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- NF-POGO Alumni Network for Oceans -

NF-POGO Alumni E-Newsletter – Volume 06, April 2014

NANO family extended

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pogo Partnership for Observation of the Global Oceans

From the Editorial Board

The Nippon Foundation-Partnership for Observation of the Global Oceans (NF-POGO) Centre of Excellence in Observational Oceanography (CofE) has been training ten young oceanographers over a period of ten months per year since 2008. These scholars subsequently become part of the NANO family. This programme has been successfully delivered four times at the Bermuda Institute of Ocean Sciences (BIOS) and Phase 2 has now already begun at the Alfred Wegener Institute for Polar and Marine Research (AWI), in Germany. This issue introduces all these future NANO Alumni.

This newsletter has come out after the NANO Coordination Meeting, where the new NF-POGO CofE scholars were introduced to some of the Alumni. Also, the inauguration of the new CofE took place at the Museum of Natural History in Berlin, and both events took place in the early December 2013. The new scholars are enthusiastic and promising towards better understanding the ocean. NANO alumni felt extremely happy and charged to meet the new members of their family. A short report on the outcomes of the meeting is presented here.

This newsletter covers a variety of topics ranging from ocean primary production to the impact of climate change on water resources in the Tibetan Plateau. This issue encompasses the biogeochemistry of many oceans from the Baltic Sea to the Atlantic and Indian Oceans.

NANO News is constantly evolving, with new features being introduced with every new issue. This edition features the addition of a comprehensive review article. In future issues, the Editorial Board would like to introduce a space for the more creative alumni to express their artistic talents, such as through poetry or cartoons. We welcome suggestions from you that may enrich this publication.

Articles in this newsletter address the advancements in ocean sciences achieved with the use of state-of-the-art instruments. Alumni in the UK and India have worked on the data obtained from such instruments, in particular gliders and Argos, and share their insights on the importance of these new methods of studying the ocean.

Finally a NANO alumnus has written a very inspirational article on her interactions during her Harvard days with one of the Noble Prize recipients for Chemistry in 2013, Prof. Martin Karplus. Along with some other interesting articles and an interview, we are pleased to bring you the sixth issue of the NANO newsletter. With this we sign off and wish you all great success in 2014!

Arvind Singh
Editor-in-chief

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nano news

NF-POGO Alumni E-Newsletter – Volume 06, April 2014

This issue:

LET US SHOW YOUR ART

Have any nice photos to share? E-mail us your seascapes, underwater photos or photos of field work and we'll include them in NANO News!

NANO News 6 cover art was compiled by Lilian A. Krug

Erratum: In the previous issue of the NANO News, Mr Kentaro Suzuki was mistakenly referred to as Dr Suzuki. He has asked us to correct this since he hasn't obtained his PhD qualification yet. NANO News Editorial board apologises for this mistake.

NANO meeting in Berlin

Olga Shatova

A NANO coordination meeting was held in Berlin, Germany, from 5th to 6th of December 2013. The meeting was mostly focused on further development of the 4 regional research projects. In addition, the meeting initiated the creation of an Outreach component in the Network: the aim is to support NANO alumni in outreach activities in their regions. Another highlight of the meeting was the attendance of 10 new NF-POGO Centre of Excellence scholars that have recently commenced their training at the Alfred Wegener Institute (AWI) for Polar and Marine Research.

The first day of the meeting was devoted to the review of NANO progress in 2013. It started off with an introductory speech from Dr. Shubha Sathyendranath and self-introduction by the participants. These were followed by presentations on the progress of NANO to date (by Dr. Sophie Seeyave), the current members of NANO (by Lilian Krug) and the NANO communication tools, including the NANO website and NANO Newsletter (by Olga Shatova). Furthermore, Mr. Kentaro Ogiue, from the Nippon Foundation, gave an inspirational talk on the underlying reasons for Nippon Foundation's support of the NANO initiative and about their vision for the bright future of the Network. The Introductory session was completed by Dr. Gerry Plumley who presented the advantages of the relocation of the Centre of Excellence to the AWI, Germany's foremost polar and marine research institution.

Group photo at the NANO Coordination Meeting Berlin 2013. Photo by Dr. Victoria Cheung.

The first day continued with progress reports on Regional Projects and plans for 2014 from representatives of the 4 regional projects: Phan Minh Thu (Southeast Asia), Ravidas Naik and Kanthi Yapa (Indian Sub-Continent), Tiago Queiroz (North and West Africa) and Vivian Lutz and Jaimie Rojas-Marquez (Latin America). Furthermore, some of the alumni presented their ideas on how to better engage NANO alumni currently residing outside their home countries and far from centres of regional research projects. Small group discussions which engaged the new CofE scholars as well as the alumni, enabled planning for the Regional Projects and discussions on NANO Outreach, and wrapped up the first day of the meeting.

Proposals for the Research projects and Outreach activities in 2014 were drafted during the second day of the meeting. Representatives of each discussion group reported back to the plenary about their ideas. This was followed by group discussions on NANO communications and ways to enhance alumni engagement in NANO activities.

The meeting was closed on the afternoon of the 7th of December and all participants then attended an Inauguration ceremony for the new NF-POGO Centre of Excellence at AWI that took place at the Natural History Museum in Berlin. Overall, the meeting was very successful: main directions for further NANO development were identified and are presented next.

Shubha Sathyendranath opened the meeting welcoming the participants on behalf of POGO Executive Director, Trevor Platt. "*NANO is the Nippon Foundation and POGO's most precious resource and represents a significant component of the leadership for ocean science in the future*". Photo by Lilian Krug

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NANO Regional Research Projects in 2014

Southeast Asia

Eutrophication in the coastal waters of Southeast Asia: An assessment.

NANO members from three countries (Vietnam, Philippines and Thailand) will investigate eutrophication, possibly enhanced by nutrient load and modulated by residence time. The study will include fieldwork, lab measurements and application of the LOICZ approach and the eutrophication index.

Indian Sub-Continent

Monitoring of HAB Species in the coastal waters of India and Sri Lanka.

Objectives:

- Analysis of the data collected during the period of 2013 from Indian and Sri Lankan coasts;
- Use of multipurpose spectrophotometer and underwater radiometer to study the spectral characteristics of phytoplankton, detritus and CDOM;
- Screening of isolated cultures for their toxin potential;
- HAB workshop/training for Sri Lankan participants for common research methodology establishment.

North and West Africa

The first stage of the project is to set up sustainable nearshore erosion monitoring observatories in Angola, Ivory Coast and Tunisia (one in each country). The data will provide invaluable information to set up a Swell/Storm Early Warning System (SEWS), and will improve our understanding of the role of local and remote forcing wave generation and its impacts along West and North African coasts. In addition, the observations will be the pillar of the modelling effort (stage 2).

Latin America

Pigment analysis using HPLC in Antares network coastal time-series stations

It is planned to transfer the leadership in the Regional Project to Mexico with the new coordinator Adriana Gonzalez Silvera. Activities in 2014 will include a regional training workshop (in Mexico) for further development of the participants skills and intercomparison of HPLC analysis results.

NANO Outreach 2014

It was proposed to promote outreach activities of the alumni by providing small grants to support outreach in developing countries. NANO will also develop an online catalogue of educational Powerpoint presentations in different languages (provided and translated by alumni). Supporting materials will also include print outs (booklets, hand outs), stationery and writing materials, which are particularly important for countries without reliable access to the internet.

Ecological use of marine phytoplankton pigments at the Antares-ChloroGIN time-series stations
The Latin American Regional Project

Jaimie C. Rojas–Marquez

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A fruitful workshop on phytoplankton pigments was carried out in the framework of the second phase of the LA-NANO Project at the Station of Marine Research of the La Salle Foundation for Natural Sciences in Margarita Island, Venezuela, from 21 to 24 October 2013. A total of 17 participants were gathered including two special guests, Suzanne Roy (Université du Québec à Rimouski, Canada) and Crystal Thomas (NASA-Goddard Space Flight Center, USA), eight representatives of the five participating countries (Argentina, Brazil, Colombia, Mexico and Peru), and seven local researchers from Venezuela (see Margarita Final Report at LA-NANO wikipage for more details and the complete list of participants).

A few lectures were offered to provide a background on High Performance Liquid Chromatography (HPLC) for the analysis of phytoplankton pigments, including topics such as: principles and comparison of methods; applications in oceanography; pigment indices; CHEMTAX; and remote sensing of Phytoplankton Functional Types, among others. Working sessions were held to discuss and interpret the pigment results of the first phase of the project provided by NASA. An outline of a manuscript using this pigment information in conjunction with satellite data was drafted. There were also intensive group discussions on the topics of phytoplankton pigment uses in oceanographic research and the possibilities of carrying out HPLC analyses in Latin America.

Another concrete outcome was the gathering of new pigment samples collected at each of the participating stations during 2013, which were brought by the participants to Margarita, and with the kind help of Laura Lorenzoni were taken to the University of South Florida and from there shipped to the NASA laboratory for HPLC analyses.

One of the main issues discussed was the strategy to obtain quality phytoplankton pigment information at the Antares stations. All participants emphasized their interest to collect data on phytoplankton pigments on a continuous basis at each time series station. It also became clear through the first phase of the project, when samples were shipped to the NASA laboratory, and through the second phase, when participants carried their own samples to Margarita that transporting samples across international or even national borders is cumbersome and risky. The long term solution would be to have samples analyzed in our own countries. At this point most time-series sites (Argentina, Colombia, Mexico and Peru) have the possibility to carry out HPLC analysis at their laboratories or at partner laboratories within their countries, while Brazil still needs to formalize such a partnership, and CARIACO holds a private agreement with NASA. Several recommendations were agreed on regarding the collection and processing of the pigment samples (see details at the workshop report). Among the recommendations it was mentioned that the use of a common method would be ideal, however, currently there is international recognition that this is not always possible (e.g., Workshop on intercomparison of methods in time series); the important point is to know the strengths and weaknesses of each method used and how they compare among each other. In this sense it was advised that occasional inter-center comparisons of samples should be run with respect to replicates sent to the NASA laboratory. The need for proper calibration of the instruments, as well as specific training of the personnel, was emphasized. Throughout the whole workshop, the necessity to complement pigment data with the identification of phytoplankton species using microscopy was emphasized.

Participants of the Ecological use of marine phytoplankton pigments at the Antares-ChloroGIN time-series-stations

Future directions for the project were also discussed, and it was agreed that Adriana Gonzalez-Silvera will act as a new coordinator starting in April 2014, working with the support of the bio-optics group from the Universidad Autónoma de Baja California (Mexico).

Finally, I would like to offer my thanks for this opportunity offered to me by NANO to enhance my work in the field of oceanography in my country integrating it with that carried out by other alumni in Latin America. Especially I am grateful to my teacher, Vivian Lutz, for trusting in my ability to coordinate this project and to Guillermina Ruiz for her unconditional support. We also thank all the participants of the ANTARES stations since they form the core of the project.

NANO SEA Planning Meeting hosted by Marine Science Institute, University of Philippines

Dr. Victoria Cheung

Scientific Coordinator for the Partnership for Observation of the Global Oceans (POGO)
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In November 2013, a planning workshop was arranged to discuss and plan a collaborative regional project proposal for submission from the Southeast Asia (SEA) region. The two-day workshop was hosted by NANO Friends, Dr. Laura David and Dr. Aletta Yñiguez of the Marine Science Institute, University of Philippines, and attended by NANO Alumni from the Philippines, Thailand and Vietnam including Joseph Palermo, Irene Alabia, Anakul Buranaprattheprat, Phan Minh Thu, Le Dinh Mau, Pham Thi Phuong Thao, and local organisers and observers Kristina Cordero and Aldwin Almo.

The objectives of the workshop were to:

1. Introduce the participants to one another to encourage networking and collaboration;

2. Provide background information on the previous year's regional project conducted by NANO members from the SEA region;

3. Discuss the next steps for the NANO SEA regional project for the coming year;

4. Prepare a project proposal and outline budget for a collaborative NANO-SEA project.

After the self-introduction of the participants, Dr. Vikki Cheung provided an overview of NANO, its achievements and its objectives. A review of the NANO SEA project from year 1 was then provided by Dr. Aletta Yñiguez, which was entitled "Harmful Algal Bloom Remote Sensing Model (RS-HAB) for Southeast Asia Region".

Representatives from each of the three countries provided short presentations giving an overview of their current research interests and what they are able to contribute to a collaborative regional project. Led by Dr. Laura David, a group discussion involving all of the workshop participants enabled a project proposal to be outlined. It was noted that in the Gulf of Thailand, red tides were a major issue, but not toxic harmful algal blooms. It was established that water quality and eutrophication were important issues that needed to be monitored and addressed in the coastal waters of all of the NANO SEA countries and the participants were able to collectively draft a proposal and agree upon the methodology and variables that would be measured. The project proposed is entitled "Eutrophication in the coastal waters of SE Asia: An assessment". The aims of the research project are to provide useful insights that can form the basis for informing stakeholders and give suggestions on how to manage water quality on a local and regional level.

The proposal which was drafted at this meeting was further refined during the NANO coordination meeting held in Berlin, Germany in the following month. An update on the project progress since the Berlin Meeting is provided in the following article.

Eutrophication in the coastal waters of Southeast Asia - An assessment

The South East NANO Project

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Dr. Buranaprattheprat

Mr Palermo

Mr Thu

Summary

In this collaborative research project, NANO members from three countries (Vietnam, Philippines and Thailand) are investigating eutrophication, possibly enhanced by nutrient load and modulated by residence time. The project includes fieldwork, lab measurements and application of the LOICZ approach and the eutrophication index. This will also enhance networking between NANO members and other collaborators, and provide capacity building within the participating institutes.

Introduction

There are concerns about degrading water quality in the region as a result of unsustainable human activities and coastal development including aquaculture and agriculture, resulting in hypoxia, algal blooms and pollution in the

the coastal environments (Brown, 1985, Chen et al., 2001, Terrados et al., 1999, Wong et al., 2007). Increasingly, nutrient overload can lead to harmful algal blooms, fish kills, impacts upon tourism and ecosystems (Atapattu & Kodituwakku, 2009, Glibert et al., 2010, O'Neil et al., 2012, Ramesh et al., 2011). Of a graver concern is the long-term effect of eutrophication. Furthermore, we observe that most human activities are located within coastal areas thus making them vulnerable to the impacts of eutrophication.

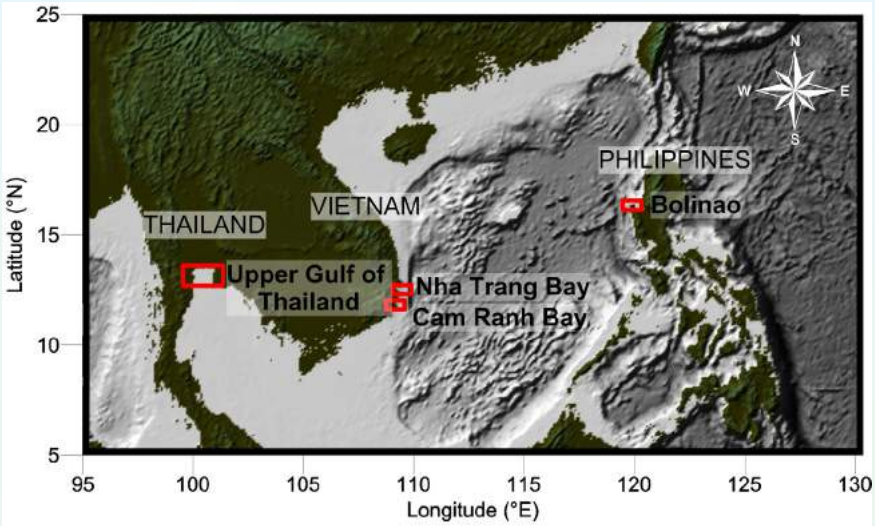

Figure 1 - Monitoring sites for the NANO-SE Asia Regional Project

The ability to accumulate or exchange nutrients in a water body is influenced by the residence time. It exhibits seasonality and can also be modified by human activities e.g. the build-up of fish cages within the systems has been shown to significantly alter residence time. To determine how impacted the systems are, the research will quantify residence time using the Land-Ocean Interactions in the Coastal Zone (LOICZ) methods and assess eutrophication indices for dry and wet seasons in four monitoring sites: Bolinao, Nha Trang Bay, Cam Ranh Bay, and Upper Gulf of Thailand (Figure 1).

NANO SEA II Project Implementation

Philippines

The NANO SEA II project in the Philippines is implemented by The Marine Science Institute (MSI), University of the Philippines (UP) as an enhancement to the existing project: '*Detection and Mitigation Technology and Early Warning System for Philippine Harmful Algal Blooms (HABTech)*', which is funded by the Department of Science and Technology (DOST) through The Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD).

