reptiles, birds and mammals, may be threatened with extinction. Even Tuna fisheries, which in the past had high dolphin by-catch levels, are still responsible for the deaths of an estimated one million sharks annually. Around the UK, evidence of the growing scale of by-catch is washed up on beaches around the south west of England and northern France annually in the form of dolphin and porpoise corpses. Progresses in technology for impact reduction, has not been as quickly established as technologies designed to increase overall catch. Although modifications to fishing gear or practises have offered an effective means of reducing by-catch, such as turtle exclusion devices and Pingers, these devices need continual monitoring and in many cases it has been difficult to demonstrate success. Therefore effective use of these devices depends on overcoming gear handling constraints and the short-term economic losses often associated with their use.

The Icelandic high technology company Star-Oddi has developed revolutionary equipment that filters out the majority of unwanted by-catch, (up to 75% of the by-catch). The Fish Selector, which is an equipment that automatically separates the fish while still in the trawl, means that discarding of fish by fishing companies could be a thing of the past.

The aims of using Fish Selector is to increase the value of the catch, avoid discard of fish and increase fishing efficiency by helping with decision making for the skipper of selecting a fishing area. In addition to benefitting the commercial fisheries companies the marine research institutes may find scientific value in using the equipment in their studies.

The Fish Selector is placed in front of the cod-end and as the fish swim through the device it is pre-programmed to select fish by specific size and species so those that are not intended for landing, are sorted out and directed away through a bypass gate. Collected information is wirelessly monitored in real-time in the bridge on the quantity of fish caught, as well as quantity bypassed. Other data can be collected such as depth, temperature and inclination.



Data on how many fish are caught and how many are released is automatically stored and sent in real time onboard the vessel. Collected information on quantity of caught fish and bypassed fish can be viewed wirelessly by the crew. The data gives insight into the quality of the fishing ground so the skipper can quickly and better estimate if fishing should continue or if movement to a different area would be beneficial.

The emphasis on responsible and sustainable fisheries has been increasing. Fishing companies using the Fish Selector can help in delivering the message to consumers that the company is making its contribution to sustainable fisheries by releasing threatened species.

In December 2010 the Fish Selector was tested on the research ship "Drofn". It operated very well on its first sea trial. Since then, focus has been on reducing the size of the equipment; a smaller volume and lower weight will make it easier to take the device onto smaller ships, increasing the market potential. Star-Oddi won first prize for the most innovative technology for the fishing industry at the Icelandic Fisheries Conference in November 2013. - **Kira Coley** (Scientific Applications Specialist at Planet Ocean Ltd) Kira@planet-ocean.co.uk, **Snorri Guðmundsson and Sigmar Guðbjörnsson** (Star Oddi, Iceland)

Using ecological indicators to assess environmental status

Ways to manage natural resources have been under development for decades, driven by an increasing need to understand the effect of man-made impacts on ecosystems. Often, it has been assumed that management could be based on the population dynamics of an individual species but new research shows how in the marine envi-

ronment whole ecosystems need to be assessed individually rather than benchmarked against all other ecosystems.

Even where two systems share physical characteristics, but are in different ocean basins, the research found that the individual systems required respective management approaches. Only when ecosystems are similar in type and share a location, for example, may a single approach suit both ecosystems.

The new study published today in PLOS ONE found that ecosystem traits, such as type (for example lagoon, estuary or bay), size, depth and location, need to be taken in to account when assessing an ecosystem's environmental status or health. The study also found that the structure and function of ecosystems differ from one to the next, posing more challenges to managing marine resources.

"This paper (*Global patterns in ecological indicators of marine food webs: a modelling approach*) is among the first to analyse a large variety of models from different systems in an organised and systematic way," said lead author Dr Sheila Heymans, who is also head of the ecology department at the Scottish Association for Marine Science (SAMS).

"It presents the largest meta-analysis of the structural and functional indicators of marine food webs to date and adds to the general theory of marine food web dynamics and its use for ecosystem conservation and management.

Food webs show the interaction between species at different feeding levels and consequently show the flow of energy and matter in ecosystems. These predator-prey interactions are a main regulator of ecosystem dynamics, and they contribute to the way ecosystems respond to natural and human impact such as fishing, habitat degradation or environmental forces.

Food web models are simplified representations of natural systems, which help us understand how biodiversity and ecosystems respond to changes. Creating food web models typically calls for quantitative modelling, integrating food web dynamics and external factors such as environmental change or fishing.

This paper analysed 105 published marine food

web models representing ecosystems from coastal lagoons to the deep sea in all the world's oceans, and from past and recent timeframes to find out whether there were general patterns in ecological traits of marine food webs. Uniquely, this paper included statistical analyses to address the variation and uncertainty thrown up by all the different model strategies and structures used in those 105 publications. The study posed new and advanced analyses on the key species concept.

An open access copy of the paper is available dx.plos.org/10.1371/journal.pone.0095845. For more information, please contact lead author Dr Sheila Heymans (sheila.heyman@sams.ac.uk) or tel: +44 (0)1631 559 418. For more graphics/images relating to this paper and for information on other SAMS news, please contact Cathy Winterton (cathy.winterton@sams.ac.uk) or tel: +44 (0)1631 559 342

Request to Review 2014 SCOR Working Group Proposals

The proposals for new SCOR working groups are now ready for review (please see review instructions at:

<http://www.scor-int.org/Annual%20Meetings/2014GM/Cover%20Letter%20for%20Proposals.pdf>.

