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- NF-POGO Alumni Network for Oceans -

NANO Regional Projects
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NF-POGO Alumni E-Newsletter – Volume 03, October 2012

From the Editorial Board:

It is my great privilege to present the third volume of "nano news", and I wish to express my sincere gratitude, on behalf of the Editorial Board, to alumni, "friends" and other colleagues in the field of oceanography, for sending their contributions, sharing scientific information, and informing the Network of all kinds of relevant activities. Special thanks go to Sophie Seeyave, Olga Shatova and Lilian Krug for their support and guidance in the preparation of this issue.

"Nano news" always provides alumni and NANO members with opportunities to exchange scientific information. It is essential to share information and knowledge to enhance collaboration between alumni members. From this point of view, I am sure that "nano news" will continue to play a very important role in achieving this core aim of NANO.

In this volume, we will introduce the most recent developments in the regional research projects funded by the Nippon Foundation in 2012, which focus on ocean observations for societal benefit, with an emphasis on different aspects of coastal water quality. We will also highlight some research activities, communications, and professional experiences of alumni and friends, as well as report on the most recent NF-POGO regional training course.

We hope all alumni and colleagues will continue to cooperate and support the publication of this newsletter. Any feedback or comments are very welcome.

Kind regards, on behalf of the Editorial Board

Yosra Khammeri

Editor-in-chief

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NF-POGO Alumni E-Newsletter – Volume 03, October 2012

This issue:

Photo by alumnus Tin H. Cong

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 two years after kick-off –Where are we now?

Dr. Sophie Seeyave - Scientific Coordinator POGO and NANO

We are already nearing the end of 2012, and this October marks two years since the exploratory meeting in London, where NANO was first conceived. NANO developed very quickly after that meeting: by June 2011 NANO had its own website, by October its own newsletter, and by April 2012 four regional NANO projects had been launched. In June 2012, we celebrated the first "official" anniversary of NANO, with the official beginning of NANO being considered as the launch of the website, since this is a central element of the network, which enables communication between POGO, the Nippon Foundation, the alumni and the NANO Friends, and communication between the Network itself and the rest of the world. To celebrate this anniversary, the NANO Support Team (consisting of Lilian Krug, Yosra Khammeri, Guillermina Ruiz and Olga Shatova) organized a competition that involved answering a number of questions on NANO and providing some feedback on the website and other aspects of NANO administration. All alumni who took part received a NANO USB pen drive and hard copies of the first two issues of NANO News, and those who answered all questions correctly received a copy of the book "Ecological Geography of the Sea" by Alan Longhurst. An additional prize was awarded to one of the winners selected at random (Mohammad Muslem Uddin, from Bangladesh), who was sent an additional text book of his choice.

Interest in NANO, from both the alumni and from outside, has continued to increase as the activities of NANO have expanded. The number of members of the website has risen from 32 in June 2011 to 170 at present, and the website now receives on average 85 visitors per day (vs 39 this time last year), from as many as 59 countries.

Perhaps the most exciting development has been the launch of the regional NANO projects in Latin America, South-East Asia, the Indian Sub-Continent, and North and West Africa. Considerable progress has been achieved already, particularly in creating links between alumni trained on different NF-POGO programmes (therefore who have never met), between scientists from different disciplines, and between neighbouring countries. Sampling is already underway, and it is anticipated that exciting new data will emerge in the next few months. Full reports on these four projects will be published in the next issue of NANO News. I very much look forward to seeing these projects develop further.

In November 2012 there will be a small meeting of NANO project coordinators, back-to-back with the "Oceans and Society: Blue Planet" Task Kick-Off Meeting in Brazil. I will be taking maternity leave from the end of January until August 2013, but I am confident that the Network is in good hands and will continue to grow during this period.

The Sargasso Sea - a critical part of the world's ocean

Prof. Howard S.J. Roe

The Sargasso Sea lies within the North Atlantic sub-tropical gyre. It is the only sea without land boundaries: its boundaries are defined by surrounding currents. The Sargasso Sea is a part of the High Seas, that area of the world's ocean that covers ca 50% of the Earth's surface but which is outside the jurisdiction and responsibility of any national government. As such it is subject to a mix of sectoral interests with no overall governance and little protection. Lack of protection in the open ocean is causing increasing international concern, and some three years ago the Bermuda Government decided to try to improve the international stewardship of the ocean surrounding Bermuda, both within and without its EEZ. This initiative lead to the formation of the Sargasso Sea Alliance, an international consortium of conservation and marine science institutions and individuals led by the Government of Bermuda. The SSA aims to secure global recognition of the importance of the Sargasso Sea; to work with existing organizations to secure protective measures for the Sargasso Sea; to establish appropriate management for this; and to use the experience gained to further the protection of other High Seas areas.

An essential part of the SSA initiative was the development of a science case setting out the importance of the Sargasso Sea. This has now been completed and can be accessed on the SSA website as http://www.sargassoalliance.org/case-for-protection. The Governments of Bermuda and the UK have accepted this case for the need to protect the Sargasso Sea and its ecosystems and the SSA is now working with other organizations and the fishing and shipping sectors to develop and establish protective measures.

The Sargasso Sea was first described by Columbus who described rafts of floating Sargassum weed, and it has become a place of mystery and legend- fears of being becalmed in mats of weed; the Bermuda triangle; stories of giant squid; and the inspiration for Shakespeare's "The Tempest".

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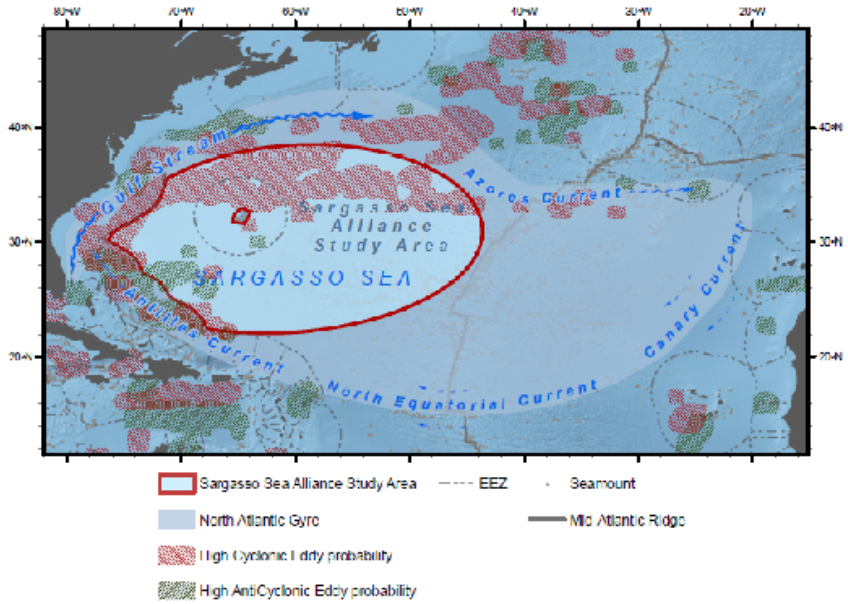

Figure 1. The SSA study area in the western basin of the Sargasso Sea

But rising above all of these myths, the Sargasso Sea is a fundamentally important part of the world's ocean because of its interdependent mix of oceanography; ecology; its role in global science and ocean monitoring; and its socio-economic and cultural values. All of these aspects are described in the science case, and the marine science areas are briefly summarized here.