Field campaigns in the water channel of Bolinao were conducted on 11 December 2013 and 26 February 2014, respectively, for wet and dry seasons. The latter was originally scheduled for March 2014 but due to other local cruise activities, oceanographic equipment at MSI was not available on the scheduled dates. A total of 17 research staff and 2 undergraduate volunteers have participated in the coastal monitoring. There were 8 researchers and 2 undergraduate volunteers on the first field campaign that covered 25 stations. There were challenges with limited manpower to carry out the entire monitoring activities in the last field campaign. There were only 7 full time researchers available that time and consequently only 15 monitoring stations were covered. However, all designated priority stations were successfully monitored as illustrated in Figure 2.

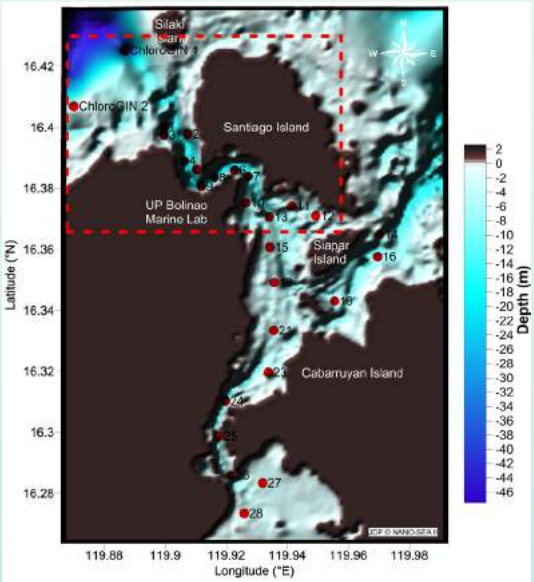

Figure 2 - Sampling stations in the Bolinao Channel. Enclosed in the rectangular box are the 15 priority stations for the oceanographic survey

The priority areas include two offshore stations (2.5 km away from the coast with depths of 40 to 50 m) labelled as ChloroGIN 1 & 2 and stations 1 to 13 located in the mouth through the middle of the water channel. This area has been of interest since it was heavily inflicted with *Prorocentrum minimum* blooms that have caused massive fish kills in the past (Azanza et al., 2005, San Diego-McGlone et al., 2008). Moreover, last April 2013, harmless algal blooms were reported in the same locality.

The field itinerary commenced around 5:30 am towards the offshore stations and later on the sampling team cruised along the inner channel of Bolinao until 6:00 pm. Two fiberglass boats and two outrigger boats were used during the first and the second field campaigns, respectively. Infinity ME, CTD and ADCP were deployed on board manually, plankton samples were collected through vertical net tows, and discrete water samples were obtained using Niskin bottles in all of the monitoring stations (Figure 3A-E). Protocols for sample collection, pre-processing and analysis were followed as described by Parsons et al. (1984), Harris (2000), Suthers and Rissik (2009), and UNESCO (2010). All of the monitoring parameters that were measured are listed in Table 1.

Project participants were involved in the training and demonstration of coastal monitoring activities in the NF-POGO AWI-CofE Regional Training Programme on the '*Detection of HABs in Southeast Asia by Remote Sensing: Operational Warning and Regional Monitoring Protocols*' held last 24 February to 16 March 2014. A short introduction to equipment and technical operation of CTD and ADCP was given. Datasets taken from the first field campaign were shared with the scholars and they were taught how to process and visualize

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Figure 3 - Highlights of the oceanographic monitoring activities in Bolinao, Philippines. A) On-site programming and calibration of ADCP. B) CTD deployment and real-time ADCP acquisition. C) Initialization of Infinity ME (Multi-exciter in-situ fluorometer) for deployment. D) Ship board pre-processing of nutrient, dissolved oxygen, pH, and chlorophyll-a samples. E) Deployment of Infinity ME and collection of plankton & discrete water samples using a Niskin Bottle on board a fiberglass boat. Photo by Joseph Dominic Palermo

data in ODV. Their results were later compared to the algal bloom event in April 2013.

Thailand

Water quality parameters at 5 major river mouths in the north of the upper Gulf of Thailand (UGoT) were measured and collected on 22 - 23 February 2014. Each site was visited by car and then a small local boat was hired to measure and collect water samples. Field observations in UGoT were carried out using RV Kasetsart 1 on 27 - 28 February 2014. The field observations started near a small island in the east (Figure 4), and the route followed a clockwise direction from offshore to near shore transect lines. Temperature and salinity were measured at 1 m intervals by using a CTD while water samples were collected at 2 depths, near the sea surface and near the sea bed. Water samples were filtered onboard and then refrigerated for further analysis in the laboratory. The chemical and biological parameters to be measured included nitrate, nitrite, phosphate, ammonia, silicate, dissolved oxygen, pH, BOD and chlorophyll-a. The vessel left the port at around 7 am and stopped in the west of UGoT after completing the field work for 4 stations at about 5 pm of the first day. All members, after having dinner, slept onboard that night. Measurements of seawater properties and water samples were completed for all 7 stations around 1 pm of the second day. The sea conditions were quite rough during the cruise due to the south wind but all members were able to handle their duties very well.

Vietnam

The environmental quality in Nha Trang and Cam Ranh Bay were investigated by the Vietnamese team (8 staff of VNIO and one from Ho Chi Minh City) on 6-9 January 2014. At Nha Trang, tourism boats were hired for two days for the field trip from 6 am to 5 pm, whereas in Cam Ranh Bay, a local fishing boat was hired to visit the sampling sites from 5 am to 7 pm. The total number of stations was 21, including 8 stations in Cam Ranh Bay, 11 stations in Nha Trang Bay and 2 stations in the river. At every station, water samples were taken from the surface and bottom water layers if the water depth was more than 5 m and at only 2 m depth in shallower waters. CTD and current profiles were measured on board and analysed on return to the laboratory. DO, nutrients, TSS and Chlorophyll-a samples were prepared on board ship, and stored at 4 °C in dark conditions. All samples for TSS and chlorophyll-a were filtered immediately after returning to the laboratory in the night time and keep in a freezer. All of the samples were analysed after the field trip finished.

In addition, participants in the VAST project (VAST-ĐLT.01/13-14) joined the field trips. That project focussed on light profiles, Fluorescent-chlorophyll-a profiles, marine optics and primary production. These parameters were measured at the same stations and at the same water depths.

Weather and *in situ* conditions were challenging and had impacts on the project participants' ability to collect samples. The strong wind and waves in Nha Trang Bay contributed to increasing the time of the field trip and the number of people involved in each activity. In Cam Ranh Bay, due to cloudy condition, light profiles could not be measured, so marine optics were given the priority for light intensive measurements in the water.

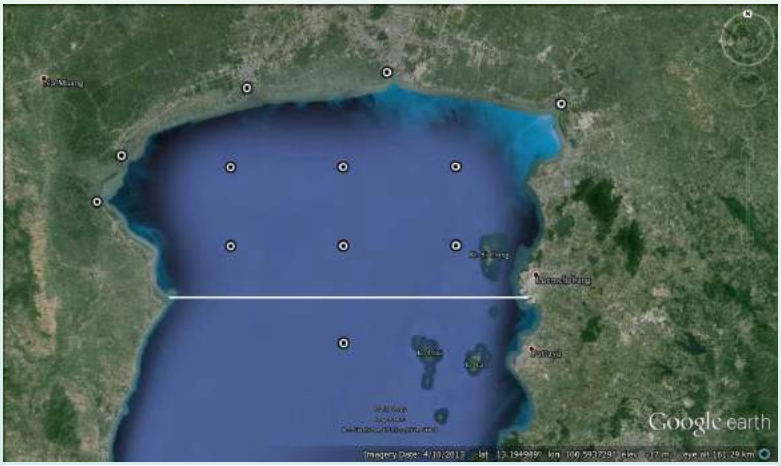

Figure 4 - The upper Gulf of Thailand. Dots represent stations for seawater measurement and samplings

Figure 5 - Highlights of the oceanographic monitoring activities in the Upper Gulf of Thailand. A) Pre-processing of water samples on board. B) Discrete sample collection. C) RV Kasetsart 1 for UGoT observation. D) Sampling at a river mouth

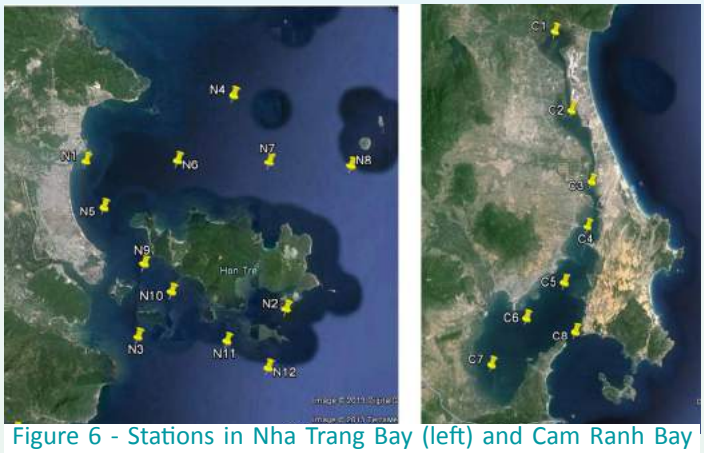

Figure 6 - Stations in Nha Trang Bay (left) and Cam Ranh Bay (Right), Vietnam.

Figure 7 - Highlights of activities of the field trips in Nha Trang and Cam Ranh Bay, Vietnam. A) Team on board in the beginning. B) Moving samples and equipment from fishing boat to coracle. C) Collected CTD profiles. D) Water collection

Table 1 - Water quality parameters monitored in the three NANO-SEA countries (P for Philippines, T for Thailand and V for Vietnam). Numbers 1, 2, 3 and 4 refer to the field work dates 11-Dec-13, 26-Feb-14, 22-23 Feb 14 and 5-10 Jan 14, respectively

	Country	P		T	V
	PARAMETERS	1	2	3	4
Biological	Chl-a (µg/l)	x	x	x	x
	Multispectral Florescence (nm)	x	x		x
	Phyto chl per functional type (µg/l)	x	x		
	Phyto cell density (# ind/m^3)	x	x		
	Zoop density (# ind/m^3)	x	x		
	Zoop Biomass (dry wt/m^3)	x	x		
	Zoop Gut Chl (µg chl-a/ dry wt (µgC)/m^3)	x	x		
	Biological Oxygen Demand (BOD)			x	x
Physical	Temperature [CTD]	x	x	x	x
	Salinity (PSU) [CTD]	x	x	x	x
	Turbidity (FU) [CTD]	x	x		x
	Density [CTD]	x	x	x	x
	Water current [ADCP]	x	x		x
	Irradiance				x
Chemical	Nitrate + Nitrite ($NO_3 + NO_2$)	x	x	x	x
	Phosphate (PO_4)	x	x	x	x
	Silicate (SiO_3)	x	x	x	x
	Ammonia (NH_4)	x	x	x	x
	TSS	x	x		x
	Dissolved oxygen (DO)	x	x	x	x
	Dissolved Organic Carbon (DOC)	x	x		
	Total Dissolved Nitrogen/Phosphorous (TDN/P)	x	x		
	Coloured Dissolved Organic Matter (CDOM)	x	x		x
	pH	x	x	x	x

For references, please contact the author at **jaydeepalermo@gmail.com**

OUTCOMES OF NANO SEA PROJECT 2013

PDF available at the SEA 2013 Project (http://www.nf-pogo-alumni.org/South-East+Asia+Regional+Project)

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NANO OUTREACH PROJECT

Call for participation
New NANO Outreach Project

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Ms Akita


Ms Orchowska

"It is a curious situation that the sea, from which life first arose, should now be threatened by the activities of one form of that life. But the sea, though changed in a sinister way, will continue to exist; the threat is rather to life itself." - Rachel Carson, (1907-1964) The Sea Around Us, 1951

Rationale

The ocean is our earth's greatest natural resource. It is the place of origin for most life forms. Global environmental change and climate change effects on oceans are largely acknowledged and studied by the scientific community. However, public understanding of the vital role of the ocean, its processes and human impacts on the ocean is still inadequate.

"Education's purpose is to replace an empty mind with an open one."— Malcolm Forbes

Education in all forms is urgently needed to address issues of climate change, environmental degradation and its impacts on ocean ecosystems. Fundamental changes in human attitudes and behaviour can help address some of the issues. Progress in this direction is critically dependent on education and public awareness. It is imperative to advance ocean science and marine literacy by providing innovative outreach opportunities for students through virtual learning and simple hands-on-practical experiences in ocean science. The goal is to share the wonders of the ocean realm with young people and the general public while inspiring awareness and action for ocean science education, marine conservation and protection, and marine ethics.

General Objectives:

1. To improve public awareness of the contemporary state of the world ocean and marine research through ocean science communication, education and outreach activities.

2. To provide a platform for NANO scholars and alumni for development of their ocean science advocacy and outreach skills.

Specific Objectives:

1. To engage active participation of NANO scholars in thinking globally but acting locally using online outreach tools for dissemination of ocean science information.

2. To motivate young people to pursue marine science and to promote sustainable use of the ocean through sharing of experiences and scientific passion in the local media.

3. To support NANO scholars in providing ocean science education in schools (e.g. presentations, seminars, films, posters, stickers, etc.) through partnerships and involvement with national educational institutions.

The focus is on ocean science communication, education and outreach.

The primary aim is to increase the awareness on ocean science to young people and the general public.

The first strategy is the establishment of an online catalogue of teaching materials.

The second strategy is the use of online materials by alumni and friends of NANO for teaching ocean sciences to young people and the general public.

The third strategy is the establishment of short-term, modest funding for ocean science outreach activities in schools. Funding will be available for good ocean science outreach proposals.

We intend to collect material prepared by NANO alumni on relevant ocean science topics for different age groups (e.g. ages 6-10, 11-13, and 14-18).

NANO Alumni are invited to actively participate in this great initiative.

Guidelines for preparing presentations:

Topic: Any topic of your interest on ocean science (e.g. Impact of plastic debris on marine ecosystems). Topics should be well-explained in simple everyday words for good understanding by the general public.

Target group: Any target group of your choice.

Format:

1. Short article (2 – 3 pages),

2. Power point presentations (15 – 30 minutes or 30 – 45 minutes)

3. Short posters

4. Animations, videos or any other materials

Mode of communication: The topics should be well-explained in simple words.

Deadline: 30 April 2014

Security: Your authorship will be secured. Only pdf versions of the presentation will be published and the author will be clearly acknowledged.

NF-POGO CofE at AWI - Introducing the new scholars

Pogonians Year 5 (2013–2014)

Compiled by Joeline Ezekiel and Shaazia Mohamed

***Check the alumni wikipages by clicking on their names**

Ms Ezekiel

Ms Mohamed

Widya Ratmaya (Indonesia): *Halo semua, apa kabar?* This is an Indonesian greeting meaning *"Hi everybody, how are you"*. Widya graduated under the Masters Double Degree Program (Indonesia-France) in Coastal Resource Management, from a Concentration Program in Planning and Management of Marine Resources at Diponegoro University, Semarang, Indonesia in April 2013. Before joining the NF-POGO CofE-AWI program, Widya studied the changes of the macro-zoo-benthos community structure in Jepara's Waters (Northern part of Central Java Province). Widya is looking for opportunities as a PhD candidate in marine biogeochemistry.

Subrata Sarker (Bangladesh): Subrata did his Master's in Marine Science at the Institute of Marine Sciences and Fisheries, University of Chittagong-Bangladesh. His Master's thesis was focused on geospatial modelling of fish habitat in the northern Bay of Bengal. Before joining the NF-POGO CofE-AWI, Subrata worked on eco-engineering for coastal defence and aquatic food production as a research associate. The objective of the project was to develop artificial oyster reefs to mitigate against coastal erosion whilst providing seed stocks that coastal villages could possibly utilize as a food source. Subrata believes that understanding the ocean dynamics from NF-POGO CofE-AWI courses will help him in his work when he returns home. For him, the CofE is the door for creating a global network and here is Subrata's message to his fellow Pogonians, "My dear Pogonian friends, other than my family in Bangladesh, you all are my family members and I hope for the rest of the days we will have a great time with our best team efforts to realize our dream in becoming oceanographers".

Shaazia Mohamed (Trinidad & Tobago): Shaazia is a Master of Philosophy research student affiliated with the University of the West Indies, Trinidad & Tobago. Her passion for preservation of marine ecosystems was the main driver for her research on Climate Change and its effects on coral reefs in Trinidad and Tobago. She has investigated the steady increase in sea temperature that has resulted in unprecedented bleaching events. Shaazia's research focuses on monitoring these events in order to promote conservation of these fragile marine ecosystems. She believes that the core skills offered through this CofE program would be a true asset towards strengthening her present research skills and also exposing her to other areas of research in oceanography. This program also provides Shaazia with the opportunity to communicate with professionals creating a forum for networking especially in the area of hydrodynamic modelling. It is for this reason that she is excited to continue research in oceanography at the PhD level whilst simultaneously creating awareness of research opportunities in related oceanography topics focused on Trinidad & Tobago and the Caribbean at large.

