

## Report for the year 2015 and future activities

### SOLAS PERU

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*Part 1: reporting of activities in the period of January 2015 – December 2015*

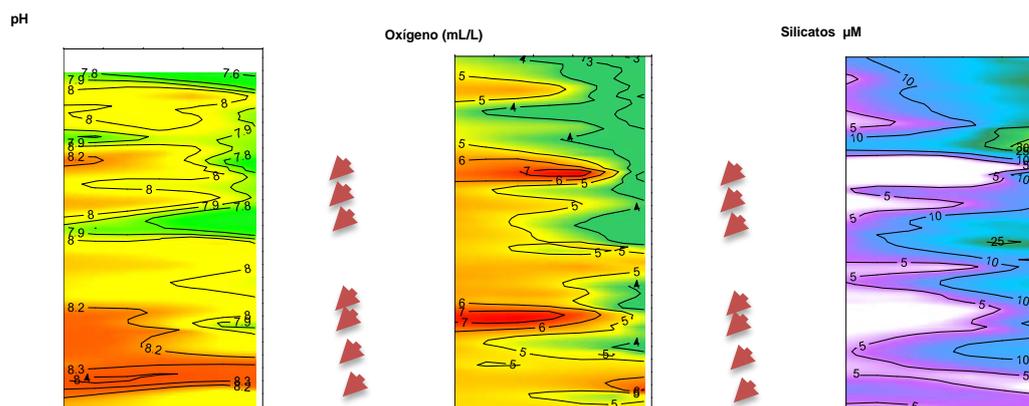
*Part 2: reporting on planned activities for 2016 to 2018/19.*

### PART 1 - Activities from January 2015 to December 2015

#### 1. Scientific highlight

##### 1- Coastal Upwelling off Perú

Since 2013 the Instituto del Mar del Perú IMARPE develop the project : **Coastal Upwelling off Peru: An Integrated study approach** as one of the main research lines of the Climate Change and Oceanography research Direction. The goal of this project is to investigate the physical, chemical processes, the atmosphere-oceanic exchange and the planktonic and benthic communities associated to the Peruvian coastal upwelling, with emphasis on the onshore-offshore gradient off Central Peru and its variability at different time scales. The study will involve different approaches, cruises and modelling, and also modern and historical data. Several international research collaborations are concurrent with this project. In particular in the SOLAS frame we develop research on the OMZ, and the acidification topics. One of the results of this research are associated with the evidence of El Niño impact in the upwelling during the last 2014 and 2015. The deep change in the water masses affect directly the pH, the oxygen and nutrients with a strong impact in the productivity and economically resources.



Boletín PPR- IMARPE. Graco et al., 2016 (see publication)

##### 2- Aerobic Microbial Respiration in Oceanic Minimum Zones

In the frame of the SFB 754 from GEOMAR Alemania and the collaboration in Peru with IMARPE in the last years there are several research initiatives associated with the Oxygen Minimum Zone studies in particular the biogeochemistry of carbon and nitrogen. One of the products of this research was related with the Aerobic respiration under this oxygen deficient areas. The results indicate that results suggest that microaerobic respiration is a major mode of organic matter

remineralization and source of ammonium (~45-100%) in the upper oxygen minimum zones, and reconcile hitherto observed mismatches between ammonium producing and consuming processes therein (see publication).

### 3- Acidification and the Peruvian Upwelling system

Since 2013, IMARPE has the contract 18007 with the IAEA to develop studies focus in the acidification and the impact in biological communities. Under this project we develop a review of the carbonate system state of the art off Perú and conduct several investigations and master thesis with calcifiant organisms. Thesis 1) The carbonate system off Peru, 2) Cocolitoforids off Perú: ecology and calcification, 3) foraminifers under low pH and 4) Bivalves under different CO<sub>2</sub> conditions. This thesis will finish on 2016. They are under collaboration with the CALHIS Project, LOCEAN-CEREGE France.

### 4- Modelling approaches for the upwelling oceanographic and ocean-atmosphere coupling

IMARPE and the Instituto Geofísico del Perú IGP develop different models in order to improve the knowledge about the oceanographic and the coupling between the ocean and atmosphere interaction. An important efforts was associated during 2015 to the El Niño conditions that modified the water column chemical and physical conditions.

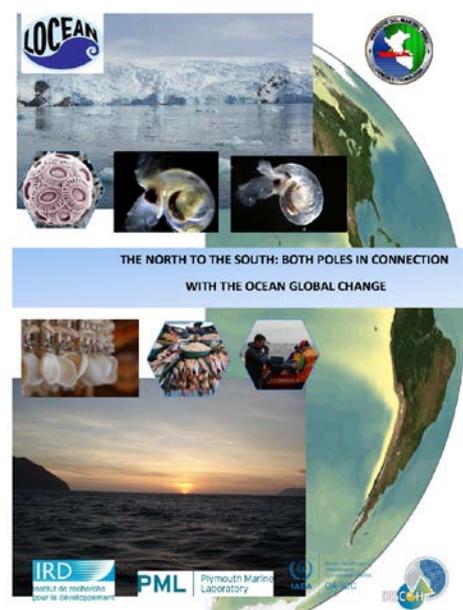
## 2. Activities/main accomplishments in 2015 (projects, field campaigns, events, model and data intercomparisons, capacity building, international collaborations, contributions to int. assessments such as IPCC, interactions with policy makers or socio-economics circles, etc.)