Proposals are available on the SCOR meeting Web page:

<http://www.scor-int.org/Annual%20Meetings/2014GM/2014GM.htm>.

The proposals can either be downloaded individually or in a file with all proposals compiled.

SCOR welcomes comments from any individual or organization, but especially seeks review by national SCOR committees. Comments received by 1st August will be summarized at the SCOR General Meeting by a SCOR Executive Committee monitor for each proposal, followed by discussion by meeting participants. Decisions on proposals will be made by 17 September.

The Challenger Society is the affiliating body for the UK to contribute to SCOR. The UK SCOR committee will be meeting in the summer, so if you would like to feed comments into the UK National Committee then please email me. Balanced comments on each proposal are more valuable than lobbying for a particular proposal. - **Karen Heywood** (Chair of UK SCOR committee)
k.heywood@uea.ac.uk

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Atmosphere and Ocean Dynamics: A Scientific Workshop to Celebrate Prof. Richard Greatbatch's 60th Birthday: Liverpool, 10-11 April 2014

Fifty three scientists travelled from China, Japan, USA, Canada, Germany, Norway and the UK (even as far afield as Norwich), to get a piece of birthday cake. It was time to celebrate Richard Greatbatch's birthday and also to fit quite a lot of science into a couple of days in Liverpool. Richard is one of the rare few that are a true expert in the dynamics of both the atmosphere and ocean and his broad interest was very often reflected in the collaborative work of those presenting. Those collaborations were also remarkable as they covered as many students and early career post-docs as they did well-established scientists.



Richard began his studies at the University of Liverpool before becoming a student of Adrian Gill at Cambridge. He has worked in many places, including Cambridge, Princeton, Imperial College London, Liverpool, Memorial University of Newfoundland, Dalhousie University and most recently at GEOMAR, Kiel as Professor of Theoretical Oceanography. As a fellow Liverpoolian, I was pleased that Richard decided to return to his hometown for this celebration and to promote tourism and local history a little. Unfortunately for us Liverpoolians, John Marshall devoted the first ten minutes of his talk to the discussion of regional accents (although also covering his own East Midlands accent) so there was a definite theme to the meeting. David Marshall showed a clip of Richard very enthusiastically singing karaoke to a Beatles number at Xiaoming Zhai's wedding. There were several fine scientific discussions smattered throughout the anecdotes

and it seemed that almost everyone had their own to tell.



The workshop themes ranged from climate variability, teleconnections and predictability to eddy parameterization, energetics, turbulence, instabilities to regional climate, atmosphere-ocean coupled processes to the thermohaline circulation, the North Atlantic Oscillation, Arctic-Antarctic asymmetries, internal waves, shelf sea processes to biogeochemistry, sediment transport and extreme events. This was truly a rich and fruity cake full of chewy topics.

The workshop was held in the Foresight Centre, opposite the National Oceanography Centre, on the University of Liverpool campus. There were 34 talks and 15 posters crammed into the two days. At the end of the second day, there was a scientific field trip up to The Top Lock pub in Chorley, where the boundaries between the atmosphere and ocean were studied in greater detail.



With the support of the Challenger Society the registration fee of two students, Yao Fu (poster:

"Equatorial deep jets in a shallow water model") and Jan-Dirk Mattiessen (poster: "Investigation of equatorial deep jets"), was covered. Also, a registration discount was given to members. The organisers, Chris Wilson, Xiaoming Zhai and Jinyu Sheng, are very grateful for this valuable help.

There will be a special issue of Ocean Dynamics covering the presentations in this workshop. - **Chris Wilson** (National Oceanography Centre, UK)

New RAPID and OSNAP cruise blogs

Staff in the National Oceanography Centre's Marine Physics and Ocean Climate (MPOC) research group, have launched a couple of new cruise blogs for the RAPID and OSNAP projects' fieldwork this spring and summer. Please take a look and share the links with friends and colleagues: <http://10yearsofrapid.blogspot.co.uk/>, <http://ukosnap.wordpress.com/> - **Penny Holliday** (National Oceanography Centre, UK)

VIEWS

Challenger Society Travel Award Report – Annette Wilson (Earth and Ocean Sciences & The Ryan Institute, School of Natural Sciences, NUI Galway)

The 2014 Ocean Sciences Meeting took place in Honolulu, Hawaii and was a truly inspirational experience that I am extremely grateful to The Challenger Society for assisting in making my attendance possible. The meeting included over 5,000 oral and poster presentations. The 2014 OSM was exceptionally well organized with its own conference app. and 12 concurrent sessions, covering all aspects and disciplines of ocean sciences running all day over the six day conference. The keynote speakers were more than inspiring, with emotional, moving and refreshing talks, particularly from Elizabeth Kapu'u-wailami Lindsey, the first Polynesian explorer and female fellow in the history of the National Geographic Society, Robert Richmond, the very humorous "Dr.Doolittle" inspired coral reef and climate change Research Professor and Director of the University of Hawaii, and Roger Hanlon, a diving biologist and cephalopod expert whom I had previously seen on TED talks!