Lobsang Tsering (Tibet): Lobsang is Tibetan by origin; however, he was raised in India. He completed his Master's in Marine Biology from Pondicherry University, Andaman Island, India. His thesis was titled "Environmental Impact of deep sea benthos on Polymetallic nodules mining from Central Indian Ocean Basin" in which he focused on taxonomy studies of macro-benthos, epibenthic organisms, and deep-sea ecology. After graduation in 2012, he joined the National Institute of Oceanography (NIO), Goa as a research assistant. During his tenure at NIO, he gained experience in intertidal studies, coastal water expeditions and deep-sea research. He was involved in a coral reef monitoring project where he helped in translocation of corals from threatened zones of pipelines to safe zone areas in the Gulf of Oman-Muscat. Apart from deep-sea study, Lobsang has a keen interest in coral reef ecology and ecosystem functional studies. From his passion for deep sea research and coral reefs, Lobsang became a certified diver. He attended SCUBA School International in Havelock Island. Lobsang would like to continue to work on coral research especially on corals located in the Indian Ocean at the PhD level, as he believes these corals are under severe anthropogenic threats.

Joeline Ezekiel (Tanzania): Joeline is a postgraduate student at the Institute of Marine Sciences, University of Dar es Salaam. She is at the final stage of submitting her Master's thesis titled "Temporal and seasonal variations of phytoplankton in Rufiji Delta/Mafia Channel, Southern Tanzania". Her desire to protect the oceans has encouraged her to become a tutor at the Fisheries Education and Training Agency (FETA), mentoring young students in aquaculture and environmental education. Joeline is a past POGO-SCOR visiting fellowship recipient. Her areas of interests are in primary production and remote sensing of the ocean.

Wilfried Panassa (Togo): Wilfried is from northeast Togo (West Africa). He completed his Master's degree in Physics at the University of Lome (Togo). He moved to Benin in 2010 where he did his second Master's in Physical Oceanography

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at the International Chair in Mathematical Physics and Applications (ICMPA-UNESCO Chair) and Co-diploma with the University of Toulouse, France, in 2012. His Master's thesis was on, "Assessment of variability and changes of water cycle in the Atlantic Ocean and West African continent''. Wilfried utilized IPCC models (CMIP3/CMIP5) to study changes in rainfall and sea level data in the context of global climate change. He received an opportunity to attend a workshop in ''Fundamental ocean modeling in global and regional scale'' organized by ICTP in collaboration with the Indian National Centre for Ocean Information Services (INCOIS), India, in August 2013. His research interest is coastal erosion which is the major threat to this country's coastline. He would also like to study coastal morphology and its hydrodynamic characteristics for the coastal area. For this he is looking forward to join the NANO-African group project on coastal erosion. This would allow him to gain experience and knowledge for further research at the PhD level on ocean modelling.

Mathew KA (India): Mathew has a Bachelors degree in Botany and Biotechnology, after which he pursued his Masters in Marine Biology at Cochin University of Science and Technology, India. Mathew was a research fellow on the Indo-Mareclim Project at the Nansen Environmental Research Centre, India. He later joined the Indian Institute of Science, Bangalore, India. His main research interest is to study the influence of climate shift on the marine ecosystem with special reference to fluxes in biogeochemical cycles. At the NF-POGO CofE AWI, he is delighted to receive world-class training from international experts in oceanography. Mathew would like to be part of future workshops and conferences in ocean science and climate change, where he would be able to contribute productively and motivate prospective students to take up research in ocean science in his home country.

Pedro Montoro Enrique Gonzalez (Cuba): Pedro is from Pinar del Rio City, the western province of Cuba. He has a Bachelor's degree in Meteorology (2010) and MSc in Atmospheric Physics (2012). Pedro works as a forecaster and researcher in the Meteorological Prediction Centre of Pinar del Rio. His research interests include climate change and numerical modelling. To Pedro, the NF-POGO CofE-AWI program is a good opportunity to increase his scientific knowledge in oceanography as a multidisciplinary science and to obtain new tools to combat the main issues of coastal areas around the world. With the knowledge gained, Pedro will return to Cuba to train other researchers through workshops and educational meetings throughout the country in order to achieve a positive change of thinking and acting. He believes this would be an important tool for collective action with the slogan "Together we have the power to protect the ocean."

Natália Tasso Signorelli (Brazil): Natália is a physical oceanographer, from São Paulo, Brazil. She graduated with a BSc in Oceanography in 2010 from the University of São Paulo, and later earned her MSc in Physical Oceanography last year from the same institution. In her Master's thesis, in collaboration with IFREMER, Brest, France, she explored the variability in the Atlantic Meridional Overturning Circulation in global oceanic models. This variability was linked to both: 1) changes in the western boundary currents close to the Brazilian shelf linked to the changes in the South Equatorial Current bifurcation position (North Brazil Current/North Brazil Undercurrent at surface and the Intermediate Western Boundary Current at intermediate level); and 2) changes in the thermohaline properties of the water masses carried by these currents (South Atlantic Central Water and Antarctica Intermediate Water). With a strong background in ocean models, she believes that the NF-POGO CofE will be important to her career back in Brazil, improving her abilities in science management and operational oceanography, and expanding her horizons.

Pogonians Year 5 (2013-2014): From left behind are Mathew, Joeline, Pedro, Shaazia, Subrata, Wilfried and Widya. In the front from right are Sutaporn, Lobsang and Natalia. Photo credit: Silvia Giesicke, AWI

Sutaporn Bunyajetpong (Thailand): The main emphasis of Sutaporn's previous research activities was in marine natural products. Together with her expertise gained from her PhD (in marine natural products) and her zeal for research related to oceanography, she was accepted as a current lecturer in the Department of Marine Science, Faculty of Science, Chulalongkorn University, Bangkok, Thailand. Sutaporn's main role at the university is to impart knowledge to her eager students whilst carrying out marine research. Participating in the NF-POGO CofE-AWI program was a perfect opportunity for her since she did not graduate directly in the field of oceanography. After NF-POGO CofE-AWI she will go back to Thailand where she will be able to: 1) teach students with the further knowledge and experience in chemical oceanography, 2) produce a new generation of oceanographers in Thailand, and 3) do useful research that has positive impacts to the community, the country and the world. Furthermore, the connections made with oceanographic experts and the fellow CofE scientists around the world will provide useful networks for her future research endeavours.

Tribute to a Great Nobel Laureate, Professor Martin Karplus

Kanthi K. A. S. Yapa
Department of Physics, University of Ruhuna, Matara , Sri Lanka

Prof. Martin Karplus of Harvard University (Emeritus professor) was one of the three Nobel Laureates in Chemistry in 2013. He was awarded the Nobel Prize for his contribution for the development of multiscale models for complex chemical systems. I had a personal acquaintance with Prof. Karplus some years back as a graduate student and I would like to share those valuable memories and experiences with the NANO community through this short article.

I was admitted to the Graduate School of Tufts University, Medford, Massachusetts, USA in September of 1983 and started my postgraduate studies in the Department of Physics. After completing my MSc degree in June 1985, I started my PhD programme under the supervision of my advisor, the late Prof. David Weaver (he was a great supervisor and had a great personality, I learned to face and overcome challenges on my own following in his footsteps). My field of study was in theoretical bio physics and the research problem centered on model building, protein folding mechanisms and molecular dynamics/kinetics (If you are wondering, I stepped into the field of remote sensing/oceanography only later, after attending one of the very first workshops held by Dr. Trevor and Dr. Shubha on Ocean Colour in Bangalore, India in 1995). My external supervisor was Prof. Martin Karplus who was the Chairman of the Department of Chemistry at Harvard University at the time. Harvard is located in the city of Cambridge, just a few kilometers away from Tufts. Prof. Karplus had been working on the problem of protein folding since late 1960s and his collaboration with Prof. Weaver in the early 1970s has resulted what is known as the diffusion–collision model, a simplified model for the protein folding process. Among his enormous contributions, developments in structure determination and folding mechanism of proteins had an enormous impact on the fields of Chemistry and Biology which may have ultimately paved the way to the highest honour, the Nobel Prize.

Among his enormous contributions, developments in structure determination and folding mechanism of proteins had an enormous impact on the fields of Chemistry and Biology which may have ultimately paved the way to the highest honour, the Nobel Prize.


Prof. Martin Karplus

Let me give a very brief description about the protein folding problem, as the great majority of the NANO community may not be very familiar with it. Three-dimensional conformation or the native structure determines the biological activity of any globular protein and the native structure folds spontaneously or in a time scale of microseconds to seconds under appropriate conditions without any information than that contained in the amino acid sequence. An essential part of molecular biology is to predict a native structure from its amino acid sequence, modeling what the genetic code does in nature. However, as many millions of different possible sequences are available even for a moderate length of amino acid chain, determination of native structure by physical methods is not possible. Therefore, only a computational model made appropriately to predict the nature of the final three-dimensional structure would provide a rational approach. The diffusion–collision model is a simplified model in which the formation of the tertiary structure of a protein takes place by diffusion, collision and coalescence of fluctuating structural elements (microdomains) such as α-helices and β-sheets. Existence of microdomains and consideration of microdomain–microdomain collisions in the model avoids examining the entire set of conformational alternatives, thus making the computation more practical as well as close to nature. Only very recently experimental studies demonstrated that the diffusion–collision model describes the folding mechanism of many proteins. My research problem was mainly about studying possible sheet–coil transitions of β-strands. Though it may not have contributed much to his Nobel Prize, I am very proud to have a paper published from my research work with Professor Weaver and Professor Karplus titled "β-*Sheet coil transitions in a simple polypeptide model**". Professor Weaver and I also had the privilege to publish a paper in a volume of the Journal of Physical Chemistry, dedicated to honor Professor Karplus acknowledging his vast contribution to molecular research titled *"Protein Folding Dynamics: Application of the diffusion-collision model to the folding of a four-helix bundle**"*.

During my time at Tufts from 1985 – 1989 I had many visits to Harvard for discussions as well as to attend regular colloquia held in the Department of Chemistry by students and postdoctoral fellows of Prof. Karplus. He had a large number of postdoctoral fellows and students working with him that time, more than 25, if I remember correctly. He attended every such colloquium and they postponed talks if he was away. I had to make a presentation as well and I vividly remember how nervous I was before my presentation, mainly because Professor David couldn't attend that meeting for some reason. I was nervous for making mistakes because not only Prof. Karplus, but also the whole audience was very knowledgeable about the topics discussed at meetings as they all had similar backgrounds. However, during the delivery I felt very comfortable and as always, Professor Karplus was very gentle in pointing out mistakes in slides or when offering suggestions about contents or procedures. He had such a great capacity that he could

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Prof. Karplus showing his Nobel Medal during his visit to the Nobel Foundation. On this occasion, the Laureates retrieve the Nobel Diploma and Medal, which have been displayed in the Golden Hall of the City Hall following the Nobel Prize Award Ceremony. The Laureates also discuss the details concerning the transfer of their prize money. Photo by Niklas Elmehed. Copyright and source for photo and caption:© Nobel Media AB 2013

work on many different problems at the same time and even further, he could remember every single problem that his students and postdoctoral fellows were working on. Those meetings were very fruitful, and although as students we could not follow and understand much of the detailed discussions, they provided a very good foundation to build up a strong research career. Also, the meeting atmosphere was very conducive to free exchange of ideas as well as very friendly and quite a majority of his research fellows and students were from outside United States which helped us to "fit in" quite comfortably. He was very much like a father figure, but a very friendly and a gentle one, all had great respect and admiration for him. One such colloquium had fallen on his birthday, which was in March, and his postdoctoral fellows had ordered a huge "ice cream" cake to celebrate his birthday as well as to surprise him. Though it was March, the day was somewhat warmer than usual and on top, Prof. Karplus was getting late coming to the colloquium as the earlier meeting he attended had dragged on, the fellows were on pins and had to use all their chemistry knowledge to keep the ice cream cake from melting, but at the end it was a great birthday celebration.

Just as Prof. Karplus had a huge group of researchers and students he also had a huge office room in the department, but there was no place for anybody to sit and talk inside the room because every floor space and every chair (except his chair, of course) was filled with piles and piles of manuscripts, papers, etc. (the majority could have been his own – coauthored by his students and postdoctoral fellows). Whoever went to the room to meet him had to reach his table very carefully without stepping on those piles and piles of papers. He had published hundreds and hundreds of papers (over 800 papers by now) and had won many prestigious awards, we knew even at that time the only award left for him to win was the Nobel Prize and he very much deserved to win it in 2013. He was a very simple, friendly and down to earth person with a pleasant and sincere smile all the time. He was a great cook too, especially French and Spanish cuisines, and he used to say that the best chemistry he did was in the kitchen. I remember once visiting his home for a dinner and he was the sole cook that evening, he greeted us still wearing the apron. Though I had very little chance to work with him directly during my postgraduate career and though I compared myself only as a tiny fish in the vast ocean of his collaborators, he was so sincere to reply promptly to my late email message sent congratulating him on his great achievement. I take this opportunity to wish him many more healthy and productive years ahead.

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Prof. Karplus receiving his Nobel Prize from His Majesty King Carl XVI Gustaf of Sweden at the Stockholm Concert Hall in December 2013. Photo by Alexander Mahmoud. Copyright and source for photo and caption: © Nobel Media AB 2013

NANO connects with an alumnus from Fiji

Zahidah (Zaidy Khan)
Centre for Resource Management and Environmental Studies (CERMES) . The University of the West Indies.

I love the ocean. It is an incredible source of beauty in this world, and the biodiversity and economic value and livelihood it provides is immense. But, what really happens under and above the ocean currents? While working in the field of marine eco-tourism, coral restoration and the aquarium trade industry in my early career, I came to realize that there are so many people who are not adequately engaged in conversations about the value of life underwater, the importance of corals, various life forms and cycles, and underwater connectivity among different ecosystems. While conducting coral reef monitoring in various remote areas, I was also fascinated by the local / traditional knowledge and management practices that fishers and divers in coastal communities across the Pacific Ocean were practicing for their daily livelihoods. I became interested in methodologies for spreading marine education and knowledge outside schools and academic institutions and ways to incorporate local and traditional knowledge into marine and fisheries management.

In 2005, I joined The Foundation of the People of the South Pacific International Communities and Coasts Programme. I worked with my supervisor, Dr. Hugh Govan, who is one of the lead practitioners in the Locally Managed Marine Area (LMMA) network. I worked as a regional coordinator in assisting with the proliferation of LMMAs and community-based marine protection area (MPA) network projects in five countries in the South Pacific region under the Coral Reef initiative. These projects expanded my knowledge of integrating marine science with social MPA networking.

After 8 years of working in the field and seeing the rise and fall of MPAs, from paper parks to destruction of MPAs via industrialization and coastal development, I asked myself whether there is still hope for conserving marine resources through MPAs.

So, what happens above the currents that is equally important to preserving what is below?

Today what inspires and continues to strengthen my passion for marine conservation are the connections above the currents: social natural resource networks and connectivity of leaders, practitioners, fishers, youth and women, scientists, policy makers and communities who are actively engaging in expanding marine resource management and conservation for the importance of livelihoods, wellbeing, poverty mitigation, and food security. One great inspiring example that I had been involved with is Vanua (Land) Tai (Sea) Resource monitors (VTRM) network, an 18 year old network in Vanuatu which is built from a community- based turtle monitoring program to now a nation-wide network of natural resource monitors who foster environmental stewardship through community-based approaches integrated with traditional and scientific knowledge of natural resources. It is inspiring for me to see an ecological network that has been set up to integrate social networks through years of communication and sharing of results and coordination among institutions and local communities. These turtle monitors and scientists of today provide a holistic systems approach to national level networking with much less NGO and donor aid interventions. More details on this network can be found on this link

http://www.fspi.org.fj/index.php/cc-projects/cbc-resource-management/project-cc1001updates/entry/vanua-tai-resource-monitors-annual-general-meeting-report.

Another example is the Caribbean National fisherfolk network, with which I am currently engaged in Grenada West Indices. By working with various social and civil society fisheries social networks and MPA / natural resource management networks, I believe there is still great hope to act now to protect and manage our marine and coastal resources. This year I have received a 2nd award from the Nippon Foundation, United Nations, The Nippon Foundation of Japan Fellowship Programme: Human Resources Development and Advancement of the Legal Order of the World's Oceans. I would like to thank the Nippon Foundation for all their continuing support.