The Sargasso Sea is bounded by clockwise rotating currents of which the Canary Current to the east is most variable and diffuse; because of this the SSA has focused on the western basin of the Sargasso Sea to the west of the mid-Atlantic Ridge. Water rotates within the gyre and is essentially trapped, together with *Sargassum* weed and any pollutants and rubbish. The residence times of surface material have been estimated to be at least 50 years and maybe much longer, and much of the oceanographic importance of the area for conservation purposes lies in this containment. But of course the oceanography is much more complex than a simple gyre, and the well known mesoscale variability, warm and cold core rings and the frontal systems, all impact the productivity, biodiversity and biogeochemistry of the region.

The Sargasso Sea is named after *Sargassum* weed, the world's only holopelagic large algae. There are two species, *S. fluitans* and *S. natans*, which form mats and concentrate in fronts and windrows. *Sargassum* also occurs elsewhere, but it is in the Sargasso Sea that it is most concentrated with thicker, longer lasting mats which in turn host diverse communities. Over 150 invertebrate species live in or on the weed, and there are ten species of fish, mollusks and crustacean that are endemic to it having various camouflage and behavioural modifications. The mats and their communities act as a food source and nursery area for fish (over 80 species breed here); juvenile loggerhead, hawksbill, green and Kemp's ridley turtles spend their lost years here; and ca. 26 species of birds feed and even roost on the mats. Below the surface, bigger fish- e.g. wahoos, tuna and dolphin fish, feed on the smaller fish spawned in the mats, and on the bottom several seamounts are home to hundreds of undescribed and possibly endemic species, whilst Sargassum weed sinks and provides food for benthic communities.

The area is on the migration route for many endangered species, including humpback whales, bluefin tuna and leatherback turtles, and it is the only place in the world where the endangered European and American eels come to spawn, linking Europe, North Africa, the USA and Canada with the Sargasso Sea. Endangered porbeagle sharks migrate south from Canada to pup in deep water of the Sargasso Sea, and basking and great white sharks have recently been found there deep below the surface. It is truly a crossroad of the Atlantic.

And it is a critical area for global oceanography. First sampled during the voyages of the Challenger, the Sargasso Sea is the site of many pivotal moments including the first *in situ* observations of deep sea animals by Beebe and Barton; the first live radio broadcast from the deep ocean; Swallow's discovery of ocean eddies; and Chisholm et al's discovery of *Prochlorococcus,* the most abundant photosynthetic organism on Earth, perhaps responsible for up to 20% of atmospheric oxygen. Rivaling these in importance are the ocean time series started at Hydrostation S by Stommel in 1954 and subsequently augmented by the Ocean Flux mooring, by BATS, the Bermuda Test Bed mooring and the atmospheric tower. Hydrostation S is the world's longest running ocean time series, and these stations together provide the longest time series of measurements in, for example, ocean biogeochemistry, particle flux, microbial oceanography, ocean optics and carbon export. They have delivered results as varied as the (surprising) productivity of the Sargasso Sea, its role in carbon export, the importance of marine bacteria in the global carbon cycle and the importance of the biological pump. The data are essential for measuring change, not just locally but at global scales.

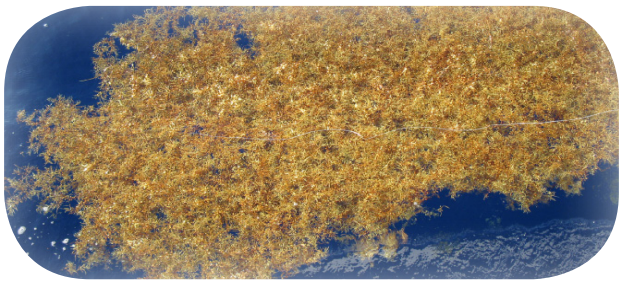

Figure 2. Sargassum weed accumulated in the waters off Bermuda (photo taken by Bennet Atsu Foli, Centre of Excellence year 2)

Professor Howard Roe is a biological oceanographer whose research interests range from whales to plankton, with excursions into sampling development and taxonomy. Director of the Southampton Oceanography Centre from 1999-2005, and founder member and past chairman of POGO, he is now a member of the Board and Executive Committee of the Sargasso Sea Alliance with responsibility for science.

Rio +20 dialogues: Ocean theme

Prof. John G. Field –Marine Research Institute, University of Cape Town, South Africa

The 3rd World Summit on Sustainable Development was held in Rio de Janeiro, Brazil in June 2012 and named "Rio +20", coming 20 years from the first summit and ten years after the Johannesburg summit in 2002. A new feature of Rio +20 was the "Rio +20 dialogues" arranged jointly by the Brazilian government and the UN Development Programme (UNDP) to publicize the event. The dialogues were arranged in 10 themes, one of which was Oceans; others included Water, Poverty, Forestry, Agriculture, etc. Academic facilitators (1 Brazilian, 1 from the North and 1 from the South) were appointed for each theme; they were responsible to invite interested colleagues to contribute ideas, suggestions and eventually, recommendations for sustainable development in relation to our theme.

The Oceans facilitators came up with 10 recommendations, which were advertised on the web, along with those of the 9 other themes, and the public was invited to vote on them over a two-week period.

The Oceans recommendations were, (in order of popularity of the invited group):

1. Launch a global agreement to save high seas marine biodiversity
2. Develop a global network of international marine protected areas.
3. Expand and implement international institutional arrangements to protect the marine environment from land-based activities.
4. Promote the creation of Marine Protected Areas designed and co-managed by artisanal fishers as a suitable tool to ensure marine governance and the sustainability of fisheries resources worldwide
5. Fishery management should be ecosystem-based, making allowance for the needs of all components of the ecosystem, including predators.
6. Fishery management procedures should be agreed among stakeholders whenever possible, with management measures agreed in advance under realistic scenarios of future ecological and fishery conditions for several years.
7. Create global ocean governance mechanisms to preserve biodiversity and genetic resources in a scenario of growing nationalization of the marine environment.
8. Avoid ocean pollution by plastics through education and community collaboration.
9. Monitor and promote international coordinated research on ocean acidification and its effects on marine life and ecosystems.
10. As far as possible, fish captured in the wild should be used for human consumption, with unmarketable by-catch used for fishmeal.

RIO+20 United Nations Conference on Sustainable Development

Some of the scenery around the city of Rio de Janeiro

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The first round of public voting chose No. 8 as the most popular recommendation so it automatically went forward to the summit meeting of the heads of state. Next, in a one-hour session, the facilitators explained the remaining recommendations to the theme panel, chosen by the Brazilian government in consultation with UNDP. This panel of ten (very much a decimal system!) put their individual views to an audience of some 2,000 people at the 3-day dialogues meeting at the new RioCentro convention centre on the outskirts of Rio de Janeiro. The panel included a son and grandson of Jacques Cousteau, and Sylvia Earle, and also other well-known public figures. After ten "short" presentations each urging the assembled crowd to vote for their favorite recommendation, the assembly voted electronically for the next recommendation to go forward: Recommendation 1 in the list above. Finally the panel had the liberty of formulating their own recommendation as the third to go forward, so the three recommendations that Sylvia Earle presented to the Heads of State were:

1. Avoid ocean pollution by plastics through education and community collaboration.

2. Launch a global agreement to save high seas marine biodiversity.

3. Take immediate action to develop a global network of international marine protected areas, while fostering ecosystem based fisheries management, with special consideration for small-scale fishing interests.

