

### News from the POGO members

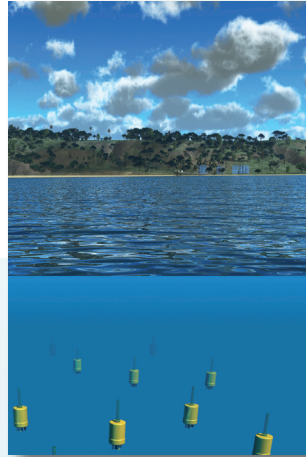
#### Swarm of Underwater Robots Mimics Ocean Life

##### Scripps researchers collaborate on new technology study using "robotic plankton"

Underwater robots developed by researchers at Scripps Institution of Oceanography at the University of California San Diego offer scientists an extraordinary new tool to study ocean currents and the tiny organisms they transport.

Scripps research oceanographer Jules Jaffe designed and built the miniature autonomous underwater explorers, or M-AUEs, to study small-scale environmental processes taking place in the ocean. The ocean-probing instruments are equipped with temperature and other sensors to measure the surrounding ocean conditions while the robots "swim" up and down to maintain a constant depth by adjusting their buoyancy.

In a new study published in the Jan. 24 issue of the journal *Nature Communications*, Jaffe and Scripps biological oceanographer Peter Franks deployed a swarm of 16 grapefruit-sized underwater robots programmed to mimic the underwater swimming behavior of plankton, the microscopic organisms that drift with the ocean currents. The research study was designed to answer some basic



Miniature autonomous underwater explorers (M-AUEs) Photo credit: Jaffe Laboratory, SCRIPPS.

questions about the most abundant life forms in the ocean—plankton and test theories about how plankton form dense patches under the ocean surface, which often later reveal themselves at the surface as red tides.

The M-AUE location data showed that the swarm formed a tightly packed patch in the warm waters of the internal wave troughs, but dispersed over the wave crests.

The research team hopes to build hundreds more of the miniature robots to study the movement of larvae between marine protected areas, monitor harmful red tide blooms, and to help track oil spills. The M-AUEs could potentially be deployed in swarms of hundreds to thousands to capture a three-dimensional view of the interactions between ocean currents and marine life. The onboard hydrophones that help track the M-AUEs underwater could also allow the swarm to act like a giant "ear" in the ocean, listening to and localizing ambient sounds in the ocean.

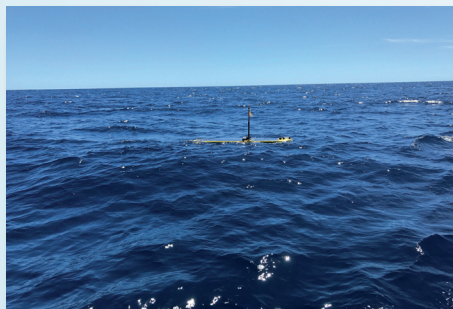
*This article was provided by Annie Reisewitz, Scripps Institution of Oceanography at UC San Diego.*

#### Ocean Drone Identifies Grouper Mating Calls

Scientists from Florida Atlantic University's Harbor Branch Oceanographic Institute (HBOI) and the University of the Virgin Islands' Center for Marine and Environmental Studies have developed a novel sensing approach using a water drone to listen in on groupers mating. The sensor package and grouper acoustic recognition computer algorithms, developed by HBOI, have been installed on a Liquid Robotics Wave Glider, which is the first readily available ocean drone of its kind.

Project lead Laurent Chérubin, Ph.D. and members of the HBOI research team, Fraser Dalglish, Ph.D., Anni Vuorenkoski-Dalglish, Ph.D., and Bing Ouyang, Ph.D., in collaboration with Richard Nemeth, Ph.D., University of the Virgin Islands, and Michelle Schärer-Umpierre, Ph.D., University of Puerto-Rico Mayaguez, set out to better understand the relationship between vocalization frequency and fish abundances. The group has been conducting work over the past year in a number of areas, including the Florida Keys, the Virgin Islands and the east Florida shelf.

Spawning season for many commercially important groupers including the Nassau, Warsaw, black, yellowfin and red hind groupers are concentrated within a couple of months each year. The concentrated nature and short duration of their spawning season makes them especially vulnerable to heavy fishing and as a result, many of the spawning aggregations have disappeared or their abundance have declined. Overfishing at these sites can reduce grouper populations significantly, and findings from this study are helping to inform fisheries managers where protective measures are necessary.