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The view on the North Atlantic phytoplankton spring bloom from seagliders

Anna Rumyantseva
Wikipage : http://www.nf-pogo-alumni.org/~Anna+Rumyantseva

Four years ago, studying theoretical physics in Lomonosov Moscow State University, I never thought I could further my scientific career in ocean biochemistry. However, experience obtained at the NF-POGO Center of Excellence at the Bermuda Institute of Ocean Sciences (BIOS) taught me about the fascinating work being conducted at the interface between physics, biology and chemistry and how they are all connected in the ocean. After graduating from the CofE, I was fortunate to be offered a PhD position at the National Oceanography Centre of Southampton (NOCS), UK.

In my PhD project I try to establish environmental factors that trigger immense phytoplankton spring blooms in the North Atlantic Ocean. Rapid growth of phytoplankton in spring has important consequences for the pelagic ecosystem. The bloom of diatoms is associated with high export of carbon to the deep ocean and is particularly important for ocean sequestration of atmospheric CO_2. The timing and magnitude of spring blooms control zooplankton community evolution that has cascading effects on higher trophic levels. For example, late phytoplankton blooms can result in low survival of larval fish. Determining what mechanism triggers rapid phytoplankton growth in spring is essential for predicting the state of the pelagic ecosystem and its role in the carbon cycle under different scenarios of global climate change.

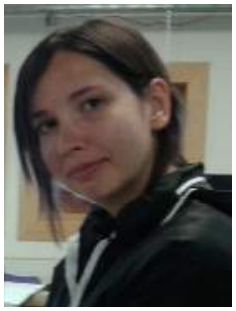
Figure 1 - Robot Seaglider on board RRS "James Cook"

At the moment several hypotheses for phytoplankton spring bloom initiation have been suggested. The classic hypothesis proposed by Harald Sverdrup in 1953 states that spring blooms start when the ocean mixed layer shoals above the critical depth, defined as the depth at which net phytoplankton losses are equal to net phytoplankton growth. However, this hypothesis has been questioned recently in a number of studies and several alternative mechanisms have been proposed, such as changes in the upper ocean turbulent mixing, shifts in heat fluxes between the ocean and the atmosphere, decreasing grazing pressure and submesoscale dynamics.

In order to test the different hypotheses for spring bloom initiation (or maybe to come up with my own hypothesis) I use data from autonomous underwater Seagliders (Figure 1). The amount of data that can be obtained by Seagliders and their ability to operate in different seasons and diverse weather conditions make them a powerful instrument for studying bio-physical interactions in the ocean. Being operated remotely, Seagliders dive and ascend in the ocean by regulating their buoyancy. Wings on a glider are designed to control its tilt in the water to allow horizontal movement. When the Seaglider comes to the surface, it communicates with a satellite, receives flight parameters for the next descent and transmits data collected on the latest dive.

In the framework of the OSMOSIS project (Ocean Surface Mixing, Ocean Submesoscale Interaction Study) two Seagliders were simultaneously deployed at the Porcupine Abyssal Plain site (North-East Atlantic Ocean, 49 °N, 16.5 °W). The aim of the OSMOSIS project is to study and parameterize processes that deepen and shoal the ocean surface boundary layer such as Langmuir circulation, mixing below the mixed layer, and submesoscale eddies. Along with the glider measurements, the project involved deployment of nine heavily instrumented moorings and measurements of mean currents and turbulence dissipation during cruises to the study area. The glider program involved one year (September 2012 – September 2013) of continuous measurements with spatial coverage of ~20 x 20 km^2 and glider turnaround every 3-4 months. The total outcome of the mission is 8458 vertical profiles of temperature, salinity, chlorophyll-a fluorescence, particulate optical backscatter, photosynthetically available radiation (PAR), and oxygen.

The glider mission was directed by Prof. Karen Heywood from the University of East Anglia (UEA). Karen and her group in UEA have great experience with running Seaglider missions in different regions of the world ocean (even in Antarctica!).



Anna is a second year PhD student in the Ocean and Earth Science division at the National Oceanography Centre Southampton, UK. Her research interests include phytoplankton ecology, biophysical interactions in the ocean and ocean turbulence. She is excited about her project and looks forward to shedding some light on the exact mechanisms that trigger phytoplankton blooms.

During the year of the deployment I had a chance to participate in the piloting of the gliders. Also on one of the cruises to the study site I was assisting Dr. Gillian Damerell (senior postdoctoral researcher, UEA) with Seaglider deployment and recovery.

The dataset obtained by the gliders is comprehensive and at the moment a number of scientists from different institutes are working on it. My part of the project is to look at the biogeochemical data from the gliders (chlorophyll-a fluorescence, particulate optical backscatter, photosynthetically available radiation). The obtained timeseries of chlorophyll, mixed layer depth and euphotic depth are shown in Fig 2. The work is supervised by Dr. Stephanie Henson (NOCS), Dr. Adrian Martin (NOCS), Dr. Stuart Painter (NOCS), Prof. Karen Heywood (UEA), Dr. Jan Kaiser (UEA) and Dr. John Taylor (University of Cambridge).

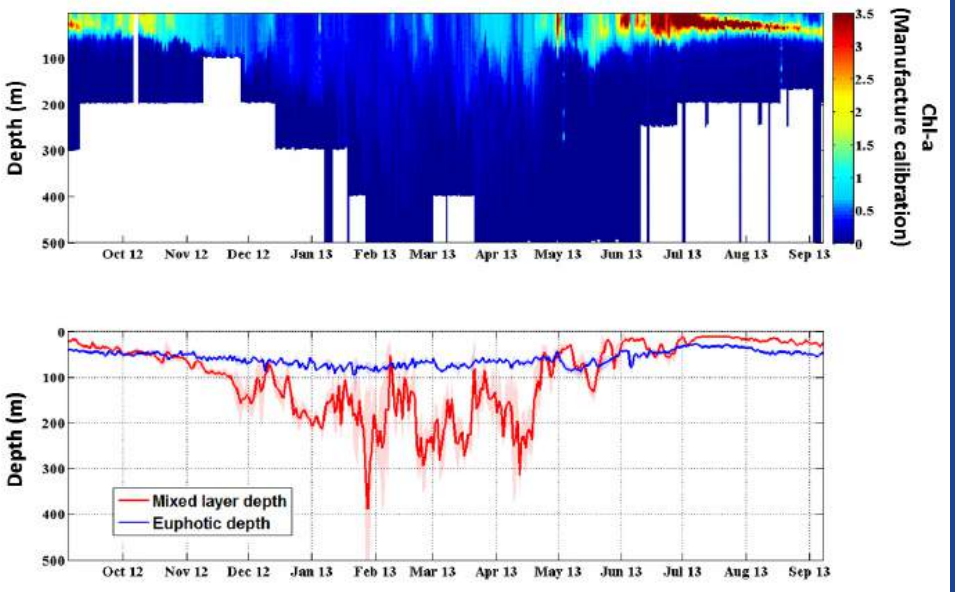


Figure 2 - Timeseries of chlorophyll-a (top), mixed layer depth and the euphotic depth (bottom) obtained by OSMOSIS Seagliders.

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Watch owned by our alumnus, Arvind Sigh

It is always time to celebrate!

Watch design competition

NANO 3rd Anniversary

On the occasion of the 3rd anniversary of NANO we are organizing a watch design competition among our alumni. Send us an original idea for an ocean, science or NANO-related design. The selected design will be produced and the winning designer will receive one! In addition, the watches produced will be used for outreach and educational purposes.

Submit a drawing in a digital format* to ssve@pml.ac.uk by 30 May 2014

*jpeg, tiff, png or eps files with at least 300 dpi resolution

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Two fascinating research cruises in the Bay of Bengal during 2013

Nilanthi Champica Priyadarshani
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With the collaboration of the Institute of Marine Research, Bergen, Norway and the Office of Naval Research, USA, two research cruises were carried out in an area east of the Sri Lankan EEZ, in the Bay of Bengal, from the 22nd October to 3rd November and 16th -25th December, respectively. The two cruises had completely distinct objectives, and the Norwegian cruise was aboard the R/V Dr. Fridtjof Nansen and the USA Cruise aboard the R/V Roger Revelle.

The R/V Dr. Fridtjof Nansen cruise (Figure 1) aimed to "survey the Mesopelagic fish and environment in the Bay of Bengal". Toward this goal, we set out to map the distribution and estimate the biomass of mesopelagic fish. We also provided details about the hydrographic regime by doing five transects that allowed us to map the plankton distribution of the area. Both Norwegian and NARA Scientists were engaged in the survey and I was lucky to participate in that cruise.

During this cruise, hydrological, biological and acoustic sampling was carried out and included 22 pelagic trawl stations, 38 CTD deployments, 209 dissolved oxygen measurements, collection of 306 water samples for nutrients, 209 samples for chlorophyll, 10 samples for phytoplankton, and deployment of 10 multi nets and 10 WP2 net samples for zooplankton. Mesopelagic fish stock was assessed in the high seas of the Bay of Bengal region and the oxygen minimum layer identified for the area during the study period. In addition, zooplankton collection was done for biomass calculations. The experience on-board R/V Dr. Fritdjof Nansen with Norwegian and NARA scientists during CTD deployments, trawling operations and lab analyses is laid in my sweet memories.

The Cruise R/V Roger Revelle – leg 3 (Figure 4) was solely devoted to deploying moorings in the Bay of Bengal which will collect data on current direction, speed, turbulence, salinity and temperature for the next two years. The moorings were deployed by Professor Hemantha Wijesekara who worked in the Naval Research Lab (NRL) in USA under the Air-Sea Interaction Research Initiative (ASIRI) Project. Moorings were deployed 100m under the ocean surface where the depths exceeded 3000m depths. Six moorings were deployed and each mooring included ADCPs, CTDs, and several temperature sensors. Meantime, CTD water samples were collected for nutrients and phytoplankton analysis.

Priya is a research officer at the National Institute of Oceanography and Marine Sciences, Sri Lanka. Her basic research areas are Chemical and Biological Oceanography. Priya is a member of the harmful algal blooms (HABs) monitoring group in Indian Ocean, funded by NF-POGO NANO.

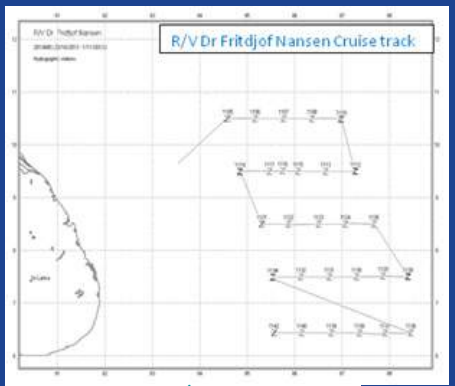


Figure 1 - The R/V Roger Revelle Cruise track

Figure 2 - Mooring deployments on-board RV Roger Revelle

Figure 3 - Laboratory activities and trawl sorting during the cruise

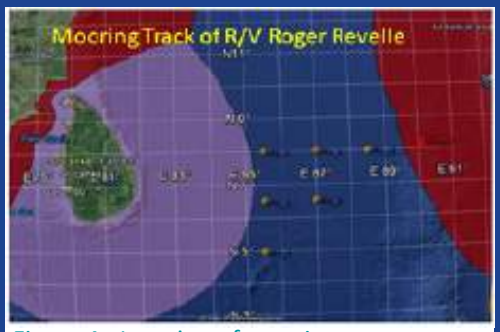
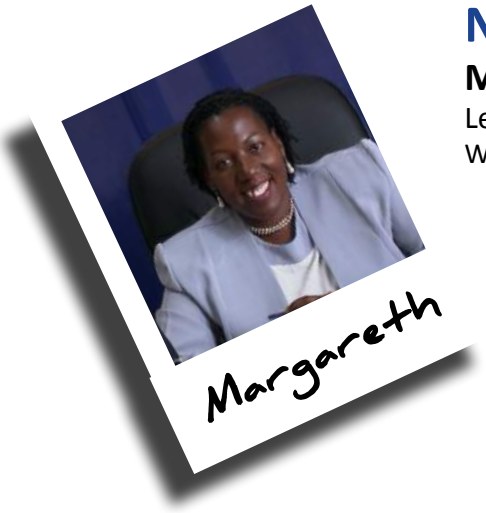


Figure 4 - Location of moorings.



NANO Profile - Q&A

Margareth Serapio Kyewalyanga

Lecturer at the Institute of Marine Sciences, University of Dar es Salaam, Tanzania
Wikipage: http://www.nf-pogo-alumni.org/~Margareth+Kyewalyanga

Senior lecturer and Coordinator of the Gender unit at the University of Dar es Salaam, Dr. Kyewalyanga has been the Head of Marine Biology and Resources Management Department and the Director of the same Institution. Board member and two-time designated Treasurer of the Western Indian Ocean Marine Science Association (WIOMSA), Margareth is involved in helping the local coastal communities, especially women, develop income-generating activities using marine resources. She attended the NF-POGO VP course in 2004/2005 in India and is an involved member of the network attending NANO meetings and being a member of NANO News editorial board from the first to the fifth issue, kindly contributing to the development of our network.

NN What is your educational background and how long have you been working in ocean science?

MK I did my M.Sc. and Ph.D. in biological oceanography, at Dalhousie University in Nova Scotia, Canada, and graduated (for Ph.D.) in 1997. My field of specialization was ocean primary production and I worked under close supervision of Prof. Trevor Platt and Dr. Shubha Sathyendranath, to whom I am very grateful! Actually, it was during that time that I started working in ocean sciences because my B.Sc. was in Chemistry and Botany. From the time I returned home to-date, I am still working in the same field at the Institute of Marine Sciences, University of Dar es Salaam, located in Zanzibar.

NN What is the most valuable experience of your studies abroad?

MK In addition to learning ocean sciences, which I did not know before, my most valuable experience abroad was to work in a team at the Bedford Institute of Oceanography (BIO), which by then was under the able leadership of Prof. Trevor Platt. It was a team of scientists with various expertise but everyone was eager to assist us students whenever we needed help: all the way from sample collection techniques to laboratory analysis and finally to computer programming or modeling.

Taking me as an example, when I went to study in Canada and having arrived from a developing country in the 1990's, I had not touched a computer before, not participated in any cruise or used any sophisticated equipment. Everything was a learning experience to me. However, my supervisors were so patient with me and mentored me in every aspect, including lessons in English! In addition I got help from the other scientists in the team and fellow students. By the time I finished my Ph.D. I was truly an oceanographer. Another valuable aspect was the way we international students worked and socialized together as if we were from the same country. Trevor and Shubha's students were like a cocktail – a mix of many cultures, religion and races, yet we felt as one: BIO was like a home far away from home.

NN What are your favourite aspects and the most challenging parts of your job? Are there any particular issues in Tanzania ecosystems that you have to deal with or would like to work on?

MK The favourable aspect of my job is to work with my students; to supervise them for their MSc or PhD work. We receive some students who have no or limited knowledge in ocean sciences, and we have to work with them and mentor them more than those who have the background. To me, it reminds me what I went through when I was a post-graduate student in Canada. I feel like giving to the students unselfishly the same way I was given by my supervisors to the point that got me molded into an ocean scientist – literally from scratch.

The challenging part was leading my Institute as a Director. This was a different task altogether, being an administrator. Just like anything new, the beginning is always tough, but after some time you manage well, if you are seriously determined. This is what happened. It took me almost a year to get used to working as a Director and after that everything went well because I worked with my colleagues in a team; I delegated tasks; and I involved the management in many aspects, striving to make informed decisions.

Issues in Tanzania that I have worked on and still want to work on include, but not limited to, empowering coastal communities (especially women) to use coastal and marine resources sustainably. They have to learn about ecosystem based management (EBM). At the Institute we have some projects in which we mentor the local communities to engage in alternative livelihood activities so as to reduce pressures on coastal resources – such as overfishing or destructive fishing methods; excessive cutting of mangroves; coral mining and so on. This is such a large aspect such that explaining it will consume all the space; but I am sure you get what I mean.

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NN From your experience, what advice would you give to a young scientist starting in this field?

MK Education has no end! You are always learning and you should have an open mind. With determination, hard-working and some initiatives, everything is possible in this field. I would like to advise young scientists to learn from experienced ones, and to take opportunities offered seriously. For those from developing countries, when given an opportunity to study abroad and learn things that you would not have learned at home, remember that you are an ambassador to your country. The best way is to get as much knowledge and skills as possible and go home to apply and share it with those who did not get such a chance. Don't get discouraged by a situation back home, you need to act and build your institution with your colleagues. You need to be the catalyst and eventually things will shape up. Remember, Jerusalem was not built in one day!

NN As a former member of the NANO News editorial board, could you please comment on the value of this type of bulletin for the progress of NANO? Do you have a vision for the future of the network?