This was my first international conference to speak at and I gave an oral presentation on my PhD research on 'Nepheloid Layers in the Whittard Canyon, North East Atlantic' at the Submarine Canyons: Oceanographic Conditions, Geological Features, and Ecological Settings session. I was extremely nervous all week in anticipation of my talk as it was on the last day but it felt fantastic giving my talk. I really enjoyed it, which I had not expect and my work was well received with questions and very useful feedback from other scientists after the session. It was amazing to be in a room of people that were interested in my work. The whole experience has motivated me and illuminated possible future avenues for my work.

A sincere thank-you to The Challenger Society for Marine Science.

Challenger Society Travel Award Report – Siobhan Vye (School of Biological Sciences, Queens University, Belfast)

The grant enabled me to travel to Connemara, Co. Galway and run an experiment in rock pools on a shore near the Carna Research Station. The experiment manipulated nutrient enrichment and the presence of an invasive sea weed (*Sargassum muticum*), with the aim of identifying the effects on biodiversity. Data collected from this experiment will give an important insight into the cumulative effects of multiple stressors and will form the final part of my PhD project.



Field site near Carna, County Galway.

During the week-long trip, a colleague and I travelled to the field site and set up the experiment. This included identifying suitable rock pools, measuring the diversity of the rock pools and quantifying the abundance of the invasive sea-

weed. We spent 6 - 7 hours on the shore each day, from around 6am until mid-afternoon. The early mornings and long hours were more than made up for by some lovely Irish spring sunshine. Highlights of the trip include the picturesque setting and the amazingly colourful algal diversity within the rock pools !. Unfortunately, the well-known Irish rain did make an appearance on the last day, but it wouldn't be field work in Ireland without it !. In addition, the trip provided an opportunity to liaise with the very welcoming staff and academics at Carna Research Station, NUI Galway. This has allowed me to forge links with members of the international marine research community. My thanks go to the Challenger Society for facilitating a productive and rewarding trip.



Quadrat surveys on a cold sunny morning.

Challenger Society Travel Award Report – Nienke van Geel (Scottish Association for Marine Science, Oban, Scotland)

I sincerely thank the Challenger Society for granting me a Travel Award which allowed me to attend the 20th Biennial Conference on the Biology of Marine Mammals held in Dunedin, New Zealand in December 2013.

At the conference, I presented a poster on the potential to investigate bottlenose dolphin movements using an array of passive acoustic monitoring equipment when dolphins are moving through geographic bottlenecks, as exemplified by a case study in the Sound of Mull (west Scotland).

Additionally, I attended four workshops, most of which were related to marine mammal conservation:

1) best practice principles for monitoring the effect of coastal development on marine mammals,

- 2) impacts of cetacean tagging: a review of follow up studies and approaches,
- 3) species distribution modelling with MGET, and
- 4) the student workshop, addressing CV writing, grant writing and writing papers.



C-POD attachment to navigation buoy. Copyright SAMS.

In addition to being able to present my work, attending this conference also provided the opportunity to get feedback from other researchers, which will contribute to improve the final stage of my PhD. Also, the increased insight into latest research, both within and beyond my particular research direction, through other presentations and posters, was useful to place my research into the wider, most up to date research context. Finally, attending the conference was a great opportunity to network, to discuss current data gaps and future research challenges and to think about future interdisciplinary research collaborations.

I thoroughly enjoyed the conference itself, and the various additional experiences including a Maui welcome, the masquerade party, and seeing some sun in the middle of winter !.

A successful Marine Imaging Workshop 2014

The beginning of April saw marine imaging experts coming together to discuss the state of imaging as a tool for gaining data about the underwater environment. This was the first meeting of its kind, bringing together 100 delegates from around the world, including many from Europe, the United States, Canada, Australia, Japan and the UK. Experts from different backgrounds brought their expertise to share with the group, so it was a melding of ideas from academia/research, government and from industry. It also united those from the computer vision field (largely computer scientists and engineers) with the end-users of images or extracted data from images to discuss common challenges, and foster collaboration and understanding between groups.

The objective of this Challenger Society sponsored workshop was to examine the stages in acquiring, preparing and extracting data from marine images, with an emphasis on methods for each. Keynote speakers Hanuman Singh (WHOI), Rafael Garcia (University of Girona) and Martin Dorhn (Ammonite) enlightened us on the latest technological advances in robotics, cameras, and lighting, and dazzled us with images of exotic seabeds and bioluminescence. Talks and posters were presented on themes of image acquisition, image processing, annotation, data management, automated annotation and biological data from images. Discussion sessions were held each day to identify common challenges and share strategies for getting the best of our image data. The workshop culminated in a look to the future of imaging, and the creation of an imaging wish list. We are looking forward to the next workshop in 2 years' time. – **Jennifer Durden** (National Oceanography Centre, UK)

Acidic Oceans: Expecting the Unexpected

Ocean Acidification (OA) has long been accepted as an equally troublesome companion of Global Warming. Studies have not only exposed impending problems, but have given scientists an insight into the complexities behind achieving a comprehensive understanding of the overall bionetwork response to this worldwide problem. However, are investigators equipped well enough to deliver precise robust data critically needed for global ocean-atmospheric models, allowing attribution of changes to both anthropogenic and natural causes ? This article discusses the considerations which need to be made whilst studying the impacts of OA, on both an ecological and techno-

logical level.