Liquid Robotics Wave Glider. Photo credit: FAU Harbor Branch Oceanographic Institute.

The new robotic sensing technology is assisting researchers with important conservation measures and making data collection easier and less costly than ever before. The purchase of the HBOI wave glider and their engineering efforts to develop and test the sensor package was funded by a grant from the Harbor Branch Oceanographic Institute Foundation (HBOIF).

*This article was provided by Carin Campbell Smith, Associate Director of Communication, FAU Harbor Branch Oceanographic Institute.*

## News from the POGO members (cont'd)

### History and evolution of the Mexican Tide Gauge Network

The present network of permanent tide gauges was established in 1952 by the Geophysical Institute of the National University of Mexico, following an arrangement between the Secretary of the Navy and the Inter-American Geodetic Survey. It constituted a rational and well planned distribution of gauges around the Gulf of Mexico, the Caribbean Sea and the Pacific coast, capable of monitoring the sea level effectively.

The fundamental task of such an undertaking is the scientific study of the material accumulated in order to discern from it the physical processes at work. Typical of all scientific work, the more we look at them, the more things one finds to study; besides the satisfaction of acquiring new knowledge, it is of a practical and immediate use to navigation, coastal engineering and even strategic for tsunami warnings.

The Center for Scientific Research and Graduate Studies of Ensenada (CICESE) was established in 1972 in Ensenada, Baja California, as a center for advanced studies, with particular emphasis on oceanography.

Since then, CICESE has maintained a tide network in operation around the peninsula of Baja California. The tide gauges installed in 1972 were carefully maintained and their records meticulously digitized and compiled. It is obvious that those mechanical gauges no longer are capable of performing their task; fortunately, revolutionary developments in instrumentation and telecommunications have allowed us the use of tide gauges eliminating essentially all moving parts, sending their

measurements through the internet to a central server on a real time basis every single second, where they are monitored both for their contents and for the behavior of the instruments (see e.g., [redmar.cicese.mx](http://redmar.cicese.mx)).

After years, the material accumulated has become a most valuable geophysical series that are at the disposal of any one asking for them, considering that sea level processes can be understood only if they are studied globally.



Mechanical tide gauge in operation at the southern end of the peninsula of Baja California, 1976. Photo credit: Modesto Ortiz-Figueroa, CICESE.

*This article was provided by Modesto Ortiz-Figueroa, Department of Physical Oceanography, CICESE.*

### Ifremer has partnered with ECA Group to develop an innovative ultra-deep Autonomous Underwater Vehicle (AUV) for survey and inspection

By selecting ECA Group through an international call for tender, Ifremer is establishing the CORAL Alliance (Cooperative Off-Shore Robotics Alliance), facilitating project development with selected industrial partners. The CORAL Alliance is funded by Ifremer, Provence-Alpes-Côte-d'Azur Region and the European Union (FEDER program).

The AUV will be able to reach depths of 6000 meters in the water column, accomplishing wide coverage acoustic mapping as well as optical inspection by hovering close to the sea floor. "The system will deploy a full range of scientific sensors in modular packages, innovating in design optimization, autonomy, payload volume and navigation capabilities. The AUV will facilitate producing accurately georeferenced, wide area, high resolution and multi parameter representations of deep water marine environments" explains Jan Operderbecke, head of the Underwater Systems Unit, located at Ifremer facilities in Toulon. After a development period of 3 years, the AUV will accomplish its first dives in 2019.



©Ifremer / ECA Group / CORAL project

Autonomous Underwater Vehicle (AUV). Photo credit: IFREMER/ ECA Group/ CORAL project.

"The association of long endurance survey and low altitude hovering capabilities will have high potential in various fields of application. For future commercialization by ECA Group of this AUV branded A6K, the system specifications are particularly interesting for missions such as deep sea mining survey, oil / gas pipeline inspections, rescue missions and mineral resource exploration", underlines Claude Cazaoulou, Director of Sales and Business Development from ECA Group Robotics Division in Toulon.

"The new vehicle will be deployed from French and international oceanographic research vessels in missions involving other deep water intervention vehicles, starting with Ifremer's Victor 6000 ROV and Nautile manned submersible" explains Jan Operderbecke from Ifremer.