MK NANO News is a great vehicle in dissemination of research results and it is keeping the network alive. Scientists, young and experienced, share their research in the bulletin. We get to know what everyone is up to, which is an easy way to link and work together for the betterment of our oceans. I like reading the bulletin; its setup is good and the contents are very attractive. I usually read it from cover to cover and it lets me know what are my colleagues or the young generation are up to and were they are. It is better than email; one even gets to see their photos to know the person better. I share the bulletin with my students, which I believe stimulates their thinking.

I believe that with training of young scientists in the NF-POGO Centre of Excellence and with the continuation in the NANO regional projects, coupled with the production of this bulletin, I see a very bright future for NANO. The network will become very popular globally, and it will continue drawing in many ocean scientists at all levels.

NN You attended the NF-POGO VP course in 2004/2005 in Kochi, India. In your opinion, what is the relevance of this type of training in pursuing a scientific career? How was your career impacted by the training?

MK **It is very relevant because mostly it was hands-on! In my case, I had studied in Canada with everything available. When I returned home, believe it or not, even getting a micro pipette was a problem. I could not do sophisticated experiments that I did at BIO; we couldn't even buy carbon-14. So, you have to do what is possible to do, such as research in seaweed farming. I spent three months in Kochi, but by then I knew what we were lacking at home and how to apply the methodologies in areas that are not of high tech. Furthermore, one learns how to network with colleagues from similar situation and so you exchange and share knowledge on how to solve similar problems back at home. It is the networking aspect that was the key.**

Therefore, the impact of the training was to open avenues in communicating and linking with colleagues in a similar area of interest. I managed to link with scientists in South Africa, in particular Dr. Ray Barlow and his team in Cape Town. We had a joint project, and did a number of cruises together in the southern western Indian Ocean, the results of which have been published in different journals.

Would you like to propose someone to be profiled as a prominent alumnus?
Send us a name and a reason and we take care of the rest!
Send an e-mail to lilian.krug@nf-pogo-alumni.org with the subject NANO Profile.

Photo by alumnus SC Tripathy

Satya Prakash
Dr. Prakash is a faculty member in the Indian National Centre for Ocean Information Services, scientist and executive officer of the Sustained Indian Ocean Biogeochemistry and Ecosystem Research program.
Wikipage: http://www.nf-pogo-alumni.org/~Satya+Prakash

Studying oxygen minimum zones in the northern Indian Ocean using Argo oxygen data

The concentration of dissolved oxygen (DO) in oceanic water is an important proxy for any change in thermohaline circulation and/or sub-surface biogeochemical cycling (Joos et al., 2003). DO concentration in the oceanic water is reported to have decreased, in both the coastal and deep ocean over the past few decades (Stramma et al., 2008). Model studies suggest that oxygen minimum zones (OMZs) are likely to expand further and intensify in the coming decades (Frolicher et al., 2009). Whether this is part of natural variability or a warming-induced change is still debatable (Frolicher et al., 2009). Irrespective of the cause, the decreasing concentration of DO is a cause of concern as it affects marine habitats. Gilbert et al. (2010) has argued that the observed areal expansion of OMZ or trend in declining DO concentration in seawater may be fictitious since most parts of the ocean are heavily undersampled for biogeochemical interpretations. They have also cautioned that the increased interest of the scientific community and a corresponding increase in the number of reports on hypoxia published in recent years may be responsible for this erroneous trend. More observations pertaining to DO and analysis thereof may be able to resolve this issue.

The northern Indian Ocean is one of the three major basins in the world Ocean which is characterized by the presence of OMZs in its sub-surface waters. The northern Indian Ocean is comprised of the Arabian Sea in the west and the Bay of Bengal in the east; both of these basins are characterized by the presence of OMZs at intermediate depths (~150-1000 m depth). Sluggish circulation or restricted ventilation, being landlocked in the north, combined with high oxygen demand at intermediate depths owing to high fluxes, may be the plausible explanation for formation of OMZs in these basins. Also, the vertical extent and strength of the OMZ is more pronounced in the Arabian Sea than the Bay of Bengal. In fact the Arabian Sea OMZ harbors one of the highest volumes of suboxic (< 5 µmol kg^{-1}) waters. The bay also harbors oxygen minima in its sub-surface waters, the dissolved oxygen concentration in the bay is always above the denitrifying limit and unlike the Arabian Sea denitrification has not been observed in the bay (Naqvi et al., 1994).

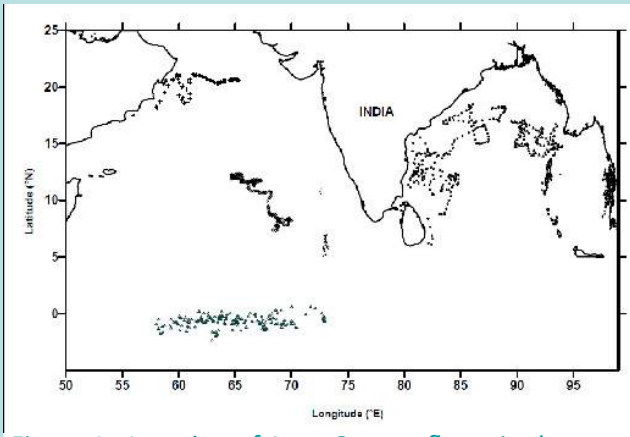

Figure 1 - Location of Argo-Oxygen floats in the Northern Indian Ocean

The Argo Project, underway since 2000, has been providing high quality data on temperature and salinity and, therefore, is a suitable platform for monitoring the ocean's interior at adequate temporal and spatial scales for studies of OMZs. The addition of bio-sensors, such as dissolved oxygen, to these floats allows real-time measurement/monitoring of biogeochemical variables and thus new insight into sub-surface processes (Gruber et al., 2010). We have analyzed several Argo-oxygen floats deployed in the northern Indian Ocean (Figure 1) to understand the variability of the oxycline depths in the northern Indian Ocean and its governing factors. Data from these floats show the presence of perennial sub-surface OMZs in the Arabian Sea and Bay of Bengal. This confirms our existing knowledge on the OMZs but at the same time provides detailed seasonal dynamics.

In the Arabian Sea the oxycline depth shows large seasonal variations: it shoals up every year during the early winter monsoon. This kind of seasonality was not observed during the Joint Global Ocean Flux study (JGOFS), probably because of limitation in the analytical techniques. A detailed analysis shows that sea level anomaly (SLA) is negative during these months: a negative sea surface anomaly suggests a decrease in the thermocline depth during the months of November/December, possibly caused by westward propagating upwelling Rossby waves (Prakash et al., 2012). The Bay of Bengal data also shows that the surface layer in the bay is mostly under-saturated with oxygen, suggesting an imbalance between air-sea exchange and biological production of oxygen taken together and the net oxygen demand, which seems to be higher in the surface layer. Considering the sensitivity of optode sensors, it will be premature to come to any such conclusion and thus these preliminary data warrant an increased number of in-situ observations along with sensor based measurements.

Further analysis of Argo oxygen data suggests that the observed variability in the oxycline depth is mainly governed by physical processes such as vertical movement of the thermocline in the northern Indian Ocean basin. There exist strong

positive correlations between depths of the thermocline, oxycline and SLA. i.e., the shallowing of the thermocline was associated with the corresponding shallowing of the oxycline and vice versa (Figure 2). Similar co-variabilities of thermocline and oxycline have also been reported from the oxygen minimum zone off Chile (Morales et al., 1999). Prakash et al., (2013) have proposed regression equations between SLA and oxycline depth to estimate the depth of the oxycline on an operational basis in the northern Indian Ocean. This could not only help understand the dynamics of seasonal variations of the oxycline depth but will also be useful for the fisher community at large if combined with satellite ocean color imagery for issuing fishing zone advisories.

For references, please contact the author at **satyap@incois.gov.in**

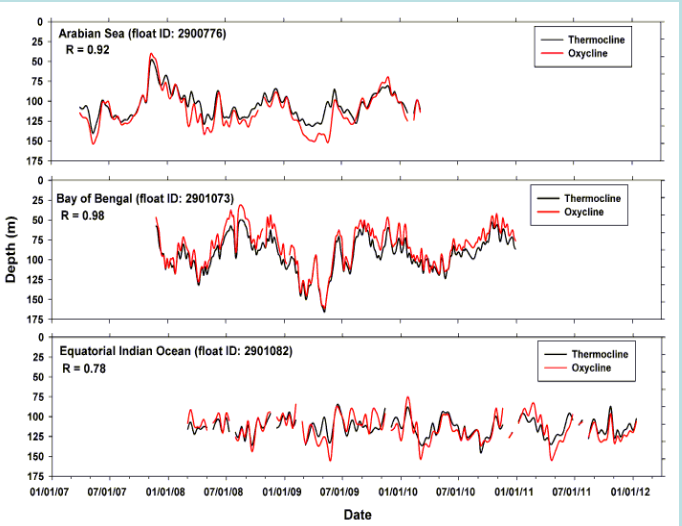

Figure 2 - Time series plots of the thermocline and oxycline for some floats in the Arabian Sea, Bay of Bengal and Equatorial Indian Ocean.

Research communications - NF-POGO alumni

Ousmane Diankha

Working at the Laboratoire de Physique de l'Atmosphère et de l'Océan Siméon Fongang and for the Ministry of Environment and Sustainable Development in Senegal, Mr. Diankha is in the last year of his PhD studies.
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Round sardinella (*Sardinella aurita*) and anchovy (*Engraulis encrasicolus*) abundance as related to temperature in Senegalese waters

Context and objective

Constituting close to 80% (by weight) of the total landings in Morocco, Mauritania and Senegal, small pelagic populations are subject to considerable fluctuations thought to be caused by environmental variability, essentially due to their relatively short life cycle (2–3 years).

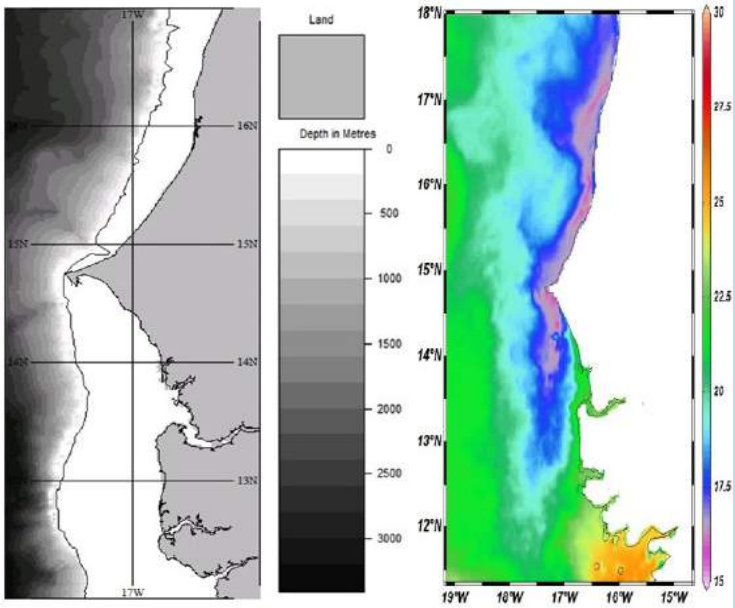

Figure 1 - The study area's bathymetry depicting the 200 m isobath as the black line (left) and upwelling structure (right).

In this study, remotely sensed thermal data (sea surface temperature, SST), the environmental factor most often used in investigations of relationships between the environment and fish behavior and abundance, and the temporal variable (month) were used to define possible temperature ranges associated with high abundance of round sardinella and anchovy off Senegal using general additive models (GAMs).

Materials and methods

Fish landed catch data To study the variability in term of abundance of round sardinella and anchovy in Senegalese waters, monthly landed catch data covering the period 1999-2009 from the statistical section of the Department of Maritime Fisheries (Direction des Pêches Maritimes) were used. The catch was considered as a proxy for abundance.

Sea surface temperature data The environmental predictor variables used for this analysis were sea surface temperature (SST, in °C). SST data were derived from the

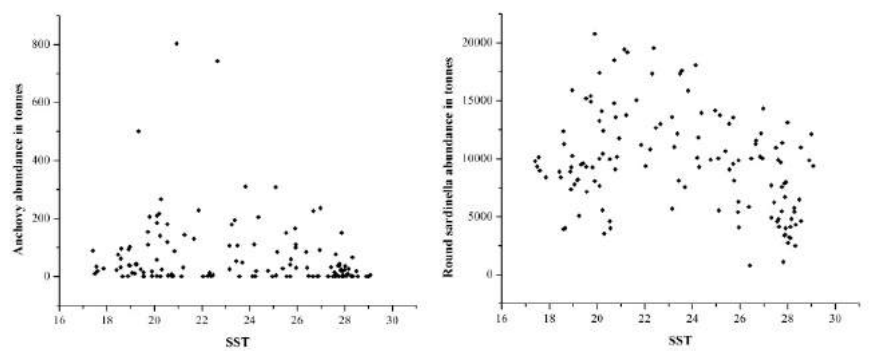

Figure 2 - The relationship between anchovy (left) and sardinella (right) abundance and SST (1999-2009).

Pathfinder V5.0 sensor (day and night images; 4.4 km resolution). Data covered the time period between January 1999 and December 2009. SST was averaged from 12°5 N to 16°4 N and from the coast to the 200 m isobaths (Figure 1).

Data analysis The generalized additive models (GAMs) were used to investigate the relationships between the environmental variable (SST) and the temporal variable (month), and abundance of round sardinella and anchovy. They enable a better understanding of the complex relationships between species and their environment. GAMs are described as a generalization of ordinary linear models (Wood, 2006). In these models the linear predictors are related to the response variables via a link function that extends the use of the regression models beyond non-Gaussian response variables. GAMs use data-driven functions, such as splines and local regression, which have superior performance relative to the polynomial functions used in linear models. The tensor-product smooth functions were used to fit the interactions between the predictors (SST, and month) and the dependent variable.

Results

Scatterplots made to assist with data screening of the variables illustrate the non-linear relationship between SST and landings of round sardinella and anchovy (Figure 2). The structure of the scatterplots suggested that these two species have a preference for higher temperatures. The highest abundance of round sardinella and anchovy was associated with SST between 19 °C and 25°C.

Table 1 shows that all models were significant (p-value=0.05). The temporal variable, month, was the most significant explanatory variable for round sardinella abundance, while for anchovy abundance, SST represented the most significant explanatory variable. Significant effects of sea surface temperature/month interaction were observed on round sardinella and anchovy abundance.

Table 1 - Significance values (p-values) of the covariate effects on round sardinella and anchovy abundance. Level of significance was set to 0.05.

Specification covariates	*Sardinella aurita* p-value	Anchovy p-value
SST	$1.12e^{-08}$ ***	0.008 **
Month	$2.6e^{-11}$ ***	0.00417 **
SST/Month interaction	$1.06e^{-09}$ ***	0.00123 **

Where significance codes are interpreted as ***: 0.001 and **: 0.01.

The effects that the explanatory variables have on round sardinella and anchovy abundance can be shown by examining the fitted contribution of each variable to total abundance plotted against the value of the variable (Figures 3 and 4). The environmental and temporal variable (SST and month) had somewhat similar effects on round sardinella and anchovy abundance. The effects of month on round sardinella and anchovy abundance were high between May and June. The effects of temperature on round sardinella and anchovy abundance were high between 22 °C and 24°C The highest effect of SST on round sardinella abundance was at 22.76 °C, whereas that on anchovy abundance was at 22.32°C.

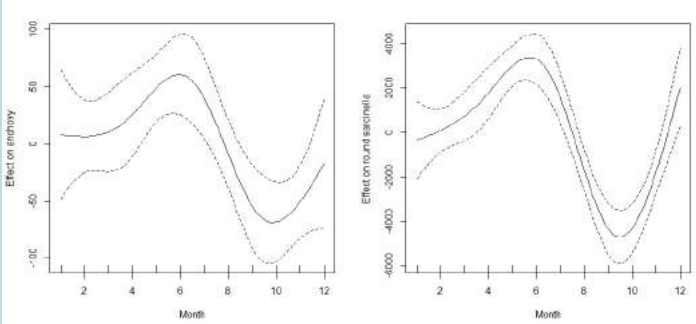

Figure 3 - GAMs-derived effect of Month on anchovy (left) and round sardinella (right) abundance (1999-2009). Dashed lines represent two standard error boundaries around the covariate main effects.

Figure 5 shows the temporal interactions of sardinella and anchovy abundance with sea surface temperature. The model fitted the maxima effects of SST on round sardinella abundance at temperatures between 22.23 °C and 24.12 °C, while those on anchovy abundance were fitted between 21.06 °C and 25.35 °C. The model also indicates that round sardinella and anchovy avoid areas with low SST.

Discussion

It is a well established fact that the effect of absolute temperature on organisms breeding and non-breeding life cycle stages is always complex due to wide variations in natural trends. The attempt has been made in this study to simplify this complexity using GAMs, a more powerful tool than regression techniques for such studies.

