POGO

Partnership for Observation of the Global Oceans

Newsletter

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News from the POGO members

Did you know that each time you scuba dive you are potentially collecting data which can help scientists better understand our seas and oceans?

The potential of scuba divers to provide vital information about the temperature of our oceans has been demonstrated for the first time using 'citizen science'. A study published in Nature's online journal Scientific Reports has shown that temperature profiles from scuba divers' computers can provide accurate records across the globe that add to our existing monitoring network in inshore areas. This offers additional data that could help us better understand our marine environment.

The work, led by the Centre for Environment, Fisheries & Aquaculture Science (Cefas) in collaboration with the Scottish Association for Marine Science (SAMS), developed the diveintoscience website that collected more than 7,600 temperature records from sport divers to build a record of global sea temperature in the first 'citizen science' project of its kind.

Dr Serena Wright (Cefas), lead author of the study, said: "Our results show that, with processing, dive computers can provide a

A scientific diver compares the performance of dive computers against that of a YSI portable CTD instrument. Photo credit: NFSD.

useful and novel tool with which to augment existing monitoring systems all over the globe, but especially in under-sampled or highly changeable coastal environments."

Co-author Dr Martin Sayer leads NERC's National Facility for Scientific Diving (NFSD) based at SAMS and has conducted numerous studies on the performance of dive computers. He said: "We hope the results from this study will encourage manufacturers and their customers to see the potential benefits of developing new dive computer models that not only support the diver but also produce high quality oceanographic data."

The temperature recordings were downloaded from decompression computers commonly worn by sport divers. Comparisons made by 'diving' computers alongside scientific instruments and with satellite measurements of water temperature in this study showed that diver computers can provide accurate records.

This article was provided by Euan Paterson, Communications and Media Officer, SAMS.

The following article reports on another citizen science programme in Australia.

Huge online global marine species database launched

Tasmanian researchers and citizen scientists have launched one of the world's most comprehensive and useful field guides to global marine species.

Reef Species of the World uses information and images collected by divers taking part in Reef Life Survey's citizen science dives during more than 8,600 underwater surveys at locations from the Arctic Circle to Antarctica, around all continents and in all ocean basins.

Located in the Reef Life Survey website (www.reeflifesurvey.com), the database provides information and underwater images for more than 4,400 species of fish and invertebrates found across the world's shallow seas.

Each species has its own page with high-quality underwater images of the different variations in appearance, a map of all the locations around the world that the species has previously been recorded, and other useful information such as how rare the species is.

Diver in the Red Sea.
Photo credit: Stuart-Smith.

Reef Life Survey Executive Officer and Institute for Marine and Antarctic Studies (IMAS) researcher Dr Rick Stuart-Smith said the new tool would be invaluable for marine enthusiasts, aquarists, students and anyone who wants to identify what they see in their day-to-day experiences with the ocean.
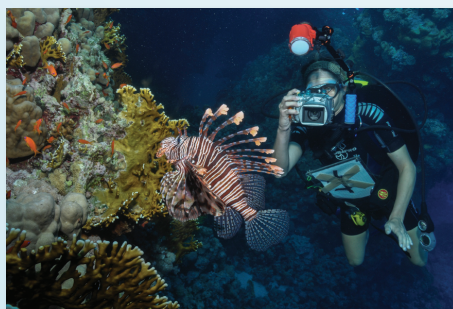
"This is a unique one-stop shop for information on reef life from all corners of the globe," Dr Stuart-Smith said.

"Users simply have to draw a box on the general area of the map on the search page, and see the species they'll encounter while snorkelling or diving.

"They can even select a few similar species to compare side-by-side.

Dr Stuart-Smith said Reef Species of the World had been many years in the making and is the result of an extraordinary number of volunteer hours spent doing dive surveys and taking photos, entering data, and populating individual species pages with images and details.

This article was provided by Andrew Rhodes, Communications Manager, IMAS.

News from the POGO members (cont'd)

Free-swimming ocean gliders help scientists understand storm intensity

WHOI engineers Sean Whelan (left) and Patrick Deane (right) release a Slocum glider into the water south of Martha's Vineyard Photo credit: Ken Kostel, WHOI.

A regional team from Woods Hole Oceanographic Institution (WHOI), Rutgers University, the University of Maine, the University of Maryland, and the Gulf of Maine Research Institute mobilized in advance of post-Tropical Storm Hermine's arrival in the U.S. Northeast to gather data from new ocean instruments that will help better predict the intensity and evolution of future tropical storms along the East Coast.

The team is part of the TEMPESTS program, funded by the National Oceanic and Atmospheric Administration (NOAA) office of Oceanic and Atmospheric Research.

Operating south of Martha's Vineyard, WHOI engineers deployed an underwater glider – an ocean robot carrying sensors that can collect data and transmit it by satellite to scientists on shore. The glider will fly underwater across the continental shelf south of New England, in water approximately 100 – 300 feet deep for up to one month. Rutgers University has also launched two gliders across the New Jersey continental shelf. In addition to the gliders, buoys built by the University of Maine are in place off-shore in Maine, Massachusetts and Maryland. The team also deployed ALAMO instruments from Hurricane Hunter aircraft to provide ocean temperature information farther off-shore and closer to the storm.

Understanding and predicting hurricane intensity has become a sort of Holy Grail of storm prediction and emergency preparedness along the East Coast.

"When Hurricane Irene hit New Jersey and New York, we had a pretty good idea of where the storm was headed," said TEMPESTS lead Glen Gawarkiewicz, a WHOI physical oceanographer, "we just didn't know how strong it would be when it made landfall. One of the reasons it's so hard to forecast is that intensity depends on sea-surface conditions directly ahead of and below the storm. Gliders and other new instruments we are testing enable us, for the first time ever, to make measurements in these very harsh conditions."