*This article was provided by Thomas Isaak, Press Relations, IFREMER.*

## News from the POGO members (cont'd)

### JAMSTEC Deep-sea Debris Database



Octacnemidae, actiniaria and marine litter taken at Sea of Japan Oki Bank at depth of 910 metres (22nd September 2009). Image credit: JAMSTEC.

Global Oceanographic Data Center (GODAC) and Japan Agency for Marine-Earth Science and Technology (JAMSTEC) have launched the Deep-sea Debris Database providing marine debris data collected from deep-sea videos and photos. They have been taken during research surveys by submersible, "SHINKAI6500", "HYPER-DOLPHIN", etc.

The deep-sea videos and photos in this website are released from the "JAMSTEC E-library of Deep-Sea Images".

Debris are categorised in detail based on the videos and photos taken during research surveys. Furthermore, other information, such as the state of the debris (accumulation point and drifting, etc.), environments around debris (types of sea bottom sediments and activities of organisms), etc. are added.

Dive information, representative dive points and date are also provided as basic information. All dive points conducted by each submersible and the points where debris was taken on videos and photos are available at "Dive Points".

We hope this database will be used widely for educational purposes and also contribute to addressing the international concerns of marine debris.

The English version of the database is available at [www.godac.jamstec.go.jp/catalog/dsdebris/e/index.html](http://www.godac.jamstec.go.jp/catalog/dsdebris/e/index.html).

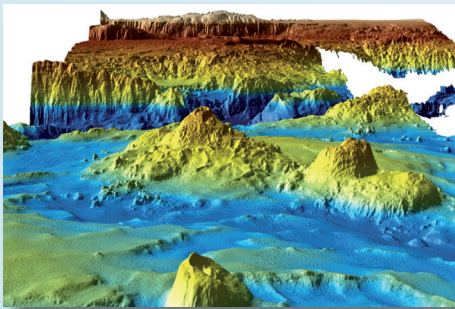
*This article was provided by Jin Tachihara, International Affairs Division, JAMSTEC.*



Photo credit: Deep-sea Debris Database. Image credit: JAMSTEC.

### Search for missing plane opens window on Indian Ocean seafloor

Detailed imaging of the seafloor used to search for Malaysia Airlines flight MH370 is providing unprecedented insights into the geological development of the Indian Ocean.



Sonar mapping of the area. Photo credit: Kim Picard and Jonah Sullivan.

IMAS Professor Mike Coffin worked with a Geoscience Australian-led team to analyse data collected for the Australian Transport Safety Bureau and led a search by vessels equipped with high-resolution multibeam sonar.

"I've been working in this part of the Indian Ocean for more than 30 years and have made many voyages to the region, but I have never before seen this level of image resolution," Prof Coffin said.

"The Indian Ocean seafloor is a complex mosaic that has formed and evolved by a combination of processes, including sea floor spreading, tectonic deformation, and hotspot volcanic activity.

"Along the southern flank of Broken Ridge, for example, we can see more clearly where rifting around 43 million years ago resulted in the seafloor plunging more than 5100 metres from the crest of the ridge to the floor of the Diamantina Trench.

"To the north of Broken Ridge the data reveal an area of seafloor erosion, where slides and debris flows have moved sediment down the slopes of a large depression some 90 kilometres in diameter.

"South of Broken Ridge, seafloor spreading created an area of abyssal ridges and fracture zones, the latter up to 900 metres deep and 12 kilometres wide, and lined with volcanic seamounts up to 1500 metres high.

"These new data are allowing us to better understand the complex events which led to the formation and modification of the seafloor in this area and we are still only in the early stages of analysing the huge amount of information collected during the search for flight MH370," Prof Coffin said.

The full publication in Eos can be read via the following link: <https://eos.org/project-updates/geological-insights-from-malaysia-airlines-flight-mh370-search>

*This article was provided by Andrew Rhodes Communications Manager, IMAS, University of Tasmania.*

## News from the POGO members (cont'd)

### Light pollution impacts sealife as much as climate change



Coastal lighting affects the behaviour of seashore animals.  
Photo credit: Kelvin Boot, PML.

Scientists discover that light pollution has serious consequences for coastal animals, and it could get worse as the human population grows.

Plymouth Marine Laboratory and the University of Exeter set up a series of laboratory experiments to determine whether highly important inhabitants of the seashore were also affected.