The results from this work confirm the hypothesis that the abundance of small pelagics such as round sardinella and anchovy is related to upwelling intensity, for which SST can be used as a good indicator. The elucidation of the relationship between

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SST and round sardinella and anchovy abundance has been enabled by using GAMs. Temperature values which had maxima effects on both species abundance appear very close, 22.3 °C for anchovy and 22.8 °C for round sardinella. However, the temperature ranges which most affected abundance of these two species are different. The temperature range for anchovy abundance (21.1°C - 25.4 °C) was wider than that found for round sardinella abundance (22.2 °C to 24.1 °C), with a difference of 2.4 °C. These results suggested that both round sardinella and anchovy tend to avoid cold temperatures (17 °C - 21 °C).

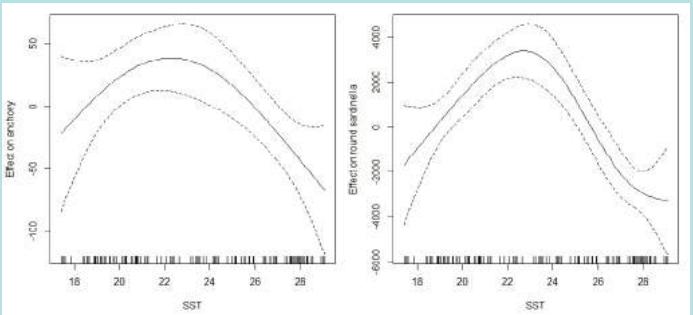

Figure 4 - GAMs-derived effect of SST on anchovy (left) and round sardinella (right) abundance (1999-2009). Dashed lines represent two standard error boundaries around the covariate main effects.

Fish appear to avoid entering the upwelling areas, possibly due to the low oxygen content of these waters (as a result of oxidation processes) and/or cold temperature (15 °C - 21 °C).

Some previous studies have attempted to link round sardinella abundance to SST. In Mauritanian waters, it has been demonstrated that temperatures below 21 °C were associated with low catch of round sardinella while sardinella was abundant in Senegalese waters where the temperature remains above 21 °C. It has been shown that abundance of round sardinella in the western Mediterranean was related to sea surface temperature warming.

Studies on anchovy tolerance to temperature variations seem to be scarce. Most studies were focused on temperature ranges related to anchovy spawning. In the Bay of Biscay, it has been reported anchovy spawning within a thermal window of 14 °C - 20 °C. In the Benguela region a thermal range of 17.4 °C - 21.1 °C was associated with the anchovy spawning period.

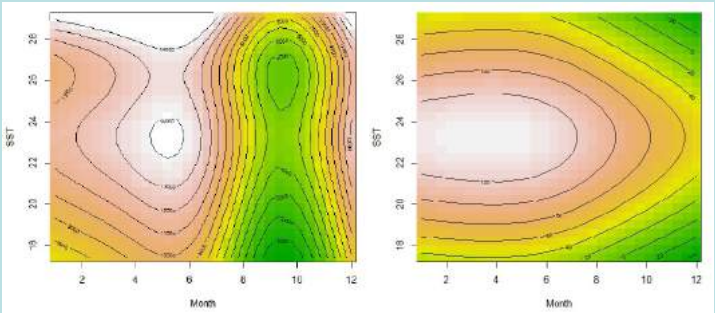

Figure 5 - GAMs-derived effect of SST-Month interaction on anchovy (left) and round sardinella (right) abundance abundance.

In conclusion, this work quantitatively identified the relationships between sardinella and anchovy abundance and sea surface temperature in Senegalese waters during 1999-2009. Results showed a high degree of coupling between round sardinella and anchovy and sea surface temperature. Abundance of round sardinella was higher than average when sea surface temperature ranged from 22.23 °C to 24.12 °C, with a maximum at 22.76 °C. Temperatures between 21.06 °C and 25.35 °C were associated with high anchovy abundance. Maximum abundance of anchovy was found at 22.32 °C.

Photo by alumnus Evgeniya Klimchuk

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Detection and attribution of climate change in marine primary production

Climate change is defined as the change in the statistical properties of the climate system over long periods of time, typically decades or longer. Several factors shape the climate, and these are known as forcings. These can be internal or external forcings. Internal forcing mechanisms are natural processes within the climate system itself e.g., thermohaline circulation. External forcing mechanisms can be either natural or anthropogenic. Variability in external natural forcings such as solar output and volcanism occur naturally and contribute to the total natural variability of the climate system. Anthropogenic external forcings are the result of human activities such as increasing concentration of greenhouse gases or sulphate aerosols. Internal climate variability occurs on all time-scales from weeks to centuries and millennia. Oceans are a fundamental part of the climate system and they have important roles on decadal and century time scales as they integrate high-frequency weather variability and interact with faster components in the atmosphere. Thus the climate system is capable of varying internally on long-time scales without any external influences. The presence of this natural climate variability means that the detection and attribution of anthropogenic climate change is a statistical "signal-in-noise" problem.

The near-surface temperature of the Earth's atmosphere has been increasing over the last several decades . Scientific consensus on climate change is that the Earth's system is warming and it is more than 90% certain that this is being caused by human activities, which increase greenhouse gases in the atmosphere. Evidence of climate change is studied from various sources such as temperature proxies, glacier thickness, arctic sea-ice loss, ice cores, and sea-level change.

Ocean Primary Production makes up approximately half of the global biosphere production, it affects the abundance and diversity of marine organisms and drives marine ecosystem functioning and fishery yields. Thus, it strongly influences climate processes and biogeochemical cycles. Marine primary production is a major sink of carbon dioxide from the atmosphere. Measurement of chlorophyll concentration allows an estimation of primary production. Primary production in the ocean is mainly regulated by solar energy and nutrients. Physical processes in the ocean like ocean circulation, mixing, upwelling, mesoscale eddies etc. affect the nutrient supply to the euphotic zone of the ocean. These processes occur on seasonal, inter-annual and decadal time scales and hence, they alter the chlorophyll concentration in the ocean on local, regional and global scales. It has been predicted that with the increase in temperature of surface ocean waters, production in tropical and mid-latitudes will decrease, whereas production will increase in higher latitudes (Figure 1).

Several studies have observed changes in marine primary production. It is observed that the global rate of decline of chlorophyll is approximately 1% of the global median per year. Changes in the size of the subtropical gyres have also been observed. These studies have used simple linear trends to observe the changes. Questions to be considered as part of my PhD research include: 1) are these changes or long-term trends caused by Earth's climate change or are they a response to natural ocean cycles? and 2) Is it sufficient to use linear trends to observe changes in primary production or do we need to use complex statistical methods?

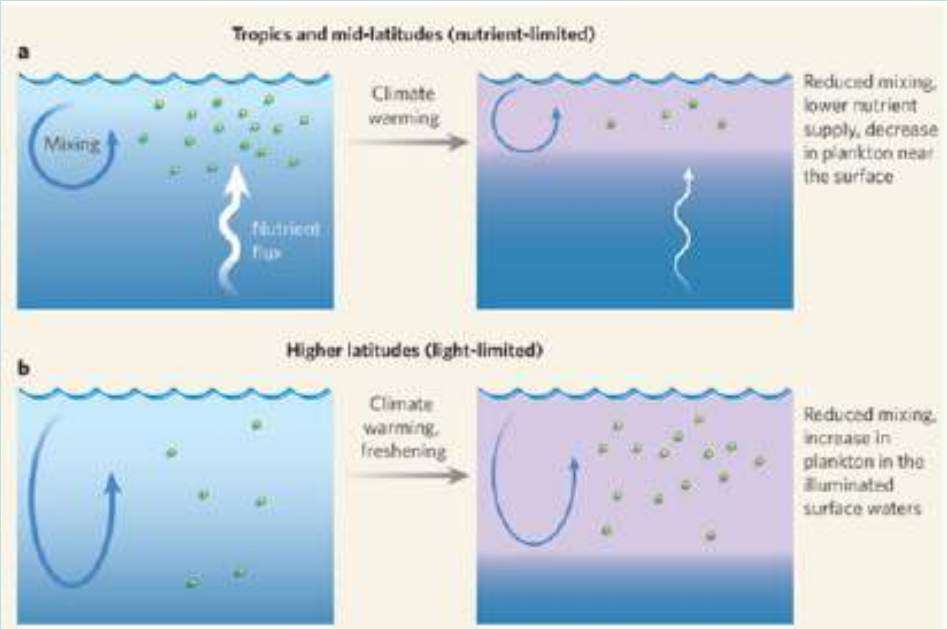

Figure 1 - Increased surface temperature increases stratification that has different effects on marine production in different regions of the global ocean. From Doney, S. C., et al., Nature (2006), 444, 695-696.

In order to detect the influence of climate change on marine primary production, it is necessary to distinguish between natural variability and human induced variability of primary production. This can be achieved by detection and attribution techniques.

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Ecology of Encrusting Assemblages in the Baltic Sea

The Baltic Sea is characterized by one of the strongest salinity gradients worldwide ranging from 0.5 to over 27 and is often described as an "oversized estuary" (Bonsdorff and Pearson, 1999). Thus changing salinity conditions that vary either on a long- (seasonal) or a a short-daily) term basis are stressful especially to sessile organisms. The effect of low salinity on species diversity has been recognized for many macrobenthic groups (e.g. Darr et al., 2014, Zettler et al., 2007). Encrusting fauna is a group of animals that lead sedentary lifestyles and after a short period of time spent in the water column as larvae, settle on the hard bottom for the rest of their life cycle, and thus are most affected by changing environmental conditions (Schumann et al., 2006). Yet, despite the fact that encrusting organisms are an important element of the marine environment (especially due to their ability to provide intensive water filtration and contribute a significant ecological component of marine coastal ecosystems), direct effects of environmental variation on the structure of Baltic Sea encrusting assemblages have not yet been accurately described.

Thus my research considers: 1) biodiversity patterns along the salinity gradients, 2) variations in depth-related shallow rocky assemblages and 3) biological interactions. For this purpose 14 locations distributed along the range of the salinity gradient were selected and compared in terms of biological parameters (Figure 1).

The study was carried out on the shallow rocky coast of the Baltic Sea in August and October 2007. Samples were collected from the littoral (~3 m depth) and hydrolittoral (transition between land and sea) zones.

The main goal was to estimate basic diversity parameters of rock-encrusting assemblages (Figure 2) with respect to the salinity conditions. I analysed the number of species, their abundance, main diversity parameters and percent coverage and then compared data between different locations to reveal the large-scale effect of the salinity gradient on benthic community structure. Secondarily, I compared two communities from different depths to estimate the influence of various physical conditions on species composition of coastal encrusting assemblages. Due to the fact that the character of marine assemblages in great part also depends on the biological factors, competitive interactions based on the type and number of encounters and its spatial variation was the other object of my interest.

The results obtained so far confirmed the strong influence of salinity on faunistic communities. From the results I concluded that the structure of encrusting assemblages is influenced both on large scales by strong salinity gradients, and on small scales by various local coastal conditions (Figure 3). Deterioration, accompanied by species diversity transition and community structure change between low and high salinity environments, was clearly visible in basic community parameters for both hydrolittoral and littoral zones. This may suggest that the salinity gradient is a major factor that defines structural and functional characteristics of the aquatic biota. At lower salinity fewer species were observed and assemblages were more uniform in comparison to high salinity where more diverse assemblages were characterized by more complex biological interactions.

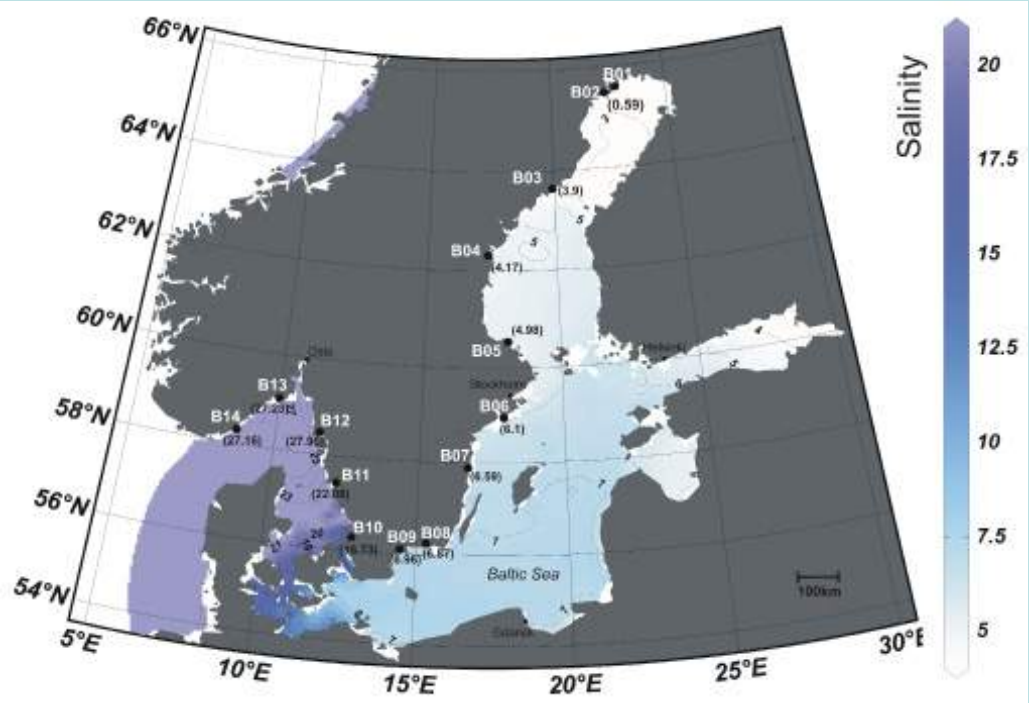

Figure 1 - Map of surface salinity in the Baltic Sea

Finally, my study gives an important supplement for environmental investigations that consider the influence of the salinity gradient, and other environmental factors on development of biological communities.

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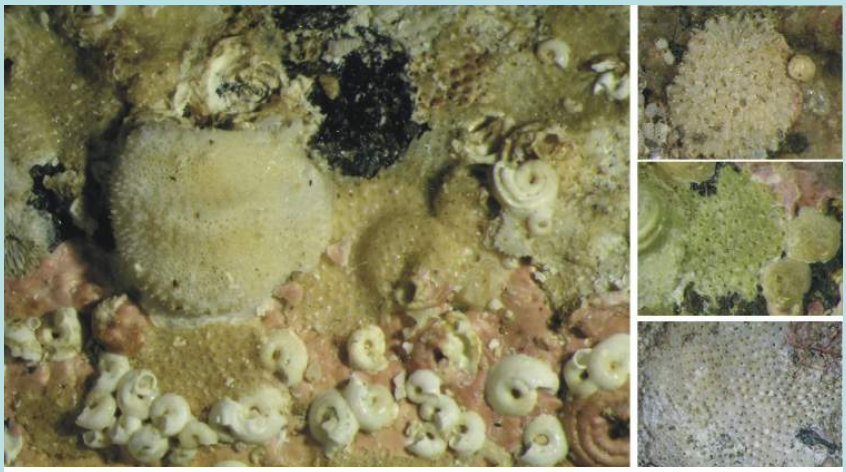


Figure 2 - A snapshot of the encrusting assemblage (on the left) and bryozoan species (on the right).