However, in parallel to the Dialogues meetings described above, the governmental ministries were negotiating the text of the document to be signed by the Heads of State, a process that we heard was fraught with often acrimonious argument as the original drafts were watered down in attempts to reach consensus. Thus by the time the Heads of State assembled in the days following the dialogues, the text had already been negotiated and there was little prospect of the three minutes allocated for presentation by each theme rapporteur making any difference to the outcome.

In summary, the Rio Dialogues were an interesting experiment that succeeded in involving many more people than would otherwise have been there, and publicized the event and issues, but made no difference to a disappointing outcome for the summit. This was to be expected, given the serious economic and political issues being confronted, and symbolized by the absence of the Heads of State of the USA, UK and Germany. As usually happens in politics, short-term issues (such as re-election) take precedence over the serious long-term issues facing our planet.

Prof. Field was, until recently, the Director of the Marine Research Institute, University of Cape Town. In the past, he has been President of the Scientific Committee on Oceanic Research (SCOR), Chairman of the Joint Global Ocean Flux Study (JGOFS), Chairman of the Global Ocean Ecosystem Dynamics project (GLOBEC), Chairman of the Global Ocean Observing System (GOOS) Scientific Steering Committee, and has held many other such honorary offices. He is the incoming Chair of POGO, starting January 2013.


Photo by alumnus Kentaro Suzuki

NF-POGO Centre of Excellence regional training in ocean colour, India 2012

A deviation from convention

Tamoghna Acharyya - National Institute of Oceanography, RC, Visakhapatnam, India

We, 23 students from different countries of various disciplines, gathered for three weeks (5-26 February, 2012) in India for the NF-POGO Centre of Excellence regional training in ocean colour. The program was jointly organised by INCOIS (Indian National Centre for Ocean Information Services), NIO (National Institute of Oceanography, RC, Visakhapatnam) and Andhra University, Visakhapatnam, India. The overall coordination was carried out on behalf of POGO, by Dr. Gerry Plumley, Bermuda Institute of Ocean Sciences, and the funding was provided by the Nippon Foundation.

All along this 3-week training, we were taught various theoretical and practical applications of ocean colour remote sensing, primary productivity and ecosystem modelling. The course comprised of lectures, hands on training of satellite data processing (SeaDAS, pigment analysis (fluorometer, HPLC), CDOM & FDOM measurements, P-I experiments, C13-based primary productivity, phytoplankton absorption and onboard operation of radiometer in the coastal waters off Visakhapatnam. We were fortunate to have outstanding experts and experienced instructors, namely Professor Trevor Platt (FRS), Dr. Shubha Sathyendranath, Dr. Aneesh Lotliker, Dr. V.V.S.S.Sarma, Dr. P.S. Swathi, Prof. N.S. Sarma, Dr. Mini Raman, Dr. Bala Krishna Prasad, Dr. T. Suresh and Dr. Das.

I found this training programme completely different from conventional ones. The entire course was designed with a great blend of lectures, computer and laboratory sessions that it never felt monotonous. This may sound trivial but I could not resist mentioning that the cost of the training was completely covered by organizers and we were provided with free accommodation and per-diem allowances of 15 USD. It implies that organizers had no hesitation to provide us with the maximum comfort so we could concentrate solely on learning. To prove the slogan "apply your acquired knowledge" to be true, we had to complete a mini project based on what we had learnt during the training. Each of us was individually monitored by instructors in the project work and they were always ready to answer our questions. I never had experienced before such a free atmosphere and cordial relation between a trainer and a trainee. Also, I can't forget how Professor Platt guided us to finalize our mini project presentations completely ignoring his severe eye injury caused by an accident as if nothing had happened to him.

Students and instructors at the regional CofE in Hyderabad, India. Photo by alumnus T. Acharyya.

On the day of valedictory function at Andhra University all the participants came up with some brilliant project presentations. When the time came to bid farewell to one another, we could not believe how three weeks had passed so fast. We departed with heavy minds but with new inspirations and spirits as meanwhile we had become members of the NANO family. So it was not the end but the beginning of a new era with new relationships.

Photo by alumni Suchismita Srichandan and Sanjiba Baliarsingh

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Harmful algal bloom remote sensing model for Southeast Asian region

NANO-Southeast Asia regional project kick-off meeting

Regional Coordinators: Hoang Cong Tin[1], Tong P. Hoang Son[2], Kathleen Silvano[3]

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[3] University of Algarve, Portugal
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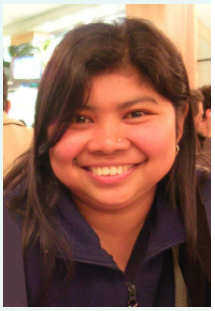
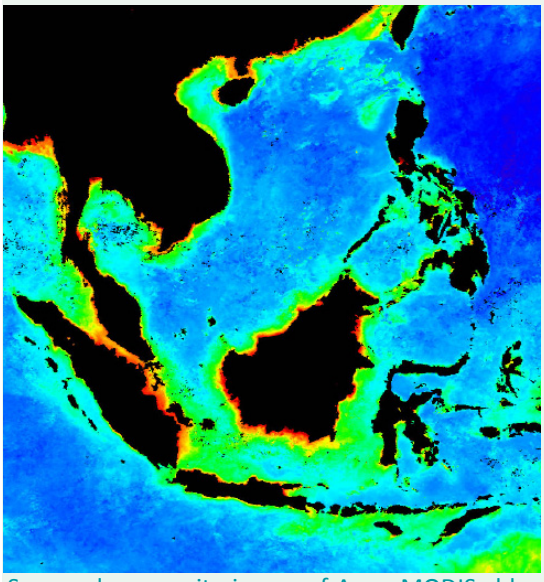


Fourteen NANO alumni and mentors participated in a two-day meeting to launch the NANO Southeast Asia (NANO-SEA) Regional Project. The meeting was held on July 6-7, 2012, in Nha Trang, Vietnam, where participants from the two collaborating countries, Vietnam and the Philippines, got together with aims to formally introduce direct involvements in the project, and set initial status and capabilities.



Seasonal composite image of Aqua MODIS chlorophyll concentration in Spring 2011 in South East Asian Seas

Participants were introduced to NANO Network and were given a background on the conceptualization of the NANO-SEA Project, starting with a briefing about two important meetings that paved the way for the creation of NANO and subsequent regional proposals. The first meeting in October 2010, London, UK, was a planning meeting where the NANO initiative was created and formed. The second meeting in Abingdon, Oxford, in September 2011, focused on developing research proposals for each region that will be undertaken through collaboration between NANO alumni in the respective regions. The regional proposals were conceived within the context of i) Global/regional monitoring rather than local problems; ii) Changes, interactions and feedbacks and on operational oceanography rather than "blue skies" research; iii) An emphasis on time-series measurements; iv) A global vision to be eventually achieved through a combination of *in situ*, satellite remote sensing and modeling data.

