POGO-15 Background Documents

2. Ancillary documents

2.1. POGO activities – capacity building
2.1.1. POGO-SCOR fellowships
2.1.2. POGO-PAP-GreenSeas fellowships
2.1.3. Austral Summer Institute
2.1.4. UCT Postgraduate Bursary

2.2. POGO activities – science coordination and outreach
2.2.1. International Cruise Information Database

2.3. Emerging initiatives
2.3.1. Ecological Monitoring
2.3.2. Ocean Exploration
2.3.3. Horizon 2020 calls (EC funding)
Report on the 2013 POGO-SCOR Fellowship Programme

This year saw the thirteenth fellowship programme implemented using POGO funds with supplementary financial support from SCOR. The announcement was posted on 7 November 2012, with a closing date of 23 December 2012.

This year saw a total of 42 applications, which was fewer than the previous year but more than the number of applicants in 2011. This was possibly a result of a shorter application period. Applications were received from 22 countries.

Ten candidates were selected hail from around the world, namely Argentina, Brazil, China, Croatia, India, Nigeria and Tanzania. This year’s host institutions included GEOMAR (Germany), LOCEAN (France), Plymouth Marine Laboratory (UK), University of East Anglia (UK), University of Maryland (US) and University of South Florida (US).

The applications were screened independently by a committee of four, with representation from SCOR and POGO. In making their selection, the committee considered the following factors:

- quality of the application;
- relevance of the application to the priority areas identified in the fellowship announcement;
- evidence that the training will lead to improved sustained observations in the region, or improved applications of such data;
- evidence that the training would lead to capacity-building with potential lasting impact on regional observations, and
- the need to maximise regional distribution of the awards.

One successful candidate from India subsequently received an offer of a permanent research position, therefore he was no longer able to accept the POGO-SCOR visiting fellowship so soon into the new post. The POGO Executive decided that by the time that they were informed, it was too late by that stage to offer the fellowship to another candidate.

One candidate who was selected was from a country that since last year has moved on to the World Bank’s list of high-income countries, therefore was unable to be supported by SCOR funds, however, following discussions between POGO Executives and SCOR, it was decided that the fellowship would still be offered to the applicant, but would be only funded by POGO.

POGO and SCOR commend the efforts from all the supervisors and colleagues at the various host institutions who agreed to devote time and energy required for the training. The programme would not have been viable without such efforts from prominent scientists and their teams.
All the people involved in each fellowship (the fellowship holder, the supervisor at the parent institute and the supervisor at the host institute) were requested to submit short reports at the end of the training period. A number of fellowships are yet to be completed and their reports are expected to be received by the end of the year, but those received so far have been enthusiastic. They indicate that these exchanges should lead to effective capacity building at the host institute and facilitate longer term collaborations between the institutes concerned. All conclude that the programme serves a useful purpose.

There is tremendous interest in the fellowship programme at all levels, both in the oceanographic institutions of the developing nations, as well as among leading scientists who are eager to contribute to this initiative. It is seen to be filling a niche in capacity building through specialised training that is not filled by intensive courses or by participation in scientific meetings. It helps improve the esprit de corps among oceanographic institutions around the world, and serves as a stepping stone to building collaborations.

Furthermore, the POGO-SCOR fellowship scheme is increasingly seen by other organisations as a model in capacity building, and similar schemes have been set up by other programmes based on the success of the POGO-SCOR model (e.g. EU projects, the Europe-Africa Marine Network, EAMNet; and the EUROMARINE consortium of European Networks of Excellence). The POGO Secretariat is often approached for help/advice on setting up similar fellowship schemes, or proposals to partner up with other organisations.

**Demography of Fellowships**

**Parent Institutions of Successful Candidates:**
- **Argentina**: Instituto Nacional de Investigación y Desarrollo Pesquero
- **Brazil**: Federal University of Rio Grande
- **China**: Xiamen University
- **Croatia**: Institute of Oceanography and Fisheries
- **India**: Nansen Environmental Research Centre, National Institute of Oceanography (cancelled), Space Applications Centre (SAC) of Indian Space Research Organisation
- **Nigeria**: Nigerian Institute for Oceanography and Marine Research
- **Russia**: Russian State Hydrometeorological University
- **Tanzania**: University of Dar Es Salaam

**Host Institutions:**
- **Germany**: GEOMAR Helmholtz Centre for Ocean Research Kiel
- **UK**: University of East Anglia
- **France**: LOCEAN, Université Pierre et Marie Curie
- **UK**: Plymouth Marine Laboratory (four different supervisors)
- **USA**: University of South Florida
- **USA**: University of Maryland Center for Environmental Science

**Gender distribution**
- Female: 5
- Male: 4
2013 Fellows

**Smitha Ammamkuzhiyil – India**

Parent supervisor and institution: Prof. Ravindranatha Menon – Nansen Environmental Research Centre, India.

Host supervisor and institution: Prof. Trevor Platt, Plymouth Marine Laboratory, UK.

Fellowship period: October 2013 (1 month)

Topic: Satellite data processing, interpretation and the modelling of primary production

Smitha Ammamkuzhiyil is currently working in an EU FP7 programme entitled “Indo-European Research Facilities for studies on marine ecosystem and climate in India (INDO-MARECLIM)”, within which she is involved in the work package "Marine Ecosystem studies including algal blooms". It comprises the synergistic utilization of ocean color and other EO data to study eddy induced algal blooms and elucidate changes in productivity in relation to climate change by way of ecosystem models. Smitha is part of a team working to design a suitable marine ecosystem model for the coastal and open ocean waters of Indian EEZ to study variations in the marine productivity. The work also includes the modelling of ocean primary production using satellite and in situ data. The candidate needs to learn the processing of satellite data that will be required as input to ecosystem models and be introduced to primary productivity modelling.

**Olubunm Nubi – Nigeria**

Parent supervisor and institution: Dr Emmanuel Adegboyega Ajao – Nigerian Institute for Oceanography & Marine Research, Nigeria.

Host supervisor and institution: Prof Martin Visbeck – GEOMAR Helmholtz Centre for Ocean Research, Germany.

Fellowship period: 8th of April to 5th of July 2013 (3 months)

Topic: 1. Analysis and interpretation of Oceanic data (Temperature, Salinity, Dissolved Oxygen, Currents, Nutrients, Chlorophyll Fluorescence, etc.) for full description of Oceanic physical, chemical, and biological conditions, and their interconnectivity.

2. Modern / Advanced techniques for Ocean Observation / monitoring

Olubunm’s present work focuses on the reassessment of the role of Equatorial UnderCurrent (EUC) in the Eastern Equatorial Atlantic upwelling systems using past and recent cruise data from various programs. He is also studying the influence of equatorial upwelling on nutrient variability and its implications on the biological productivity along 10W and 2E in the eastern equatorial Atlantic (EEA).

The outline:

- Study on nutrients and biological productivity in the EEA for years 2005, 2006, and 2007; (Onset and final phase situations) and Seasonal variability along 10W in June and December using EGEE data set.
- Study on nutrients distribution and biological productivity at different longitudes (10W and 2E);
- Inter-annual variability along 10W with respect to the onset of the equatorial upwelling periods between 2005 and 2007.
- Comparison with past data from the region for observable trends linkable to climate change.

Olubunm received training in:
- MATLAB on handling NetCDF data: Since most oceanographic data are available in netCDF file, he was extensively taken through the use of MATLAB, ODV, and FERRET in handling netCDF data.
- Accessing ARGO data via CORIOLIS and other websites.
- Analyses and interpretation of ARGO data using MATLAB and OCEAN DATA VIEW (ODV)

The fellow also attended a week ISOS short course on “WRITING LAB” at Christian-Albrechts Universität zu Kiel, Germany. This gave him a better insight into writing and reviewing oceanographic reports/documents. He also attended seminars on SFB 754 projects (particularly on Oxygen Minimum Zone), and also accessed materials on proposals for the project. The fellow took up the opportunity to visit another laboratory within IFM-GEOMAR where the disciplines of chemical oceanography and biogeochemistry are the focus, and with the help of various experts in different fields of oceanography, Olubunm was able to achieve the main goals of the training in line with POGO-SCOR framework: Analysis and interpretation of Oceanic data and their interconnectivity and modern and advanced techniques in ocean observation / monitoring; and using his present research data, was able to produce a manuscript that has been sent out for reviews.

Olubunm also gave a presentation titled “Investigating the hypothesis of surface enrichment due to zonal advection in the eastern equatorial Atlantic” using the application of his newly acquired skills and working data.

Zhiyu Liu – China
Parent supervisor and institution: Dr Hao Wei – Tianjin University of Science and Technology, China.
Host supervisor and institution: Dr Marina Lévy - LOCEAN, Université Pierre et Marie Curie, France.
Fellowship period: December 2013 to January 2014 (3 months)
Topic: The Study of Internal Wave-Submesoscale Eddy Interactions

Since 2004 when Zhiyu started his PhD project on internal waves and turbulent mixing in tidally energetic shelf seas, my research has been focusing on the study of oceanic internal waves. Recent studies suggest that the coupling between internal waves and mesoscale/submesoscale structures are vital to regional ocean dynamics as well as several biogeochemical processes. The South China Sea, where internal waves are among strongest of the world’s oceans and mesoscale & submesoscale processes are very energetic, is apparently a perfect natural laboratory for studying the coupling of the two distinct types of processes. However, Zhiyu’s research expertise so far is mainly on internal waves, experience on the study of mesoscale & submesoscale processes is largely lacking. The applicant is to learn the art of ocean dynamics study at submesoscale regime from Dr. Marina Lévy, a world leading scientist in the field.

Gunjan Motwani – India
Parent supervisor and institution: Ms Mini Raman – Space Applications Centre (SAC) of Indian Space Research Organisation, India.
Host supervisor and institution: Dr Ruth Airs, Plymouth Marine Laboratory, UK.
Fellowship period: 31st of May to 29th of August 2013 (3 months)
Topic: Phytoplankton pigment analysis by HPLC and its application in the
development of phytoplankton functional type (PFT) algorithms.

As a research fellow of SAC-Gujarat University collaborative project on measurement of inherent optical properties (IOP) of coastal-offshore waters of the Arabian Sea for development of satellite based inversion algorithms, Gunjan’s main work involves:

1. Measurement of spectral absorption properties of particulate and dissolved organic matter of water samples obtained from various cruises using UV-VIS spectrophotometer.
3. Collection, preservation and taxonomic identification of phytoplankton samples obtained from various cruises in the Arabian Sea.

The candidate requires training in HPLC techniques for separation and quantification of various phytoplankton pigments from sea water samples, calibration of standard pigments, various methods using HPLC for the analysis of pigments, their merits and disadvantages and maintenance and calibration of HPLC system.

Marina Azaneu - Brazil
Parent supervisor and institution: Prof Rodrigo Kerr Duarte Pereira – Federal University of Rio Grande, Brazil.
Host supervisor and institution: Prof Karen Heywood University of East Anglia, UK.
Fellowship period: 23rd of July to 30th of September (2 months)
Topic: Using seagliders as an important tool for observing ocean shelf regions.

In Marina’s master dissertation the applicant used a Southern Ocean in situ dataset to assess a reanalysis product in representing dense water masses. Part of the in situ data was obtained by the Brazilian Group of Oceanography of High Latitudes (GOAL). The applicant not only analysed the in situ data, but also contributed to obtaining and processing those data. The correct processing and management of hydrographic data is essential for the maintenance of datasets, and the seaglider is a new tool that will expand the GOAL data collection and improve the understanding of the Southern Ocean shelf areas. The study of Antarctic continental shelf regions is extremely important for better understanding of ocean processes, which is essential for the applicant’s research.

The training will consist of analysis, processing and the management of data from seagliders obtained in the northwestern Weddell Sea under the GENTOO (Giders: Excellent New Tools for Observing the Ocean) project, aiming the investigation of physical oceanographic processes occurring in the region. Moreover, a cruise is planned to recover/deploy gliders in the North Atlantic, where the applicant will have the opportunity to be trained in the field how to deal with the equipment. The training will reinforce the ongoing FURG-UEA collaboration, in which is planned to use seagliders to monitoring ocean process in the continental shelf and slope of Brazilian and Antarctic coast. Acquire knowledge of seaglider data processing and management will be an important key in the implementation of this new tool at FURG and highly complement the dataset and studies carried by the GOAL. The data that will be analysed during the training and the data that will be obtained using the training capabilities acquired will contribute to
understanding the Southern Ocean process and will possibly contribute to the dataset that will be evaluated in the applicant’s PhD thesis.

Žarko Kovač – Croatia
Parent supervisor and institution: Dr Mira Morović – Institute of Oceanography and Fisheries, Croatia.
Host supervisor and institution: Dr Shubha Sathyendranath, Plymouth Marine Laboratory, UK.
Fellowship period: 4th of August – 4th of November (3 months)
Topic: Modeling primary production of the Adriatic Sea.

Žarko’s research topic is modeling of marine primary production. This is a part of the national research project: “Cooscilations of atmosphere and the sea important for the ecosystem of the Adriatic Sea”. The goal of the topic is formulating a dynamic biooptical model of primary production for the Adriatic Sea focusing on the primary production module. Phytoplankton interacion with light, nutrients and zooplankton will be considered, as they determine spatio-temporal dynamics of primary production. Spectral distribution of underwater solar radiation will be taken into account by the optical model and the link will be made to growth rates of phytoplankton. The topology of the ecosystem food web and it’s structure, which determines the resulting time dynamics of the system will also be studied. The idea is to use measured data of temperature, salinity, solar radiation, underwater light field, nutrients, phytoplankton and zooplankton biomass and to incorporate them into the dynamic model. This will be performed through optimization of the model parameters on the measured data. Further goals are to establish a connection with the hydrodynamical model and to make a coupled hydrodynamic and ecological model.

Ezequiel Cozzolino – Argentina
Parent supervisor and institution: Dr Vivian Lutz – Instituto Nacional de Investigacion y Desarrollo Pesquero, Argentina.
Host supervisor and institution: Prof Frank Müller-Karger – University of South Florida, USA.
Fellowship period: 1st of October to 30th Of November (2 months)
Topic: Advanced training in the processing of remote sensed oceanographic data (e.g., SST and chlorophyll concentration) for the Argentine Sea; for its use in oceanographic and fisheries studies.

Ezequiel is receiving some training with the aim of being incorporated to the Remote Sensing Laboratory at INIDEP. In this period I have learned some basics about the theory of obtaining oceanographic information through remote sensing, and its applications in fisheries research. I collaborate in different projects at my institute which require satellite information to complement fisheries evaluations. I have put together a first report on the kind of ocean remote sensing information available on public internet sites (e.g., NASA, NOAA, ESA, CONAE), providing a tutorial on how to easily download this information for researchers not experts in the subject. At this point it will be extremely valuable to enhance my knowledge about all the detailed steps involved to process raw satellite data to obtain refined products (e.g., SST, Chlorophyll concentration, fluorescence peak height).

The project/training should focus on acquiring the necessary knowledge to process full resolution (1.1 km) daily Level 1A data (sea surface temperature and reflectance) from
MODIS-Aqua, and if possible from VIIRS, sensors. Learning how to use SeaDAS software in the most efficient way, getting acquainted with the versions of the algorithms used for the different properties (chlorophyll, PAR, etc.), as well as the best decisions regarding quality control of the pixels taking into consideration possible contaminations (flags due to clouds, negative radiance, sunglint, etc.), to arrive to final products. I would be interested in learning also about the most efficient way to calculate, in order to be incorporated automatically in a web-page, time series of these results. These will be useful to study climatologies and anomalies. These tools will be relevant for environmental studies for fisheries applications, as well as for the long-term monitoring of possible plankton changes at the Antares centers.

**Dubrava Kirievskaya – Russia**

Parent supervisor and institution: Prof Mikhail Shilin – Russian State Hydrometeorological University, Russia.  
Host supervisor and institution: Dr Jacqueline Grebmeier – Chesapeake Biological Laboratory, USA.  
Fellowship period: 25th of July to 26th of October 2013 (3 months)  
Topic: The Chukchi Sea benthic data synthesis: contribute to the assessment of a potential vulnerability of the ecosystem.