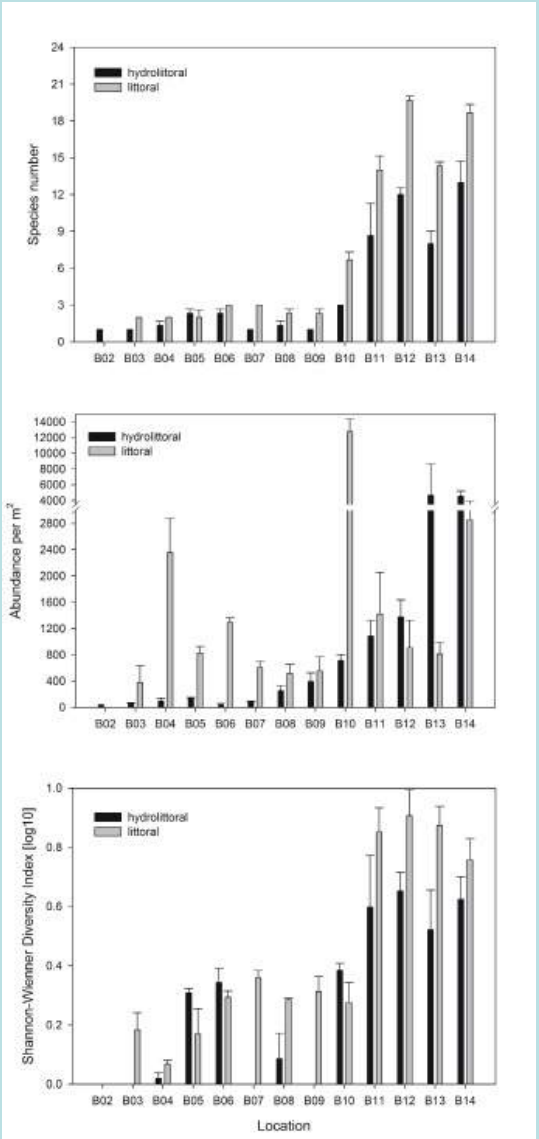


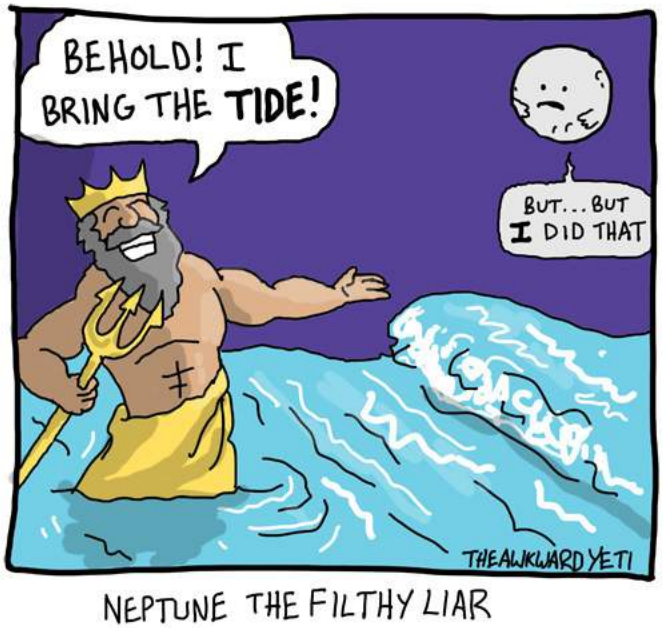
Figure 3 - Basic community parameters: species number, abundance and diversity.

FUN BREAK

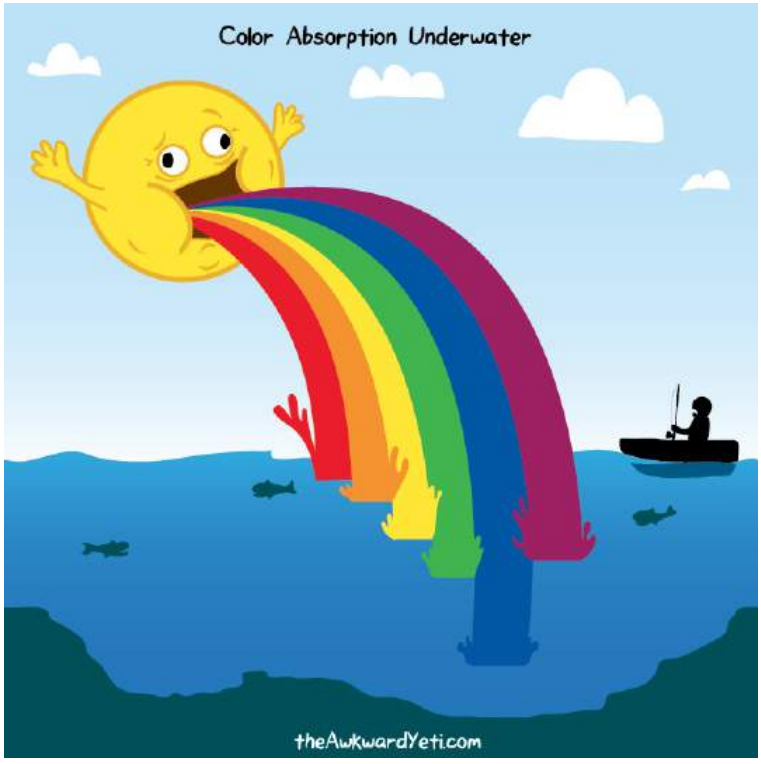
The Awkward Yeti (http://theawkwardyeti.com/) is a creation of Nick Seluk, who kindly authorized the use of his comics to illustrate this NN issue.

Nick is raising funds to produce The Awkward Yeti material, including a children's book about science. If you wish to collaborate, learn how to in https://www.kickstarter.com/projects/106395834/the-awkward-yetis-great-big-project-3-books-and-a?ref=card

Have any cartoons to contribute? Send them to us for inclusion in the next issue!



NEPTUNE THE FILTHY LIAR



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NANO website: www.nf-pogo-alumni.org

Gerry Giliant Salamena
Mr Salamena started his masters at James Cook University, Australia. The focus of his studies will be an investigation of ENSO and monsoons in determining the magnitude of upwelling in the Banda Sea.
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From Bermuda to Ambon Bay: My small step in climate science

Sea surface temperature (SST) is a key parameter controlling heat, momentum, salt and gas fluxes within the atmospheric-oceanic boundary layer (Emery, 2002). One role of SST is that it influences heat exchange between the surface layer of the ocean and the atmosphere contributing to climate patterns over large areas including continents and oceans around the equatorial region. This exchange influences precipitation and evaporation, which in turn influence weather and seasonal and inter-seasonal variability over these areas. On the global scale, there are convection cells, providing longitudinal convection cells along the region (e.g. Walker circulation) and latitudinal convection cells such as Hadley cells (Dima & Wallace, 2003; Lau & Yang, 2003), which are representative of heat transfer between the ocean and the atmosphere to drive global scale climate events such as the El Nino Southern Oscillation (ENSO) phenomenon and monsoon zonal wind activities (Chao, 2000; Lau & Yang, 2003). On a small scale, SST significantly influences atmospheric condition over urban areas (Oda & Kanda, 2009) and affects the local weather.

The influence of SST changes on climate patterns at both large and small scales, as explained above, has become an interesting topic for me since I finished a 10 months training with the NF-POGO Centre of Excellence in Bermuda and my final project was entitled "Investigation of climate modes influencing flood risk in Jakarta, Indonesia". The project, under the guidance of Dr. Falk Niehörster, Risk Prediction Initiative Program of BIOS, was to analyze the role of global signals, as shown by SST changes, in influencing extreme precipitation, the atmospheric parameter causing floods in Jakarta. By using the empirical orthogonal function (EOF) method, I then learned how monsoons and ENSO events influence mean and extreme precipitations, respectively. Figures 1a and 1b show how principal components (PCs) of the first dominant signals of climate modes, which appear from the EOF method, are monsoon and ENSO indices, respectively.

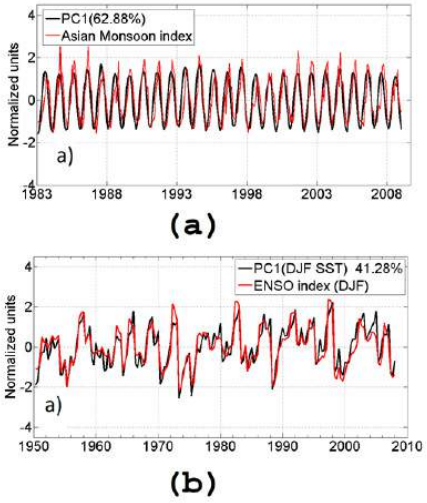

Figure 1 - Detection of climate signal influencing (a) mean and (b) extreme precipitations of Jakarta via SST change.

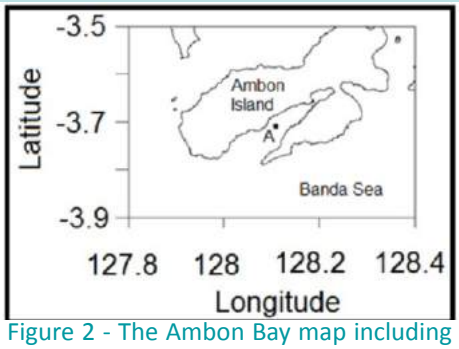

Figure 2 - The Ambon Bay map including the *in situ* station of SST, "A"

After returning to my hometown, which is a small island called Ambon Island, I was in a situation where I could directly apply the skills acquired in Bermuda since the anthropogenic activities, such as deforestation, play an essential role for the urban climate of the island. However, I had to deal with heat exchange between sea surface and the atmosphere on a smaller scale: urban heating island (UHI) compared with the scientific analysis of climate matrices done in Bermuda. By using the bulk formula, I investigated the significant role of SST changes on Ambon Bay in determining the urban climate of the island. The monthly SST data were collected from an in situ station ("A" in Figure 2). Generally, the major finding of the work was that SST was predominantly lower than air temperature implying the domination of negative sensible heat flux (Figure 3). This means that the bay receives heat energy from the atmosphere. Between June and August (negative value of x-axis on Figure 3), upwelled waters in Banda Sea cools the bay to trigger negative sensible heat flux on the boundary. Interestingly, the negative sensible heat flux from December to February (positive value of x-axis on Figure 3) is caused by land heating instead of SST since insolation is effective in this period. This is because the bay is narrow so that the higher air temperature over land would be more effectively mixed with the lower air temperature over the waters, increasing the air temperature over the bay. This work is well documented in my recent publication:

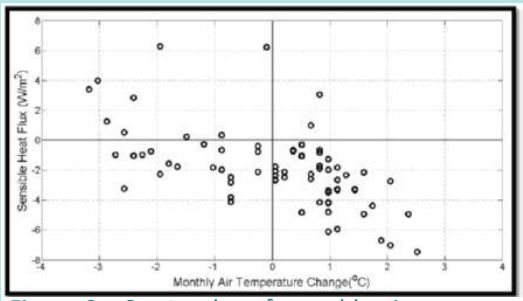

Figure 3 - Scatterplot of monthly air temperature change vs. the sensible heat flux over the Ambon Bay

Salamena,G.G.(2013). Heat transfer on atmosphere-oceanic boundary in the outer ambon bay of indonesia. Marine Research in Indonesia. 38(1): 21-29

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Impact of Climate Change on Water Resources of the Tibetan Plateau, China

Lailah Gifty Akita, Peter Frenzel , Sascha Fürstenberg

Ms Akita is finishing her PhD studies at the Institute of Geosciences, Friedrich Schiller University Jena, Germany. Dr. Frenzel and Dr. Fürstenberg work in the same institute.

Introduction

The unique natural environment of the Tibetan Plateau consists of the white clouds, blue sky, mighty crystal clear rivers and gorges, streams, springs, mountains with eternal white snow and glaciers (moving bodies of ice that persist over time), turquoise clear lakes and vast highlands (Figure 1 a and b). The ecosystems of the Tibetan Plateau are of utmost importance. The unique plateau ecosystem is an important part of the 'eco source' of China and plays a significant role in maintaining the ecological security of the country (Li et al., 2010b). The changes in climate over the Tibetan Plateau are important not only for local ecology and environment but also for the climate outside the region (Yanai and Wu, 2006). The Tibetan Plateau represents an ideal region for the study of the responses of natural ecosystems to climatic changes due to its unique climate and fewer human disturbances (Zhuang et al., 2010). It serves as a natural sensor and monitor for global warming and change in its related environment (Jin et al., 2005; Qin et al., 2009; Searle, 1995). The climate of the Tibetan Plateau region is crucial for water resources, especially freshwater, for 1.4 million people living in the Asian continent (Immerzeel et al., 2010). The major factors determining the climate of the Tibetan Plateau are the latitude and altitude. The aim of this paper is to provide a short synopsis of the impact of climate change on water resources of the Tibetan Plateau, and to improve our understanding of the potential reconstruction of historical climate and environmental changes.

Figure 1 - (a) Turquoise (green blue) clear lake Tangqung Co and surrounding highlands with white clouds and blue sky; (b) The mountain regions of Tibet covered with snow

History of the Tibetan Plateau

Tibet and Tibetan geograghy was first recorded in the seventh century A.D. Tibet is an English name derived from names To Bo (old pronunciation in Tibetan language) and To Fan (Chinese word) (Shén and Liu, 1973). To is a Tibetan word for Highlands, Bo is a word describing the Tibetan themselves. Tibet is also pronounced as Bhota, this was recorded in the Sanskrit manuscripts in the seventh century. The English word Tibet, of Turkish origin, is a corruption of both syllables (Shén and Liu, 1973). The capital city of Tibet is Lhasa, the land of God, with the main river Tsanpo, first recorded in the seventh and the eight centuries (Shén and Liu, 1973).

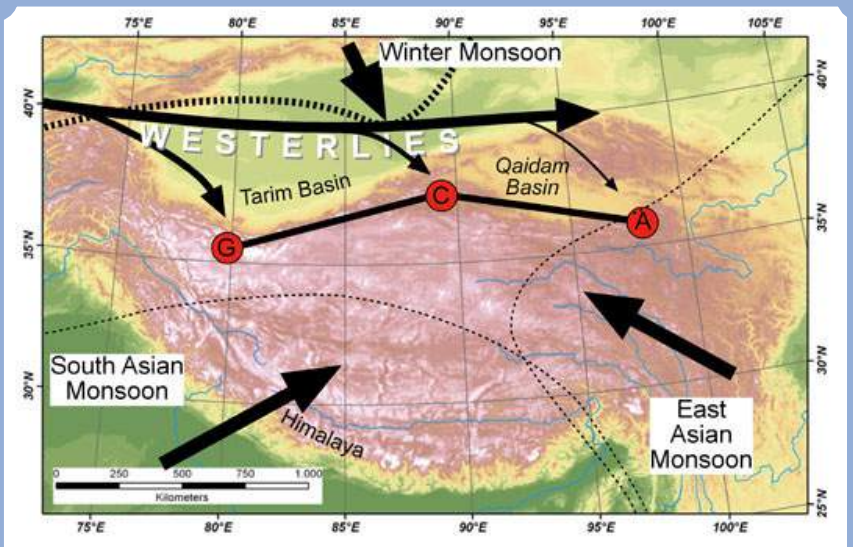

Figure 2 - Major climatic systems on the Tibetan Plateau: the Westerlies, the East Asia Monsoon, the cold polar airflow from the Siberian high pressure, and the South Asia (Indian) monsoon (http://www.pgg.rwth-aachen.de/tip/).

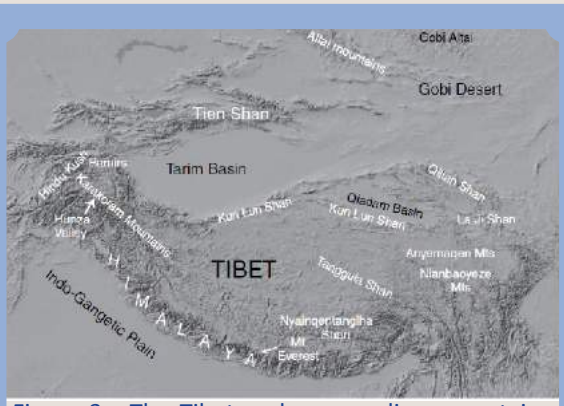

Figure 3 - The Tibet and surrounding mountains regions (Lemhmkuhl and Owen 2005; Owen 2000)

The First Glimmers of Tibetan Plateau

The Tibetan Plateau (75-105°E, 27.5-37.5°N) is the highest and largest plateau of the world, and a region of highlands in Asia. The Tibetan Plateau is defined by a total area of about 2,500,000 km^2 and average elevation of ~4,500 meters above sea level (Qin et al., 2009), is a product of the collision of the northward-drifting India- Australia plate with the Eurasian plate (Yin and Harrison, 2000). It is often recognized as the "Roof of the World" (Qiu, 2007) or "Third Pole of the World" (Qiu, 2008) with its high altitude and its important role in the Earth's climate system (Jin et al., 2005) as an indicator of climate change (Yao et al., 2012a).

The Tibetan Plateau is located in the interaction zone of the polar air masses from Arctic, continental air masses through central Asia (Westerlies), Indian (South) and East Asian summer monsoon (An, 2000; An et al., 2001; Hodges, 2006; Immerzeel and Bierkens, 2010; Prell and Kutzbach, 1992; Raymo and Ruddiman, 1992) (Figure 2). Monsoon (derived from Arabic word 'Mausim') is defined as seasonal rainfall or the reversal of the direction of the prevailing surface wind between summer and winter (Webster et al., 1998). The uplifting of the plateau was the most dramatic tectonic event during the recent geological history of the solid Earth evolution. It plays a prominent role in the evolution of the Asian monsoon system. The Tibetan Plateau is known for its significant mechanical heat and thermal effects on regional and global Earth's climate and environment (An, 2000; Duan et al., 2012; Harris, 2006; Herzschuh, 2006; Kutzbach et al., 1993; Liu and Chen, 2000; Ruddiman and Kutzbach, 1990). On the Tibetan Plateau, air temperature and precipitation increase from north to south and from west to east, influenced by the Asian monsoon climate and local topography.