This article was provided by Ms Stephanie Murphy, Manager of Public Information and Internal Communications, WHOI.
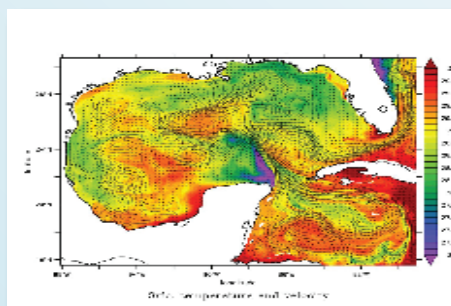
CIGoM: Oceanographic observational network generating scenarios of possible contingencies related to the exploration and production of hydrocarbons in the Mexican EEZ Gulf of Mexico deep-water region

Activities to establish a Mexican oceanographic observational network of physical, geochemical and ecological processes in the Gulf of Mexico began in March 2015. The project is sponsored by the CONACYT-SENER Hydrocarbons Fund awrded to a consortium led by CICESE with several participating institutions from Mexico: UNAM (ICMyL, CCA, IBT, IG), CINVESTAV-IPN, UABC, CIDESI, INECC-SEMARNAT, and Baja Innova; as well as from other countries, from the USA: SIO-UCSD, WHOI, UCSB, RSMAS-UM; from France: LOCEAN, UPMC-Paris and LEGOS; and GEOMAR from Germany.

The project proposes a comprehensive system of oceanographic observations, baseline studies and numerical models to generate scenarios of potential impacts of large oil spills.The purpose is to strengthen scientific, technological and human capabilities of the Mexican oceanographic community in order to address the challenges associated to the production of hydrocarbons in the Gulf of Mexico, using interdisciplinary approaches and cutting-edge technologies.

High-resolution numerical simulations performed with the Regional Ocean Modeling System (ROMS) as part of CIGoM.
Figure credit: Alejandro Parés-Sierra, CICESE.

The project aims to implement and use a large number of oceanographic observational platforms in real time—spatially fixed and mobile—to perform data assimilation and oceanographic surveys, covering different spatial and temporal scales to characterize the baseline conditions. Also to typify hydrocarbon degradation processes—with special emphasis on microbiology—in order to provide the necessary knowledge on the processes controlling the large ecosystem of the Gulf of Mexico. These data will feed a comprehensive system of numerical and experimental simulations to reproduce observational outcomes.

All of these efforts will improve our knowledge on the physics, biogeochemistry, and ecology of the Gulf of Mexico, which will greatly aid in the generation of more realistic spill-scenarios and the assessment of possible consequences based on this scientific information.

This article was provided by Juan Carlos Herguera, Oceanology Division informs, CICESE.

News from the POGO members (cont'd)

NSF grant to help make holographic imaging available for more applications
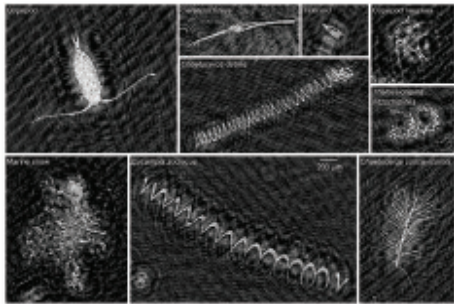

Image examples acquired with Wet Labs HOLOCAM
Image credit: Sullivan, FAU.

The advent of submersible digital holographic imaging systems made it possible to view microscopic particles such as phytoplankton as they exist undisturbed in nature in 3D, which is essential for documenting particle characteristics that are lost through other traditional sampling methods (e.g., bottles, nets). These can include 3-D spatial distributions, particle orientation to the underwater light field, and the existence of naturally occurring and fragile formations such as particle aggregates and phytoplankton chains or colonies, all of which can help us better understand the ecology of phytoplankton. To date the technology has not matured such that it can be used in a broad range of deployments, but a recent National Science Foundation grant awarded to FAU Harbor Branch Oceanographic Institute's Research Professor Jim Sullivan, Ph.D., is intended to accelerate the process.

Dr. Sullivan led the team that produced the WET Labs HOLOCAM, one of three commercially available in situ holographic oceanographic sensors and the only one capable of sampling truly undisturbed particle fields. Although its capabilities are leading-edge, the HOLOCAM relies on its tether for power and shipboard data storage, which limits how and where it can be deployed. The other sensors similarly have advantages and disadvantages, but the new platform, the AUTOHOLO, is designed to be autonomous and to compensate for the limitations of current technology.

The AUTOHOLO will be capable of imaging single-celled or colonial phytoplankton, many species of zooplankton, larval fish, organic aggregates (i.e., marine snow, fecal pellets), and inorganic sediment grains while simultaneously estimating the surrounding dynamic flow field. Deployment options will include fixed benthic mounting, suspension within the water column, mounting on a vertical profiling platform, towing behind a research vessel, or mounting on an AUV. Mechanical copper shutters and wipers over the optical windows will counteract biofouling over long deployments. Finally, the design will also be guided with the goal of keeping manufacturing costs as low as possible to foster commercialization and widespread adoption of the technology, as well as the science it will enable.
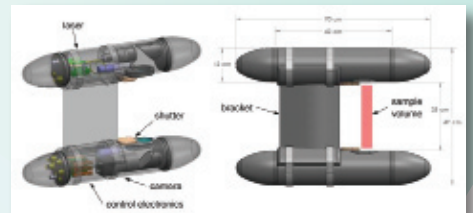
Design drawings of the AUTOHOLO.
Image credit: Sullivan, FAU.

This article was provided by Larry Macke, ELS, Research Communications Project Manager, FAU.

Thirty years on, a groundbreaking "gem" still shines

The ocean temperature-measuring XBT may be expendable, but its data is priceless

Bruce Cornuelle (left) and Dean Roemmich, oceanographers at Scripps Institution of Oceanography, creators of the eXpendable BathyThermograph (XBT), which has changed the face of oceanography. Photo credit: Scripps Institution of Oceanography.