Dubrava’s PhD thesis is devoted to the assessment of vulnerability of biogeocenosis of the Chukchi Sea. Biogeocenosis is the main indicator of the ecosystem conditions as well as its vulnerability to climate change and anthropogenic influence (Pogrebov et.al, 1994). For completion of this research the applicant is collecting data from the Chukchi Sea such as biological data (taxonomy of benthos, abundance, biomass) and oceanological data (ocean temperature, currents, granulometric and geochemical compositions of the bottom sediments). Synthesis of benthic data and data of physical characteristics of the environment, (especially the sediments) allows us to make the assessment of vulnerability of biogeocenosis (to oil contaminations, particularly). Assessment of the potential vulnerability of such systems is very important for the future sustainable development of the area (e.g., the construction of the oil wells, shipping activities). The proposed assessment is based on special algorithms identified from the literature (WWF, 2011) and specific software being created with a GIS specialist that will map the current status of biogeocenosis of the Chukchi Sea and information about potential vulnerability of biogeocenosis. The main constraint of this research is a deficiency in access of available data sets, especially for the US part of the Chukchi Sea. The proposed collaboration with Dr. Grebmeier in the USA will allow access to both publically-available datasets in the US and ones being organized in her laboratory as part of a multi-institutional synthesis activities she is leading in this complex ecosystem. Drs. Jackie Grebmeier and Lee Cooper at CBL/UMCES (the host institution) have three decades of experience working in the Pacific Arctic and Chukchi Sea, including multiple US-Russian collaborative programs since the 1980s to the present. Interactions during my visit, both in the laboratory at CBL and on an Arctic cruise, will allow me to learn from their longterm efforts in the Chukchi Sea, be training in their laboratory benthic sorting and sediment analysis activities, and exchange data sets for the overall goal of this project.

**Joeline Ezekiel – Tanzania**

Parent supervisor and institution: Dr Yohana Shaghude – Institute of Marine Sciences, Zanzibar, Tanzania.  
Host supervisor and institution: Dr Marie-Fanny Racault, Plymouth Marine Laboratory, UK.  
Fellowship period: 29th of April to 29th of July 2013 (3 months)
Topic: Seasonal and spatial variations of phytoplankton in Rufiji Delta, Southern Tanzania, based on ocean colour remote-sensing and in-situ data.

Joeline is currently working on a dissertation under the title “Assessment of Seasonal and spatial variations of phytoplankton distribution and abundance off Rufiji Delta, southern coast of Tanzania by the use of satellite data”. Her objectives are to upgrade her skills with respect of remote sensing data analysis and interpretation and on ecological modelling which eventually will allow the extrapolation of the data in relation to productivity of the ocean. Joeline would also like to further analyse the data using advanced analysis methods so as to reveal in detail the dynamics of phytoplankton in the ocean.

Joeline is interested in the study of phytoplankton productivity comparing in situ, remote sensing data and simulations. Phytoplankton play an important role to marine ecosystem in fixing atmospheric carbon and providing the primary food source for the zooplankton, together forming the base of the oceanic food chain. She would like to be trained in the following areas;
- Creating a seasonal record of ocean color products for my region including Chl-a and Total Suspended Matter(TSM).
- Comparing data from different satellites e.g. MODIS/MERIS
- Comparing different algorithms for Chl-a and Total Suspended Matter to choose an optimal product.
- Extracting information for comparison of in situ data
REPORT ON POGO-SCOR FELLOWSHIP PROGRAMME 2013

Trainee's Report

Name of Trainee: Ms Marina Azaneu Duarte Pereira
 Supervisor (Parent Institution): Prof Rodrigo Kerr

Supervisor (Host Institution): Prof Karen Heywood

Dates of Training: 23 July - 30 September 2013

Subject of Training: Using seagliders as an important tool for observing ocean shelf regions

1) Please provide a brief description of activities during the training period:

A field trip occurred in the first week of the training period in Oban, Scotland. During this period, the research group, composed by the trainee and researchers from University of East Anglia (UEA) and British Antarctic Survey Institute (BAS), deployed and tested tree seagliders: SG502 Minke, SG537 Fin (equipped with an Echo-sounder) and the equipment from BAS.

Firstly, we used the SAMS (Scottish Marine Institute Oban) seawater tank for ballasting and centre location on seagliders (Figure 1a). Selft tests, sim dives and echo-sounder testing were also executed. After the preliminary tests, the seagliders were deployed and recovered from the R/V Seol Mara vessel. Along the week the seagliders were deployed several times, during which the group realized the trimming and piloting of the equipment (Figure 1b). We also tested the ARGOS tags and calibrated the Echo-sounder during the dives. We were split into teams, so the trainee could participate of all activities. The group presented the basic procedures for the equipment deployment and recovery, and also the main commands for piloting.

After the field trip the training was develop at the UEA. The trainee learned how to process the raw dataset using the toolbox developed by the university researchers. The main causes of data outliers and offsets were discussed and a basic treatment was applied to the raw data. After learning the basic steps on how to deal with the raw dataset obtained in Oban, the trainee worked with seaglider data from the GENTOO project (Giders: Excellent New Tools for Observing the Ocean), deployed at the western Weddell Sea on January 2012. The basic treatment was applied to this dataset and the altimeter information was compared to the bathymetric data GEBCO_08 grid¹. Hydrographic properties, as potential temperature, neutral density and depth were determined based on the seaglider’s measurements. Aiming to explore the versatility of the dataset, it was used to evaluate the dense waters spilling out of the shelf. The properties and the thickness of the dense water layer was investigated (Figures 1c and 1d).

2) What applications of the training received do you envision at your parent institution?

My parent institution is currently submitting a project that includes the purchase of seagliders to investigate Antarctic waters. This means that all the knowledge acquired during the training will be directly applied in my institute. I intend to help implement this new technology transferring the experience that I acquired in seagliders deployment, recovery and piloting to the GOAL (Oceanographic Group of High Latitudes) researchers at FURG/Brazil (Federal University of Rio Grande/Brazil) through courses and documentations. Moreover, I intend to help develop our own protocols and toolbox for seagliders data processing, based on that used by the host university. Moreover, the information obtained in the ¹ http://www.gebco.net/data_and_products/gridded_bathymetry_data/
evaluation of seagliders data from GENTOO project is very interesting, and will possibly be used in an article as a cooperative work between the two institutes.

3) Please provide your comments on the Fellowship Programme.
   The training provided by the fellowship was very productive and definitely enhanced the trainee experience and knowledge about new technologies for ocean observing. The training also reinforced the ongoing FURG-UEA collaboration, enhancing the possibility for new joint work opportunities.
   The fellowship payment was done as soon as I arrived at the host institution, which was providential. The POGO secretariat was also very helpful, answering all my questions promptly. The host supervisor received me greatly, giving me access to all data, toolboxes and assistance. In addition, the field trip provided really improved my training experience.

4) Please provide details as to how your contribution towards living expenses was spent. Attach receipts for all major expenses.
   The fellowship was basically spent with a bedroom rent (650 GBP), daily bus tickets (4 GBP for return), internet access and food. Regarding food, it was generally spent 5 GBP daily with sandwiches for lunch. Subsidies were purchased at supermarkets for the other meals and there is no estimation of the general costs. The supervisor of the host university paid the field trip and the meeting that the trainee participated.

Figure 1: a) Ballasting and centre location on seagliders in SAMS seawater tank; b) Seaglider being deployed from the R/V Seol Mara vessel; c) Neutral density along seagliders’ dive for each defined profile and map with defined profiles; d) Dense water layer thickness.
REPORT ON POGO-SCOR FELLOWSHIP PROGRAMME 2013

Trainee’s Report

Name of Trainee: Joeline Ezekiel  Supervisor (Parent Institution): Dr Yohana Shaghude

Supervisor (Host Institution): Dr Marie-Fanny Racault  Dates of Training: 29 April - 29 July 2013

Subject of Training: Seasonal and spatial variations of phytoplankton in Rufiji Delta, Southern Tanzania

1) Please provide a brief description of activities during the training period:

During the first days, Dr Marie-Fanny Racault gave me a quick tour of the Plymouth Marine Laboratory (PML) and the Hoe and introduced me to the people in the lab. During the training period, while learning new methodologies in ocean colour remote-sensing, I was working on my thesis with the title “Temporal and spatial variations of phytoplankton in Rufiji Delta, in Southern Tanzania, using ocean colour remote-sensing and in-situ data”. Specific activities included: working with a linux workstation; retrieval and processing of available remote-sensing data (i.e. chlorophyll, Total Suspended Matter (TSM), Sea-Surface Temperature (SST); learning of remote-sensing data visualisation tools and familiarisation with computer programming using ferret PMEL NOAA, Matlab and excel software; The specific tasks were:
   1. Validating remote-sensing observations of chlorophyll (by comparing data with previously collected in-situ measurements from Rufiji delta and Mafia channel);
   2. Characterizing the spatial distribution and seasonal cycle of phytoplankton in the Rufiji delta and Mafia channel
   3. Studying interannual variability using statistical techniques (e.g. calculation of trends, anomalies, correlation, hovmöller diagram…) and
   4. Investigating the influence of environmental variables on the temporal and spatial distribution of phytoplankton (using the previous collected in-situ measurements from Rufiji Delta and Mafia channel)

Other tasks includes; Literature Reviews for my M.Sc dissertation and I also got an opportunity to do oral presentation at the PML-KIOST international symposium which was held at PML.

2) What applications of the training received do you envision at your parent institution?

The POGO SCOR Fellowship has given me the opportunity to get remote sensing data which was highly challenging in my home institute, get hands on experience on the tools and methods for remote-sensing data analysis especially Ferret PMEL NOAA (which is a publicly and freely available software). The fellowship has given me the opportunity also to work on my thesis and I am due to present my report here at my parent institute which is going to be a good platform to share my results and transfer of the knowledge gained during my training at PML. My study at Rufiji Delta/Mafia Channel is the first case study utilizing EO satellite based data to measure chl-a, and as such it is expected to provide some vital information for other future studies in Tanzania. After submission of the dissertation, I am planning (in collaboration with my parent supervisor at the Institute of Marine Sciences (IMS) and my host supervisor at PML to synthesize the main results of my work for publication.

3) Please provide your comments on the Fellowship Programme.
The Fellowship programme was much more than I expected. Since my arrival at PML Dr. Marie-Fanny have been very helpful both professional and social wise. The moral and material support from POGO secretariat has been very helpful to make my stay at PML comfortable. During my stay I was able to present my results at the PML-KIOST workshop (KIOST is the Korea Institute of Ocean Science and Technology), which was very useful for my thesis and for my experience as an early career scientist, especially public speaking. Thanks also to Trevor and Shubha for their useful comments on my presentation and their kind carefullness about my welfare there at PML as well. Furthermore, I have been able to establish networking with not only POGO researchers but also the whole PML scientists community. My visit at PML in the UK has been an extremely rewarding experience and particularly good for my education as a master student as well as for my future career as a scientist. We hope to develop further collaboration and potentially PhD studies.

4) Please provide details as to how your contribution towards living expenses was spent. Attach receipts for all major expenses.

I used the stipend to pay for rent, which was 80 GBP per week, food and other essential personal stuffs.

Please return completed form by e-mail to: pogoadmin@pml.ac.uk

IMPORTANT: Please also mail the completed form with attached receipts to:

POGO Secretariat
Plymouth Marine Laboratory
Prospect Place
The Hoe
Plymouth
PL1 3DH
UNITED KINGDOM
Trainee’s Report

Name of Trainee: Bellineth Valencia Ramirez Giraldo

Supervisor (Parent Institution): Dr Alan Giraldo

Supervisor (Host Institution): Dr Marja Koski

Dates of Training: 23/04/13 – 11/07/13

Subject of Training: Copepods grazing and pellet production: there are changes in particle production according to the sexual condition and vertical distribution?

1) Please provide a brief description of activities during the training period:

The activities done during the training can be divided in three periods: before the cruise (April 29 to May 29), during the cruise (May 29 to June 18), and after the cruise (June 19 to July 11).

During the period before the cruise all activities that I did were directed towards preparation of a work plan to be carried out during the cruise, as well as to develop the skills needed to work with live copepods during the cruise. After defining the target species for the experiments, I searched and read the methodology and results of around 70 research articles published for the copepod *Calanus*. As a result of these readings, I prepared a draft plan with possible methodology to be followed during the cruise and the experiments to be performed: egg production, hatching success, pellet production, grazing by copepods, grazing by microzooplankton (dilution experiment), and gut clearance. Likewise, during the period before the cruise, I did laboratory work that consisted mainly of learning to recognize female vs. male copepods, to sort out live females from a sample, and to carried out laboratory experiments (e.g. respiration, grazing, and egg production) with the guidance of Marja and DTU Aqua master students.

During the cruise, every day we carried out vertical tows to collect zooplankton samples with a WP2 net (200m to surface). From these samples, I sorted out *Centropages* sp. females because the copepod *Calanus* sp. were not observed during the first days of sampling. The samples collected and the experiments performed during the cruise were directed to assess the carbon budget of *Centropages* sp. by developing reproduction (egg production and hatching success), grazing, pellet, and respiration experiments (WP2 samples), and vertical distribution analysis by collecting stratified samples (Multinet). During twelve days of the cruise, I did a 24h egg production and pellet production experiments by sorting out 20 females and putting them individually in Petri dishes. From the eggs obtained, during four days of the cruise, I did hatching experiments allowing eggs to hatch during four days. Additionally, I did two grazing experiments to quantify how much *Centropages* were eating and if they showed some preference for autotrophic organisms (measured by chlorophyll extraction during the cruise) or for heterotrophic organisms (microzooplankton counts). For this purpose, I collected water from the rosette from two different depths (chlorophyll maximum and below the chlorophyll maximum), and I took initial and final samples for chlorophyll analysis and microzooplankton counts (samples...
preserved in Lugol). Likewise, I did one experiment for microzooplankton grazing (dilution experiment) using also water collected from the two different depths, and I did two gut clearance experiments by performing five or six zooplankton tows, freezing the samples at -80°C, and sorting out the copepods and putting them in acetone for chlorophyll extraction.

After the cruise, most of the time was directed toward the analysis of the 40 microzooplankton samples collected during the two grazing experiments for copepods. Also, Marja and I had some meetings to talk about the analysis of the information obtained during the cruise and we planned the preparation of a manuscript with this information.

2) What applications of the training received do you envision at your parent institution?

There are mainly three applications of the knowledge that I gained during the training period, one that can be applied in a short term and two that can be applied in a long term of time. In a short term, the first purpose is to share the knowledge gained with undergraduate and graduate students that work with plankton in the Research Group in Oceanographic Sciences at University of Valle, letting them know about the research that other researchers are doing (DTU Aqua and PAP researchers) with the aim to attract their interest to explore a new line of research, and to encourage them to start to do small experiments with live zooplankton. In a long term, the aim will be to explore the possibility to do a project of carbon flux in the Colombian Pacific in collaboration with DTU and/or PAP researchers, and to explore the possibility to do a zooplankton course with Colombian professors that are working with zooplankton and DTU and other international researchers.

3) Please provide your comments on the Fellowship Programme.

For me, to have the opportunity to participate in this fellowship programme was an enriching experience. I learned a lot during the time that I spent at DTU Aqua laboratories, not only because of the facilities that they have to work with live zooplankton, also because I had the opportunity to share with master and Ph.D. students, and highly experienced researchers. Likewise, the experience during the cruise was very good. It was the first time that I participated in a so complete research in biological oceanography and in a research vessel so well equipped with large laboratories with everything that you need to do a state of the art research. Also, I had the opportunity to share with researchers from different countries that work in different areas. For all these reasons, I consider that I accomplished my purpose of participating in this fellowship programme and I consider that this is a very good opportunity for researches working in developing countries to learn from highly experienced researchers, to work in well equipped laboratories, to try to agree future collaborations between institutions (host and parent institutions), and in this way strengthen the research capabilities at the parent institutions.

4) Please provide details as to how your contribution towards living expenses was spent. Attach receipts for all major expenses.