Using the dogwhelk (*Nucella lapillus*), a key seashore species, the study kept one group of dogwhelks in artificially-lit night sky conditions, while a control group experienced a more natural night/day cycle, and the results were clear.

Those dogwhelks kept under night-time lighting sought out refuges far less than those under 'normal' conditions, so were exposed for much longer, spent longer seeking food and so were thought to be energetically deprived, and potentially at increased risk from predation if they had exhibited these behaviours in nature. These individuals continued to respond to and handle prey whether they could 'smell' predators in their surroundings or not. The animals that had not adapted to night-time lighting, on the other hand,

were more likely to respond to prey under night-time light even if scent cues were present; this might indicate an opportunistic approach towards using vision instead of smell under illuminated conditions at night to evaluate predator risk. This study, published in the *Journal of Animal Ecology*, therefore shows, for the first time, that night-time light changes species interactions at the heart of the way in which natural food chains work, raising concern about how generalised these impacts may be for natural marine wildlife.

This study highlights that night-time lighting in coastal cities can impact biodiversity on rocky shores popular with beachgoers. Dogwhelks play a key role in ecological balance and disturbing these balances can have major ramifications across habitats and within food webs.

Unlike for climate change, the solution for night time light pollution is well within reach, as restricting the use of lights to specific colours can much limit their negative impacts on wildlife.



Dogwhelks  
Photo credit: Kelvin Boot, PML.

This article was provided by Helen Murray, Communications Officer, PML.

### Beluga whales on the 'climate change' diet

A researcher at the Scottish Association for Marine Science (SAMS) has found evidence that marine species in the Arctic may have already been forced to alter their diets because of reducing levels of sea ice in the region.

Dr Thomas Brown has devised a method to measure how much of a species' diet is derived from sea ice. Using the formula to monitor the eating habits of the beluga whale, he found a substantial change in how one community, based off Baffin Island, was getting energy from food. His findings have been published in the journal *Limnology and Oceanography*.

The Arctic's population of beluga whale is already listed as 'near threatened' by the International Union for Conservation of Nature (IUCN). Because of overfishing and hunting that took place leading up to the 1980s, the Cumberland Sound community studied by Dr Brown is also described as 'threatened' by the Committee on the Status of Endangered Wildlife in Canada.



Beluga whale. Image credit: Wikimedia Commons.

Dr Brown's findings show that since 2000 these beluga whales and their prey, which are thought to be mainly Greenland halibut and Arctic cod, are adjusting to changes in the supply of food. He showed that, in contrast to before 2000, these fish and whales now appear to have an increasing reliance on energy sourced from open water algae, rather than the Arctic's energy-rich sea ice algae that grows within the Arctic ice during spring. Current trends in Arctic sea ice extent and thickness show decline, with the National Snow and Ice Data Centre reporting record low average monthly sea ice extents in the Arctic during the months of January, February, April, May, June, October, and November in 2016, suggesting increasing influxes of Atlantic-derived waters into the Arctic

Ocean as the cause.

SAMS will host this year's UK Arctic Science Conference, September 19 – 21.

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

## News from the POGO members (cont'd)

### POGO-20 Annual Meeting in West Africa

The meeting will be hosted at the "Ocean Science Centre Mindelo" in Cape Verde

Following a proposal from the GEOMAR Helmholtz Centre for Ocean Research Kiel/ Germany and the Instituto Nacional de Desenvolvimento das Pescas, Mindelo/Cape Verde, the POGO Board of Trustees has agreed to have its 2019 Annual Meeting in the small island state of Cape Verde off West Africa.

Through the long-standing cooperation between the two institutions, Mindelo has become a regional marine and atmospheric science and education hub. Major assets such as the "Ocean Science Centre Mindelo" (OSCM), the 22 m research vessel *Islandia*, as well as the "Cape Verde Ocean Observatory" (CVOO) an open ocean time-series some 60 nautical miles from Mindelo, provide a unique basis for field work in this scientific hot-spot region.

At the same time, the OSCM facilities such as laboratories, workshops, meeting rooms, guest researcher offices and lounge area lend themselves for international summer schools and regional capacity building programmes.