The actual NANO-SEA regional proposal, "**Harmful algal bloom remote sensing model for Southeast Asian region**", was presented followed by presentations from both countries to guide and facilitate discussions in the subsequent working group sessions. Members of the Vietnamese oceanography group and the Philippine oceanography group and Harmful Algal Bloom (HAB) project presented interesting topics pertinent to the NANO project:

- "Simulation of HAB migration in Southern Central Vietnam" software developed by A/Prof. Bui H. Long;
- "Integrated oceanographic and modeling studies to investigate HABs in the Philippines with a focus on Sorsogon Bay, Philippine" by Dr. Aletta T. Yñiguez;
- "Marine Bio-optic in coastal waters of Vietnam: approaches and estimation" by Mr. Phan M. Thu;
- "Detecting red tide using ocean colour images for Vietnam waters" by Lau V. Khin;
- "Perspective, potential and realistic application of marine remote sensing in Vietnam" by Mr. Tong P.H Son and Hoang C. Tin;
- "The approaches of HAB model in coastal waters of Vietnam: Yes or No" by Dr. Doan N. Hai, Nguyen N. Lam and Nguyen C. Thoi.
- "Remote sensing of suspended particulate matter in coastal waters and related on-going French projects in Vietnam" by Sylvain Ouillon;
- "An approach of ROMS model and satellite data for assessment the environmental water quality" by Nguyen Chi Cong.

These presentations provided information on the research capabilities of each country in terms of facilities, resources and the level of data support that are currently available during the initial phase of the NANO project.

Ideas on various topics, such as sampling plan and ability for ocean colour algorithm development in Mekong Delta, Vietnam, were discussed. Details such as locations, sampling methods, algorithm development, and tasking were given attention. Thus, a sampling plan and data utilities as input data for biochemical-oceanography of HAB modeling in Philippine and Vietnam waters was made. A list of action items and corresponding responsible persons for each research component were also assigned.

Among the highlights of the meeting was a group session discussing further steps for the NANO-SEA regional project and potential collaboration of other ocean colour remote sensing research projects in Southeast Asia (SEA). This discussion among alumni, supervised by Dr. Gerry Plumley and Dr. Laura David, pointed out possible initiatives of extending NANO networking among alumni and mentors through organizing regional training courses on ocean colour remote sensing, scientific exchange, co-authoring of scientific papers, and proposals for regional joint projects. As an immediate action, an outline was made for "**Remote sensing in marine environmental monitoring in South East Asia Region**", (a.k.a. "SEA Remote Sensing"). This networking initiative foresees a promising future for marine remote sensing research community in SEA, opening and promoting capacity building programs from NF-POGO and other supporting projects.

Group photo of participants at the meeting. From left to right: Nguyen C. Cong, Dr. Doan N. Hai; Lau V. Khin, Phan M. Thu, Nguyen C. Thoi, Dr. Laura T. David, Dr. Aletta T. Yñiguez, Dr. Gerry Plumley, Tong P.H. Son, and Hoang C. Tin.

The kick-off meeting culminated with parting words from observer/supervisor Dr. Gerry Plumley, saying that the two-day meeting had brought him background information to engage in discussions on future collaboration. He also acknowledged that remarkably, the meeting was not only for NANO-SEA Project, but also an excellent chance for SEA alumni and mentors to work together for capacity building. He believes that "SEA Remote Sensing" will see fruition in the future.

Monitoring of HAB species in the coastal waters of India and Sri Lanka

Regional Coordinator: Ravidas Naik

National Centre for Antarctic and Ocean Research, India
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The importance of phytoplankton studies has moved beyond the context of fisheries in the recent past, to global warming, climate change and also to human health due to Harmful Algal Blooms. HABs are natural phenomena and historical records indicate their occurrence long before the advent of human activities in coastal ecosystems. Among the total marine phytoplankton species, approximately 7% are capable of forming algal blooms (red tides). Dinoflagellates are the most significant group producing toxic and harmful algal blooms accounting for 75% of the total HAB species. The consequences of HABs have been felt on the Indian sub-continent in terms of mass fish mortality and even some human fatalities. Though the dynamics of blooms are complex, the role or mechanism of chemical and biological factors are now reasonably well understood. However, comparable understanding of physical factors is lacking. The impacts of these factors in combination with local inter-annual meteorological conditions vary from one geographical location to the other and thus influence bloom dynamics differently. In view of this, the following objectives have been proposed under the Indian sub-continental regional project: (1) Study of the dinoflagellates community structure with reference to HAB species and dissolved phytotoxins in the coastal waters of Indian and Sri Lankan subcontinent, (2) Use of remote sensing and bio-optical properties to understand HABs in this region. The proposed work will generate baseline data on HAB dynamics and toxins present in the study area; and, if possible, a HAB culture collection centre for studying the bloom dynamics and toxin characterization.

So far, sampling has been carried out at two locations in Indian waters: off the Goan coast (Arabian Sea, west coast of India) and off Visakhapatnam (Bay of Bengal, east coast of India). Both sampling sessions were carried out during July (monsoon season). Sample collection in Sri Lankan waters is done at Trincomalee, about 5 km off the east coast of Sri Lanka (depth is about 60m). The sampling will take place monthly and the first samples for the HABS project were collected on August 23, 2012. The next sampling trip is planned for the end of September.

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Implementation of Pigment analysis using HPLC in Antares coastal time series stations

Latin American regional project

Regional coordinator: María Guillermina Ruiz

National Institute for Fisheries Research and Development (INIDEP), Argentina
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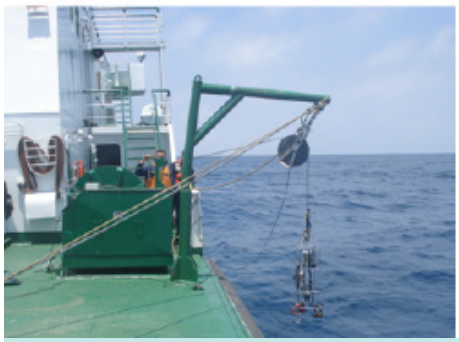
Project objectives

The Latin American Regional Project (LA-NANO Project) aims to implement pigment analyses using HPLC in the ANTARES network time series stations.

Since its beginning in 2003, the ANTARES network (www.antares.ws) has received support by organizations such as POGO, IOCCG and the IAI. Furthermore, in 2006 ANTARES served as a seed for a global network named "Chlorophyll Globally Integrated Network" (http://www.chlorogin.org/world; ChloroGIN,) of which ANTARES forms its Latin American regional branch. Today it involves 11 coastal time series stations around Latin America and the Caribbean and many of its members are also NANO Alumni and NANO Friends.