For my fellowship programme, I received from POGO 1150 Euros per month for 2 months. For the first period, the stipend was spent as follows: 55% in accommodation, 11% in transportation, 25% in feeding, and 9% in laundry. For the second period, the stipend was spent as follows: 41% in accommodation, 9% in transportation, 25% in feeding, and 12% in laundry. There are no receipts for laundry because these were coin machines that did not provide receipts.
REPORT ON POGO-PAP GreenSeas FELLOWSHIP PROGRAMME 2013

Trainee’s Report

Name of Trainee: Veli Caglar Yumruktepe  Supervisor (Parent Institution): Dr Baris Salihoglu

Supervisor (Host Institution): Dr Richard Lampitt  Dates of Training: 05/05/13 – 23/07/13

Subject of Training: Model-Data Integration of Key Nitrogen Cycle Processes

1) Please provide a brief description of activities during the training period:

I can divide my activities at Southampton to three different parts. The first part was the pre-cruise time, where I have spent considerable amount of time for the preparation of equipment for the experiments. The experiments included incubations on deck, therefore we had to build a conceptual marine environment with different light levels, and constant temperatures in 4 parallel incubators. We had gained experience by discussing with the scientists that did similar work in previous cruises, and used their techniques and procedures for successful experiments. Use of similar techniques also provided us a comparison with their previous work. Apart from cruise preparation, I also had the chance to discuss with experts the modelling work that I am carrying on. I gave a brief talk about my previous modelling work for the PAP site, and later on had individual meetings with the experts. This way, we managed to discuss the problems in my model, and the ways to overcome those.

The second part of my fellowship was the PAP Site cruise in June. We carried out experiments focusing on the uptake of nitrate and ammonium by phytoplankton, and nitrification processes by nitrifiers. The experiments included incubations on deck representing the different light levels and depths in the marine environment, where at the end of the cruise, we further investigated the effect of changing pH on these processes. The idea behind this was to evaluate the influence of ocean acidification on the nitrogen cycle in the marine environment. We are hoping that the results will provide a direct estimate of crucial life cycle processes to be used in models, especially for the PAP site.

Third part of my fellowship was the post-cruise period, where I had intense discussions with experts from different fields. I needed guidance for the theoretical details in the model. These were the important processes of carbon and nutrient flow through state variables used in the models. I had discussions with experts about the fate of matter in the marine environment, mostly organic matter export to deep ocean, which is the main focus of my modelling study. These discussions included field observations and experiments, to satellite estimations. I also had the chance to talk to modelling experts, and discussed the theoretical background of my model and the strategy to be taken to incorporate new ideas, or new observations in the field.
2) What applications of the training received do you envision at your parent institution?

After the expertise I gained from this fellowship, we now have the conceptual experimental knowledge on how to build incubations on deck, sampling at sea, necessary laboratory work and their limitations. Our institute has the access to three different seas, with three unique ecosystems, the Mediterranean, the Marmara and the Black Sea. The technique followed at the PAP site will be carried on to these three seas and unique estimations of vital rates will be made. We are also planning to train new students, so that the technique can be sustained in time, and hoping that this study will be used in our time series stations at different regions.

Scientists in our institute are also running physical and ecosystem models in all of the seas mentioned. The modelling expertise will be transferred, and I will personally be involved in this issue, hoping to improve the modelling skills of my colleagues and their individual models.

3) Please provide your comments on the Fellowship Programme.

I can say that I truly gained a lot from this programme. I had the chance to work in a highly professional environment, and managed to meet many experts of my field. The personal communications I made was exceptionally valuable. I really believe that I will carry on working with them and hopefully collaborate on future scientific works. Also, the chance for me to attend a different and highly advanced vessel, and observe the state-of-the-art work scientists are carrying on was remarkable. I witnessed a well planned, and successful cruise, with all the scientific works linking with each other for a better bigger picture. I will try hard to achieve such a thing in our cruises back home.

I also thank all the POGO members, that made it possible for me have such an experience. From the beginning to the end, everything was flawless. Even though the fellowship was for nearly three months, including the planning and managing, it was much more than that, and really appreciate the effort taken.

4) Please provide details as to how your contribution towards living expenses was spent. Attach receipts for all major expenses.

I have spent 1300£ for the accommodation, including electricity, water, heating, internet and buss pass. This adds up to nearly 75% of what I had been offered by POGO. The remaining part of my scholarship was spent on food expenses alone.

Please return completed form by e-mail to: pogoadmin@pml.ac.uk

IMPORTANT: Please also mail the completed form with attached receipts to:

POGO Secretariat
Plymouth Marine Laboratory
Prospect Place
The Hoe
Plymouth
PL1 3DH
UNITED KINGDOM
Period of Activity: Academic year 2012
Title of the UNESCO Chair or Network: Coastal Oceanography

The UNESCO IOC Chair in Oceanography is the umbrella for capacity building in Ocean Sciences at University of Concepción. This year the Chair was additionally supported by the Partnership for Observation of the Global Oceans (POGO), LIA MORFUN, the Fulbright-Commission Chile, the Embassy of France in Chile, COPAS Sur-Austral, Vice Rectory of Research and Development, Faculty of Natural and Oceanographic Sciences, Department of Oceanography and Graduate School at University of Concepcion.

Report established by: Function / Title:
Professor Dr. Silvio Pantoja / Chairholder and Coordinator
Summary

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II. Available resources: Page 3
  1. Human resources: Page 3
  2. Material resources: Page

III. Activities: Page 6
  1. Education/Training/Research
     a) Courses and students
     b) Expenses by funding source
  2. Conferences/Meetings.
  3. Missions/Travels abroad
  4. Visiting Professors/Fellowships
  5. Information and documentation activities
  6. Others

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V. Forthcoming activities: Page 31

VI. Development Prospects: Page 31

Annexes
Annex 1: Target groups
Annex 2: Geographical coverage
Annex 3: Funding sources
I. Address

<table>
<thead>
<tr>
<th>Name</th>
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<tbody>
<tr>
<td>Function/Title</td>
<td>Professor Dr.</td>
</tr>
<tr>
<td>University/Institution</td>
<td>School of Natural and Oceanographic Sciences</td>
</tr>
<tr>
<td>Faculty/Department/Center</td>
<td>Department of Oceanography/COPAS Sur-Austral</td>
</tr>
<tr>
<td>P.O. Box</td>
<td>P.O. Box 160-C</td>
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<tr>
<td>Street</td>
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</tr>
<tr>
<td>City</td>
<td>Concepcion</td>
</tr>
<tr>
<td>Country</td>
<td>Chile</td>
</tr>
<tr>
<td>Phone</td>
<td>+56 41 220 4520</td>
</tr>
<tr>
<td>E-mail</td>
<td><a href="mailto:spantoja@udec.cl">spantoja@udec.cl</a></td>
</tr>
<tr>
<td>Website</td>
<td><a href="http://www.udec.cl/oceanoudec">www.udec.cl/oceanoudec</a></td>
</tr>
</tbody>
</table>

II. Available resources

Please specify for each item, when available, total cost and funding sources (for guidelines see Annex 3)

Human resources

1. - For the administration of the UNESCO Chair or Network
   • Chair holder and Coordinator of the Austral Summer Institute (ASI) at UDEC
   • Manager for ASI
   • Administrative assistant (part time)

2. - For the teaching/training/research activities. Please specify number of full Professors, researchers, visiting professors, lecturers, others
FACULTY MEMBERS IN THE GRADUATE PROGRAM IN OCEANOGRAPHY
2012

- Arancibia, Hugo (Dr. rer. Nat. Bremen, Fisheries Ecology, Stock Evaluation)
- Carrasco, Franklin (Dr. University of Concepcion, Benthic Ecology)
- Castro, Leonardo (Ph.D. Stony Brook, USA, Biological Oceanography)
- Cisternas, María Eugenia (Dr. rec. Nat. Heidelberg, Germany, Geology)
- Daneri, Giovanni (Ph.D. Southampton, Biological Oceanography)
- Escribano, Rubén (Ph.D. Dalhousie, Biological Oceanography)
- Farías, Laura (Dr. University of Concepcion, Biogeochemistry)
- Fernández, Camila (Dr. Université de la Méditerranée, Francia)
- Figueroa, Dante (Dr. Rec. Nat., Goettingen, Physical Oceanography)
- Gallardo, Cristian (Dr. Sciences, CICESE, Mexico)
- Gallardo, Víctor Ariel (Ph.D. S. California, Biological Oceanography)
- Galleguillos, Ricardo (Ph.D. Wales, Population Genetic and Evolution)
- González, Humberto (Dr. rec.nat. Bremen, Biological Oceanography)
- Kelm, Ursula (Ph.D. U.K., Geology)
- Lange, Carina (Ph.D. Buenos Aires, Geological Oceanography)
- Macaya, Erasmo (Dr. Marine Biology, Wellington, New Zealand)
- Marchant, Margarita (Dr. rec. nat. Bremen, Geological oceanography)
- Moffat, Carlos (Ph.D. MIT/WHOI, Physical Oceanography)
- Morales, Carmen (Ph.D. London, Biological Oceanography)
- Oyarzún, Ciro (Dr. University of Concepción, Fish Biology)
- Pantoja, Silvio (Ph.D. Stony Brook, Chemical Oceanography)
- Pincheira, Marcos (Dr. rec. nat. Heidelberg, Geology)
- Pizarro, Oscar (Ph.D. Gothenburg, Physical Geography)
- Quiñones, Renato (Ph.D. Dalhousie, Biological Oceanography)
- Salamanca, Marco (Ph.D. Stony Brook, Chemical Oceanography)
- Sobarzo, Marcus (Dr. University of Concepcion, Physical Oceanography)
- Schneider, Wolfgang (Dr. Nat. Sciences, Hamburg, Physical Oceanography)
- Tapia, Fabián (Ph.D. MIT/WHOI, Biological Oceanography)
- Ulloa, Osvaldo (Ph.D. Dalhousie, Biological Oceanography)
VISITING PROFESSORS ACADEMIC YEAR 2012 (throughout January 2013)

- Gabriela Campana, Instituto Antártico Argentino, Argentina
- Cristina Dorador, Universidad de Antofagasta, Chile
- Ernesto Gramsch, Universidad de Santiago de Chile, Chile
- Edgardo Hernández, Instituto Antártico Argentino, Chile
- Klaudia Hernández, Universidad Austral de Chile, Chile
- Wade Jeffrey, University of West Florida, United States
- Fabien Joux, Observatoire Océanologique de Banyuls-sur-mer, France
- Verónica Molina, Universidad Andrés Bello, Chile
- Elías Ovalle, Universidad de Concepción, Chile
- Miguel Rivas, Universidad de Tarapacá, Chile
- Alberto Piola, Servicio Hidrográfico de la Armada, Argentina
- Alexander Murray, Marine Scotland Science, Scotland
- Nabeil Salama, Marine Scotland Science, Scotland
- Rodrigo Montes, Universidad de Concepción, Chile
- María Vernet, Scripps Institution of Oceanography, United States
- María Nielsdóttir, National Oceanography Center Southampton, United Kingdom
- Ian Salter, Observatoire Océanologique de Banyuls-sur-mer, France

3. - For the information and documentation activities

- Director Graduate Program in Oceanography
- Administrator, School of Natural Sciences and Oceanography
- Administrator, Department of Oceanography
- Administrative Assistant, Graduate Program in Oceanography

4. - For other activities

- Administrative personnel Department of Oceanography

2. Material resources

1. - For the administrative work

- Office for Chairholder and Administrative Assistant
2. - For the teaching/training/research activities

- Offices for faculty members and visiting professors, Campus University of Concepcion
- Classrooms, Campus University of Concepcion
- Student Computer Room, Campus University of Concepcion

3. - For the information and documentation activities

- Library at the School of Natural Sciences and Oceanography and University Main Library

4. - For other activities (please specify)

III. Activities

Please provide information on items 1 to 7 for each activity, when available, and specify: Target groups, in accordance with Annex 1 –Geographical coverage, in accordance with Annex 2 –Funding sources, in accordance with Annex 3.

1. Education / Training / Research

* Title and expected results for each course:

**Austral Summer Institute XIII (ASI XIII)**

Understanding physical, chemical and biological processes in the marine environment

Courses for the Academic Year 2012 throughout January 2013.

1. Symposium UV radiation and marine ecosystems: Current research and strategies for the future (5-7 December, 2012)

- Lic. Gabriela Campana, Instituto Antártico Argentino, Argentina
- Dr. Cristina Dorador, Universidad de Antofagasta, Chile
- Dr. Camila Fernández, Observatoire Océanologique de Banyuls-sur-mer, France. Visiting Professor UDEC
- Dr. Ernesto Gramsch, Universidad de Santiago de Chile, Chile
- Lic. Edgardo Hernández, Instituto Antártico Argentino, Argentina
- Dr. Klaudia Hernández, Universidad Austral de Chile, Chile
- Dr. Wade Jeffrey, University of West Florida, United States
- Dr. Wade Joux, Observatoire Océanologique de Banyuls-sur-mer, France
- Dr. Verónica Molina, Universidad Andrés Bello, Chile
2. Why do diseases emerge in marine aquaculture? And what can we do to limit this? (7-11 January, 2013)

- Dr. Alexander Murray, Marine Scotland Science, Scotland
- Dr. Nabeil Salama, Marine Scotland Science, Scotland

3. Circulación y masas de agua en el Atlántico Sudoccidental (7-11 January, 2013)

- Lic. Alberto Piola, Servicio Hidrográfico de la Armada, Argentina

4. Trace metals in the oceanic carbon cycle (14-18 January, 2013)

- Dr. María Nielsdóttir, National Oceanography Center Southampton, United Kingdom

5. Coastal Antarctic ecosystems and the case of the Larsen Ice Shelf System (14-18 January, 2013)

- Dr. María Vernet, Scripps Institution of Oceanography, United States


- M.Sc. Rodrigo Montes, Ph.D. (c) Universidad de Concepción, Chile

7. Chemical and biological characteristics of the oceanic phosphorus cycle (21-25 January, 2013)

- Dr. Ian Salter, Observatoire Océanologique de Banyuls-sur-mer, France

2. Duration

The UV Symposium lasted 3 days. The last day was devoted to practical activities. The Symposium included poster presentations by groups of local high school students.

All of the other courses lasted 5 days, except the course “Análisis de series de tiempo en ecología y oceanografía” which lasted 10 days.

Target groups: Graduate and senior undergraduate students from Latin American countries. Selection was based on academic credentials. Although we favored the admission of students with experience (and focused) in the particular area of the
course they applied to, we also accepted interested students with no background in the specialty. Students registered in Graduate Programs received two credits per course from the Graduate School at University of Concepcion.

**Partnership:** (please specify the name of the Institution, city, country)

- Intergovernmental Oceanographic Commission (IOC/UNESCO), Paris, France
- Partnership for Observation of the Global Oceans (POGO), Dalhousie, Canada
- Laboratorio Internacional Asociado (LIA-MORFUN), Concepción, Chile
- Fulbright-Commission, Chile
- Embassy of France in Chile
- COPAS Sur-Austral, University of Concepcion, Concepcion, Chile
- Department of Oceanography, University of Concepcion, Concepcion, Chile
- School of Natural and Oceanographic Sciences, University of Concepcion, Chile
- Vice rectory of Research and Development, Chile
- Graduate School, University of Concepcion, Concepcion, Chile

**Geographical coverage for partners and participants**

A total of 98 students, from Argentina, Brazil, Canada, Cuba, Chile, Ecuador, France, Peru and Uruguay, participated in our activities during the academic year 2012 (throughout January 2013) distributed as shown in Figure 1.

12 students attended two courses, and 1 student attended three courses.
* Outputs: Please specify number of doctoral students

Of the 98 participant students, 22 students were from Ph.D. programs from Chile and other countries and 15 students were from M.Sc. programs from Chile and other countries (Figure 2).