In the development of our German-Cape Verdean cooperation, we have greatly benefited from POGO training and education programmes. In fact, all four OSCM/CVOO technicians, Péricles Silva, Ivanice Monteiro, Nuno Vieira and Elizandro Rodriguez, were supported through the POGO-SCOR Fellowship Programme. Péricles Silva, the CVOO Ocean Site Manager, also participated in the 2012/2013 Centre of Excellence which was modelled on the NF-POGO Centre of Excellence in Operational Oceanography at the Bermuda Institute of Ocean Sciences.

With this key personnel and the emerging local research infrastructure, Mindelo is well suited to not only host the POGO-20 Annual Meeting in January 2019 but also to attract further attention and support major regional research and education projects in marine and atmospheric sciences. Following its inauguration in November 2017, the Ocean Science Centre Mindelo is looking forward to welcome marine researchers from all over the world.



Ocean Science Centre Mindelo under construction on the Cape Verde archipelago in the tropical North Atlantic. Photo credit: Filipe Mandel.

*This article was provided by Prof. Arne Körtzinger and Ms. Cordula Zenk, Helmholtz Centre for Ocean Research Kiel, Germany.*

## Capacity Building updates

### Testimonial from Gláucia Berbel



Gláucia Berbel on SAMOC/ AtlantOS/Go-ship Cape Town-Montevideo Cruise. Photo credit: Gláucia Berbel

As part of the POGO SAMOC Working group led by Prof Edmo Campos, a student from the University of São Paulo was supported to join the SAMOC/AtlantOS/Go-SHIP Cape Town-Montevideo cruise. Here is her testimonial.

"I am Gláucia Berbel from Instituto Oceanográfico – Universidade de São Paulo and chemistry teacher from Instituto Federal de São Paulo. I've participated in the SAMOC/AtlantOS/Go-SHIP Cape Town-Montevideo cruise for sampling waters from latitude 34°S.

The experience was amazing because I was on one of the best oceanographic vessels (*Marian S. Merian* – Germany) and worked with outstanding scientists from several countries as well as dedicated PhD students. Beside samplings from CTD for salinity, temperature, tracers (CFC and SF6), dissolved oxygen, carbonate system, nutrients and nitrogen isotopes, there were some lectures not only about South Atlantic circulation and its importance for global climate but also mode waters, carbonate system and the importance of tracers (CFCs). I was responsible for measuring dissolved oxygen and data processing. Besides, I was in contact with different analytical methodologies for measuring carbonate systems and new sampling methods for tracers gases (CFC and SF6).

I would like to thank the crew of *Maria S. Merian* for their hospitality. In addition, I want to thank my scientific colleagues for everything. Finally, I would like to thank POGO for this great opportunity."

*This testimonial was provided by Gláucia Berbel, University of São Paulo.*

## POGO Annual Meeting

### 18<sup>th</sup> POGO Annual Meeting in Plymouth, United Kingdom

This year's POGO Meeting was hosted by Plymouth Marine Laboratory (PML), United Kingdom, from 24-26 January 2017. The meeting was well attended with over 60 participants from 20 countries coming together.

After a warm welcome by Chief Executive of PML, Stephen de Mora, a few moments were taken to remember and reflect upon the contributions of Graham Shimmield who sadly passed away the previous month. The Chair of POGO, Karen Wiltshire started the session with an overview of POGO business and a variety of presentations showcasing the oceanography and observing technology in Plymouth were presented by scientists from PML and the Sir Alister Hardy Foundation for Ocean Science.

Mr Kentaro Ogiue from the Nippon Foundation addressed the plenary, reaffirming the partnership with POGO and announcing the call for proposals from the Members to host Phase III of the NF-POGO Centre of Excellence in Observational Oceanography. A series of flash presentations from new and selected Members of POGO provided an interesting review of the research interests of the global membership and reports on the progress made by POGO-led working groups provided an update on the activities and initiatives driven by POGO Members over the past year.

A series of workshops took place on the topics below, followed by reports, discussions and recommendations going forward for each topic:

- Engaging with industry, led by the POGO Industry Liaison Council
- Arctic observations
- Innovative biological observations

The conference dinner sponsored by Sonardyne and held at the National Marine Aquarium gave an enthralling experience as the sharks and rays swam by as the participants enjoyed their meals.

The next POGO annual meeting will be hosted by Scripps Institution of Oceanography, USA from 23-25 January 2018.



POGO Members attending the POGO-18 meeting hosted by Plymouth Marine Laboratory. Photo credit: Helen Murray, PML.

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