One of the focuses of study in ANTARES is the temporal variations in phytoplankton communities. Phytoplankton functional types (PFT) are groups of phytoplankton species that have specific roles in the biogeochemical cycles and marine food chain. These groups have been pointed out as keys to improve the knowledge on ecosystem dynamics and effects of climate and anthropogenic changes in the marine environment. One of the most efficient methods to analyze pigment composition is High Performance Liquid Chromatography (HPLC), which allows the identification of different phytoplankton groups through their particular marker or suites of pigments. To accomplish this, samples will be sent to be analyzed by HPLC at the NASA (USA).

Strengthening interactions among NANO and ANTARES networks is the second main objective of this project. This includes promoting capacity building by the training of graduate and undergraduate students in the sampling, analysis and interpretation of the measurements, as well as the exchange of knowledge and experience between researchers.



Scenes from the ongoing LA NANO Project: Alumnus Valeria Segura filtering water samples at EPEA station; Researchers at Cartagena laboratory; Collection of samples aboard the ARC Gorgona at Cartagena station; A liquid nitrogen dewar storage of biological samples; The R/V Puerto Deseado ready to set sail

The third main objective of the LA-NANO Project is to collect the relevant satellite information from the dates corresponding to the proposed HPLC-pigments sampling. Sea surface temperature and ocean colour images will be processed for the participating ANTARES stations.

Project Progress

I was awarded a 1-year fellowship to help in the coordination and development of the LA-NANO Project. This is a great opportunity for me to get experience in this interesting field of knowledge, working in connection with experts in this field such as NANO Alumnus Ana Dogliotti and other NANO Friends such as Shubha Sathyendranath, Vivian Lutz, Frank Müller Karger and Milton Kampel.

I introduced the idea of the project to the ANTARES stations´ PIs and NANO alumni. I invited them to participate by sending out a survey aiming to recover information about the following: willingness to participate, acknowledge the fact that data from HPLC analysis had to be posted in the SeaBASS database, and other methodological aspects. Six stations replied enthusiastically: CARIACO (Venezuela), Cartagena (Colombia), Ensenada (Mexico), EPEA (Argentina), IMARPE

(Peru), and Ubatuba (Brazil). This means we will have samples from the South Atlantic Ocean, the South and North Pacific Ocean and the Caribbean Sea under the LA-NANO project.

Then, I distributed a protocol to the participating stations in which a procedure about how to collect the pigment samples was described. This protocol was discussed previously among NANO friends and alumni especially by Vivian Lutz, Frank Muller-Karger, Eduardo Santamaría del Ángel, Ana Dogliotti, and some Antares members. The discussion was not in vain. It was noticed that Cartagena station did not have the required elements to store the samples until analysis. Thus, it was decided to allocate part of the LA-NANO Project budget to buy a liquid nitrogen dewar for Cartagena station.

Since the completion of the preparatory phase, the sampling phase of the project is now underway. CARIACO, Cartagena, Ensenada, EPEA and Ubatuba stations collected samples during July and are close to set sail for their second cruises, while IMARPE is getting ready for their first campaign scheduled for the end of August.

At the same time, under the guidance and collaboration of NANO Alumnus Lilian Krug, I created a web page for the project at NANO Wiki (http://www.nf-pogo-alumni.org/Latin+American+Regional+Project). Here the project progress is being described and the results will be published. Among other tasks I am working hard to update the ANTARES website. This allows ANTARES researchers to be up to date with their fellows' activities and research interests. Several NANO friends expressed their interest in contributing with their expertise to this NANO project: Vivian Lutz, Frank Muller Karger, Milton Kampel, Li Zhai and Marie-Fanny Racault.

Lessons learnt

In the first place, LA-NANO Project taught me how important good communication is. Even speaking the same language, it is not easy to transmit to someone exactly what you are thinking. Rather than writing, it is better to speak. If face to face is not possible, at least through the phone or the Internet. Saying "no, thanks" is preferable to a long silence. When asking for questions, you have to be sure people in the other side understood what you meant, even if it requires asking the same thing ten times in different ways. I learnt this after I got 5 wrong answers to one of my questions… this meant having to do the job again and an undesired loss of time.

Only when you get involved in a project like this you can see beyond the potential rewards it could bring. I am completely sure the hardest part of the LA-NANO Project is to build working relationships, and this is absolutely impossible without involvement and engagement. Apart from getting pigment compositions, by the end of the LA-NANO Project we expect to have new working collaborations among students with similar interests, new friendships, and, why not, the development of a new project or the continuation of this one? Only those who get involved will seize this huge opportunity.

Coordinating a project like this is complex but challenging. It has to do with communicating with people, being patient and organized. It has a lot of the "planning ahead" and "time management" thing. I remember once I was waiting for an answer from the Colombian liquid-nitrogen thermo provider. I checked e-mails during the day, but nothing. Finally, late in the afternoon, I got a short message from the provider's mobile phone saying "*Thanks. Today is a public holiday. I will write to you on Monday.*" Immediately, I plot my calendar with the public holidays of all the participating countries. Now I am ready to coordinate the next stage: shipping the samples to the NASA...

Future Perspectives

¡Viento en popa! While the six stations are away in the ocean collecting samples, I will be busy taking several courses at INIDEP, the National Research and Fishery Development, located in Mar del Plata, Argentina. By the end of August I will take a course on "Phytoplankton Pigments" dictated by Dr. J. Carreto, a recognized specialist in pigments from Argentina, and early in September I will attend a course by NANO Alumnus Dr. Ana Dogliotti on "Remote Sensing of Ocean colour: theory and satellite image processing". In this way, one of the expected outcomes of the NF-POGO program, which is the transfer of knowledge from young people who received first hand training to new students in their countries, will be accomplished.

The scheduled date for the last sampling is mid November, so we are planning to do the shipments to NASA no later than the end of that month. Do you want to know the results? You will have to keep updated with future issues of the NANO-News!

Go online for updates and more details

NANO Regional Projects: http://www.nf-pogo-alumni.org/Regional+projects

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Monitoring of coastal pollution and erosion in North and West Africa

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Environmental issues such as coastal pollution and erosion have become very serious and recognized as growing problems in many of the nation's coastal areas.

One of the projects launched following the decisions of the NANO meeting in Abingdon, September 2011, was to focus on these issues in North and West Africa.

Research in the field of coastal pollution and erosion lacks research facilities, cooperation between institutions, professional training of personnel and modern data management tools.

The purpose of the African project is to monitor the state of pollution and erosion in coastal zones and to understand the risks related to these activities. It aims to contribute to the solution of environmental problems, in particular, revision of methods and intercalibration, and the creation of a common database and standards for the countries involved in the project.

Regular communications were arranged during the preparation period, strengthening the interaction and collaboration among NANO scholars, which is also an objective in this project. Some 14 NANO alumni and friends from 10 different countries will participate in the workshop in December 2012, in the Polytechnic High School of Dakar, Senegal. The workshop will be hosted by Ousmane Diankha, one of the NANO alumni, who recently returned from the NF-POGO Centre of Excellence (year 4).

The workshop theme is "Challenges in Coastal Pollution and Erosion in North and West Africa" where participants will discuss the monitoring strategies and methods for coastal pollution and erosion in North and West Africa, with a practical session and demonstration of relevant methods.