**Figure 2: Academic Background ASI XIII Students**
- Students per Course

**Symposium UV radiation and marine ecosystems: current research and strategies for the future (5-7 December 2012)**

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<tr>
<td>1</td>
<td>Gadiel Alarcón</td>
<td>M.Sc. in Oceanography</td>
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<tr>
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<td>Marcia Astorga</td>
<td>M.Sc. Student in Biochemistry &amp; Bioinformatics</td>
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<tr>
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<td>Angela Bahamondes</td>
<td>Undergraduate Student in Geophysics</td>
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<td>7</td>
<td>Luciano Caputo</td>
<td>PhD in Aquaculture</td>
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<tr>
<td>8</td>
<td>Marcela Cornejo</td>
<td>PhD in Oceanography</td>
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<td>9</td>
<td>Javiera de la Paz</td>
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<tr>
<td>10</td>
<td>Nathalie Delherbe</td>
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<td>Cynthia Escares</td>
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<tr>
<td>15</td>
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### Circulación y masas de agua en el Atlántico Sudoccidental (7-11 January 2013)

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<tr>
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<td>M.Sc. Student in Biosciences</td>
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<tr>
<td>18</td>
<td>Javier Rabellino</td>
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Why do diseases emerge in marine aquaculture? And what can we do to limit this? (7-11 January, 2013)

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**BRAZIL**

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**Trace metals in the oceanic carbon cycle (14-18 January, 2013)**

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Coastal Antarctic ecosystems and the case of the Larsen Ice Shelf System
(14-18 January, 2013)

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**Análisis de series de tiempo en ecología y oceanografía** (14-25 January, 2013)

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Chemical and biological characteristics of the oceanic phosphorus cycle (21-25 January, 2013)

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<td>4 Francisco Santibañez</td>
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<td>5 Jeannet Vera</td>
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**EXPENSES**

- **EXPENSES UNIVERSITY OF CONCEPCION GRADUATE SCHOOL**
  **US$** (1US$ = 471.54 CLP)

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<td>Per Diem Alberto Piola</td>
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<tr>
<td>Per Diem María Vernet</td>
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<tr>
<td>Airfare María Nielsdóttir</td>
<td>1,829</td>
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<tr>
<td>Lodging María Nielsdóttir</td>
<td>999</td>
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<tr>
<td>Per Diem María Nielsdóttir</td>
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<td>Item</td>
<td>Amount (US$)</td>
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<td>--------------</td>
</tr>
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- **EXPENSES UNIVERSITY OF CONCEPCION SCHOOL OF NATURAL AND OCEANOGRAPHIC SCIENCES**
  US$ (1US$ = 480 CLP)

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- **EXPENSES UNIVERSITY OF CONCEPCION DEPARTMENT OF OCEANOGRAPHY**
  US$ (1US$ = 480 CLP)

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- **EXPENSES UNIVERSITY OF CONCEPCION, COPAS SUR-AUSTRA**
  **US$ (1US$ = 480 CLP)**

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EXPENSES LIA MORFUN
US$ (1US$ = 480 CLP)

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EXPENSES UNIVERSITY OF CONCEPCION, VICE RECTORY OF RESEARCH AND DEVELOPMENT
US$ (1US$ = 480 CLP)

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### EXPENSES PARTNERSHIP FOR OBSERVATION OF THE GLOBAL OCEANS, POGO (1US$ = 477 CLP)

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<tr>
<td>Javier Rabellino</td>
<td>Uruguay</td>
<td>231</td>
<td>Circulación y masas de agua en el Atlántico Sudoccidental</td>
</tr>
<tr>
<td>Evangelina Garavento / Maria Luiza Fontes</td>
<td>Argentina / Brazil</td>
<td>377</td>
<td>Circulación y masas de agua en el Atlántico Sudoccidental</td>
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<tr>
<td>Catarina Cecilio / Melissa Carvalho</td>
<td>Brazil / Brazil</td>
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<tr>
<td>Ana Laura Pita / María Noé Espinosa</td>
<td>Uruguay / Uruguay</td>
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<td>Circulación y masas de agua en el Atlántico Sudoccidental</td>
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<td>Uruguay</td>
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<td>Trace metals in the oceanic carbon cycle</td>
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<td>Chile (Valparaíso)</td>
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<td>Coastal Antarctic ecosystems and the case of the Larsen Ice Shelf System</td>
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<tr>
<td>Paula Cossi / María Carolina Ribeyro</td>
<td>Argentina / Brazil</td>
<td>377</td>
<td>Coastal Antarctic ecosystems and the case of the Larsen Ice Shelf System</td>
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<td>Trace metals in the oceanic carbon cycle - Chemical &amp; biological characteristics in the oceanic phosphorus cycle / Análisis de series de tiempo en ecología y oceanografía</td>
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<tr>
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<tr>
<td>Jorge Nath / Carlos Quispe</td>
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### UNIVERSITY OF CONCEPCION, Tuition fee ASI XIII (1US$ = 477 CLP)

<table>
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<tr>
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<td>Verónica Ruiz / Guillermina Ruiz</td>
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<td>906</td>
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</table>

### EXPENSES FULBRIGHT COMMISSION – CHILE US$ (1US$ = 480 CLP)

<table>
<thead>
<tr>
<th>ITEM</th>
<th>AMOUNT (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airfare Maria Vernet</td>
<td>1,607</td>
</tr>
<tr>
<td>Honorarium Maria Vernet</td>
<td>2,800</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>4,407</strong></td>
</tr>
</tbody>
</table>
• EXPENSES EMBASSY OF FRANCE IN CHILE US$  (1US$ = 480 CLP)

<table>
<thead>
<tr>
<th>ITEM</th>
<th>AMOUNT (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lodging Gabriela Campana</td>
<td>372</td>
</tr>
<tr>
<td>Lodging Edgardo Henríquez</td>
<td>372</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>744</strong></td>
</tr>
</tbody>
</table>

2. Conferences and Meetings

Modelling: How does it help us understand aquatic animal health?
Date: Wednesday, January 9th 2013
Venue: Faculty of Natural and Oceanographic Sciences, Campus University of Concepcion
Speaker: Dr. Alexander Murray, Marine Scotland Science, Scotland

El destino de las aguas del Plata: viento, descarga continental y las corrientes de borde oeste del Atlántico Sudoccidental
Date: Thursday, January 10th 2013
Venue: Faculty of Natural and Oceanographic Sciences, Campus University of Concepcion
Speaker: Lic. Alberto Piola, Servicio Hidrográfico de la Armada, Argentina

LARISSA, the LARsen Ice Shelf System: Integrating biology, geology and glaciology to understand abrupt environmental changes in coastal Antarctica
Date: Wednesday, January 16th 2013
Venue: Faculty of Natural and Oceanographic Sciences, Campus University of Concepcion
Speaker: Dr. María Vernet, Scripps Institution of Oceanography, United States
**Iron biogeochemistry in (sub-) polar regions**

Date: Thursday, January 17th 2013

Venue: Faculty of Natural and Oceanographic Sciences, University of Concepcion

Speaker: Dr. María Nielsdóttir, National Oceanographic Center Southampton, United Kingdom

**The importance of species diversity for regulating biogeochemical fluxes: Insights from the biological carbon pump**

Date: Monday, January 21st 2013

Venue: Faculty of Natural and Oceanographic Sciences, University of Concepcion

Speaker: Dr. Ian Salter, Observatoire Oceanologique de Banyuls-sur-mer, France

3. **Missions / Travels abroad**
   Destination; Purpose; Duration; funding sources; Outputs
   * None

4. **Visiting professors / Fellowships**
   Number; Duration; University of origin; funding sources
   a. As reported in section III

5. **Information and documentation activities**
   * Web page: www.udec.cl/oceanoudec/oceanografia
   * Multimedia material (n/a)
   * Poster ASI XIII (Attachment 1)
   * Course Reports by Lecturers (Attachment 2)

IV. **Impact**

Please describe shortly (one page maximum) the impact of the mentioned activities on the human, social, economic and cultural development at national, regional or international level.

Almost one hundred students were trained in specialized aspects of oceanography this year at the Austral Summer Institute of the UNESCO IOC Chair in Oceanography. Since this inception, the Chair was devoted to building capacity at the graduate level in the region and we will continue with. The success of the
activity is shown first of all by the number of applications received, the interest shown by the student participants, and the willingness of renowned scientists worldwide to spend time with students of the South-American region. This has resulted in the first interaction of future scientists with senior researchers that has opened up opportunities for graduate studies.

V. Forthcoming activities

The Chair will continue developing the Austral Summer Institute (ASI) at University of Concepción with the possibility of integrating this activity with those of Campus do Mar. Campus do Mar is a project lead by Universidad de Vigo and sponsored by the three Galician universities, the Spanish Council of Scientific Research (CSIC) and the Spanish Institute of Oceanography. This could mean replicating the Austral Summer Institute in Spain and Chile.

VI. Development prospects

Please see Forthcoming activities above

Annex 1

Target groups

Undergraduate students: 18

M.Sc.: 19

M.Sc. Students: 16

PhD Students: 21

PhD: 13

Professionals: 11
Annex 2

Geographical Coverage

• National

(Includes international graduate students at University of Concepcion): 73

• Regional

Please specify countries and regions

Africa

Arab States

Asia/Pacific

Eastern and Central Europe

Western Europe and North America: (France and Canada) 2

Latin America: (Argentina, Brazil, Ecuador, Colombia, Cuba, Peru, Uruguay): 23

• Interregional

Please specify regions

• International
### Annex 3

#### Funding Sources

<table>
<thead>
<tr>
<th>Funding Source</th>
<th>Type of Organization/Institution</th>
<th>Period</th>
<th>Amount (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNESCO Contribution</td>
<td></td>
<td>April 2012 /January 2013</td>
<td>0</td>
</tr>
<tr>
<td>Other Contributions:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Host Institution</td>
<td>Host Institution Graduate School UDEC</td>
<td>May 2012 /January 2013</td>
<td>10,194</td>
</tr>
<tr>
<td>Host Institution</td>
<td>Host Institution School of Natural and Oceanographic Sciences, UDEC</td>
<td>April 2012 /January 2013</td>
<td>1,929</td>
</tr>
<tr>
<td>Host Institution</td>
<td>Host Institution Department of Oceanography, UDEC</td>
<td>December 2012 /January 2013</td>
<td>1,755</td>
</tr>
<tr>
<td>Host Institution</td>
<td>Host Institution COPAS Sur-Austral, UDEC</td>
<td>April 2012 /January 2013</td>
<td>15,554</td>
</tr>
<tr>
<td>Own resources, tuition fee</td>
<td></td>
<td>January 2013</td>
<td>1,836</td>
</tr>
<tr>
<td>LIA MORFUN</td>
<td></td>
<td>October 2012</td>
<td>9,265</td>
</tr>
<tr>
<td>Partnership for Observation of the Global Oceans (POGO)</td>
<td></td>
<td>January 2013</td>
<td>5,000</td>
</tr>
<tr>
<td>Source</td>
<td>Date</td>
<td>Amount</td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------------</td>
<td>-----------------</td>
<td>--------</td>
<td></td>
</tr>
<tr>
<td>Fulbright Commission/Chile</td>
<td>January 2013</td>
<td>4,407</td>
<td></td>
</tr>
<tr>
<td>Embassy of France in Chile</td>
<td>December 2012</td>
<td>744</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>50,684</strong></td>
<td></td>
</tr>
</tbody>
</table>

The Austral Summer Institute XII collected US$ 3,000 from tuition paid by 12 students. Funds are in a dedicated account (UNESCO Chair) administered by the School of Natural Sciences and Oceanography.
Annex 4 (N/A)

Outputs Form 1: Publication

Title of activity: ________________________________
Title: Author(s) Publisher(s) Year
Number of pages
Type of document/material
Book
Periodical
Others (specify, please) _________________________
Teaching / learning material
Language(s) _________________________________
Main keywords (4 or 5)
SHORT ABSTRACT
(Brief description of the content in English, French or Spanish)

Annex 5 (N/A)

Outputs Form 2: Multimedia material
Title of Activity:
Title:
Producer and/or distributor (with address):
Year:
Teaching/learning material
Type of material:
Video
CD ROM
Videoconference
Other type of material
(Please specify): _______________________________
Duration:
Format:
Language(s):
Main keywords (4 or 5):
ETWARYSING LEKRAJ
St Joseph Road, Terre Rouge.
Telephone: +00(230) 2482777
Cell Phone: +00(230) 7144889, 9515476
Email: etwarysing.lekraj09@gmail.com

PERSONAL INFORMATION

Date of Birth: 9th July 1988
Place of Birth: SSRN Hospital, Pamplemousses
Citizenship: Mauritian
Gender: Male
Marital Status: Single
Languages: English, French, Creole and Hindi

EDUCATION/QUALIFICATION

2009-2012: University of Mauritius (UOM), Bachelor’s Degree in Marine Science and Technology (with Honours) with Second Class First Division.


2008: General Certificate of Education (GCE), A-Levels.
University of Cambridge Advanced-Levels (A-levels) General Certificate of Education (Mathematics (C), Chemistry (D), and Physics (D))

2006: General Certificate of Education (GCE), O-Levels.
University of Cambridge General Certificate of Education (English Languages (C))

University of Cambridge Ordinary-Levels (English Languages (D), French (B), Mathematics (A), Additional Mathematics (B), Chemistry (B), Physics (B), and Biology (C))

OTHER QUALIFICATION/SKILLS


Diving: PADI Open Water, PADI Advanced Open Water (expected AUG 2012).

First Aider Certification, BSSR School of Para Medical Studies Ltd.

Computer Literate, Certificate in Information and Communication Technology (IC³), Ministry of Information Technology and Telecommunications, 2008.
WORKSHOPS AND CONFERENCE ATTENDED


“Seaweed Biodiversity and Biogeography”, University of Mauritius and University of Cape Town, 4th–8th July 2011.

“Biogeochemical Cycling in Coral Reefs and its links to Climate Change”, University of Mauritius & Shizuoka University Japan, 26th – 28th April 2011.


EMPLOYMENT HISTORY

June 2012- present: Reef Conservation (Mauritius) - Volunteer Project Assistant.

Non-Governmental Organization (NGO) which works on projects concerning the restoration of several lagoons and on various sensitization campaigns. Developed communication skills with locals mainly school children, sampling techniques, underwater photography skills and monitoring skill.

August 2012- present: University of Mauritius (UOM) – Conduct Survey.

Currently working on a survey, “Assessing the vulnerability of coastal communities due to climate change”, in collaboration with/under the supervision of a researcher from the University of Mauritius. Developed interpersonal skills and team work.

October 2011- February 2012: University of Mauritius (UOM) – Disc Jockey (DJ).

DJ at UOM Radio Campus. Worked as a team and developed skills such as time management.


Developed skills in customer service, team work and work under pressure.


REFEREES

(1) Ranjeet Bhagooli (PhD, MSB)
Department of Biosciences,
Faculty of Science,
University of Mauritius,
Le Réduit.

Ph: +00(230) 4037916
E-mail: r.bhagooli@uom.ac.mu

(2) Bahorun Theeshan (PhD, MSc)
Department of Biosciences,
Faculty of Science,
University of Mauritius,
Le Réduit

E-mail: tbahorun@uom.ac.mu
Progress report on the International Research Cruise Information Database and web-site - a joint POGO-CoML-NOAA initiative

Status: 30 September 2013

PROJECT OVERVIEW
To develop, update and maintain an international cruise information database to facilitate resource sharing and information exchange related to past and planned research cruises.

ACCOMPLISHMENTS/PROGRESS/STATUS
The POGO Cruise Information Database (www.pogo-oceancruises.org) was launched in May 2007 and is maintained by the British Oceanographic Data Centre (BODC). The website focuses on vessels greater than 60m in length and incorporates three major databases, including a research vessel directory, a cruise programme database and a database of Cruise Summary Reports (these are completed at the end of a cruise and describe the measurements made. They are quite widely used in Europe, but not in North America. Japan also uses them. They were developed by IOC’s International Oceanographic Data and Information Exchange (IODE) programme).

The priorities for the remainder of 2013 and for 2014 are:

- Continue requesting cruise programmes and enter into database, including updates to 2013 programmes and 2014 (and beyond) cruise programmes
- Continue to work with operators to improve timeliness and content of cruise programme information
- Develop links with POGO members not currently supplying information, through POGO contacts and also ship operators (ISOM), making a special effort to contact and obtain information from Brazil, Canada, India, South Korea, and Russia
- Utilise spreadsheet input for preliminary Cruise Programme from CCHDO, IOCCP and GO-SHIP and other sources
- Improve links with other projects and programmes including Argo, OceanSITES, IMBER, SOLAS, GEOTRACES and EURO-BASIN
- Advertise to other organisation and request links on their web-sites (e.g. IOC/IODE, ISOM, ESOM, GOSIC, national ship operator sites, UNOLS, R2R, SeaDataNet)
- Develop links with JCOMMOPS (in particular the Ship Logistics Coordinator) possibly leading to exchange of information through Web Map Services (WMS)
- Routine maintenance of the system and web-site – including ensuring the research vessels database is kept up to date
- Synergy from working with EU EUROFLEETS-2 project, including:
  Encourage more automatic input of cruise programme information by using software developed by SeaDataNet (Mikado). This allows one to map the fields of a database into the
agreed standard fields. When this has been done once, it is a simple matter of running the software to generate the information in the required format, including using the standard codes/dictionaries. Simple checks can also be incorporated (e.g. checking that the end of the cruise is after the start). This should improve efficiency and remove the need for most of the manual checking and editing.