The eXpendable BathyThermograph (XBT) has changed the face of oceanography. For three decades, the torpedo-shaped instrument has been launched by scientists hitching rides on container ships to measure the temperature of the upper ocean, opening an entirely new world of data to scientists about long-term changes in the ocean.

Two scientists from Scripps Institution of Oceanography at the University of California San Diego, Dean Roemmich and Bruce Cornuelle, ushered the transformative piece of technology into existence in the mid 1980s. The two researchers persevered through sleepless nights and grueling shifts of field deployments to build an unprecedented ocean observing program known as the High Resolution XBT (HR-XBT) Network.

The HR-XBT Network served as a precursor to the groundbreaking ocean-observing program called Argo that was led by Roemmich and established in the early 2000s. Since then, Argo has deployed over 3,000 free-drifting profiling floats across world oceans. The floats provide data on subsurface ocean temperature, salinity, and currents.

While the HR-XBT Network measures the heat and mass entering and leaving a section of the ocean, Argo floats drift with the current to measure the heat remaining in the ocean section. Together Argo and XBT measurements provide information on the heat flux from the ocean to the atmosphere. Argo measurements, therefore, make XBT measurements more valuable and vice versa.

Thanks to HR-XBT ocean temperature measurements, the world has gained insight on global ocean warming and other ocean and climate related variability in heat content. HR-XBT data have also been used to calculate circulation across sections of the ocean.

"Thirty-year datasets are rare gems in oceanography. The longer these transects can be maintained, the more scientifically valuable they become," said Roemmich.

The full article is available at: https://scripps.ucsd.edu/news/around-pier-thirty-years-groundbreaking-gem-still-shines
This article was provided by Ms Tashiana Osborne, research student, Scripps Institution of Oceanography

News from the POGO members (cont'd)

Prof. Sun Song headed a delegation to US SCRIPPS Institution of Oceanography

Prof Song and Dr Leinen signed MOU in SIO
on March 22.
Photo credit: Sun Xiaoxia, IOCAS.

Recently, Director Sun Song and the group form IOCAS visited Scripps Institution of Oceanography (SIO), UC San Diego at the invitation of the Institute Director Margaret Leinen. The two sides signed a cooperation agreement, on overall cooperation in areas of common interests, to promote the development of the two sides in the field of ocean and earth science.

During the visit, based on the retrospect of the corporation history between IOCAS and SIO, Director Sun Song described in details the IOCAS discipline layout, personnel structure, research projects, capacity building, international cooperation and communication, education, etc. Members of the delegation made reports and communicated about the research progress on ocean, deep sea and offshore and climate by IOCAS.

Subsequently, the SIO research unit responsible person invited the delegation to visit the various research units, with the description and discussion on the research progress in the field of ocean and climate and marine ecosystem long-term observation, marine biotechnology, marine ecology, coral reef ecosystems, the West Pacific Ocean circulation, ocean chemical etc. to the delegation.

Through this visit, the two sides carried out in-depth exchanges and discussion on the basis of scientific and applied research and other common areas of interests, which laid a very important foundation for further cooperation research in the framework of the agreement.

This article was provided by Prof Xiaoxia Sun, Vice director of Jiaozhou BayMarine Ecosystem Research Station, IOCAS.

Dr Leinen and Prof Song participated in the Groundbreaking ceremony of the Qingdao Science and Education Park, Chinese Academy of Sciences. Photo credit: Sun Song, IOCAS.

AWI scientists present optical method for monitoring of the water masses

More melt water is entering the Artic Ocean from the glaciers due to climbing temperatures. In addition, the rivers are carrying large amounts of sediment from thawing permafrost. By this, the nutrient content of the sea water is increasing in the river estuaries and it is getting more turbid. How the Arctic Ocean will react to such changes is a very big question, which is concerning scientists around the world. Because the availability of nutrients, and increasing or decreasing turbidity subsequently affect the biological communities: This could be a factor affecting the micro-algae with the lack of light for photosynthesis, while the bacteria might appreciate the increase of food.

In order to observe the distribution of different water masses and the substances contained therein, measurements are needed locally. Rafael Gonçalves-Araujo and Prof. Dr. Astrid Bracher from the Alfred Wegener Institute (AWI) have now published the usage of a new optical method by which it is easier and quicker to identify different water masses. In the journal Nature Scientific Reports (doi: 10.1038/srep33978), high-resolution spectral fluorescence measurements of dissolved organic compounds are presented. Specifically, they have used this optical method to distinguish water masses from the Eurasian and Canadian basins, which leave the Arctic Ocean through the Fram and Davis Straits.

Laptev Sea: high content of organic matter imparts the brownish color to the water. Photo credit: Rafael Gonçalves-Araujo.

In the future, this method should allow a more cost effective and more comprehensive method to investigate the impacts of global warming in the Arctic region. Scientists will continue to develop their sensors for the FRAM observatory. They will then be used on gliders or floats and autonomously measure the fluorescence spectra for the determination of the water masses. This allows data, with a higher spatial and temporal resolution, to produce a more complete picture of the oceanographic conditions in the Arctic region, which up until now required the time-consuming sampling on-board research vessels and measurements of the oxygen isotopes in the laboratory.

This article was provided by Dr. Folke Mehrtens, Press Officer, Communications and Media Relations, AWI.

News from the POGO members (cont'd)

Improving analytical quality and nutrient data comparability through the use of Certified Reference Materials (CRMs).

A bottle of the new nutrient CRMs available from JAMSTEC as an activity of SCOR Working Group 147.Photo credit: JAMSTEC.