The benefit of the implemented activities will include scientific progress in the field, strengthening of the Network of Alumni, enhanced collaboration between countries, and aims to contribute towards an eventual reduction in pollution at the land-sea interface.

I would like to thank Ms. Olga Shatova and Dr. Sophie Seeyave for their guidance and support.

Ocean colour variability across the southern Atlantic and southeastern Pacific

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Wikipage: http://www.nf-pogo-alumni.org/~Natalia+de+Moraes+Rudorff

At the end of 2010, my advisor Dr. Milton Kampel (INPE) and I were invited by Dr. Robert Frouin (Scripps Institution of Oceanography (SIO), University of California San Diego, USA) to participate in an oceanographic expedition across the southern Atlantic and southeastern Pacific on board R/V Melville (SIO). The partnership between Dr. Frouin and Dr. Kampel had begun with the ANTARES Regional Network program and strengthened throughout two short-term courses held in Brazil with the Visiting Professorship – NF/POGO program. The invitation for the MV1102 cruise was an excellent opportunity to join the group and obtain valuable *in situ* data across important oceanic and coastal regions, which further became the study object of my thesis. My previous experience with ocean colour *in situ* data collection was with the ANTARES Ubatuba (SP, Brazil) coastal station. MV1102 was my first long-term cruise across an oceanic basin, and it was an incredible opportunity to be onboard R/V Melville with experienced scientists and students from different parts of the world. The researchers, technicians, and students that joined the group included: Dr. Vivian Lutz (Instituto Nacional de Investigación y Desarrollo Pesquero (INIDEP), BA, Argentina), Msc. Mayza Pompeu (Instituto Oceanográfico da Universidade de São Paulo (IOUSP), SP, Brazil), Brian Schieber (SIO), MSc. Zied Ben Mustapha (Université du Littoral Côte d'Opale (ULCO), Lille, France) and Msc. Clemence Goyens (ULCO). The cruise was realized under the "Whitecaps and Optics" project organized and coordinated by Dr. Frouin (funded by SIO and NASA), which main goal was to study the effects of whitecaps and rough seas on the retrieval of ocean colour products and to characterize the distribution of the optical properties throughout the different regions along the cruise transect.

R/V Melville departed from Cape Town, South Africa (34°S, 18°E) on February 19th, 2011, and arrived at Valparaiso, Chile (36°S, 76°W) on March 13th, 2011 (Figure 1). It passed though important biogeochemical systems from the South-African Benguela Upwelling Ecosystem, across the South Atlantic Subtropical Convergence Zone (SACZ), the Patagonian Shelf Large Ecosystem, throughout the Magellan Strait, and to the Chilean Fiords and coast in the southeast Pacific. Despite the important role of these systems in regional and global biogeochemical cycles, it is a sector with very few *in situ* data sets and with high challenges to satellite ocean colour remote sensing due to the optically complex water types, sea surface roughness due to constant forcing of the westerlies and persistent cloud coverage, especially in the SACZ.

The ship stopped once a day around noon (local time) for radiometric and bio-optical collections of the surface and water column, totalling 20 CTD stations. Radiometric measurements were realized using above and in-water radiometers: ASD Fieldspec (ASD Inc.); SIMBAD; HyperOCR II (Satlantic Inc.); PRR (Biospherical Inc.); and TriOS (Optical Sensors Inc.). A Hydroscat-6S (HOBI labs Inc.) was deployed to measure the backscattering coefficient at 6 ocean colour bands. Water samples were collected with a rosette bottle system, coupled with a CTD (*Conductivity Temperature Depths*), at 4 depths distributed in the sub-surface, chlorophyll maximum, and up to ≈100 m depth. Along the cruise track sub-surface samples were also collected with the ship flow-through system (4 m deep), totalling 114 sub-surface stations. The water samples were separated into sub-samples immediately filtered for analysis of: the coloured dissolved organic matter (CDOM) absorption (a_s); particulate absorption (a_p); fluorometric chlorophyll-a concentration (Chl-a); High Performance Liquid Chromatography (HPLC) pigment analysis; particulate inorganic and organic carbon (PIC and POC); flow cytometry; and microscopy analysis for taxonomic phytoplankton characterization. All CTD stations had a complete set of sub-samples, while the flow-through stations had a smaller set, with samples for at least Chl-a, a_s and a_p analysis. MODIS and MERIS data were received onboard the ship during the entire cruise. The MERIS data, processed by Francois Steinmetz (HYGEOS, France) using the POLYMER algorithm, were available in quasi real time.

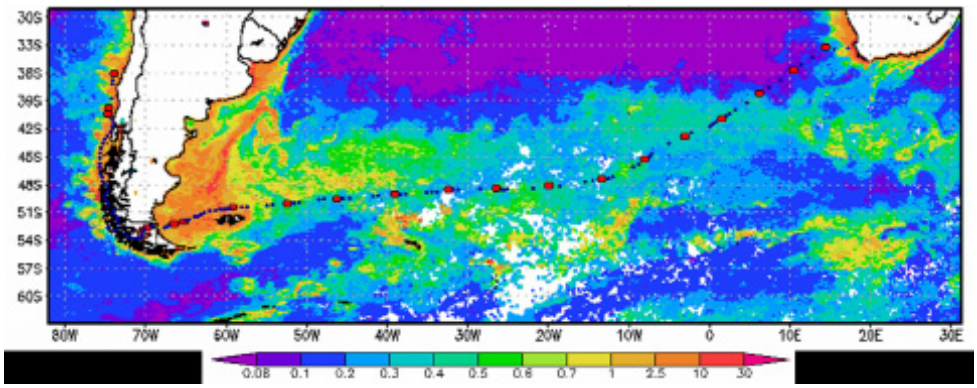

Figure 1: MV1102 stations overlayed on a Chl-a map (mg.m^{-3}) of MODIS 4 km - 8 day composite (02/18-03/06/11). The red dots are the CTD stations and the dark blue dots flow-through stations.

Previous page: Photos of field work

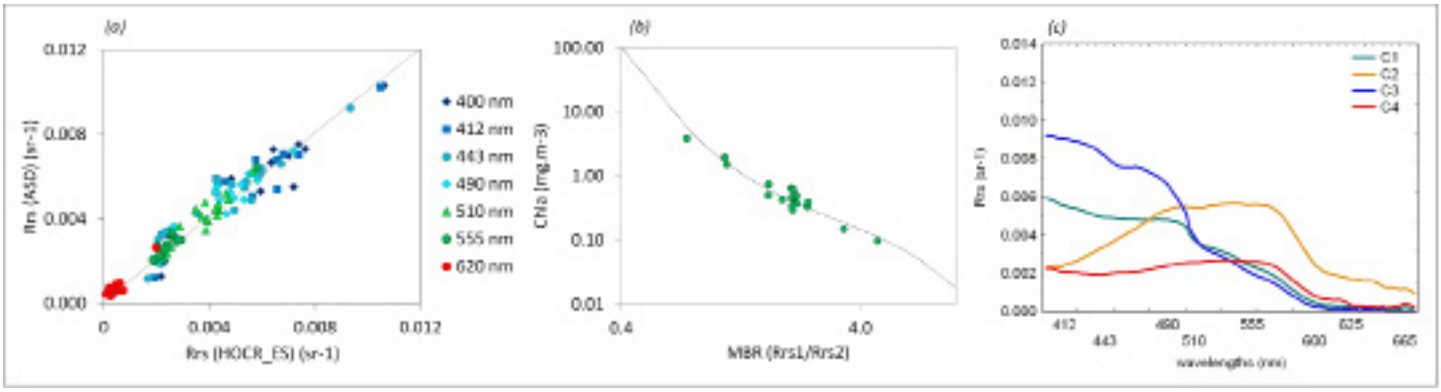

Figure 2: (a) Comparison of the above-water ASD and in-water HOCR approaches for the above-water remote sensing reflectance (R_{rs}) retrievals; (b) Comparison of Chl-a using the Rrs (HOCR) and OC4v4 maximum band ratio (MBR) algorithm, with Chl-a measurements (HPLC and fluorimetric); and (c) Mean R_{rs} of each water type, grouped in a K-means cluster analysis