1. Cruise Programme Database
The cruise programme database currently includes details of about 2700 cruise programmes covering 60 research vessels from 20 countries. The table below indicates the content by year since 2007 when the project began. Since the start of the project cruise programmes have been regularly supplied by Australia, Belgium, France, Germany, Japan, Netherlands, Norway, Sweden, UK and USA (UNOLS including Bermuda); more recently Greece, Ireland, Italy, Portugal, Romania and Spain have provided input. Some cruise programmes have also been provided by China, Finland and Iceland. Work has continued with UNOLS to finalise a more automatic flow of cruise programme information (~150 cruises for large ocean going vessels, plus further cruises for regional cruises) which can be regularly updated during the year. A similar approach is being established for UK vessels.

A review of possible contacts was carried out and subsequently requests for new information were sent out. This has elicited the following responses:

<table>
<thead>
<tr>
<th>Country</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>Updated information received from CSIRO. E-mail also sent to AIMS.</td>
</tr>
<tr>
<td>Brazil</td>
<td>Response received that the information will be submitted after the week of 25th Sept 2013</td>
</tr>
<tr>
<td>Iceland</td>
<td>Response received containing new contact details. Information for 2014 will be provided when available.</td>
</tr>
<tr>
<td>Indonesia</td>
<td>Response received that the research vessel is less than 60m. Replied that even though vessel is less than 60m, we will be pleased to include cruise programme information.</td>
</tr>
<tr>
<td>Japan</td>
<td>Response received and questions have been answered. Cruise programme information under preparation.</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>Response received saying that they will be ready to share information in a few months.</td>
</tr>
</tbody>
</table>

These will be followed up again if no programmes are delivered over the next month. Requests for new information, and reminders, have also been sent to the following countries so far with no response: Argentina, Bahamas, China, Ecuador, Malaysia, Mexico, NATO, New Zealand, Pakistan, Panama, Peru, Russia, South Africa, South Korea, Taiwan, Thailand, and Ukraine. Regular reminders are being sent to these countries.
<table>
<thead>
<tr>
<th>Year</th>
<th>No. of programmes</th>
<th>No. of Countries</th>
<th>No. of vessels</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>537</td>
<td>13</td>
<td>32</td>
</tr>
<tr>
<td>2008</td>
<td>494</td>
<td>13</td>
<td>40</td>
</tr>
<tr>
<td>2009</td>
<td>357</td>
<td>14</td>
<td>35</td>
</tr>
<tr>
<td>2010</td>
<td>392</td>
<td>14</td>
<td>32</td>
</tr>
<tr>
<td>2011</td>
<td>474</td>
<td>12</td>
<td>33</td>
</tr>
<tr>
<td>2012</td>
<td>450</td>
<td>14</td>
<td>37</td>
</tr>
<tr>
<td>2013</td>
<td>213 (+208 UNOLS)</td>
<td>13</td>
<td>26</td>
</tr>
<tr>
<td>2014</td>
<td>22</td>
<td>2</td>
<td>5</td>
</tr>
</tbody>
</table>

**Table 1: Number of cruise programmes received per year**

Ship operators are provided with a blank spreadsheet and guidance notes to assist in completion of the spreadsheet. Wherever possible they are encouraged to extract from their own databases rather than re-type information. The ship operators who have replied are cooperative but, in general, do not have a lot of time to spend on this or have other more pressing priorities. The databases maintained by the various ship operators are all different and where information is provided on their web-sites it is often in the form of pdf files with variable amounts of detail, so this is not suitable for software (e.g. web services) to automatically access. We request that the SeaDataNet vocabularies are used in the spreadsheet, but even when the BODC vocabularies are listed, these are not often used – although this has improved for European contributors with the EUROFLEETS projects. This means that work has to be done at BODC translating the information into the appropriate codes. Information is currently being requested for 2014 cruises (and 2015, etc., if available).

Software has been developed to enable smooth flow of cruise programme information from UNOLS with little manual intervention (and include all their ships). Although this software is operational, a decision by the US Navy not to publically release information about the region to be visited by forthcoming cruises has hampered implementation. UNOLS information for 2013 has not been loaded to the database. It might be possible to acquire some geographic information if the ship name is not provided. This will be followed up with UNOLS.

When contacting information suppliers the importance of providing information to the Cruise Programme Database to better meet Argo needs. For the Cruise Programme Database to be of maximum use to Argo the following is required: information available at least 6 months ahead (preferably 1 year), improved information about working area for the cruise (e.g. image of planned cruise track), name of PI/Chief Scientist and contact details. The name of the research vessel is not necessary at this time, and it is understood that the information may be preliminary, especially if it is provided a long time in advance. We are continuing to work with Argo, in particular with the international Argo Data Management Team and European Argo projects, to improve the Cruise Programme Database.

To improve the flow of information in a more automated way to the cruise programme database, the SeaDataNet Mikado software has been adapted and extended for use with cruise programme information. The Mikado software allows one to map the fields of a database (e.g. in this case
that maintained by a ship operator) into the agreed standard fields. When this has been done once, it is a relatively simple matter of running the software to generate the information in the required format (as XML files), including the use of the standard codes/dictionaries, which can be forwarded to BODC. Checks can also be incorporated (e.g. checking that the end of the cruise is after the start). This should improve efficiency and remove the need for most of the manual checking and editing.

The website includes an initial browse facility giving summary information on the left hand side of the web page; this shows the number of cruises undertaken by vessel name, country of operator, discipline (e.g. physical, chemical, biological), sea area and cruise status (planned, underway, completed). It also provides a quick link to search by geographic area (latitude/longitude range) and time period. A more advanced search facility, which allows searching by a combination of items is also available. Coloured dots indicate whether a cruise is planned, currently taking place, or has been completed. There is also an option to show if the cruise has been cancelled. This is updated automatically for the in progress and completed cruises.

One of the continuing problems encountered is the lack of geographic information – most operators will provide some general description of the area to be visited, but do not have latitude-longitude ranges available in their own systems. BODC add these in, but this is a time consuming exercise. Some cases are reasonably straightforward, others may only have a text description (e.g. Porcupine Abyssal Plain, Off Omaezaki, Sagami Bay). The latitude/longitude range is important to the cruise programme database as it is the basis for the geographic searching, and this information is viewed on a map. Provision of good geographic information has been stressed when requesting information for the Cruise Programme Database.

The online Content Management System (CMS) for the cruise programme information, established in 2008, is in regular use by NIOZ, Netherlands, for RV Pelagia cruises, and in 2013, has been adopted by Germany for their 7 vessels. The CMS can be reached at the POGO International Cruise Information Database web-site (www.pogo-oceancruises.org) and selecting “Planned Cruise Programmes” and “Updating Cruise plans via the online Content Management System” or directly at: www.pogo-oceancruises.org/vu_cruises/welcome.asp

Until this year system had been designed so that:

- Each operator can only manage its own records AND for a fixed set of vessels
- Where a vessel is shared and thus operated by two (or more) operators, each operator manages and sees only its own records (see e.g. Argos in Sweden)
- The CMS works on the basis that the account holder is also the operator - thus they cannot change the operator.

During 2013, the CMS was upgraded to allow more flexibility for updating and to allow a national contact rather than the ship operator to enter and update records. So now BSH, Germany, can add and update the cruise programmes for the 7 vessels for which it provides information even though they belong to different operators. This should also encourage more regular updating.
Regular checks are made on the GO-SHIP site to look for new information. GO-SHIP receives and disseminates information about forthcoming cruises from the International Ocean Carbon Coordination Project (IOCCP) and the Climate Variability and Predictability Program (CLIVAR). Note that the GO-SHIP cruise programme information was last updated ?? these details may be quite sparse, and will be initially marked preliminary, and updated with more detailed information as plans are confirmed, and care taken that duplicate entries are not created.

The EU-funded ‘EUROFLEETS: Towards an Alliance of European Research Fleets’ (www.eurofleets.eu) is a four year Integrated Infrastructure Initiative (I3) FP7 project running from September 2009-August 2013, with 24 partners and coordinated by Ifremer, France. One work package, WP2: Virtual research fleet platform, which is led by Maris (our partner for the POGO work) and including BODC, is based on the same databases (programmes, vessels, cruise summary reports) as the POGO system, and includes regional vessels as well as ocean-going ones. The system utilises and builds on the developments carried out for POGO, and POGO in turn will benefit from an enhanced system. In particular the EUROFLEETS project will develop more automatic harvesting from the operator databases and refresh the information at regular intervals using the SeaDataNet Mikado software (described above). These developments are beginning to improve information provision from the project partners. A follow-on EUROFLEETS project began in 2013, with an increased number of partners, which will continue to develop the virtual research fleet platform, including the cruise programme database for European research vessels.

2. Global Directory of Ocean-going Research Vessels
The Global Directory of Ocean-going Research Vessels has been operational since early July 2007. It has been developed by EurOcean with support of MARIS and it contains characteristics, owners and operators’ information for ocean-going research vessels. The content format conforms to the Oceanic database, operated by the University of Delaware. This global directory has been developed as a special version online research vessel directory for all European vessels previously developed by EurOcean, which can be found at the EurOcean portal (www.eurocean.org). It contains up-to-date information on ocean-going Research Vessels, operated worldwide, and is accessible from the www.pogo-oceancruises.org website.

The Directory software was upgraded to enable research vessel operators to maintain the vessel information themselves by an online Content Management System. During the second half of 2007 European operators were invited by EurOcean to validate and improve the entries for their vessels. Subsequently the identified operators of these non-European vessels have been invited to validate and update their entries, using the online Content Management System.

The Research Vessel Directory now contains facts and figures of approximately 170 Research Vessels. The Research Vessels are provided with a ship code, identifying a unique hull, through cooperation with ICES, US NODC and BODC. These ICES ship codes are used in each of the 3 databases in the full POGO system as linking pin. There are nine vessels in the database which are less than 60m in length of which Belgica is the shortest at 50.90m. Cruise programmes for vessels less than 60m unless have not been specifically requested unless it was deemed useful to do so (e.g. Bermuda with Atlantic Explorer at 51m), or the operator requested it (e.g. Finland, with Aranda at 59.80m, Belgium with Belgica).
3. Cruise Summary Reports (CSR) database and Content Management System (CMS)
The Cruise Summary Report (CSR) database has been developed by BSH/DOD, Germany. It focuses on details of completed cruises and provides a first level inventory of oceanographic measurements made and samples taken. The ROSCOP (Report of Observations/ Samples Collected by Oceanographic Programmes) was conceived by IOC/IODE in the late 1960s in order to provide an inventory for tracking oceanographic data collected on Research Vessels. The ROSCOP form was extensively revised in 1990, and was re-named the Cruise Summary Report (CSR). Most marine disciplines are represented in the CSR, including physical, chemical, and biological oceanography, fisheries, marine geology/geophysics, marine contamination/pollution, and marine meteorology. Traditionally, it is the Chief Scientist's obligation to submit a CSR to his/her National Oceanographic Data Centre (NODC) not later than two weeks after the cruise. In the past these have been periodically transmitted to the ICSU World Data Centres for Oceanography and to ICES.

The CSR activity gained new momentum in Europe during EU-funded marine data management projects EURONODIM and Sea-Search under the lead of BSH/DOD, Germany. The combined ICES and Sea-Search/SeaDataNet CSR database now comprises details of approximately 40,000 oceanographic research cruises primarily from Europe and North America, some information extending back over the last 40 years. This ongoing CSR database can be found via the POGO research cruises website at www.sea-search.net/roscop.

As part of the POGO-CoML-NOAA initiative BSH/DOD has developed a special version of the CSR database, that gives access to Cruise Summary Reports of all ocean-going vessels worldwide larger than 60 metres. It is directly accessible from the www.pogo-oceancruises.org website. There is an online Content Management System (CMS) to allow Chief Scientists and NODCs of countries outside Europe to prepare and deliver their Cruise Summary Reports. This is now available and linked into the International Research Cruise Information system. It can be found at: http://seadata.bsh.de/csr/online/pogo_index.html. The general login/password is csonline/jellyfish. A short User Guide is available.

Retrieval software has also been developed in line with that used for SeaDataNet, but with the POGO “look and feel” and limited to POGO ships. This allows searching of all cruise summary reports provided to BSH, including those supplied before the POGO system was developed, but restricted to the larger research vessels. Links have also been implemented between the cruise programme part of the system and the CSR database.

HIGHLIGHTS
The Cruise Programme Database continues to be operational and contains approximately 2700 cruise programmes from 20 countries. Requests and reminders for 2013 cruise programmes are underway. Further links are being developed with Argo and Euro-Argo to ensure that the Cruise Programme Database meets their needs.

The Research Vessels Database continues to be operational and updates and amendments have been made during the year. Vessel operators have access to the database and are able to update details of their own vessels.
The Cruise Summary Report (CSR) database is operational for input of new CSRs and searching of existing ones. It is linked into the POGO Cruise Information site.

Outreach activities since January 2013 have been twofold: (i) at the final EUROFLEETS annual meeting (October 2012), the POGO research cruise information system was described – and as noted above, it has formed the basis for the EUROFLEETS system, and (ii), at the SeaDataNet plenary meeting and associated IMDIS conference.

The figure below shows access to the POGO Research Cruise Information System web-pages during 2013 (January to September). It shows fairly regular usage, with slightly higher numbers of visitors than in the previous 3 years, and a large peak in the number of visits during spring 2013. This coincides with the conclusion of EUROFLEETS and the commencement of EUROFLEETS-2. These figures exclude robots/spiders, etc. visiting the site.

![Figure 1: Usage statistics for 2013 (January to September)](image)

<table>
<thead>
<tr>
<th></th>
<th>2013</th>
<th>2012</th>
<th>2011</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average number of unique visitors/month</td>
<td>341</td>
<td>331</td>
<td>311</td>
<td>270</td>
</tr>
<tr>
<td>Average number of visits/month</td>
<td>726</td>
<td>473</td>
<td>451</td>
<td>388</td>
</tr>
<tr>
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SOCIETAL BENEFITS
The project was undertaken to enhance resource sharing and information exchange related to past and planned research cruises. Benefits include:

- Helping scientists from different countries coordinate future funded research through information about research vessels of opportunity;
- Aiding in retrospective ability to find data in regions of interest;
- Making it possible for projects to conduct joint work and to fill empty berths;
- Creating capacity-building and training opportunities;
- Aiding in tracking and distributing data;
- Allowing cost sharing among institutions, projects, and nations;
- Making possible intercomparisons, intercalibrations, and validation among different data types (e.g. CTD vs. Argo, in situ vs. remote sensing).
Need for a global, long-term programme for ecological monitoring

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Next year, the United Nations aims to complete its first World Ocean Assessment, a process akin to the regular reporting of the Intergovernmental Panel on Climate Change. The assessment is timely and crucial: the world’s oceans are threatened by many anthropogenic stressors, from pollutants, nutrient runoff and overfishing to warming, deoxygenation and acidification. Current ocean-observation programmes are not fit for purpose.

Variables such as temperature, salinity and chlorophyll levels are monitored globally by satellites, water-column-profiling floats and moored sensor arrays. Ecological monitoring of marine systems, by contrast, is woefully inadequate and has been too long dismissed as too hard and too costly. As a result, the phytoplankton, zooplankton and micronekton (krill and small fish) that comprise the bulk of ocean ecosystems are examined on an ad hoc basis, rather than systematically.