Nutrients have been measured since the very earliest days of scientific ocean observations, as far back as the late 19th century. With so much historical data being available it should now be presenting an ideal opportunity to use this data for studying current climate change, however, these datasets are of limited use because most historical nutrient data has poor comparability (IPCC Report, Bindoff et al., 2007). One major reason for this is that there have not been easily available certified reference materials (CRMs) to allow reliable comparisons between samples from the same ocean area, but sampled and analysed by different laboratories, over the historical time frame. In order to improve this comparability, it is important that all nutrient results are referred to certified nutrient reference materials analysed at the same time as the samples. It is also crucial to follow recommendations for analytical protocols so as to allow comparability throughout the world-wide marine chemistry community. Although a few nutrient CRMs have been available in recent years they are not in widespread use.

To address this, one of the aims of the SCOR Working Group #147 (co-chaired by Michio Aoyama, (JAMSTEC/Fukushima Univ), and Malcolm Woodward (PML)), is to produce and make available to the global community a range of CRM's of different concentrations.

These will be sold and distributed by JAMSTEC, after production on commission by KANSO Co. Ltd, Japan. These CRM's will be available from early November this year.

Previous commercial batches of KANSO CRMs have been shown to be stable and have been analyzed by many laboratories as part of previous global inter-comparison studies. These have been seen to be improving analytical comparability with their use over recent years (http://www.scor-int.org/SCOR_WGs_WG147.htm).

SCOR WG 147 is also focused on revising the International GO-SHIP nutrient manual, sharing best practices, and will also be holding a nutrient analytical training workshop at NIOZ, The Netherlands, in late 2017.

The overall aim of SCOR WG 147 is to improve global oceanic nutrient data comparability and contribute towards improving research into climate-related changes in the ocean.

This group is also working closely with the International Ocean Carbon Chemistry Project (IOCCP), (http://www.ioccp.org/index.php/nutrients).

This article was provided by Dr. Akihiko Murata, JAMSTEC, Dr. Michio Aoyama, JAMSTEC/Fukushima Univ., and Dr. Malcolm Woodward, PML.

A new record of deep convection in the Irminger Sea

Data from a profiling mooring in the Irminger Sea showed that deep convection occurred down to 1400 m in the winter of 2014-2015. This is the deepest mixing observed in the basin since the start of this mooring record in 2003. Deep convection is an important process in the global ocean circulation as it cools and ventilates the subpolar North Atlantic. The observations from 2014-2015 show that the Irminger Sea was once more filled with cold, fresh, and oxygen-rich water. This process was formerly thought only to occur in the Labrador Sea.
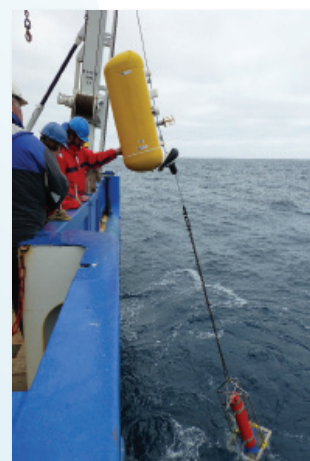
In coupled climate models the strength of the overturning is related to the strength of convection in the Subpolar Gyre. Some models predict that convection will weaken due to the input of freshwater released from the melting ice on Greenland. As a result the transport of warm water north would weaken with the consequence that the region around southern Greenland would cool while the majority of the Earth warms as a result of climate change.

The CTD profiler that recorded the deep convection is brought on deck of the NIOZ research vessel Pelagia. Photo credit: Laura de Steur, NIOZ.

In temperature observations of the Earth's and ocean's surface in 2015, a similar pattern seemed to appear. The Earth warmed while the ocean southeast of Greenland cooled. This led to the speculation that convection had already weakened as a result of increased melting of Greenland's ice cap and that the Atlantic overturning circulation had been affected sooner than expected. Our observations from the Irminger Sea show that this is not the case. Two physical oceanographers from NIOZ Royal Netherlands Institute for Sea Research, Femke de Jong and Laura de Steur, have shown that the temperature evolution in the Irminger Sea can be explained through regional interaction between the ocean and atmosphere. The strong convection in the winter of 2014-2015 was caused by an extremely cold and long winter. This shows that even though some meltwater may have entered the basin, there is no sign of it limiting deep convection.

The measurements in the Irminger Sea were funded by the European North Atlantic CLIMate (NACLIM) project and are part of the international OSNAP (Overturning in the Subpolar North Atlantic Program, www.o-snap.org).

For more details see the full article article: de Jong, M. F., and L.de Steur (2016), Strong winter cooling over the Irminger Sea in winter 2014-2015, exceptional deep convection, and the emergence of anomalously low SST. Geophys. Res. Lett., 43, doi:10.1002/2016GL069596.

This article was provided by Dr Femke de Jong, Postdoc (NIOZ) and Research Scientist at Duke University.

Partnership for
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News from the POGO members (cont'd)

Combining satellites and Argo-floats to quantify energy sources supporting life in the deep, dark ocean

The mesopelagic region, between 100m and 1000m, is one of the largest ecosystems on the planet and holds most of the ocean's fish. Yet it is a vastly unexplored and poorly understood ecosystem.

The mesopelagic has been thought to be sustained by a 'rain' of fast-sinking organic aggregates of dead plankton and waste products from surface-living organisms – the 'biological carbon pump'. Whilst this organic carbon source is very important, it is insufficient to support the vast array of life in the mesopelagic layer. Now scientists have investigated another oceanographic mechanism – the seasonal mixed-layer pump. This takes non-sinking particles and dissolved organic carbon from the surface to the depths, supplying an additional pulse of organic carbon. During spring storms, strong winds mix surface water and the organic carbon it contains deep into the ocean. The deeply-mixed carbon is then 'trapped' by the shallow summer mixed layer and becomes available in the mesopelagic, but how much does it contribute to the world ocean carbon flux?