Figure 4 - Water resources of Tibet, lake Tangra Yumco with an inflow and lagoon

The Tibetan Plateau is surrounded by the highest mountains of the world such as Himalayas, Pamir and Kunlun Shan (Figure 3). Large amounts of water are stored in forms of glaciers, snow fields and lakes (Xu et al., 2008). The Tibetan Plateau has 36,800 glaciers, with a total glacial area of 49,873 km^2, and a total glacial volume of 4561 km^3 (Yao et al., 2007). Most geologists believe that the Tibetan Plateau was first covered by oceans in the past. The retreat of the oceans led to the creation of enormous fresh water and brackish lakes on the Tibetan Plateau. The lakes have the inflow of a river or stream but without an outlet (Figure 4). There are over 1,055 lakes (> 1.0 km^2) on the Tibetan Plateau accounting for 39% and 51% of the total lake number and area in China and often referred to as 'Asia's Water Tower' (Bai and Xu, 2004; Lu et al., 2005) or "Land of Snow" (poetic name) (Shén and Liu, 1973) due to the storage of the largest ice mass outside the north and south Polar Regions. The studies of brackish lakes is very important in climatological and palaeoenvironmental research. They are significant: 1) for the understanding of past climate and environment change; 2) for gaining in depth knowledge on the responses of modern brackish lake ecosystems to the global climate changes; and 3) for recommending adaptation strategies to promote the sustainable management of water resources in the future.

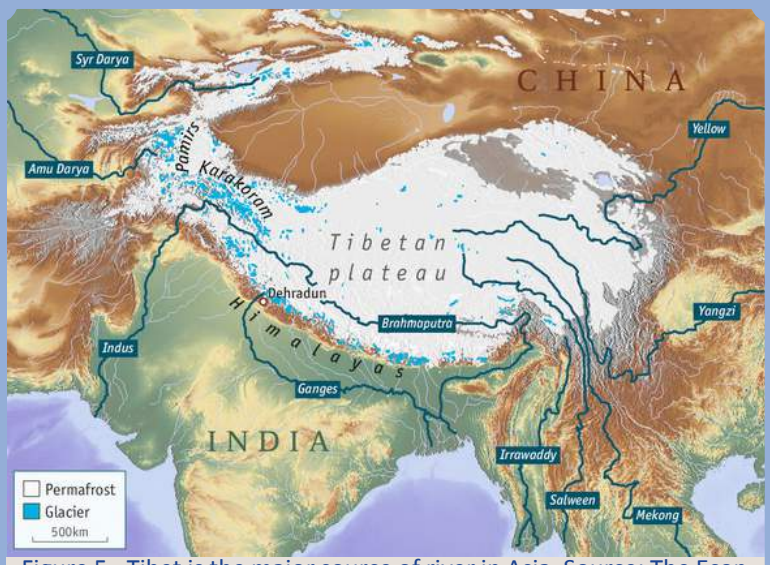

Figure 5 - Tibet is the major source of river in Asia. Source: The Economist.

Water Resources of the Tibetan Plateau

The Tibetan Plateau has the largest number of glaciers which supplies water and regulates the climate

(arid region) in upland and lowland areas of Asia adjacent to it. Furthermore, it serves as a source of the ten major Asian rivers (Figure 5) providing fresh water resources for over 1.4 billion people (Immerzeel et al., 2008). Therefore, the sustainability and management of these water resources is critical. The Asian monsoon is dominated with precipitation concentrated in just a few months, the perennial flow of the rivers largely relies on the constant flux of the glaciers in Tibet (Immerzeel, 2008; Immerzeel et al., 2010).

The Tibetan Plateau as epicentre for climate change

The Earth climate is influenced by the distance from the Sun to the composition of the atmosphere, the layer of gases that surround the Earth. On a local scale, the climate is controlled by a particular region's latitude, altitude, wind patterns, proximity to the ocean and the make up of its surface (Desonie, 2008). The effects of global warming are more pronounced at higher altitudes (e.g., Tibetan Plateau) (Duan et al., 2006; Li et al., 2010a; Wei and Fang, 2013). Human activities such as burning of fossil fuels or forest releases greenhouse gases into the atmosphere lead to rising greenhouse gases, which help to trap more of the planet's reradiated heat and help to raise global temperatures, and this is now commonly referred to as 'global warming' (Desonie, 2008). Throughout the Earth's history temperature has been positively correlated with the level of greenhouse gases (Desonie, 2008). Climate change, the alteration of the Earth's patterns of precipitation and temperature over a long period of time, is marked with 'global warming', a consistent rise in global average temperature over the past century, as a result of increased greenhouses gases (GHG) (e.g carbon dioxide) (Solomon et al., 2009). The significant part of the increase in global temperatures of ca. 0.6°C (IPCC 2001) will have possible effects on the water resources (e.g. aquatic ecosystem), especially in snow-dominated regions, as well as on the livelihood of people that depend on the water resources (Bates et al., 2008; Giorgi et al., 2011; Seager et al., 2010). The impact of climate change will affect the global hydrological cycle and regional water resources (Arnell 1999; Barnett et al., 2005) including precipitation and its distribution, snow accumulation, melt water, and evapotranspiration, surface and subsurface flows (Hansen et al., 2010; IPCC, 2007) and shift in monsoonal circulation (Annamalai et al., 2013). Currently, specific regional effects are uncertain (Arnell, 2004; IPCC, 2001; IPCC, 2007). On a global scale, rapid retreat of mountain glaciers is not only contributing to global sea-level rise but also threatening freshwater supplies in many of the world's most populous regions (Thompson et al., 2006). The glaciers on the Tibetan Plateau and its surroundings are experiencing shrinkage as a result of global climate warming, impacting on hydrological processes including water availability (e.g., water discharge of large rivers of Asia) (Bolch et al., 2012; Kaser et al., 2010; Yao et al., 2012b). The advancing of glacier has shifted to retreating due to rapid climatic warming in the 21st century (Yao et al., 2007). Advancing glaciers store precipitation and reduce summer runoff while shrinking glaciers contribute to more meltwater and increase runoff. The intensity and frequency of precipitation, melting or growing of glaciers is uncertain. There may be more flooding in some areas in the short term, or drought in other places in the long term. The glacial retreat has caused an increase of ~ 5.5% in river runoff and rising lake levels in some lakes on the Tibetan Plateau (e.g. areas with large glaciers coverage such as the Nam Co and Selin Co) (Yao et al., 2007; Yao et al., 2004).

Tibetan Plateau Environment

The major ecosystems of the Tibetan Plateau include desert, alpine grassland and temperate forest (Zhuang et al., 2010). Tibetan vegetation is divided into three ecological zones: 1) High altitude steppe grasslands; 2) the forest of the eastern and south-eastern plateau, and 3) the mixed shrub and agriculture lands of south-central Tibet. All interspread with high mountain ranges with extensive alpine zones and ice field providing a unique habitat for the World's rarest wildlife species (e.g., Tibetan antelope, the snow leopard, giant panda, gazelle), plants and herbs (Miehe et al., 2011). The Tibetan Plateau soil is light brown or grayish depending on the humus content. It is the alluvial soil, its parent material being sand blown by wind over the gravel and shingle (Shén and Liu, 1973).

The climatic and atmospheric trends are already affecting species (both plants and animals) physiology, distribution and phenology (Hughes, 2000). The life cycles of many organisms are strongly influenced by temperature and precipitation. The global climate warming and changes in precipitation regimes (Hansen et al., 2010; IPCC, 2001), have been reported to fluctuate the onset and dormancy of vegetation growth, in the last century (Linderholm 2006). This could alter the seasonal biological processes such as flowering of plants and plant growth, animal migration, which depend on accumulated temperature, the total heat required for an organism to develop from one point to another in its life cycle economy (Penuelas and Filella, 2001; Schwartz and Chen, 2002). Furthermore, this may have ecological consequences, the changes of plant and animal cycles from cold and wet to warm and dry ecosystems and potential impacts on human health, agriculture, forestry and global economy (Penuelas and Filella, 2001; Schwartz and Chen, 2002). In the future, warmer conditions are generally expected to advance phenological events such as flowering and fruiting in plants, and to hasten development time in those species that respond to cues such as degree days (Hughes, 2000). The alteration of vegetation surrounding water resources (e.g. lake) may impinge on the biotic and the physical structure of the water body.

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Conflict of interest on shortage of water resources

'The battles of yesterday were fought over land. Those of today are over energy. And the battles of tomorrow may be over water. Nowhere is the danger greater than in Asia. Drought, urbanization, pollution, and inadequate infrastructure have made Asia the world's most water-scarce continent on a per-capita basis. Many of its water sources cross national boundaries, creating the potential for international conflict as supplies dwindle. Now global warming is raising the stakes further, causing rising sea levels, more severe floods and droughts, and the melting of the glaciers in the Tibetan plateau' (Chellaney, 2011).

The high mountains and uplands play an extremely important and distinctive role in the hydrological processes of the planet and in the regional hydrology of all continents. Water may become scarce due to increasing population growth. Conflict for water resources can rise as a result of the global climate change. This may result in the inter-state and intra-state competition over water resources. Equitable adaptation strategies and mitigation policies should be implemented to reduce the risk of conflict over competition for water resources.

Reconstruction of Past Climate in Tibet

Climate change over the past century and long-term reconstruction of climate over the past millennium indicate that the Earth is warming (Hughes, 2000). Climate change is monitored through systematic sustained global Earth observatories. Meteorological records are insufficient for recording climate change in the past and there is scarcity of data from remote regions of the world which include the Tibetan Plateau. Established natural archives such as ocean sediment cores, lake sediments, and biological indicators (e.g., ostracods, minute crustaceans), are continuously used for the reconstruction of past climate and environmental changes (Battarbee, 2000; Cohen, 2003). Reconstructing the environment from a few million years ago may improve our understanding of climate and environmental changes. Indices of environmental change serve as useful information for public awareness and policy makers to implement mitigation strategies to combat the change.

Summary

• The Tibetan Plateau is the largest and highest plateau on Earth.

• The uplift of the Tibetan Plateau is a major event in the recent geological history of the Earth.

• The Tibetan Plateau is characterized by a complex interaction of atmospheric teleconnections, hydrological, geological and environmental processes that influence the Earth's climate, hydrological cycle and biodiversity.

• The climate of the Tibetan Plateau is unique due to the influence of the Asian monsoon and the local topography.

• The Tibetan Plateau has a unique ecosystem of freshwater and brackish lakes, and the source of the largest river systems of Asia.

• Climate change and its impacts on the Tibetan Plateau need be taken into account in the regionalization of the ecosystems in terms of function, threats, restoration, sustainability and conservation.

• Reconstruction of past climate change facilitates a better understanding of geological and historical, climate and environmental effects on biota and ecosystems, as well as assessing current responses, and future management strategies.

Figure 6 - The alpine ecosystems of Tibet

For references, please contact the first author at lailah.lailah@gmail.com

Opportunities announcements

1st Ocean Global Change Biology Gordon Research Conference
Waterville Valley Resort, USA
6 – 11 July 2014

This GRC will approach two pressing research questions - "How will ocean biota respond to multiple concurrent alterations of their environment?", and "How will their cumulative responses affect ocean productivity, biodiversity and biogeochemistry?". The Student Fellowship Grant Program will assist 10 to 15 graduate students by covering US$600. Applications deadline to the fellowship is 1st May 2014.

Deadline
8 June 2014

Contact: http://www.grc.org/chairs.aspx?chair=c14650
http://www.grc.org/programs.aspx?year=2014&program=oceanglob

DISCO XXIV and PODS VIII Meetings
Hawaii, USA
5 – 9 October 2014

These symposia provide recent graduates, or soon to graduate PhD-level oceanographers (individuals who received their PhD after June 30, 2013 or will complete their degree before July 1, 2015) in the fields of chemical oceanography (DISCO) and physical oceanography (PODS) with an opportunity to present their dissertation research and to forge professional relationships that will facilitate their future research and academic careers.

Deadline
21 Apr 2014

Contact: disco@soest.hawaii.edu and pods@soest.hawaii.edu
www.soest.hawaii.edu/disco and www.soest.hawaii.edu/pods

Ocean Optics XXII
Portland, USA
26 – 31 October 2014

Registration and abstract submission for the 2014 Ocean Optics Conference taking place in Portland, Maine, USA is open. After registration, participants are eligible to submit an abstract which can be uploaded and edited up until the abstract submission .

Deadline
15 May 2014

Contact: jenny@tos.org
http://www.tos.org/oceanopticsconference/

Mares Conference on Marine Ecosystems Health and Conservation
Olhão, Portugal
17 – 21 November 2014

This international and open conference will bring together scientists from different levels and disciplines to discuss and address main issues about marine ecosystems health and conservation. Some of the themes covered are Future Oceans; Biodiversity effects on the functioning of ecosystems; Biological invasions; Overexploitation of natural resources, etc.

Deadline
1st June 2014

Contact: maresconference@ugent.be
http://www.maresconference.eu/

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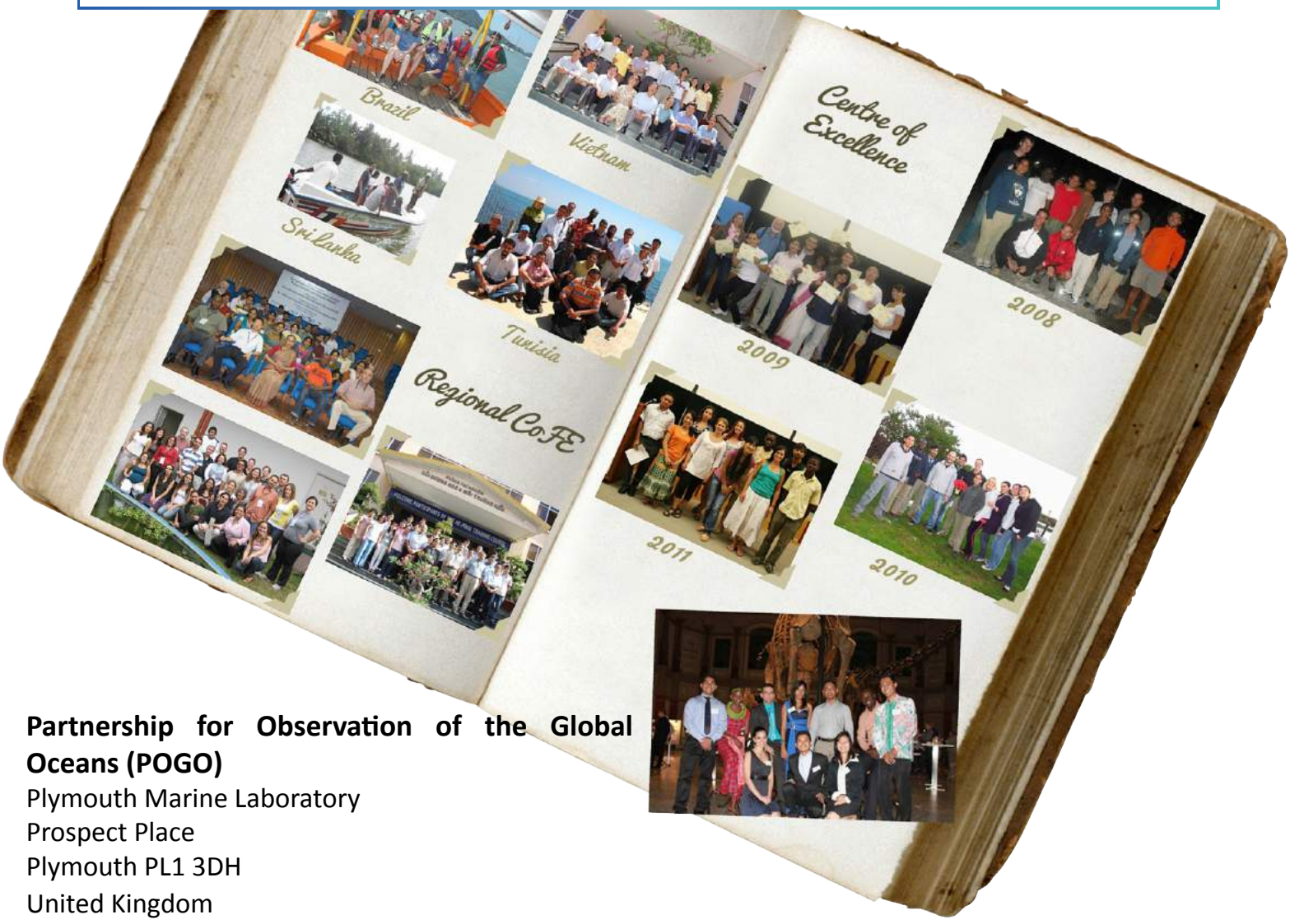

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