### 1- Workshops “ KOSMOS PERU 2017 “AN OMZ MESOCOSM EXPERIMENT”

During 2014/2015 in Kiel, Germany at the GEOMAR institute and in Lima take place several workshop In the frame of the project "Future Changes in the ocean upwelling system off Peru, KOSMOS Perú " led by Dr. Ulf Riesebell the German Institute GEOMAR and Michelle Graco from the Instituto del Mar del Peru (IMARPE) with the participation of more than 60 scientist, mainly from Germany and Perú, IMARPE and Peruvian universities UPCH, UCSUR. The project is in the logistic phase and we have the permission for marine research off the San Lorenzo Island as a natural observatory and laboratory. The experiment will be launch in 2017. (information [mgraco@imarpe.gob.pe](mailto:mgraco@imarpe.gob.pe))

### 2- SIDE EVENT COP 21

“The north to the south: both poles in connection with the ocean global change” *side event* (9



July 2015, Paris) was organized by the University Paris VI UPMC, LOCEAN (France) and the Instituto del Mar del Perú (Perú) with the Plymouth Laboratory UK and University of Washington, Seattle USA. The side event combine research form the north to the south about the ocean and climate change and the importance in a global problem to have actions around the world in order to multiply the initiatives and impulse every stakeholders. This side event is connected with several side events presented during the COP 20 in Lima, Peru December 2014.

### 3- LAOCA Latinoamericana NETWORK of Acidification

Last December 2015 was established at Concepción Chile the Latin American Ocean Acidification network (LAOCA) with the participation of Perú University Pedro Ruiz Gallo, Lambayeque, IMARPE Callao, Chile, Colombia, Argentina, Brazil, Mexico, Ecuador. The goal of LAOCA is combine efforts between Latin countries to develop a regional research on acidification directly connected with the GO-ON and international reference in this relevant and significant topic for the upwelling areas.

### 5-Low Oxygen Network GO2NE

Last December IOC- UNESCO initiated the network of scientist focused on oxygen in open and coastal ocean. IGP and IMARPE participate in this first meeting to develop terms of reference and a plan for the multidisciplinary IOC UNESCO network.

### 4-Participation in several international conferences / OSC Open Science Conference 2015, Kiel Germany/ IMBER Italy/ AGO Fall meeting San Francisco USA

Several students and professionals from Perú, IGP, UPCH, IMARPE represent Peruvian research in topics related with the upwelling of Perú.

### 3. Top 5 publications in 2015 (only PUBLISHED articles) and if any weblinks to models, datasets, products, etc.

\*Kalvelage T., Gaute Lavik, Marlene M. Jensen, Niels Peter Revsbech, Carolin Löscher, Harald Schunck, Dhvani K. Desai, Helena Hauss, Rainer Kiko, Moritz Holtappels, Julie LaRoche, Ruth A. Schmitz, Michelle I. Graco, Marcel M.M. Kuypers. 2015 Aerobic Microbial Respiration In Oceanic Oxygen Minimum Zones. PLOS ONE DOI 101371.

\* Dale, A. W., Sommer, S., Lomnitz, U., Montes, I., Treude, T., Liebetrau, V., Gier, J., Hensen, C., Dengler, M., Stolpovsky, K., Bryant, L. D., and Wallmann, K., 2015: Organic carbon production, mineralisation and preservation on the Peruvian margin, Biogeosciences, 12, 1537-1559, doi:10.5194/bg-12-1537-2015, 2015.

\* Bettencourt, J.H., C. López, E. Hernández-García, I. Montes, J. Sudre, B. Dewitte, A. Paulmier, and V. Garçon, 2015: Boundaries of the Peruvian Oxygen Minimum Zone shaped by coherent mesoscale dynamics, Nature Geoscience, doi:10.1038/ngeo2570.

## PART 2 - Planned activities from 2016 to 2018/19

### 1. Planned major field studies and collaborative laboratory and modelling studies, national and international (incl. all information possible, dates, locations, teams, work, etc.)

-The main field study will be the KOSMOS experiment that will take place between January and April 2017, off San Lorenzo Island.

- In the frame of the SFB 754 research cruises off Peru with the Meteor and IMARPE research Vessels.

### 2. Events like conferences, workshops, meetings, schools, capacity building etc. (incl. all information possible)

-Symposium-Australia Fourth International Symposium on the Ocean in a High-CO2 World Participation of IMARPE in the symposium with a grant IAEA/ Monaco May 2016.

### 3. Funded national and international projects / activities underway (if possible please list in order of importance and indicate to which part(s) of the SOLAS 2015-2025 science plan the activity topics relate – including the themes on 'SOLAS science and society' and 'Geoengineering')

-National with international efforts to carry out multidisciplinary research focus in the SOLAS OMZs-EBUEs Mid-Term Strategy Initiative topics

- 1- National project of the Upwelling System of Peru- OMZ IMARPE
- 2- ASLAEEL Project KOSMOS 2017 Perú- GERMANY/ GEOMAR/ OMZ IMARPE
- 3- El Niño and the peruvian upwelling two projects. 1) IGP, LEGOS, 2) IMARPE- IRD-UPCH.
- 4- IAEA Project- contract- Upwelling and acidification IMARPE, UPCH
- 5- LMI DISCOH IRD- Upwelling, modelling- several partners from France LOCEAN, CEREGE, TOULOUSE and IMARPE.

**4. Plans / ideas for future projects, programmes, proposals national or international etc. (please precise to which funding agencies and a timing for submission is any)**

**5. Engagements with other international projects, organisations, programmes etc.**

**Comments**