Since the Industrial Revolution, the mean ocean surface acidity is estimated to have increased by 25-30%, equivalent to a drop of 0.1 pH, roughly 100 times faster than any change in acidity known within the last 20 million years. Predictions suggest an increase by a further 150-200 %, representing an additional drop of 0.3 pH, by the end of this century.

Global unease as to the consequences of altering this ancient balance has seen OA become one of the fastest growing areas of research in marine sciences over the last few decades. In 2011, Andersson & Mackenzie (*Biogeosciences Discussions*, 2011) documented a Google internet search for OA as generating around 605,000 results; a replica search this week generated just under 3.2 million, demonstrating the dramatic surge of international interest from both the Public, Government and Scientific communities.

Although the specific effects of warming, acidification and changes in circulation will vary across ocean basins, it is clear that there will be multiple impacts on ocean and coastal ecosystems throughout the world. For aquatic ecosystems, the consequences of long-term exposure to rising carbon dioxide (CO₂) concentrations are still poorly understood and while the detection of direct effects (physiological) is readily achievable, it will not necessarily shed light on the principal drivers which will be key in shaping future communities. Effects on individual species are likely to cascade throughout the entire ecosystem, influencing species interactions, food web dynamics, migration patterns and the overall bionetworks resiliency.

The complications in studying ecosystem-level impacts, include yielding not only 'unexpected results' but also some of the strongest ecological responses (i.e. phase-shifts) which are often unanticipated as the impact of one component (e.g. OA) on another (e.g. kelp decline), requires knowledge of a third species (e.g. kelp competitors) or mediating factors (e.g. interactions among stressors). The real problem therefore, is understanding the combined effects of additional stressors (i.e. global warming effects) which happen in line with rising acidity. Laboratory experiments can offer insight into how synergistic effects of added stressors determines alterations of marine communities in high CO₂ conditions, however,

this doesn't take into account adaptations and shifts in competitive pressure, nor the natural spatial and temporal variation of pH and dissolved CO₂ in their native habitats.

The measurement of OA is historically complex and the correct determination of at least two parameters is necessary to obtain a valid description of the whole carbonate system and hence correctly interpret organism responses. Although dissolved CO₂ is relative to the pH and partial pressure of CO₂ (pCO₂), due to previous difficulties with pCO₂ resolution and disputes in pH measurement protocols, total alkalinity (AT) and dissolved inorganic carbon (CT) were the favoured parameters for ocean carbonate calculations. However, now that technology has developed allowing for more robust measurements of small-scale pCO₂ and stable pH readings, there is debate on what parameters offer the least uncertainty. This has resulted in difficulties with comparability of data, and an assortment of the four parameters being measured in various experiments. Therefore, not only an appreciation of ecological variables is required but also standardisations in methods for measuring OA across the scientific community.

Freshwater Systems

Acidification of freshwater was a problem that was first identified in Scandinavia during the early 1970s. Freshwater ecosystems typically have a neutral pH, but inconsistencies can occur between acidic or alkaline, depending on factors such as rainfall and buffering capacity. The acidity of freshwater lakes and streams is predominantly determined by the soil and rock types of an area, since 90% of the water entering these systems has passed through the ground. Biota within these systems can be influenced directly by changes in water quality during both short acidic episodes and longer-term sustained periods of acidification as well as indirectly, by alterations to the balance of acid-sensitive and acid-tolerant organisms at different trophic levels.

Marine Systems

Similarly to freshwater, local topography and biological activities can cause pCO₂ and pH fluctuations in marine environments. A change in the balance between the respiratory CO₂ production and photosynthetic CO₂ consumption of marine reef organisms, can cause substantial pH gradients on a diel cycle, which may be more prominent in shallow water reefs where there is re-

stricted exchange with the open ocean. As these temporary variations seem to occur regularly, it might not simply be the range over which pH varies that is important for tolerance to acidification, but also the duration. Shallow submarine CO₂ seeps are among the few sites in the world within which the ecological consequences of long-term (multi-decadal) exposure to high CO₂ can be assessed in situ. Habitats such as those found around Castello Aragonese (a small volcanic island located in Ischia), can provide a real-time model for the future acidity levels forecasted by 2100, and consequently these acidic conditions are fatal to otherwise native species, home only to jellyfish, seagrass and algae.

Although species living in environments that naturally experience significant variation in pH and/or pCO₂ may be more tolerant of anthropogenic acidification, the combined effects of both the chemical and biological alterations can adversely impact biogeochemical processes. Another unforeseen outcome is the possible adverse impacts on marine mammals' ability to communicate using low frequency noise. Seawater chemistry influences the absorption of sound and how sound travels underwater. With the drop in pH forecasted by the end of this century, seawater's ability to absorb sound could see it travel up to 70% farther, resulting in the potential interference of marine mammal communication by low frequency noise generated from anthropogenic causes (i.e. military sonar, shipping and seismic exploration). Research in parts of the north Atlantic has already found a decrease of 15% in low frequency sound absorption, and is thought by some to be a result of increase acidity. Therefore, it's important to recognise the mechanisms which can cause both natural and anthropogenic fluctuations, and how the local topography influences the deviations.