By combining satellite data from the European Space Agency Ocean Colour-Climate Change Initiative with in-situ measurements obtained by Argo and Bio-Argo floats, partially-funded by the UK NERC, PML scientists estimate the pump moves around 300Mt p/a of carbon. The average in high altitude regions represents 23%, but possibly in excess of 100% of the better studied flux of faster-sinking, larger particles and aggregates. Research leader, Dr Giorgio Dall'Olmo, from PML, adds:

"Most methods for measuring carbon transport into the deep ocean have not measured how neutrally-buoyant or slowly-sinking organic particles are redistributed through the water column, missing the potentially important contribution from the seasonal mixed-layer pump. Our new global estimates show an additional flux of organic carbon to the mesopelagic region and that's important when we try to understand which sources of energy fuel the mesopelagic ecosystem."

Further information: http://www.nature.com/ngeo/journal/vaop/ncurrent/full/ngeo2818.html

This article was provided by Helen Murray, Communications Officer, PML.
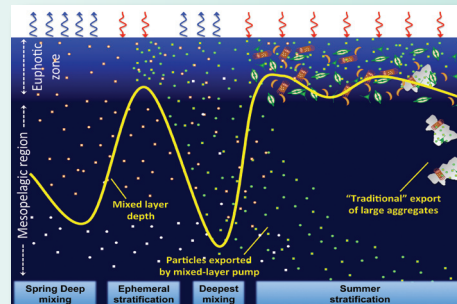
Schematic demonstrating how seasonal variations in mixed-layer depth can pump organic particles from the surface to the mesopelagic ecosystem. Image credit: Dall'Olmo et al (2016).

Capacity Building updates

The 4th Year Scholars arrive at the NF-POGO Centre of Excellence at the Alfred Wegener Institute

The 10 new NF-POGO Centre of Excellence scholars have recently arrived at the Alfred Wegener Institute and are starting their training in observational oceanography. This year's scholars arrived from Bangladesh, Brazil, Cameroon, Egypt, Iran, Indonesia, India, Sudan, Tunisia and Turkey.

The training programme will last ten months and will provide a multi-disciplinary approach to enable the young scientists to learn a broad understanding of oceanographic processes.

The new scholars of NF-POGO Centre of Excellence in Observational Oceanography. Photo credit: Uwe Nettelmann/AWI

Juan Manuel Molina

Testimonials from POGO-SCOR Fellows 2016-2017

Tell us about your training

Juan: *"The training I received comprised the development and calibration of environmental and bioenergetic models for chondrichthyans."*

Celeste: *"The aim of the training program was to gain experience on the application of practical tools of data retrieval, temporal analysis and modelling of plankton and environmental long-term data."*

How did you benefit from the programme?

Juan: *"The programme allowed me to learn state of the art modeling techniques that are novel in my country and allowed me to familiarize with them. Additionally it helped me make contacts with overseas' researchers in this field which I hope will be the base of future collaborations."*

Celeste: *"The programme offered me the opportunity to learn novel statistical techniques to analyse time series and to apply ecosystem modelling approaches. The application of such tools provided novel insights on the long term dynamics of phytoplankton and microzooplankton communities over the last three decades in an estuarine system of Argentina.*

Celeste López Abbate

Capacity Building Updates (cont'd)

View of Hakodate city from Mount Hakodate. Hakodate is the port city by excellence, with two large bays at each side. People from all over Japan come to eat squid and crab which are captured in the waters of the bay. Credit: Molina.

Celeste: "*The programme also allowed me to interact with key scientists working on current topics of ocean sciences and to expand my international network which hopefully will promote future bilateral collaborations.*"

What are your future aspirations?

Juan: "*There is still much to do, the end of the training is just the beginning of the real work. I hope to publish my preliminary results after some more work. Being at a teaching position at my local university I hope to be able to disseminate the gained knowledge and awaken the interest of students in these techniques.*"

Celeste: "*I hope that the dissemination of the gained experience among my colleagues contribute to the awareness on the precious value of oceanographic time series. The thoughtful application of specific analytical techniques will hopefully contribute to the current debate of expanding climate and anthropogenic forcing in coastal marine ecosystems from the Southern Hemisphere.*"

Reports on member-led POGO professional training initiatives

Continuous Plankton Recorder (CPR) Technical and Ship's Liaison course

Members involved:

Sir Alister Hardy Foundation for Ocean Science (SAHFOS)

CSIR - National Institute of Oceanography Regional Centre, Kochi, India

Dates of Training: 8-19 February 2016

The funding was used to support Dr. R. Jyothibabu, a scientist from NIO in India, to attend 2 training courses hosted by SAHFOS in Plymouth, UK. The first was a CPR technical course, which was a five-day practical course aimed at new technicians and scientists wishing to operate a CPR from a research vessel. Taking a hands-on approach, the course covered: preparation of filtering silks, setting up and maintaining a CPR, record keeping of CPR tows and samples, CPR unloading and processing and sample preservation.

Jyothibabu receiving a towed CPR from a ship. Photo credit: SAHFOS

Having passed the course Jyothibabu receives a certificate of competence from SAHFOS's director Willie Wilson. Photo credit: SAHFOS.

This was followed by a ships liaison course, which was another five-day course aimed at managers and scientists wishing to start a CPR survey. The course included: liaising with the shipping community, sourcing a volunteer ship, maintenance plans and legal responsibilities, tow arrangements suitable for volunteer merchant ships, and introduction to CPR software for sample tracking and positioning.

Dr. Jyothibabu has been involved in a project called VACCIN (Vulnerability assessment and development of adaptation strategies for climate change impact with special reference to coasts and island ecosystems of India). Part of this project looks at using a CPR as an efficient platform to monitor the plankton. Although there was funding in the project to purchase equipment there was no funding to cover the costs of training on how to use the equipment. Prior to the POGO grant, India had no experience in the fundamental skills needed to operate a CPR survey. The POGO training fund has allowed this project to progress as envisaged, by funding the travel and subsistence costs associated with attending the essential CPR operations courses described above (with significant in-kind contributions from SAHFOS to cover training materials and staff time). Without the POGO fund the CPR component of the VACCIN project would probably have been cancelled or at least severely delayed. From a wider perspective, it has allowed the outreach of the CPR survey to other parts of the globe and in a region that would benefit from long-term basin-scale monitoring, thus contributing to the goals of the Global Alliance of CPR Surveys (www.globalcpr.org).