Most natural ocean processes vary on annual to decadal timescales. To identify shifts resulting from climate change, observations need to span 50 years or more. Neglect of ecological monitoring has left the ocean-science community effectively bereft of such long-term data. The Census of Marine Life, for example, is an international effort that aims to characterize marine biodiversity, but over only a decade. Today, there are just two ecological data sets that are sufficiently long to fit the bill — and each has limitations.

A global ocean-observation network needs to be established within the next five years to provide baselines against which ocean health can be assessed in the coming century. Alongside physical oceanographic data, such a network must track the status of species in marine ecosystems around the world.

Ecological time series are the Cinderellas of ocean science: long-neglected drudges, eking out their existence at the edge of what is in fashion, they now find themselves in favour at the climate change ball.

Their dismal state was brought home last year when one of us (J.A.K.) reported a 63% decline in the abundance of 24 species of mid-water (mesopelagic) fish off the coast of California, apparently in response to reduced oxygen levels at those depths (200–1,000 metres). The study was based on ecological and oceanographic time-series data from the California Cooperative Oceanic Fisheries Investigations (CalCOFI), which has sampled the waters off southern California since 1951. The results had wide ramifications.

Reduced oxygen levels at mid-ocean depths are a predicted consequence of global warming, because temperature affects ocean stratification, mixing and ventilation. Southern California waters contain a diverse mix fish species, the habitats of which extend to both the cooler northern Pacific and warmer subtropical waters. On setting up a special session at the 2012 annual meeting of the North Pacific Marine Science Organization to examine trends across the northern Pacific, where similar oxygen declines had been reported, it emerged that there are no other time-series data sets for the mid-water fauna.

Monitoring what happens at mid-ocean depths is crucial for judging marine health. This layer is the metabolic engine of the ocean: 90% of the organic matter that sinks from the surface is processed there. Many more species of fish live at mid-ocean depths than near the surface.
The global biomass of mesopelagic fishes is estimated to be 1 billion–10 billion tonnes — more than an order of magnitude greater than that of commercial marine fish landings, which is less than 100 million tonnes. Many fishes reside at mid-water depths in the day to avoid predators, and rise towards the surface to feed at night in the largest animal migration on Earth. As major consumers of zooplankton and prey of higher predators, mid-water fishes are a key vector in the transport of carbon to the deep ocean.

So, why are there so few time series for marine ecosystems? Most ocean observations come from coastal or fishery programmes. Coastal stations record quantities that are easy to measure from a pier (temperature, salinity and chlorophyll), are crucial to water quality (algae, nutrients and oxygen levels) or conditions that are relevant to local shipping (winds, waves and currents). Fishery surveys focus on commercially exploited species. Most oceanographic sampling is limited to variables that can be measured routinely from ships, moorings, gliders and floats.

In the 1990s, the Global Ocean Observing System (GOOS), developed by the UN’s Intergovernmental Oceanographic Commission, held out promise for a worldwide monitoring network. But funding has limited its achievements to predominantly physical measurements — the low-hanging fruit. As part of the open-ocean GOOS programme, the Argo project successfully seeded the world’s oceans with some 3,000 floats to profile temperature and salinity. But the coastal GOOS programmes focused on easy observations and local hazards.

Few GOOS operations are systematic. The United States, for example, is served by 11 regional associations, each with its own instrumentation. Assessments speak of the lack of ecological observations as a persistent ‘gap’ in the programme. In November, GOOS will be holding its first Expert Workshop in Townsville, Australia, to establish panels to cover biogeochemistry, and biology and ecosystems. The need is pressing.

Thanks to Argo and satellites, there is now excellent coverage of temperature, salinity and chlorophyll for a good proportion of the world’s oceans. But there are still few ecological time series, in particular species-level data for the plankton that form the base of marine food webs.

Plankton can be surveyed using simple technology. Some of the strongest evidence of climate-linked changes in zooplankton abundance has come from the Continuous Plankton Recorder (CPR) survey of the North Sea and north Atlantic, dating to 1946. The rugged CPR instrument (originally brass but now stainless steel) samples the plankton while being towed by merchant ships on regular routes. The plankton are embedded on a silk strip and spooled into a tank of the preservative formaldehyde, then their species identified. The resulting time-series data have proved to be a treasure trove for understanding the ebb and flow of plankton and fish populations in relation to natural climate oscillations in the north Atlantic and to climate warming.

The longevity of the CPR programme is due to its simplicity. CalCOFI, conversely, is a comprehensive project that endeavours to monitor the oceans from ‘winds to whales’. As a joint programme between the Scripps Institution of Oceanography in La Jolla, California, and the state and federal agencies responsible for fisheries since 1949, CalCOFI’s quarterly acoustic and egg and larval surveys provide data to assess commercial species such as sardine, anchovy and hake.

From the outset, the CalCOFI surveys have been embedded in a suite of observations of the fishes’ physical and biological environments. They yield much of our understanding of how the California Current ecosystem responds to drastic fluctuations in temperature and
productivity caused by the El Niño cycle, an abnormal warming of ocean waters in the eastern tropical Pacific, as well as to decadal changes in ocean currents and to climate change.\(^9\)

As well as CPR and CalCOFI, there are notable programmes being set up or expanded. These include the Japanese Odate project, which analyses zooplankton collections off the coast of Japan for their species composition. But it remains to be seen whether these programmes will run long enough to identify climate-related changes.

Today, the ocean-science community is in the embarrassing position of being asked to assess the state of the world’s oceans but lacking the means to do so. Yet it is technically and economically feasible to develop multidisciplinary programmes along the lines of CalCOFI that simultaneously meet marine-management, conservation, scientific and infrastructure needs.

The CalCOFI programme costs about US$5 million a year. Instituting similar initiatives globally to cover the roughly 50 large marine ecosystems that characterize the bulk of ocean life\(^10\) would amount to about $250 million a year. If efforts were coordinated across existing fisheries and environmental-monitoring schemes, the extra cost would be lower.

The United States would need only to find $30 million a year to monitor its six large marine ecosystems. This amount approaches the projected $55-million yearly running cost of the US Ocean Observatories Initiative (OOI), the $386-million infrastructure cost of which has been agreed by the US National Science Foundation. From 2015, the OOI will provide a range of physical, chemical, geological and biological observations for a few slices of the ocean over 25 years, but only a few of the species-level observations that are required to assess ecosystem status.

The impending World Ocean Assessment makes clear that the ad hoc ocean-monitoring arrangements developed since the mid-twentieth century are poorly suited to current needs. Ecological baselines need to be established and time series maintained. This essential task is neither too difficult nor too costly. We hope that the upcoming GOOS workshop will mark a watershed.

Ocean Exploration’s Second Decade
Decadal Independent Review of the U.S. Ocean Exploration Program Invited by NOAA Science Advisory Board

In February 2012 the chairman of the NOAA Science Advisory Board (SAB), Raymond Ban, invited an expert review of our nation’s Ocean Exploration Program, for which NOAA is the lead agency through its Office of Exploration and Research (OER). The charge to the reviewers is available at http://explore.noaa.gov/about-oer/ under the “Program Review” tab.

The members of the Panel, operating as a working group of the SAB, were chosen to span domains of ocean exploration (e.g., geology, biology, archaeology); the public and private sectors; science, technology and education; and individuals with and without prior involvement with the Ocean Exploration program. Co-chairs Jesse Ausubel and Paul Gaffney met in person three times with professional staff members of the Ocean Exploration program before the meeting of the full group. The professional staff members carried out an extensive historical documentation of the program, as well as a written self-evaluation to the Panel. The full panel met May 7-8, 2012 in Silver Spring, MD.

Many members of the NOAA Ocean Exploration and Research program office attended the two-day meeting, as well as representatives of other Federal agencies and leading non-governmental participants, including Robert Ballard and Larry Mayer, co-chairs of the former Ocean Exploration Advisory Working Group to NOAA’s SAB. The presentations from the meeting are available, together with other materials relating to the review at http://explore.noaa.gov/about-oer/ under the “Program Review” tab.

The Panel relied on Ocean Exploration Program staff, the Ocean Exploration Advisory Working Group Co-chairs, and others during the review meetings. These participants included: Larry Mayer (co-chair, Ocean Exploration Advisory Working Group), Bob Ballard (co-chair, Ocean Exploration Advisory Working Group), Michael T. Jones (Chief Technology Advocate, Google, Inc.), David Balton (Deputy Assistant Secretary for Oceans and Fisheries, State Department), Brian Midson (National Science Foundation), Katy Croff Bell (Ocean Exploration Trust), Bob Detrick (Assistant Administrator, Office of Oceanic and Atmospheric Research (OAR)), Craig McLean (Deputy Assistant Administrator, OAR), Cynthia Decker (Executive Director, NOAA SAB), Tim Arcano (Director, OER), John McDonough (Deputy Director, OER), Sharon Hamilton (OER), Steve Hammond (OER), Fred Gorell (OER), Paula Keener (OER), David McKinnie (OER), Sharon Mesick (OER), Jeremy Potter (OER), Craig Russell (OER), Court Squires (OER), Nathalie Valette-Silver (OER)
The Panel offers one finding and ten recommendations.

**Finding:**
There is undiminished motivation for ocean exploration.

**Recommendations:**
1. Strategic Goals and Priorities
2. NOAA Leadership Support Required
3. A National Forum on Ocean Exploration
4. Radical New Management Models
5. Targeted Expeditions
6. *Okeanos Explorer*
7. Technology
8. Extended Continental Shelf
9. Branding
10. Ocean Exploration Advisory Board

program in ocean exploration in which discovery and the spirit of challenge are the cornerstones. Multidisciplinary exploration approaches, covering all three dimensions of space, as well as the fourth dimension of time, should include natural and social sciences as well as the arts. The U.S. Ocean Exploration Program should be global in scope, but concentrated initially in areas under U.S. jurisdiction. Results must be carefully documented and widely disseminated; the program must be innovative and bold.

The 2000 Panel recommended the U.S. government establish the Ocean Exploration (OE) Program for an initial period of 10 years, with new funding at the level of $75 million per year, excluding capitalization costs. The 2000 Panel recommendations are listed to the right.

The present Panel affirms the brief definition of exploration of the 2000 Panel: Exploration is the systematic search and investigation for the initial purpose of discovery and the more elaborated definition of the US Navy: Systematic examination for the purposes of discovery; cataloging/documenting what one finds; boldly going where no one has gone before; providing an initial knowledge base for hypothesis-based science and for exploitation.

The Panel affirms that Ocean Exploration is distinct from comprehensive surveys (such as those carried out by NAVOCEANO and NOAA Corps) and at-sea research (sponsored by National Science Foundation, Office of Naval Research, and other agencies), including hypothesis-driven investigations aimed at the ocean bottom, artifacts, water column, and marine life.

The present Panel finds undiminished motivations for the U.S. National Program in ocean exploration. In fact, spurred in part by the OE program, a renaissance of ocean exploration has occurred during the past decade, both nationally and globally. Most famously, in March 2012 “Titanic” film director James Cameron’s vertical torpedo visited the Mariana Trench’s Challenger Deep, Earth’s deepest valley. The first human to visit the Challenger Deep since 1960, Cameron descended in 2 hours and 36 minutes and ascended in a remarkable 70 minutes. The project involved many partners, including the National Geographic Society, Rolex Corporation, Alfred P. Sloan Foundation, and Cameron’s own enterprises. It attracted billions of web hits, more than any prior event. Among other highly visible ventures in ocean exploration during the past decade were the cooperative international Census of Marine Life, the Russian flag-laying at the North Pole seafloor, and the renewed visits to the RMS Titanic.
As the documentation prepared by the OE program proves, OE has itself, and more often in partnership, generated impressive successes in science (for example, in discovery of new species and of unexpected locations of outgassing methane); mapping (for example, in parts of the Arctic Extended Continental Shelf); education (through innovative use of telepresence multiplying the number of young Americans experiencing exploration); and politics and diplomacy (for example, in unprecedented joint programs exploring Indonesian waters). The quantity of success in relation to cumulative expenditure through the OE program’s first decade (about $185 million in direct expenditures) motivates continuation.

Moreover, the present panel finds the work of the Ocean Exploration program is unfinished. For example, vast areas of the Arctic and Eastern Pacific remain unexplored. Vast volumes of mid-waters of the deep ocean, Earth’s largest habitat, also remain unexplored. And new technologies and sensors make revisiting areas that were explored with older approaches fresh and urgent. Immense areas of the U.S. ECS and EEZ have still not been mapped in a contemporary way, much less systematically sampled.

Since Benjamin Franklin took measurements of what he called the Gulf Stream on his transatlantic crossings in 1775 to 1776 and published the first map of it in 1785, ocean exploration has been part of American greatness and spirit. May ocean exploration continue as an inspirational and fruitful part of the American experience.
1. Set Strategic Goals & Priorities

The OE program must establish processes in order to define program boundaries and set measurable goals and priorities mindful of the particular risks of exploration (i.e. accept risk, unpredictability)

As the OE program enters its second decade, its most fundamental need is to revisit strategic goals and priorities, including those established by the 2000 Panel, and to have a regular and transparent process to update them. De facto priorities during the first decade included recruiting staff members, developing contracting and granting procedures, and securing the Okeanos Explorer as well as participating opportunistically in expeditions. The time is now right to set substantive goals for the program, actively. The fact that OER operates at a level of about $20 million per year rather than the $75 million the 2000 Panel recommended adds urgency to setting goals and priorities.

The present panel did not itself seek to set priorities or, for example, recommend cruise tracks. We believe goal setting and prioritization should be the continuing responsibility of the OER office, assisted by the Advisory Board now in formation, in a transparent process involving the larger community, including stakeholders of various kinds. In fact, the first action NOAA needs to take is to set the process for definition of program boundaries and development of goals and priorities.

We are mindful that voyaging into the unknown should and will bring surprises, and that OER should accept a higher level of risk than more traditional research funders. However, broad priorities can be set about, for example, geography or habitat, and targets for number of expeditions, days at sea, and leveraging. Finally, the OE program will be evaluated by inputs (such as ship days), processes (such as competitive procedures used to select expeditions), and outcomes (such as discoveries, mapped seafloor, data volume, publications, and increased public understanding). The OE program should have goals and priorities with respect to inputs, processes, and outcomes.

A possible major goal is resource stability over a decade, starting at $20 million per year. This amount would be without any financial obligations associated with the National Undersea Research Program (NURP), which has sometimes been managed in conjunction with the OE program. An area for especially careful articulation is cooperative international expeditions, which may be politically directed, and for which there should be clear benefits, such as unique access to an EEZ and a (substantially) paying partner.
2. NOAA Leadership Support Required

Top NOAA Leadership must publicly and repeatedly articulate the importance of ocean exploration to the nation and to NOAA’s own mission

As persuasively presented in the 2000 Presidential Panel report, reasons abound for support for ocean exploration for the United States and for the U.S. government. The 2000 Presidential Panel recommended designation of a lead agency for the national program, and the White House and Congress appropriately chose Commerce/NOAA. Success in ocean exploration inspires values in citizens that set the context for much of NOAA’s other work. It also provides information that sets the context for action not only by NOAA, but also many other federal as well as state agencies.

The Panel stresses that as lead agency, NOAA and its own top leadership must consistently advocate for top achievement in ocean exploration.
3. A National Forum on Ocean Exploration

The OE Program should implement PL 111-11’s requirement to establish and enable an annual high-level National Forum on Ocean Exploration across sectors to encourage partnerships, investments, technology development, and expeditions

- Engage federal and state agencies, nonprofits, private foundations, for-profit companies
- Initiate the Forum domestically, then perhaps broaden it to international stakeholders
- Consider providing related service functions to support exploration such as help with permitting; information clearing house

The 2000 Presidential Panel recommended establishing an Ocean Exploration Forum to encourage partnerships and promote communication among commercial, academic, private, non governmental organizations and government stakeholders. The recommendation has yet to be implemented. At the same time, we observe that many of the most successful OER and other ocean exploration efforts of the past decade span a broad range of public and private stakeholders.

The present Panel urges OER to test the recommendation to establish an annual high-level National Ocean Exploration Forum and substantially fund it. While informal networking has achieved some important partnerships (described in the OER’s internal evaluation), a more systematic effort might achieve yet more. The Forum could be a kind of marketplace where explorers could present ideas to individuals and organizations that could help in a variety of ways, including permits, technology, risk assessment, funds, and communications.