Technology Considerations in the Field

The stressors which could influence the outcome of ecosystem-level responses to ocean acidification are abundant and varied, depending on environmental characteristics. In addition, the data is influenced by the parameters measured, therefore, it is important to perhaps overcompensate in order to achieve a comprehensive data-set which may animate additional components previously overlooked. The technology used to acquire this information will need careful consideration.

Multi-parameter integrated systems can be de-

veloped to specification, however, what is measured, where the systems will be deployed and how long for, all influence the type of technology used and in some cases, the design or calibration of the individual sensors. Long time-series data sets are vital to determine accurately what changes are taking place, especially to avoid seasonal variability which may distort data.

Considerations of climate and location attributes are also essential. Areas of low dissolved O₂ (DO), nutrient rich waters, high phytoplankton abundance or tropical climates, are likely to experience elevated levels of biofouling, resulting in regular maintenance requirements or disruptions of the sensors ability to record accurate results (i.e., recording of CO₂ may be from the biofouling organisms, and not a true representation of the environment and disturbed time-series). Similarly, the power supply endurance of modern instruments following extended deployments, can be disregarded if the sensor itself gets fouled within a short period. The ability to visit and recover the sensor if it is deployed without real-time telemetry will also reflect on the length of time it will need to be underwater (i.e. Polar Regions are seasonally dependent).

Even the best technology currently available will have its limitations whether it is resolution, long term stability and endurance, or deployment depth restrictions. For example, although there are many pH monitoring solutions on the market, not all are suitable for ocean chemistry research, not just in regards to accuracy and stability, but in terms of maintenance requirements and depth limitations which reduce suitability for platforms such as AUVs, floats and gliders. Whilst technology is developing to meet these needs and overcome the current limitations, it is vital that the best available instruments should be utilized to ensure that the data acquired by them are meaningful now and in the future.

Some of the Latest Monitoring Solutions

Developed by ocean acidification researchers at MBARI and Scripps, the Sea-Bird SeaFET™ Ocean pH sensor has been used extensively for ocean acidification research, coral reef research, coastal marine biology and environmental monitoring.

Phytoplankton abundance combined with high resolution pCO₂ sensors, may help in providing long term data into natural variations in different

environments. Satlantic's new series of Photosynthetically Active Radiation (PAR) sensors provide highly accurate measurements of PAR (400 – 700 nm) for a wide range of aquatic applications. PAR sensors provide superior data along with high quality construction to stand up even in the harshest conditions and applications include oceanographic and freshwater productivity studies, vertical profiling, as well as laboratory photosynthetic physiology studies.

Additionally, monitoring pO_2 in line with pCO_2 can provide estimates in primary production and respiration of these organisms. Sea-Bird has developed an individually calibrated, high-accuracy, optical oxygen sensor to assist in critical hypoxia and ocean stoichiometric oxygen chemistry research. Used alongside Sea-Bird CTD systems, the SBE 63 optical dissolved oxygen sensor has been designed to set the oxygen measurement standard for oceanographic research.

The HydroCTM CO_2 sensor is a unique underwater carbon dioxide sensor for in-situ and online measurements of dissolved CO_2 . The HydroCTM CO_2 is designed for profiling, AUVs and rosettes or for long-term deployment on buoys, moorings or even biogeochemical profiling floats, like the Sea-Bird Navis float; its high-precision optical analysing NDIR system makes it well suited for air-sea gas exchange, ocean acidification, climate studies and carbon capture and storage (CCS-MMV) research.

It is likely that in order to achieve certainty in data, over-compensation by measuring multiple parameters at once will not only provide insight into influencing factors at that location, but also strengthen the overall robustness of the result. There is still plenty of scope for investigating OA and the need to deliver precise data for global ocean-atmospheric models, which allow attribution of changes to both anthropogenic and natural causes. Technology is advancing to help deliver relatively simple sampling methods for CT, AT, pH and pCO_2 , as well as a growing understanding of the interdependencies affecting the overall bio-networks responses, on both chemical and biological levels. - **Kira Coley** (Scientific Applications Specialist at Planet Ocean Ltd) Kira@planet-ocean.co.uk

SALTS

An ode to DY008 (first scientific voyage of the new RRS *Discovery*)

We went to sea in March fourteen
for science and glory, and country, and queen
We were English and Scots, German, Irish and Welsh,
we were Swedes and Greek and even the French!

We arrived in Southampton, and there she lay
all shiny and glinting, black, white and grey.
She was tied up the dockside, with thick new rope
but in the cabins, no hangers, or dish for the soap!

Our spirits were high
as dolphins swam by.
We had trials at speed
to measure her greed.

With trials complete
and our spirits replete
we set off to seek
the Celtic Deep.

We put out some moorings, thermistors and landers.
For CANDYFLOSS, Sharples and Richard Sanders
The crew were relentless,
their efforts were endless.

It was mud galore
till the winches said: "no more" !
The winches were fried,
but still we tried.

Then came the flood, of the met-lab and galley
as scuppers turned fountains, water ran down the alley.
The chefs were aghast !
Shouting : "Oh bother, oh blast" !

But our engineers,
the best of their peers,
rose to the challenge
and sealed-off the malice !

We took pictures of sediment, black mud and white sand
but could not lay upon it, a single hand !
Alas, for those winches,
we came within inches !