After the cruise I had the opportunity to follow up some of the analysis at different laboratories in Brazil (IOUSP and Universidade Federal do Rio de Janeiro – UFRJ), Argentina (INIDEP) and USA (SIO). The last one was an opportunity provided by the POGO-SCOR Visiting Student Fellowship program that allowed me to stay 3 months with Dr. Frouin at SIO were I made some analysis and data processing from the cruise.

My thesis topic is about "Ocean colour variability across the southern Atlantic and southeastern Pacific". The main objectives are to analyze the bio-optical variability associated with the dominant phytoplankton groups and the particulate and coloured dissolved organic matter, across the different regions, and to study the implications for ocean colour remote sensing. The hypothesis is that the Southern Atlantic and Southeastern Pacific can be partitioned into bio-optical provinces that have specific optical properties governed mainly by the distribution of the dominant phytoplankton groups and the different biogeochemical systems. The application of a generalized semi-analytical model with a class-specific parameterization could significantly enhance the retrieval of ocean colour products, and enable more comprehensive studies for the region of interest. The work includes: a) a description of the oceanographic, biogeochemical and bio-optical properties, across the different regions along the cruise transect; b) uncertainty analysis of the radiometric and bio-optical data; c) analysis of the relations between the inherent and apparent optical properties and phytoplankton pigment concentration; as well as, the identification of the sources of deviations from the global fits (for empirical and semi-analytical models); d) statistical analysis for the partitioning of potential bio-optical provinces; e) application of a generalized semi-analytical model with a class-specific parameterization (testing the performance against the global fit); and finally f) the application of the class-based model to a MODIS time-series data set (8 years of a monthly composite (February-March)), for a final analysis of the bio-optical and phytoplankton distribution of the region of interest.

Figure 2 shows some of the results obtained so far. Figure 2 (a) shows a comparison of the above and in-water approaches for the retrieval of the above-water remote sensing reflectance (Rrs), as part of the uncertainty analysis. The differences were on the order of ten percent and highest for the stations under the most adverse environmental conditions, with strong winds, waves and broken clouds. The band ratios had lower uncertainty levels (10-15%), although still not as good as the 5 % level required in the SeaWiFS protocol. This highlights the challenges in acquiring accurate in situ radiometric measurements and the needs for improvements especially of data processing and corrections schemes. Albeit for some purposes of bio-optical modeling and ocean colour remote sensing these uncertainties may still be within acceptable levels as some products may have even higher uncertainties associated to its measurement (such as the Chl-a, for instance). More into analysis of the bio-optical variability, Figure 3 (b) shows a plot of the Chl-(a) retrieved using in situ Rrs with the maximum band ratio OC4v4 algorithm (O'Reilly, 2001), compared to Chl-a measurements, with the HPLC and the fluorimetric method. The deviations from the global fit are in part due to the uncertainties of both R_{rs} and Chl-a, and in part due to the different proportions of CDOM and detritus that vary not only with the total Chl-a, but also with the different phytoplankton groups and dynamics of the biogeochemical systems. Figure 3 (c) shows a pre-classification of the water types using a cluster analysis applied to the R_{rs} data. The classes were associated to the following water types, and systems: 1) clear oligotrophic waters, with high R_{rs} in the blue for stations in the Southeast Atlantic and Southeast Pacific (blue line); 2) mesotrophic waters of the SACZ, with intermediate R_{rs} (red line); 3) eutrophic waters of the Patagonian Shelf and Chilean Coast, with low R_{rs} in the blue, due to high Chl-a and organic matter absorption (magenta line); and 4) turbid waters of the Magellan Strait, with relatively low R_{rs} in the blue, due to high Chl-a and organic matter (CDOM and detritus), and high R_{rs} in the longer wavelengths due to the presence of inorganic sediments in suspension (green line). These classes will be further analyzed in terms of the bio-optical properties and possible characterization of bio-optical provinces, to apply the class-based approach for ocean colour modeling.

Thecamoebians and ostracods from holocene sediment of Volta Lake, Ghana

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Introduction

Thecamoebians (brackish to freshwater protists) and ostracods (small bivalved crustaceans), are two groups of microfossils, which provide useful environmental and palaeolimnological information on lakes systems responses to environmental and climatic changes.

Thecamoebians (also called testate amoebae) are protists belonging to the phylum Sarcodaria, superclass Rhizopoda. They are inhabitants of mosses, dampsoils, freshwater lake bottoms, floating algal mat, etc. and depend upon other protistans, flagellates, diatoms and fragments of mosses and lichens for food supply (Patterson & Kumar, 2002). They are a diverse and important component of the microbial trophic level within the benthic community of lakes and wetlands, where they play a critical role in food webs as the intermediate between bacterial and benthic invertebrate communities (Patterson & Kumar, 2002). These benthic protozoans, particularly those belonging to the Order Thecolobosa (Arcellinida), superfamily Arcellacea, produce a fossilizable test (shell) of pseudo-chitinous material that is variably agglutinated by different species (Medioli & Scott, 1983). The variable agglutination allows for the differential identification of species and strains. After death, their tests fossilize and are found in all aquatic and moist terrestrial sediments, although the preservation potential varies between species (Boudreau et al., 2005; Patterson & Kumar, 2002).

Ostracods are microscopic, bivalve crustaceans (mostly 0, 5 - 2 mm) with valves of low-Mg calcite. The two valves comprise the carapace and protect the soft body parts. The valves are closed by adductor muscles that are attached to the carapace. These muscles leave scars on the valves and can be used to identify individuals to the family and superfamily levels. Other important taxonomic characters used for identification are the structure of the marginal zone of the valve, the external valve surface, pigmentation of the carapace, and differences in appendages and other soft parts (Meisch 2000, Horne et al., 2002).