The Forum might also provide creative opportunities to integrate education and outreach into exploration from its outset. The K-20 educational community as well as experts in workforce development would bring valuable perspectives and networks.

It would seem practical to experiment with the Forum first on the national level, to learn what kind of agenda is most useful and how the event might be organized. Subsequently, the Forum might expand to international scope.

To conceive the Forum, the OE program might hold a small brainstorming session with representatives from organizations likely to be interested. This group might evolve into a planning committee for the actual first Forum. Operating the Forum would constructively place the Office of Ocean Exploration and Research at the nexus of much of the ocean exploration going on in America and the world.
4. Radical New Management Models

Consider providing related service functions to support exploration such as help with permitting; information clearing house

- Carefully evaluate administrative overhead and business processes in both OE and the relevant parts of NOAA
- Improve the transparency of expenditures and commitments
- Credibly value partnerships
- Consider competitive Cooperative Institute models
- Explore multi-year funding strategies
- Consider crowd-sourcing, prizes, medals
- Check new models for consistency with Congressional intent

As the chart below indicates, OER has experimented with several modes of operation, and allocated effort among them. These include spending on external or targeted competitions, its own dedicated vessel, and mapping of the Extended Continental Shelf. Especially in light of the prospect that the OER will continue with a budget of about $20 million per year, far short of the $75 million per year (plus capital expenditures) recommended by the 2000 Panel, efficiency and leverage matter. Thus, the present Panel makes a series of recommendations consistent with the analyses that the OER program staff prepared for the Panel that will clarify costs and revenues (including partnerships and their dollar value where appropriate).

The Panel also recommends consideration of shifting a major part of OER funds to a NOAA Cooperative Institute model. In this model, NOAA would issue a competitive request for proposals (RFP) to operate a Cooperative National Institute on Ocean Exploration. Such a competition could produce valuable new matches and partnerships and possibly lower some costs. It could also involve, and the Panel recommends, a multi-year commitment, which would give greater stability to the OE program, which has tended to fluctuate harmfully from year to year. The RFP might also be a way to introduce new styles of activity, including crowd sourcing and prizes.

In considering new management models, data management looms large. The Panel notes the good performance of the OE program in its first decade in data quality assurance and quality control, archiving, and dissemination, and the valuable role played by the OER partnership with NOAA’s National Environmental Satellite, Data, and Information Service (NESDIS, especially the National Coastal Data Development Center).

The Legislative as well as Executive branch must maintain enthusiasm for ocean exploration, if the OE program is to succeed. Consideration of new management models might offer a chance to engage with members of Congress and the professional staffs, to learn their views about how the program might be strengthened.
5. Targeted Expeditions

The OE Program should:

- Restore the extramural Targeted Expedition program to at least $10 million every year
- Derive targets from the Strategic Plan. These may be geographic, thematic, and/or phenomenological (e.g. Arctic, vents, ocean acidification)

In 2005 the OE program achieved a peak expenditure of more than $15 million on targeted expeditions, including both external awards and telepresence exploration. Since 2005, targeted expedition expenditures have exceeded $10 million only once, and less than half of the amount has gone for external, competitive awards (blue parts of bars). The funding in 2002-2005 stimulated the American exploration community; many excellent proposals were submitted, and truly exceptional ones funded, such as the Arctic Hidden Ocean and the Deep Sargasso Sea expeditions.

The lack of opportunity in recent years has created frustration. The Panel recommends a return to at least the level of 2002-2005. Priorities should be derived from the strategy developed in Recommendation No. 1. The 2012 Panel notes the special attention the 2000 Panel gave the Arctic Ocean and the high payoffs from the work of the OE program in the Arctic.

The Panel again stresses the need for a richer picture of the commitments of NOAA and the entire US government in ocean exploration. The 2000 Presidential Panel sought to catalyze an enhanced national effort, not only an effort of one office of one agency. While the present panel emphatically recommends a larger OER targeted extramural expeditions program, it also appreciates that OER’s success cannot be judged by its own budget and allocations alone.
6. Okeanos Explorer

The OE Program should:

- Consider diverting all Okeanos Explorer funds for targeted exploration charters
- Confirm the Okeanos Explorer’s real continuing annual and daily costs

The 2000 Presidential Panel recommended that the OE program operate a flagship vessel, the symbol of America’s ocean exploration program and an indispensable platform for it. The OE program refurbished the Okeanos Explorer for this purpose and is the only vessel owned by the U.S. government dedicated to ocean exploration. A 68-meter former Navy vessel, the Okeanos Explorer launched in 2010 and has conducted successful expeditions to Indonesia, Galapagos Rift, and Mid-Cayman Rise. Equipped with cameras that allow real-time viewing for scientists and the public, the Okeanos Explorer has pioneered use of “telepresence technology.” Narragansett, RI is the homeport of the Okeanos Explorer.

The OE program, in search of leverage and complementary capabilities, has also worked extensively with the Exploration Vessel (E/V) Nautilus, a 64-meter research vessel currently based in Bodrum, Turkey operated by the Ocean Exploration Trust under the direction of Ballard. Nautilus also has a high-bandwidth satellite system to facilitate remote science and education, often via the Inner Space Center at the University of Rhode Island, which shares a live feed with Exploration Command Consoles located around the world.

The concept of a flagship vessel made sense in the framework of a larger OE program, and it retains attractive aspects. However, in light of likely budgets, the Panel recommends careful consideration of alternate uses of the OE funds for exploration charters. The questions of lock-in to a homeport and ship are major. Weighing benefits and costs requires full accounting of the costs of the Okeanos Explorer, including expenditures within NOAA outside the direct OER program, and the extent to which funds now used for the Okeanos Explorer could be redirected.

In the course of its work, the Panel received estimates that the full annual operating costs of the Okeanos Explorer for FY12 ranged from $6.1 million to more than $8 million. Accurate, consistent, complete information for prior years was also unavailable to the Panel. Part of the difficulty is that OER budgets for core program operations aboard the Okeanos Explorer, while other funds come in ship-time equivalent funded by NOAA’s Office of Marine and Aviation Operations and OER pays for additional days at sea. NOAA, OER, and OMAO must have full, consistent, timely information on Okeanos Explorer costs in order to make both strategic and operational decisions.
OE must partner to stay abreast of new technologies:

- Development of sensors, exploration instruments and vehicles, and information technology (hardware and software) costs too much for OE alone to lead
- OE pioneered telepresence, but the context is changing fast and staying abreast is critical

The 2000 Presidential Panel report recommended and anticipated a major role for the OE program in technology development. In ocean exploration, “technology” could include sensors, exploration instruments (CTDs, grabs, water column samplers, etc.), and all the on-deck hardware to support these instruments (some of which may include UUVs and ROVs), and IT (hardware, software, antennae, communications suites and all the “stuff” that makes telepresence work).

In practice, technology development and deployment have proven too costly to manage with the reality of the OER budget. OER expeditions have, however, been early adopters and creative users of relevant technologies. For example, the 2006 Sargasso Sea expedition on the NOAA ship *Ron Brown* used the MOCNESS (Multiple Opening/Closing Net and Environmental Sensing System) to sample marine life as deep as 5000 meters at 5 stations in the Western North Atlantic, depths from which soft animals had rarely been retrieved intact. The system consists of multiple nets of various meshes opened and closed by computer control at desired depth. The panel recommends imaginative applications of technology continue as a criterion for setting priorities for exploration.

The important exception in technology development has been telepresence, in which OE showed foresight and has been a leader. Telepresence matters greatly because it can multiply by very large factors the people who experience or contribute to ocean exploration. Sensors and other equipment delivering real time data that can challenge students in both formal and informal settings and assist problem solving and conduct of citizen science. In 2012 telepresence is widely accepted. Students in fact are very comfortable with the idea of watching action at a distance and controlling it on a tablet computer or with a video game controller.

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NOAA relies on cutting edge technology to plot, coordinate and communicate. *Courtesy of University of Rhode Island Inner Space Center.*
Located in the Atlantic, Pacific, Arctic, Gulf of Mexico, and Caribbean Sea, the U.S. Exclusive Economic Zone (EEZ) is the largest in the world, covering 11,351,000 square kilometers. The shelf area covers 2.2 million square kilometers, the 4th largest, after Russia, Canada, and Australia, and larger than Alaska and Texas combined.

The portion of the continental shelf beyond the 200 nautical mile limit is known as the Extended Continental Shelf (ECS). Countries wishing to delimit their outer continental shelf beyond 200 nautical miles must submit information on their claim to the Commission on the Limits of the Continental Shelf. Countries were supposed to lodge submissions within ten years of the UN Conference on the Law of the Seas (of which the U.S. is not a signatory) coming into force in the country or by May 13, 2009.

In six areas the U.S. likely has an ECS: Atlantic Margin, Arctic Ocean, Bering Sea, off the west side of Guam/Northern Mariana Islands, and in two areas in the Gulf of Mexico. In nine areas the U.S. may have an ECS: Gulf of Alaska, western end of the Aleutian Islands, Northern Mariana Islands, Hawaii’s Necker Island, Johnston Atoll, Kingman Reef and Palmyra Atoll, and three areas off the U.S. west coast.

Preliminary studies indicate that the U.S. ECS totals at least one million square kilometers, about twice the size of California, or one half the size of the Louisiana Purchase. The process to determine the outer limits of the U.S. ECS requires collection and analysis of data describing the depth, shape, and geophysical characteristics of the seabed and sub-sea floor. Since 2003, U.S. agencies have been engaged in gathering and analyzing data to determine the outer limits of the U.S. ECS.

The Panel recognizes that NOAA (and OER) are not leading the U.S. ECS effort, where the Navy (NAVOCEANO), University-National Oceanographic Laboratory System, and U.S. Coast Guard play much larger roles. However, OER can finish its appropriate pieces soon, say, 3 years, and appropriateness ought to be articulated in the Strategic Plan. A key benefit is that while carrying out ECS geophysical surveys, OE explores many other phenomena while “mowing the grass” for operational survey purposes. In 2009 the Okeanos Explorer undertook test missions on the Mendocino Ridge and Necker Ridge surveying more than 30,000 square kilometers, the size of Maryland.

The panel judges the work of the ECS program, including its OER component, excellent and urges acceleration, so that the survey of potential U.S. ECS regions appropriate for OER is completed by the end of 2015.
9. Branding

OER could highlight the benefits of ocean exploration by cultivating a network of iconic ocean champions like Hollywood director James Cameron. Image source National Geographic at http://tinyurl.com/cwzyob8

OER works with technology proponents such as OpenROV co-founder Eric Stackpole to promote deep sea exploration. Courtesy OpenROV.

The OE Program should:

- Develop icons
- Cultivate champions

While most people know the U.S. government has a space program, few know that the U.S. government has an ocean exploration program. The panel found the website of the OE program excellent and current in terms of content, and noted several major successes with national and global media about OE-supported discovery, for example, about marine life in the Arctic and Indonesia. The OE website is a major provider of educational material, giving NOAA an entry into secondary school and collegiate classroom instruction, aquariums, and state marine resource agencies. The value of this connection for ocean exploration, for NOAA, and for the U.S. government need more careful evaluation.

The panel recommends the OE program, as part of its strategic planning, clarify its priorities about meriting wider and deeper public understanding of America’s achievements in ocean exploration, of the U.S. government program, of NOAA’s particular contributions, or simply of the substance of the discoveries themselves.

Whatever the priorities, the Panel notes the importance of icons and champions in successful engagement programs.

A possible goal for the OE program is to be associated constructively and authentically with almost every major achievement in ocean exploration carried out in large part by Americans or American organizations or in the U.S. EEZ.
10. Ocean Exploration Advisory Board

The OE Program should establish an Ocean Exploration Advisory Board and:

- Coordinate with the NOAA Science Advisory Board to multiply influence and achieve efficiencies
- Avoid conflicts of interest

The new Advisory Board should assist the Program in the development of a five-year Strategic Plan and monitor implementation progress.

Through 2011, the Ocean Exploration Advisory Working Group of the SAB provided guidance to the OE program. 2010 legislation calls for the establishment of an Ocean Exploration Advisory Board reporting directly to the Administrator. The Panel recommends prompt appointment of the new Board. Because of the need to harmonize the OE program with other NOAA efforts, for example, in research and data management, the panel recommends the new Board operate in close conjunction with the SAB, perhaps occasionally meeting back-to-back or with some overlap in schedules, so the groups can exchange views directly. Some joint memberships might also be useful.

A principal role of the new Board can be to advise the OER program office in carrying out OE’s federal responsibility to set strategic goals and priorities, the Panel’s first recommendation. We close by repeating the first and most fundamental recommendation of the Panel: To set strategic goals and priorities for OE’s second decade.

The panel thanks NOAA for the opportunity to serve America’s interests in ocean exploration and acknowledges excellent, fully open support from the OE staff members, especially Tim Arcano, John McDonough, and David McKinnie. In the bottom left photo taken on May 8, 2012, the panel members are from left to right: James Delgado, Susan Avery, Paul Gaffney, Jean May-Brett, Terry Garcia, Steven Ramberg, Marcia McNutt, Rodey Batiza, Jesse Ausubel, Eric Lindstrom, Cameron Hume, Jeffrey Karson, James Kendall, and Jerry Schubel (liaison with NOAA SAB).
BG-13-2014 Ocean literacy – Engaging with society – Social Innovation

Specific challenge: The development of the new maritime economy can have important socioeconomic consequences in coastal areas and in the marine space (synergies and/or conflicts of use between old and new activities). These developments, together with the pressures from human activities and climate change on the marine environment, make it crucial to engage with citizens and stakeholders about seas and ocean challenges.

We will not achieve a sustainable exploitation of marine resources and a good environmental status of our seas and oceans unless citizens understand the influence of seas and oceans on their lives and how their behaviour can have an impact on marine ecosystems. This is a prerequisite to develop the ecosystem based approach for marine activities and promote the understanding/protection of marine ecosystem services.

Scope: Proposals should focus on compiling existing knowledge in the broad area of Seas and Ocean Health (environmental status, pollution affecting marine biodiversity and ecosystems, ecosystem services). Attention will be paid to the impact this has on citizens, including on Human Health. Information collected should be turned into communication material, to be used for dissemination and engagement with societal stakeholders and public at large, e.g. via schools, aquaria, maritime and science museums. Ocean literacy in the EU should be promoted in a traditional or in a proactive mutual learning way by engaging with citizens as responsible actors of change in marine challenges. In line with the objectives of the EU strategy for international cooperation in research and innovation (COM (2012) 497), proposals should benefit from the inclusion of partners established in third countries, in particular the US and Canada, given the high potential for knowledge sharing in this field.

The Commission considers that proposals requesting a contribution from the EU in the range of EUR 3.5 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected impact:

- Develop citizens’ understanding of the importance of Seas and Ocean Health, as well as interactions and interdependencies between the two, fostering behavioural change;
- Support the ecosystem based approach in the management of maritime activities and contribute to the objectives of the Marine Strategy Framework Directive,
- Maximize the societal impact of EU funded marine and maritime research.

Type of action: Coordination and support actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

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61 For such activities, synergies may also exist with the European Researchers' Night action under the Marie Sklodowska-Curie part of the Work programme.

62 This is without prejudice to the general rules on the funding of legal entities from third-countries, as set in part A of the annex to the work programme.

63 See Galway Statement on Atlantic Ocean Cooperation Launching a Canada- European Union- United States of America Research Alliance (Galway, 24th of May 2013)
BG-14-2014: Supporting international cooperation initiatives: Atlantic Ocean Cooperation Research Alliance

Specific Challenge: Marine and Maritime scientific and technological cooperation is instrumental in building dialogue, sharing knowledge and mutual understanding between different scientific communities, cultures and societies. It is a key component to tackle major societal challenges, underpin policies, and stimulate innovation. The EU has adopted various initiatives including the 'Blue Growth', the EU Atlantic Strategy and its Action Plan (2014 – 2020) to increase such cooperation. Furthermore the Galway Statement and the recently endorsed Atlantic Ocean Research Alliance provides a unique framework for stimulating strategic cooperation between education, research, technology and industrial communities in order to jointly address challenges related to the sustainable exploitation of the Atlantic resources and thus promote economic growth and jobs for citizens and societies of both sides of the Atlantic.