Let's hope we can find, the winch engineer,
as we're heading for help, to Cornwall, oh dear !
A night out in Falmouth, to drown our sorrow.
No doubt we'll regret it, come tomorrow.

A jolly night out
was had all around,
we had a drink and danced with flair !
But now, there's glitter in our hair.

To work he went, the engineer
He fixed the winches, to applause and cheer !
We set off west with much delight,
but now the time was getting tight.

We SPI-ed and cored to our hearts content,
but hit a rock and the corer was bent !
We put out the lander, the flume and the SAP,
Till the winch said "no more, I'm giving up".

It was time for the 'lecky', a cheeky chap,
who went to work, and brought it back !
We lost NOC's lander, but found it later,
when the storm had calmed and our chances greater.

It was Autosub's time,
all yellow and fine.
It avoided the prop, the ship and a trawler
and off it went, ... the creepy crawler !

It went with a burst,
but flew high at first.
It went again, at the chief's decision,
And what delight - a successful mission !

We bagged four sites, of mud and sand,
but the taste behind, was rather bland.
Our hopes postponed, for another year.
All trips delayed – the decision clear.

More trials are needed,
the advice was heeded.
No doubt in time,
she'll be mighty fine.

A sight of land, in Southampton docks,
help is at hand as we forward the clocks.
But wait..., we can't believe it !

The cranes are bust ! We cannot leave yet !

At last it's finished.
A memory diminished.
In March fourteen we went to sea,
and we were there..., on our 'Disco'
- **SSB Poet in Residence**

CALENDAR

20th – 21st May 2014: Society of Maritime Industries Annual Conference Bristol, UK



Society of Maritime Industries Annual Conference 2014

**THE UK MARITIME INDUSTRIES:
BUSINESS OPPORTUNITY IN THE DRIVE FOR EXPORTS**

20 & 21 MAY 2014 | BRISTOL

LISTEN, LEARN AND DEBATE WITH THE INDUSTRY ELITE AT THE SOCIETY OF MARITIME INDUSTRIES ANNUAL CONFERENCE 2014

REGISTRATION IS NOW OPEN

EARLY BIRD DISCOUNT AVAILABLE UNTIL 24 JANUARY

DOWNLOAD THE FULL PROGRAMME

Once again the Society of Maritime Industries conference has brought together a strong line up of speakers to inform on key topics and discuss the critical issues including:

"Technology and opportunity for the UK's world class maritime industry"

Join industry leaders for the premier maritime engineering conference of the year in Bristol on 20 and 21 May 2014.

REGISTER NOW AND HEAR FROM:

Mr Bob Nugent, Director, AMI International
discusses the competition in warship and submarine construction from the US, France, Germany, Spain, Italy and Sweden.

Mr Nigel Gardiner, Managing Director, Drewry Shipping,
talks about commercial shipbuilding in the Far East and the equipment opportunities this presents.

Dr Andrew Tyler, Chief Executive, Northrop Grumman (UK & Europe)
offers a view of the naval and maritime security markets in Europe.

Mr Gordon Rankine, Director, Beckett Rankine
talks about the design and construction of ports and naval bases abroad based on UK expertise.

Mr Peter Chivers, Chief Executive, National Composite Centre, Bristol
discusses how the National Composite Centre can ensure the marine industry has the technology to maintain its competitive edge.

THE OTHER THEMES ARE:

Future market trends and responding to economic, political, regulatory and technology change
Does a strong and flourishing domestic market support or prelude the need to export?

CLICK HERE TO VIEW THE SPEAKERS ON THESE THEMES AND THEIR TOPICS

THE TWO DAY EVENT ALSO INCLUDES:

PRE-CONFERENCE INDUSTRIAL VISIT - PORT OF BRISTOL AT AVONMOUTH

Today, the new Port of Bristol at the mouth of the Avon has replaced the historic port in the very heart of the city where, from the Middle Ages, up to the mid-twentieth century, trade, commerce and engineering made Bristol one of the most important maritime cities in the United Kingdom.

Delegates will be hosted by the Port Authorities on the commercial and business aspects of the enterprise and will undertake a conducted tour of the facilities.

ONE-TO-ONE MEETINGS

On Tuesday 20 May a structured programme of one-to-one meetings (optional) will be held between delegates participating in the conference. These meetings provide an excellent opportunity to network face-to-face with some of the biggest names in the industry.

CONFERENCE RECEPTION AND DINNER

The networking reception and dinner will be held on the evening of Tuesday 20 May in the newly transformed M Shed museum, with its panoramic views of the ancient docks and the city of Bristol and offers the chance to network in a more informal setting.

REGISTER NOW FOR THE EARLY BIRD DISCOUNT RATE

19th-21st June 2014: 1st International Symposium on Natural Resource Management Palma (Mallorca), Spain

The UNESCO/SA NOSTRA Chair in Business and Environmental Management, hosted by the University of the Balearic Islands, is pleased to announce the 1st International Symposium on Natural Resource Management on "*Understanding Wetlands: A Key Issue in the Transition to a Sustainable Economy*". The Symposium will take place at the Centre de Cultura "SA NOSTRA".