The training providers reported that "Jyothi was an enthusiastic student and performed well on the end of course assessment. He was punctual, attended all of the scheduled training and left the course with all the skills required to operate his own CPR survey."

The trainee, Dr. Jyothibabu, wrote a few months after the training: "I am happy to inform you that we have sucessfully operated the CPR for the first time in the northern Indian Ocean, onboard NIO vessel Sindhu Sankalp, during her previous cruise (during SSK 091). The CPR was operated for almost a distance of 60 miles during the transit voyage from the Bay of Bengal to Arabian Sea."

The training has also fostered an on-going collaboration between SAHFOS and NIO. SAHFOS has been giving continued technical and operational advice to Dr. Jyothibabu, and will also be supplying Dr. Jyothibabu with the necessary consumables needed for the continued operation of a CPR survey. Discussions on integration of data generated with the SAHFOS/Global Alliance of CPR Surveys (GACS) database and consistent methodology took place during the training, and Dr.Jyothibabu has been asked to join the GACS community.

Reports on member-led POGO professional training initiatives (cont'd)

Emerging Trends in Ocean Observations and Ocean Data Analysis

Members involved:

Indian National Centre for Ocean Information Services (INCOIS)

National Institute of Oceanography (NIO), Goa

Woods Hole Oceanographic Institution (WHOI), USA

Group photo. Credit: B Madhusudan Rao,
ITCOocean/INCOIS.

Dates of Training: 4-15 July 2016

The course was attended by 55 trainees, including 7 foreign trainees from six countries (Egypt, Iran, Morocco, Mozambique, Saudi Arabia and Sri Lanka). In addition, 18 trainees attended the course through video conferencing from Chennai.

The training schedule consisted of morning theory classes and afternoon practical sessions. A computer lab with 17 desktops with the required software was set up for this purpose. All the trainees were divided in groups, each of three for practical sessions. A total of 23 lectures (each of 90 minutes) were delivered and 12 practical sessions were conducted. The theory classes focussed on recent advances in ocean observations, real time communication system, analysis techniques-Fourier analysis, filters in time and space, Confidence level tests, Hypothesis testing, EOF analysis, real time oceanographic data sets, satellite remote sensing of oceans, data assimilation, Indian Ocean Expeditions-past and present, marine ecosystems observations, and bio-geo-chemical observations.

The practical sessions involved study of variability of ocean parameters (Current, temperature, sea level etc) at different time scales. Various techniques such as Fast Fourier Transform (FFT), Morlet Wavelet transform, Time series filter analysis, EOF (Empirical Orthogonal Function) analysis were used to analyze the data. Trainees used only open source software (e.g. FFT code, Morlet Wavelet code, Timer series filter (Lanczos Filter) and EOF analysis code). The freely available data sets (RAMA current observation, OSCAR current data, Altimeter sea level data, TMI sea surface data) were provided. A few guest lectures were also organized during the course. Two faculty members (Prof. Eric D'Asaro, University of Washington and Dr. Thomas Farrar, Woods Hole Oceanographic Institution) from USA visited and delivered a number of lectures.

The performance of the trainees was assessed through the tutorial assignments. One set of RAMA observed current data and one set of satellite observed data were provided to each group. The aim was to analyze the data using FFT, Wavelet, Time series filter of same data and EOF analysis of satellite data to know the variabilities present in the data, when it is strong, how magnitude of the ocean parameters vary at different periods and what are the spatial modes strongly present in the data. On the final day of the course, each group presented their results in the presence of all faculty members.

It was felt by the faculty members that the trainees showed remarkable understanding of the various advanced topics covered in the course and a good skill in applying these techniques in the analysis of ocean data sets. Most of the trainees were quite comfortable in using advanced software and various platforms and many of them tried to go through software programs to understand more details.

The feedback received from all the trainees suggests that the course was conducted in a highly professional manner, with top scientists in these fields delivering the lectures. They were quite confident that they would use the new skills acquired during the training course more meaningfully in their PhD/research work.

The possibilities of more scientific and technical collaborations (like participation in international cruises) will be explored in future. The centre has plans to host young sponsored researchers for a period of 6-12 months to work with eminent scientists on a mutually agreed project.

The objectives of ITCOocean (in addition to many) are to provide advanced training in Operational Oceanography for young researchers and scientists and decision makers/officials from the IOR countries on a regular basis, to enable the creation of a large pool of skilled manpower. Thus such training initiatives by POGO complement the objectives of ITCOocean. The POGO funds helped in bringing the international trainees to attend the course. Five trainees were provided the international air fare enabling them to visit India to attend the course. The accommodation and food were provided by INCOIS to all the foreign participants. This certainly helped in giving opportunities to the trainees from less developed countries to undergo training and exposure to the advanced topics/themes in operational oceanography, all delivered by top experts in the field from among the best institutions in the world.

The organisers felt that such POGO funded training initiatives will help ITCOocean to emerge as a nodal institution in the Indian Ocean region to address the regional requirements of the ocean community and extend the most recent and relevant scientific/ technological information services for the benefit of society.

Reports on POGO working groups

Observing and Modeling the Meridional Overturning Circulation in the South Atlantic (SAMOC)

The SAMBA/GO-SHIP Cruise

Celebrating the SAMOC 7th anniversary with a trans-basin hydrographic section along 34.5oS in the South Atlantic

Starting in 2009, the South Atlantic Meridional Overturning Circulation (SAMOC) has been implementing a climate observing system to study the MOC variability in the South Atlantic and its role in climate change. SAMOC is carried out as in international collaboration, with participating institutions from Argentina, Brazil, South Africa, Europe and the United States of America. An important component of SAMOC is the monitoring of meridional transports across a transatlantic line along 34.5oS, from South Africa to Brazil, the SAMOC Basin-wide Array (SAMBA; Fig. 1).