However, further efforts are needed to create appropriate operational conditions among the relevant marine research and innovation activities and programmes related to the Atlantic ocean with a view to enhance their effectiveness and impact and facilitate synergies and allow for new collaboration initiatives.

Scope: In line with the objectives of the EU strategy for international cooperation in research and innovation (COM (2012) 497), proposals should contribute to implementing the Transatlantic Research Alliance, launched by the Galway Statement on Atlantic Ocean Cooperation in May 2013, and should benefit from the inclusion of partners from the US and Canada. Proposals should underpin the establishment and implementation of the Atlantic Ocean Cooperation between the EU, its Member States and partner countries joining transatlantic research alliance as well as building on existing initiatives and programmes to increase coherence and coordination of ocean research cooperation programmes.

Proposals should address the following priority areas in an integrated way, identified in the Galway Statement:


Within these priority areas, proposals should facilitate the mapping and connectivity of relevant on-going research activities and programmes in the Atlantic and the identification of research gaps. Proposals should also consider ongoing work to create a European Marine Observation and Data Network (EMODnet). Proposals should contribute to aligning the planning and programming of research activities, in view of launching joint Research & Innovation initiatives, while building on existing ones (e.g. Joint programming Initiative "Healthy and Productive Seas and Oceans", marine ERA-NETs (e.g. Seas-Era) and also national and multilateral initiatives). Proposals should facilitate a shared use of infrastructures, as well as dissemination and knowledge transfer activities leading to an optimal exploitation of projects results, fostering mobility and networking of researchers.

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64 This activity directly aimed at supporting the promotion of coherent and effective cooperation with third countries is excluded from the delegation to REA and will be implemented by the Commission services.

65 Galway Statement on Atlantic Ocean Cooperation Launching a Canada- European Union- United States of America Research Alliance (Galway, 24th of May 2013)

66 This is without prejudice to the general rules on the funding of legal entities from third-countries, as set in part A of the annex to the work programme.
Proposals should also establish a long-term knowledge sharing platform (existing knowledge or to be generated), in the areas mentioned above, to allow for long-term usability of the data, information and knowledge thereby ensuring tangible value creation from invested resources. This platform should comprise a classification system, which allows for an easy, focused, quick and reliable use and analysis of the information collected and stored. The principle of open access would need to govern such a platform. To enhance the exploitability of the platform for policy making and stakeholder consultation purposes, representatives from funding agencies and these communities should be consulted in their design. Options to secure the long-term viability of this platform should be included in the proposal. Cooperation is as well encouraged with partners established in other third countries (e.g. Brazil).67

The Commission considers that proposals requesting a contribution from the EU in the range of EUR 3.5 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected impact:

- Support the implementation of the Galway Statement on an Atlantic Ocean Research Alliance.
- Improve the international cooperation framework of marine research programmes thus creating the basis for the development of future large-scale joint international marine research programmes.
- Establish a long term knowledge sharing platform for easy access to available information and data holding significant commercial potential relevant to the EU Blue Growth Agenda

Type of action: Coordination and support actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

**BG-15-2014: European polar research cooperation**68

**Specific challenge:** Nowhere is climate change more evident than in the high latitudes. Increased shipping for transport and tourism purposes, highly variable fish stocks, increased oil and gas exploration and mining are challenges and opportunities faced in polar regions that require sound scientific knowledge of vulnerabilities and risks in order to develop appropriate regulatory policies. In the 2012 Joint Communication to the European Parliament and the Council 'Developing a European Union Policy towards the Arctic Region', the Commission and the High Representative point out that the EU will 'support research and channel knowledge to address the challenges of environmental and climate changes in the Arctic'. Rapid environmental changes in the Arctic and parts of the Antarctic continent have global impacts both by accelerating global warming and in a geo-strategic and socio-economic dimension. European countries operate world class research infrastructures in both Arctic and Antarctic regions and are leading in many fields of polar research with regards to climate, ecosystems, life in extreme environments, pollution monitoring and other aspects. Making the

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67 This is without prejudice to the general rules on the funding of legal entities from third-countries, as set in part A of the annex to the work programme.

68 This activity directly aimed at supporting the promotion of coherent and effective cooperation with third countries is excluded from the delegation to EASME and will be implemented by the Commission services.
most efficient use of these resources and the latest scientific developments, for addressing the abovementioned challenges requires a high degree of coordination within Europe and beyond.

**Scope:** Proposals should coordinate polar research in Europe and develop a comprehensive European Polar Research Programme. By setting up a continuous stakeholder dialogue the action should communicate user needs to the appropriate scientific community and/or research programme managers. In line with the objectives of the EU strategy for international cooperation in research and innovation (COM (2012) 497) proposals should contribute to implementing the Transatlantic Research Alliance, launched by the Galway Statement on Atlantic Ocean Cooperation in May 2013, and should benefit from the inclusion of partners from the US and Canada. Cooperation is as well encouraged with partners from other third countries, such as Russia, Japan, China, India and Latin American countries, also by supporting Belmont forum cooperative research actions. This initiative strives for enhanced coordination with international research organisations and programmes related to polar research (e.g. AMAP, WCRP, and JPI ‘Climate’) as well as with relevant operational services including Copernicus. It is also expected to provide support to the coordination and optimisation of existing monitoring and modelling programmes and related infrastructures and work towards interoperability of and open access to observational and modelling data and related products.

The Commission considers that proposals requesting a contribution from the EU in the range of EUR 2 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

**Expected impact:**

- Substantially increase the scale and ambition of polar research cooperation in Europe.
- Increase the coherent and efficient use of European resources.
- Improve global cooperation.
- Induce a step change in the domain of open data access, quality control and interoperability.
- Contribute to policy advice at national and EU level and support to the EU’s international commitments with respect to the Arctic Council, the Montreal protocol, and UNFCCC and others related to polar sciences.

**Type of action:** Coordination and support actions

*The conditions related to this topic are provided at the end of this call and in the General Annexes.*

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69 This is without prejudice to the general rules on the funding of legal entities from third-countries, as set in part A of the annex to the work programme.

70 This is without prejudice to the general rules on the funding of legal entities from third-countries, as set in part A of the annex to the work programme.

71 Arctic Monitoring and Assessment Programme

72 World Climate Research Program

73 Joint Programming Initiative

74 United Nations Framework Convention on Climate Change
BG-16-2015: Coordination action in support of the implementation of the Joint Programming Initiative on 'Healthy and Productive Seas and Oceans'\textsuperscript{75}

**Specific challenge:** Following the implementation of the actions foreseen by the Commission’s Communication on Joint Programming to tackle Europe’s major societal challenges, the Competitiveness Council has welcomed the progress made by EU Member States in Joint Programming Initiatives launched so far. Several Council Conclusions on Joint Programming invite the Commission to support JPIs via Coordination and Support Actions\textsuperscript{76} to help achieving their main goals. By making more efficient use of MS investments and resources, JPI Ocean should help to address the societal challenges related to our seas and oceans, and consolidate the European marine research area.

**Scope:** Proposals should build on the outcomes of the CSA Oceans project in support to the implementation of the Strategic Research and Innovation Agenda (SRIA) of JPI Oceans and in ensuring further alignment and convergence of national Research and Innovation activities and investments on marine research in line with the European Commission Recommendation of 2011\textsuperscript{77}. In this context, proposals should provide support for the designing and implementation of new transnational joint activities including joint calls if appropriate and using the most suitable and effective methods and tools for collaboration such as those proposed by the 'Voluntary guidelines on Framework Conditions', adopted by the High Level Group on Joint Programming. These new joint actions, in interface with other initiatives, should focus on relevant issues and grand challenges identified in the JPI Oceans' implementation plan and provide support to key marine and maritime related EU policies and strategies.

Proposals should be used to establish and consolidate an operational network of marine and maritime research funders and other key players in Europe, with a view to ensure alignment of national research agendas and actions implemented in the framework of other initiatives such as marine ERA-Nets (e.g. Seas-Era) and Article 185 initiatives (e.g. Bonus 'Joint Baltic Sea Research Programme).

Cooperation between relevant EU marine research institutes should be further stimulated for better coordination in the collection of marine data, the use and sharing of marine research infrastructures of transnational interest. Proposals should also include measures supporting other ERA priorities such as improving researchers' mobility and training. The international dimension of JPI Oceans should be further elaborated where appropriate and where there is added value, in order to achieve greater coherence at sea-basin and international level.

The Commission considers that proposals requesting a contribution from the EU in the range of EUR 2 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

**Expected impact:**

\textsuperscript{75} This activity directly aimed at supporting public-public partnerships with Member States and associated countries, technology platforms with industrial partners and earth observation networks is excluded from the delegation to REA and will be implemented by the Commission services.

\textsuperscript{76} Council Conclusions of 12 October 2010, of 26 November 2010 and of 8 December 2011

\textsuperscript{77} Commission Recommendation of 16.9.2011 on the research joint programming initiative 'Healthy and Productive Seas and Oceans' (2011/C 276/01)

Societal Challenge 2: Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the bioeconomy

- Streamline effective trans-national European research networking and synergies among national and EU research programmes and Member States investments related to healthy and productive seas and oceans.
- Progress towards the creation of a European Research Area in marine research.
- Improve integration and alignment in sharing, use and funding of research infrastructure between Member States and enhanced cooperation in data collection. Contribute to the implementation of key marine and maritime policies

Type of action: Coordination and support actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.
recommendations for infrastructure works to help protect sensitive ecosystems in high risk areas.

In line with the objectives of the EU strategy for international cooperation in research and innovation (COM (2012) 497), proposals should benefit from the inclusion of partners established in third countries, in particular the US and Canada\textsuperscript{55}, given the high potential for knowledge sharing in this field\textsuperscript{56}.

The Commission considers that proposals requesting a contribution from the EU in the range of EUR 4–6 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

**Expected impact:**

- Develop an integrated capacity to optimally respond to major marine pollution events (particularly oil & gas) combining oceanographic modelling of pollution behaviour, physical, chemical and biological mitigation as well as infrastructures;
- Mitigate negative impacts of marine pollution on the marine environment, coastal economies and communities;
- Improve the integration between the scientific community and relevant government agencies charged with dealing with pollution, including cross-border and trans-boundary co-operation;
- Reduce risks of the new offshore economy and improve the business environment for Blue Growth investments;
- Contribute to the implementation of the Directive 2013/30/EU on safety of offshore oil and gas prospection, exploration and production activities and to the Offshore Protocol of the Barcelona Convention in the Mediterranean;
- Contribute to the effectiveness of EMSA’s operational capacity to respond to pollution from oil and gas installations.
- Improve societal acceptance of offshore activities.
- Increase competitiveness of European industry including SMEs within the marine industrial sector.

*Type of action:* Research and innovation actions

*The conditions related to this topic are provided at the end of this call and in the General Annexes.*

**Ocean observation technologies/systems**

**BG-8-2014: Developing in-situ Atlantic Ocean Observations for a better management and sustainable exploitation of the maritime resources**

*Specific challenge:* The challenge is to conduct the Research and Innovation activities necessary to the deployment of an Integrated Atlantic Ocean Observing System (IAOOS), building on existing capacities on both side of the Atlantic. The Atlantic Ocean is the most

\textsuperscript{55} This is without prejudice to the general rules on the funding of legal entities from third-countries, as set in part A of the annex to the work programme.

\textsuperscript{56} See Galway Statement on Atlantic Ocean Cooperation Launching a Canada– European Union– United States of America Research Alliance (Galway, 24th of May 2013) and related Final scientific report
prominent maritime domain situated at the doorstep of Europe. However, the sustainable exploration, exploitation and protection of this maritime domain require a knowledge base and predictive capabilities which are currently fragmented or not yet available. The creation of this knowledge base and predictive capability requires systematic collection of ocean observations recorded both remotely using Earth observation satellites and in-situ. Central to the development of the IAOOS should be the acquisition and use of in-situ observations and their integration with remote sensed data across the whole Atlantic Ocean in order to fill out the existing observational gaps. Applications based on the Copernicus Marine Monitoring service and the European Marine Observation and Data Network (EMODnet) may enable addressing this challenge.

**Scope:** The Integrated Atlantic Ocean Observing System initiative should cover the whole Atlantic with the objective to deliver the knowledge base supporting the understanding of the Ocean Process at the level of the entire basin. Another focus of proposals should be to fill the observational gaps regarding the in-situ part of the Integrated Atlantic Ocean Observing System including through the optimisation of existing systems and the use of new ocean observation technologies enabling reducing the costs of in-situ ocean observation and integration of the biological dimension into observing systems. The research and innovation necessary to underpin the full and open discovery and access to the ocean observations and facilitating the interoperable exchange of ocean observation as promoted through GEO (Group on Earth Observation) at the scale of the Atlantic Ocean should require the participation of international partners from both sides of the Atlantic. In line with the objectives of the EU strategy for international cooperation in research and innovation (COM (2012) 497), proposals should contribute to implementing the Transatlantic Research Alliance, launched by the Galway Statement on Atlantic Ocean Cooperation in May 2013, and should benefit from the inclusion of partners from the US and Canada.

The Commission considers that proposals requesting a contribution from the EU in the range of EUR 15–20 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

**Expected impact:**

- Enhance societal and economic role of the Atlantic Ocean in Europe.
- Provide leadership for Europe in implementing GEOSS.
- Increase temporal and geographic coverage of observational data in the Atlantic Ocean.
- Integrate standardised in-situ key marine observations including biological, (meta)genomic data into process models and forecast systems.
- Improve modelling outputs and reduce cost of data collection in support of ocean-related industrial and societal activities.
- Increase competitiveness of European industry and particularly SMEs within the marine industrial sector.
- Increase safety for offshore activities and coastal communities
- Contribute to make better informed decisions and documented processes within key sectors (manufacturing, ICT, maritime industry, environment technology, marine science and fisheries).

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57 Galway Statement on Atlantic Ocean Cooperation Launching a Canada- European Union- United States of America Research Alliance (Galway, 24th of May 2013)
58 This is without prejudice to the general rules on the funding of legal entities from third-countries, as set in part A of the annex to the work programme.
Societal Challenge 2: Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the bioeconomy

- Improve the implementation of European maritime and environmental policies (e.g. Marine Strategy Framework Directive, Common Fisheries Policy, EU Integrated Maritime Policy).
- Enhance documentation necessary to cope with global challenges such as climate change, scarceness of natural resources and global scale hazards.

**Type of action:** Research and innovation actions

*The conditions related to this topic are provided at the end of this call and in the General Annexes.*

**BG-9-2014: Acoustic and imaging technologies**

**Specific challenge:** Acoustic and imaging technologies (including LiDAR\(^\text{59}\)), combined with data processing have made considerable progress in the past 20 years and can provide remarkable insights into the state of marine ecosystems, from the water column to the seabed (and its habitats).

Acoustic technologies can be active (echosounder, multibeam sonar) or passive (devices to 'listen' and interpret marine sounds). They operate from a wide range of platforms, offer promising perspectives for characterising seabed and sea column habitats, species and ecology and can strongly support marine environment and fisheries management, as well as offshore activities and safety (e.g. detection of seeps, geologic events… etc.).

Imaging technologies have also proven to be powerful instruments to characterise the marine environment, its biomass, biodiversity, detect and provide estimates of pollution and marine litter. They can therefore be of important support to marine environment and fisheries management (e.g. marine litter assessment for the Marine Strategy Framework Directive - MSFD). However improvement is still needed to increase performance and cost efficiency of these technologies, whether it is to monitor the oceans, or to support marine industries.

**Scope:** Proposals should cover innovative technologies to improve the performance and the cost efficiency of underwater sensors and survey systems needed for acoustic detection, imaging or LiDAR, as well as the (fixed or mobile) platforms supporting them and signal and image processing to interpret raw data. Subsequent use of this information as part of an integrated framework of multi-modal data sources should also be considered.

Proposals should bring together marine scientists, technology providers and end-users (including policy makers), with a view to support implementation of MSFD, characterisation of good environmental status or to enhance a sustainable European maritime economy.

The Commission considers that proposals requesting a contribution from the EU in the range of EUR 4–6 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

**Expected impacts:**

- Strengthen the competitiveness and safety of the European maritime industry by developing innovative and cost efficient underwater acoustic and imaging technology devices and survey systems;

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\(^{59}\) Light Detection and Ranging