2014 is the FAO International Year of Family Farming. Given wetlands are intimately linked to agriculture –which has led the Ramsar Convention to choose *Wetlands and Agriculture: Partners for Growth* as the World Wetlands Day theme for 2014–, the UNESCO/SA NOSTRA Chair organizes a symposium on wetlands aimed at disseminating knowledge about the value of these ecosystems, rich in biodiversity but especially vulnerable to anthropogenic impacts, in an attempt to contribute to their preservation. For this reason, the symposium wants to be a meeting point between researchers from different fields focusing on the study of wetlands –from post-graduate and PhD students to renowned scientists– and wetlands’ managers, thus bridging the gap between academic researchers and managers.

In particular, the symposium aims to bring together renowned researchers from different academic fields within natural and social sciences to provide a snapshot of the state-of-the-art research on wetlands, share experiences and identify threats and challenges that should be tackled by further research. Additionally, it wants to serve as a platform for research dissemination among the relevant stakeholders involved in wetlands management, thus fulfilling the UNESCO Chair mission of building bridges between academia, civil society, local communities and policy-makers.

Keynote speakers

Dr. Jos T.A. Verhoeven, Utrecht University (The Netherlands) Dr. Edward B. Barbier, University of Wyoming (USA) Dr. Nick Hanley, University of Stirling (UK)

Registration is free. To apply for the Symposium, fill in the on-line registration form. The closing date for registration is **April 30th, 2014**.

Participants are invited to take part in all or some of the ideas exchange sessions. In this sense, they will have to specify in the application form which session/s they are interested in and if they want to attend these sessions as listeners or discussants. In this latter case, at the beginning of May 2014, they will be required to send a title and a brief summary of the work they would like to discuss with other participants and the keynote speakers. They will also be informed about the details of their presentations (e.g. length of the presentation, etc.).

For further information about the Symposium, please contact the Symposium Secretariat (cate-draunesco@uib.es).

23rd-27th June 2014: Integrated Marine Biogeochemistry and Ecosystem Research (IMBER) Open Science Conference

Bergen, Norway



“Future Oceans – Research for marine sustainability: multiple stressors, drivers, challenges and solutions”

This is a call for abstracts reminder, that the Integrated Biogeochemistry and Ecosystem Research (IMBER) Project will convene an Open Science Conference with the goals of:

- highlighting research results from the IMBER project and activities,
- promoting integrated syntheses of IMBER-relevant research, and
- developing a new global research agenda for marine biogeochemistry and ecosystems in the Anthropocene.

Plenary Speakers for our Conference include:

- **Alida Bundy** (Bedford Institute of Oceanography, Canada)
- **Claudio Campagna** (Wildlife Conservation Society, Argentina)
- **Jean-Pierre Gattuso** (CNRS, Lab. d'Océanographie de Villefranche, France)
- **Nicolas Gruber** (ETH Zurich, Switzerland)
- **Alistair Hobday** (CSIRO, Australia)
- **Eileen Hofmann** (Old Dominion University, USA)
- **Corinne Le Quéré** (University of East Anglia, UK)
- **Kon-Kee Liu** (National Central University, Taiwan)
- **Coleen Moloney** (University of Cape Town, South Africa)
- **Carol Robinson** (University of East Anglia, UK)

The list of contributed sessions and workshops is available at

www.imber.info/index.php/Meetings/IMBER-OSC-2014/Sessions-Workshops.

The Call for Abstracts is open

www.imber.info/index.php/Meetings/IMBER-OSC/Announcements/IMBER-Open-Science-

[Conference-Call-for-Abstracts](#). Deadline for abstract submission is 31 January 2014. Contributions are welcome from all marine research communities.

We encourage you to submit an abstract, and we look forward to meeting you in Bergen. - IMBER IPO, on behalf of the Organising Committees futureoceans@imr.no

29th-31st July 2014: UKPN Polar Marine Science Workshop

The workshop is an interdisciplinary meeting of early career researchers, focussing on all aspects of marine sciences in the polar regions. It will be hosted at the University of East Anglia in Norwich, registration closes May 21st

The theme of the workshop is polar marine science, including physical, biological and chemical sciences of the oceans, as well as links with atmospheric and cryospheric processes. The workshop is funded by the [NERC iSTAR](#) project, itself an interdisciplinary project researching the impact of ocean heat transport on the melting of Pine Island Glacier in West Antarctica.

This workshop aims to bring together 40 – 45 early career polar researchers to present their science and gain knowledge of cutting edge research, funding opportunities and career pathways. We invite talks or posters in any field of polar marine science and also welcome research in progress from early career research students. It will be a great opportunity to present in front of peers and get feedback on your research from a wide range of specialists.

There will be excellent opportunities to build networks with fellow early career scientists as well as senior scientists, who will share their perspectives in a series of panel debates and workshops. Our keynote speaker on Tuesday night is polar explorer [Antony Jinman](#), who also specialises in educational outreach whilst on expedition. Polar technologies such as Autosub, UAVs, AUVs, seal tagging and moorings will be introduced by experts in the field and provide the opportunity to learn more about how they could be used in your research.

There is a registration fee of £50. Some funds will be available to cover this, as well as travel to Norwich and accommodation for the workshop, depending on demand.

For more information and registration please visit: <http://polarnetwork.org/events-and-workshops/2014-polar-marine-science-workshop/>

You can connect with fellow participants on Facebook: <https://www.facebook.com/events/1377274915857549/>

14th-18th August 2014: The third International Marine Conservation Congress (IMCC)

Scottish, Exhibition & Conference Centre, Glasgow, UK.