The field component in SAMBA includes continuous observations of the western boundary currents in the eastern and western ends of the line, employing PIES (Pressure Inverted Echo Sounder) and C-PIES (PIES equipped with Currentmeter). Regional oceanographic cruises near both ends are conducted at least once a year to acoustically retrieve the data stored in the PIES/C-PIES and to carry out maintenance operations. During these cruises, full-depth hydrographic stations are conducted in order to survey physical and biogeochemical properties along the sections (see Fig. 1). As of October 2016, a total of fifteen cruises have been conducted at both sides of the SAMBA.

In spite of the relatively short length of time of SAMBA observations, a valuable data set has been collected, contributing to the understanding of the present state of the MOC and its higher-frequency variability in the South Atlantic. For instance, the near seven years of observations from the PIES has yielded an unprecedented data set for studying the characteristics of the time varying volume transport across 34.5oS, from intra-seasonal to interannual time-scales [e.g: Meinen et al, 2013; 2016]. However, the continuation of this effort will be crucial if the quantification and long-term monitoring of the role of the South Atlantic and the MOC on global climate is to be realized.

The awareness of the needs for sustained commitments was one of the motivations for the creation, in mid 2015, of a POGO sponsored Working Group (WG), intended to enhance SAMOC by strengthening its international partnership. The WG overall goals were to expand the international moored arrays, to conduct more intense samplings of hydrographic properties along the whole extent of the SAMBA line, and to conduct and analyze the results of numerical experiments. Additionally, the WG would establish closer links with similar North Atlantic MOC initiatives such as RAPID-MOCHA and OSNAP, allowing for inter-comparison of the array designs, data analysis techniques and methods for calculating the transports of volume, heat and freshwater, enabling best practices to be shared amongst all teams observing the Atlantic MOC.

Starting in July 2015, supported with funds provided by POGO, members of the WG participated in a number of international meetings, making presentations about SAMOC and discussing ways of strenghtening the observational effort, mainly along SAMBA. In some of these events, when enough number of the WG members were present, side meetings of the WG were conducted. These POGO sponsored activities revealed extremly fruitful. Today SAMOC has established a strong link with AtlantOS, a project of the European Union H2020 program. This link with AtlantOS helped to strengthen even further the south-south collaboration, with SAMOC being included as one of the main topics of a collaboration program between Brazil and South Africa.

Perhaps one of the main achievements of the POGO WG resulted from the participation of some its members in the GO-SHIP/Argo/IOCCP conference in Galway, Ireland (Sep 2015). Contacts and discussions occurred during that meeting greatly contributed to the decision to have a GO-SHIP cruise along 34.5oS. The proposed SAMBA/GO-SHIP cruise will be carried out on board the German RV Maria S. Merian (MSM60), in January 2017. It will be the first full depth ship occupation of the SAMBA line, all the way from South Africa to Brazil. The oceanographic program will consist of full water depth (down to 5200m) CTD, O2, fluorescence, and LADCP sampling. The water samples will be analyzed for oxygen, nutrients, carbon, chlorophyll structure, and transient tracers (CFC12 and SF6). The sampling and measurements will be performed to the highest standards with the aim to qualify as a GO-SHIP cruise.

The expedition will be conducted with personal originating mostly from the SAMOC core PIs countries: Brazil, Argentina, South Africa, France, and UK. It will be a milestone in the cooperation between South Atlantic bordering countries and Europe in general, and Germany in particular. The meridional heat and volume flux estimates over that section will provide a benchmark for the SAMOC geostrophic end-point array. The biogeochemical data will be compared to historic data that have been acquired along the WOCE/GO-SHIP A10 section (30°S) with the aim of quantifying trends, particularly in the inorganic carbon and transient tracer content. The A10 section was occupied by the German RV METEOR in 1993, as part of the WOCE program, and again in 2003 by the Japanese RV MIRAI. The cruise will be also a contribution to the EU H-2020 AtlantOS project.
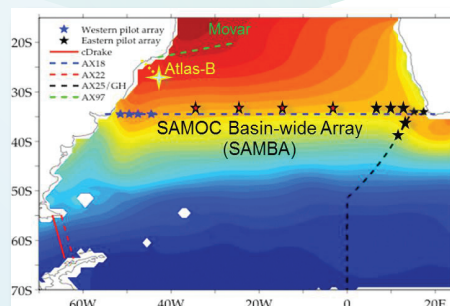
Map showing the various monitoring arrays deployed as part of the SAMOC Project (C-Drake, Good Hope line, SAMBA).

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This article was provided by Prof. Edmo J. D. Campos (IOUSP) & Dr Johannes Karstensen (GEOMAR Helmholtz Centre for Ocean Research Kiel)

Reports on POGO working groups (cont'd)

Implementing IQOE Science Recommendations on Marine Noise Exposure and Broad-Scale Acoustic Monitoring

The POGO Working Group on "Implementing IQOE Science Recommendations on Marine Noise Exposure and Broad-Scale Acoustic Monitoring" met on 31 March-1 April 2016 in London, back-to-back with the IQOE Science Committee Meeting. The group discussed the 5 main goals of the WG:

I. Comprehensive monitoring of ocean noise

A. Recommendations/Standards for acoustic monitoring methods to measure ocean soundscapes including information on efforts to measure long-term changes in ocean sound levels; methods to study the distribution, density, and behaviour of vocalizing marine mammals and fish; and active acoustic measurements to provide information on ecologically important aspects, including the prey field.

B. Update inventory in IQOE science plan of existing broad-scale acoustic monitoring observations, infrastructure, and technologies.

II. Effects of Noise on Marine Life

A. Review laws and regulations from different jurisdictions used to assess, monitor and mitigate effects of noise.

B. Recommendations to standardize global approaches to noise exposure criteria (for individuals and ecosystems).

C. Recommendations for assessing and mitigating acute effects of high intensity human sound sources, including recommendations for precautionary safety zones that are simple and practical.

For each topic, discussions covered the key questions, research approaches, disciplines required for teams, suggestions for team members, a schedule and resource requirements. The group also discussed whether there were other groups working on similar topic and how they should interact with them.

POGO representation at international meetings

The 42nd SCOR Annual Meeting - Sopot, Poland (5-7 September)

One of the Vice-Presidents of SCOR, Sergey Shapovalov (PP Shirshov Institute of Oceanology of the Russian Academy of Sciences), reported upon POGO's activities over the past year at the 42nd SCOR Annual Meeting, held in Sopot, Poland. The meeting was hosted by the Institute of Oceanology, Polish Academy of Sciences and attended by about 50 participants, representing 19 countries and several international organizations such as IOC, IAPSO, IABO, and IAMAS.

Of significant interest to the meeting participants was the scientific session devoted to the Polish maritime research. Many reports were given about observations in the oceans, which is of particular interest to POGO. Within

Delegates of the 42nd SCOR Annual meeting, 5-7 September, Sopot, Poland.
Photo Credit: T. Jankowski

the agenda of the meeting was a wide range of issues. The delegates heard information on the activities of 14 existing SCOR WGs and reviewed 11 proposals for new WGs. As a result of intensive discussion, it was decided that two new WGs would be supported: Iron Model Intercomparison Project (FeMIP) and Measuring Essential Climate Variables in Sea Ice (ECV-Ice).

This year there were elections of SCOR Executive Committee members. Marie-Alexandrine Sicre from France was elected to the post of the President of SCOR. For the first time in the history of SCOR, a woman was elected to this post and was enthusiastically received by all participants of the meeting. POGO Executive Committee member Sun Song (IOCAS) who also attended the meeting, was re-elected for a second term as one of the Vice Presidents for SCOR as was Sergey Shapovalov.

When considering the interaction with the POGO it was noted that SCOR and POGO have many areas of mutual interest and have a good history of cooperation spanning the 16 years of POGO's existence. The two organizations have co-sponsored a visiting fellowship program for ocean observations since 2001 and worked together to develop the International Quiet Ocean Experiment (IQOE). SCOR and POGO also work together in relation to global capacity building for ocean science.

More information about the meeting can be found on the website http://www.scor-int.org/Annual%20Meetings/2016GM/SCOR_GM_2016.html

MTS Ocean Observations panel, OCEANS '16 - Monterey, USA (20 September)

Delegates of the 2nd Global Ocean Summit, 26-28 September 2016, Qingdao, China.
Photo Credit: QNML.

Francisco Chavez (Monterey Bay Aquarium Research Institute) represented POGO on a discussion panel on the topic of "Strengthening Intergovernmental and Scientific Collaboration to Advance the Global Ocean Observation System" at the MTS/IEEE meeting on 20 September 2016. This panel addressed the roles and responsibilities of the various organizations that have a stake in global ocean observing. Speakers also included representatives from IOC/ GOOS, NOAA/CEOS, Blue Planet and ICES who described their organizational roles in the promotion and coordination of ocean observations.

POGO representation at international meetings (cont'd)

Delegates of the 2nd Global Ocean Summit, 26-28 September 2016, Qingdao, China. Photo Credit: QNML.

The 2nd Global Ocean Summit - Qingdao, China (26-28 September)

The 2nd Global Ocean Summit was organised by POGO's newest Member Qingdao National Laboratory for Marine Science and Technology (QNLM) at Oceantec Valley. Among the participant list were heads of nearly 70 marine-related institutions, universities and international organizations and programs from around the world. Margaret Leinen (Scripps Institution of Oceanography) gave a keynote speech entitled "International developments in observing the global ocean" highlighting POGO's vision to establish world-wide cooperation for a sustainable, state-of-the-art global ocean observing system that serves the needs of science and society. Presentations were also given by several of POGO's members including, Sun Song (IOCAS), Yoshihisa Shirayama (JAMSTEC), Gilles Lericolais (IFREMER), Susan Avery (WHOI), Debbie Thomas (GERG) and Edmo Campos (IOUSP).

Announcing the 3rd Blue Planet Symposium

We are pleased to inform you that the 3rd Symposium will be held in College Park, MD, USA, May 31-June 2, 2017. The Symposium will serve as a forum for discussion of societal information needs resulting from the important role the oceans play in Earth's life-support system and the challenge of minimizing the impacts of human activities on the oceans while utilizing the resources of the oceans to meet our needs. The symposium will also be a platform for the participating communities to exchange information on their activities and identify potential pilot and prototype projects for Blue Planet to focus on in the coming years. The Symposium will address four subthemes:

• The changing oceans
• Threats from pollution, warming and acidification
• Processes and life at the interfaces with the oceans
• Sustainable use of ocean resources

The symposium is open to scientists, researchers, and students from academia, industry and government, users of ocean observation data and information, and other stakeholders engaged in monitoring, understanding and managing the oceans.

Registration will open in January 2017. We will be seeking community input prior to the Symposium - details to follow.

Visit the Blue Planet Symposium website http://symposium.geoblueplanet.com/ regularly for all the latest information.

POGO led the creation of Blue Planet in 2011, which is now an Initiative within the Group on Earth Observations (GEO), and a collaboration with many relevant partners and stakeholders. Visit the new Blue Planet website for more information: www.geoblueplanet.com.

Other News

We are delighted to welcome a new POGO member who has recently joined our international forum:

Based in Qingdao (China) with a national and global vision, Qingdao National Laboratory for Marine Science and Technology (QNLM) conducts research of both basic and cutting edge levels in line with the national strategy for marine development. Aiming to be a world-class comprehensive research center for marine science and technology, as well as an open platform for collaborative innovation, QNLM brings in resources and professional teams to upgrade Chinas competence in independent innovation, and take the lead in Chinas marine science and technology.

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