The IMCC is currently the most important international meeting for marine conservation professionals and students. Organised by the Society for Conservation Biology, the first IMCC in Washington DC, 2009 and the second in Victoria, 2011 each attracted over 1,200 participants.

As well as the main conference there are a variety of workshops, short courses, symposia, focus groups and student activities. More information on the content of the event is available at www.conbio.org/mini-sites/imcc-2014.

8th–11th September 2014: Challenger Society for Marine Science Conference

Plymouth University, Plymouth, UK

This biennial conference attracts over 300 leading UK marine scientists and science managers, as well as showcasing cutting edge marine science and technology. The conference is noted for its training of young scientists and networks, and includes a fantastic optional 3 course dinner at Plymouth Guildhall, and a public lecture by an eminent authority on relevant societal marine issues. Please join us in September for a truly memorable conference. Quality campus accommodation is available as part of the booking process. Please book early to avoid disappointment, and before 30th June for earlybird registration. <http://2014.challenger-society.org.uk/>



Challenger Conference for Marine Science



Registration & call for abstracts: Programme themes

- Physical dynamics and connections of coastal oceans: from estuaries to the continental slope
- Observing and modelling the open ocean: from pole to pole and surface to seafloor
- Biogeochemical Cycles
- Remote-sensing of the marine environment
- Modelling Food web dynamics and Ecosystem functioning
- Modelling Interactions between Hydrodynamics and the Environment
- Exchanges at the air-sea interface: current status and future outlook
- Emerging Technologies
- Marine Time series
- Marine Microbes
- Marine Biodiversity
- Deep-Sea Ecosystems
- Marine policy: Challenges and tools for managing marine and coastal resources

Keynote Speakers

Prof Jason Hall-Spencer—Ecosystem effects of ocean acidification
 Prof Icarus Allen—Towards next generation of marine ecosystem models
 Dr Isabelle Rombouts—Pelagic biodiversity: from patterns to emerging processes
 Dr Emily Shuckburgh—The polar oceans in a changing climate
 Dr Adrian Glover—Environmental futures in the deep-sea mining frontier



Abstracts must be received by 30th June 2014

To register & submit an abstract, please visit:
<http://www.2014.challenger-society.org.uk/>

29th September - 1st October 2014: 2nd International Symposium on Submarine Canyons

British Geological Survey, Edinburgh

The 2nd symposium of the International Network for submarine Canyon Investigation and Scientific Exchange (INCISE) will take place at the British Geological Survey in Edinburgh from 29th September to 1st October 2014. The symposium will combine traditional conference-style oral and poster presentations with a set of break-out working-group discussions focusing on key themes. The deadline for submission of abstracts is 1st July 2014. See www.incisenet.org for further details.

28th–31st October 2014: ESA – Earth Observation for Ocean-Atmosphere Interactions Science 2014

Frascati (Rome), Italy



14th-15th November 2014: Sail Training International Annual Conference

A Coruña, Spain.

The research strand builds on work by STI over the last 10 years to develop research in sail training and is in response to an increasing amount and quality of research in this area. The audience for the event will be from the broader STI conference so presenters should be aware of the need to connect theory and practice. The research strand is designed to both create a forum to discuss research processes but primarily to disseminate research findings (philosophical and empirical) to enhance practice.

The purpose of the research strand within the annual conference schedule is to advance the empirical, conceptual, and theoretical bases of sail training. The aim is to bring together a wide array of researchers to explore current and future trends in using the sail training for educational and therapeutic purposes. **Deadline is 15 June 2014**

For further information about the conference, and the detailed abstract submission instructions contact the STI office:

<http://www.sailtraininginternational.org/>

Persons wishing to present (oral and/or poster) at the conference must submit an electronic copy of their abstract, following submission requirements, to: Paul.Bishop@sailtraininginternational.org

CSMS email addresses are president, admin, membership, secretary and treasurer@challenger-society.org.uk Contributions for next month's edition of Challenger Wave should be sent to: john@vectisenvironmental.com by the 31st May

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

Autonomous Vehicle Technician



Fixed Term Appointment for 2 years

Salary range £19,918 - £22,231 per annum

The Scottish Association for Marine Science (SAMS) is one of the leading marine organisations in the UK. We currently have a vacancy within our Physics and Technology Department following the addition of 5 Seagliders to our existing AUV pool.

The Autonomous Vehicle Technician will assist in the day to day technical running of the North Atlantic Glider Base (NAGB). Duties include Seaglider maintenance, preparation and deployment and recovery. This will involve time at sea. As a member of the glider piloting team rota you will be expected to work out of hours as required. Specific training will also be provided.

The ideal candidate will have a HND or higher science/engineering qualification or experience with AUVs. We require a committed, enthusiastic and flexible team worker.

For further information and to apply for this position online, go to: www.sams.ac.uk. Alternatively, please write to: Human Resources, Autonomous Vehicle Technician (Job Ref. D01/14.FC), The Scottish Association for Marine Science, Scottish Marine Institute, Oban, Argyll, PA37 1QA or e-mail recruitment@sams.ac.uk

Closing date: Friday 23rd May 2014

SAMS is a registered Scottish charity (SC 009206), has an equal opportunities policy and welcomes applications from all sections of the community.