Ostracods live in fresh, brackish, and marine waters, including streams, springs, ponds, lakes, estuaries and oceans. Some taxa are found in groundwaters, semi-terrestrial environments, or even in terrestrial plants that accumulate water, such as bromeliads. Some are benthic, living on or within the bottom substrate, while others are nektobenthic, with swimming abilities, but also live on the bottom substrate or plants. Some species can live in interstitial environments (Mezquita et al., 2005). Benthic Ostracods display different tolerances to water column physico-chemical variables. Eurytopic species are adapted to a wide range of environmental conditions, while stenotopic species are adapted to a narrow range of environmental conditions. Ostracods are mainly detritivores and also readily feed on dead animals. Ostracods form an important component in the food chain of some fish. Like other crustaceans, ostracodes moult, generally passing through eight stages to reach adulthood.

An Ostracod's life cycle may last a few months or more than 2 years (Horne et al. 2002, Smith & Horne 2002). Freshwater Ostracods reproduce sexually and also by parthenogenesis. Ostracods constitute a model group in palaeoecological studies, and are used as indicator species in climate and ecosystem change studies (Griffiths & Holmes 2000, Holmes & Chivas 2002, Horne et al. 2002, Smith & Horne 2002, Schwalb 2003, Viehberg 2004, Martens et al. 2008).

Although microfossils have been extensively studied from other parts of the world, the knowledge on these groups in Africa is very limited. In Africa, paleolimnological studies using ostracod fauna include focus on Tanganyika and Malawi lakes, East Africa (e.g., Palacios-Fest et al 2005; Park & Cohen 2011), Qarun Lake, Egypt (Keatings et al 2010), Retba and Mbawana lakes, Senegal (Sarr et al 2008), Bal Lake, Nigeria (Holmes et al 1999). The use of microfossils for palaeolimnological studies on tropical man-made Volta Lake, Ghana in Western Africa is still unknown. The primary aim is to provide a brief overview on microfossils from Holocene sediment in Akosombo Gorge Area of Volta Lake, Ghana.

Study area and sampling techniques

Bottom sediment was collected with an Eckman grab (surface area, 0.0225 m^2) operated from a boat to a water depth of 23.0 m at Akosombo Gorge Area (Stratum II) of Volta Lake (Latitude 6°14'34.7'' and Longitude 0°5'37.6'') on 13th September 2010. Volta Lake (Figure 1) has a surface area of 8,500 km^2, length of about 400 km and it runs in north-south direction. The deepest portion of the lake is about 90 m, whereas the average depth is about 30 m and the shoreline about 5,500 km (Ofori-Danso & Antwi 1994). The sediment was a black mud. Environmental parameters recorded during the time of sampling were: air temperature 30.7°C, surface water temperature 28.8°C, pH 7.56, and conductivity 59.6 μScm^{-1}. Microfossils were observed and illustrated using a light microscope with digital camera.

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Plate 1 Microfossils present in Holocene sediment, Volta Lake, Ghana

Results

We found two groups of microfossils in relatively high diversity and abundance:

(a)Thecamoebians: 1, *Difflugia corona* Wallich, 1864, 2-12, *Difflugia oblonga* Ehrenberg, 1832, 13-16, *Difflugia tricuspis* Carter, 1865, 17-20, *Difflugia urceolata* Carter, 1864.

(b) Ostracods: 21-25, *Afrocythere rostrata* Klie, 1935, 26-28, *Alicennula serricaudata* (Klie, 1935), 29, *Cypria?* sp., 30-32, *Cypridopsis?* Sp.

Discussion

All the taxa identified (Thecamoebians and Ostracoda) occur in environments dominated by freshwater (very low salinities) mostly lakes and large rivers, indicative of low oxygenation and stressed environment.

The Difflugia group apparently dominates water bodies with higher pH and nutrient loading. Patterson et al. (1985) and Escobar et al. (2008) suggest pH and other water properties to be more influential than climate on the distribution of thecamoebian. Roe at al. (2010) further suggest that dissolved oxygen may also be an important influencing variable for the distribution of thecamoebian.

The ecological preferences of the thecamoebians reflect the measured pH and a sediment with high organic content. They indicate an elevated trophic level for the lake system. It has been recently shown that thecamoebians have considerable potential as quantitative lake water quality indicators, particularly in areas influenced by nutrient inputs (Roe et al., 2010).

The Ostracod species present are indicators of a polluted environment. Pyrite, the so called fool's gold, FeS_2, may be found within basin of water bodies or bottom sediments. Oxidation of this mineral leads to the formation of sulfuric acid, which undergoes chemical changes to form H_2S in anaerobic conditions. The brown coating on Ostracod valves may be due to oxidation of Iron (II) to Iron (III) ($Fe_2(SO_4)^3$) precipitation caused by high organic contents within the sediments.

Conclusion

Thecamoebians (testate amoebae) and Ostracoda (small crustaceans) have proven to be valuable proxies commonly used in paleolimnological and paleoenvironmental studies. Understanding environmental controls and the parameters influencing the recent distribution of thecamoebian and ostracods at broader spatial scales will improve our ability to interpret fossil records.

The poor state of knowledge on Quaternary freshwater microfossils in Western Africa, Ghana initiated a check on a Holocene sediment sample for potential microfossils. The preliminary data provide evidence of smaller microfossils (thecamoebians and Ostracoda) in Volta Lake, Ghana. These microfossils can even be a better tool for ecologist in Ghana if the taxonomical and ecological studies on their distribution are improved.

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Present research activities:

I have been working in the Biogeochemistry group at the National Institute of Oceanography (NIO) Regional Centre in Visakhapatnam, India, since Jan 2011. In the last year I have been mainly engaged in studying coastal (offshore of Visakhapatnam and Kakinada bay) and estuarine (Godavari) biogeochemistry with special emphasis on phytoplankton identification by microscope as well as pigment analysis by Reverse Phase-HPLC. Samples are collected from both these systems to observe the differences in phytoplankton community composition. Factors such as nutrient availability, light transparency and biomass are also measured to be able to interpret the above mentioned differences in phytoplankton composition in both systems.

Based on earlier results, coastal waters are almost entirely dominated by diatoms whereas in the estuary phytoplankton dominance varies seasonally, simultaneously with river discharge pattern, low tide and high tide regime, and nutrient availability. The analysis of phytoplankton samples were carried out microscopically by determining total cell counts and by calculating the percentage contribution of each group.

In addition to this, nutrients were also analyzed manually as well as using an autoanalyzer, for intercalibration of data generated from these two methods. The nutrients such as ammonia, phosphate, silicate, nitrite and nitrate were analyzed from the studied areas on a regular basis so as to determine the optimum conditions for phytoplankton growth and correlate these with phytoplankton pigments, POC and other related factors. The estuary, being a dynamic ecosystem, was generally characterized by a surplus amount of nutrients, which enhanced phytoplankton growth compared to that in coastal waters. In coastal waters, the nutrient source was limited due to reduced cycling and low input from terrestrial sources such as rain fall and sewage which led to low phytoplankton abundance along the coast. The estuary was not always characterized by high nutrients, and sometimes nutrient availability played a vital role in selecting for one group of phytoplankton which became dominant.

My other research activity is analyzing different marker pigments of phytoplankton as well as chlorophyll and their degradation products. Each group of phytoplankton has its own pigment composition by which we can attempt to identify them. Some pigments are markers of a particular phytoplankton, such as peridinin for dinoflagellates. Other phytoplankton groups do not have a particular marker pigment, but rather a suite of pigments, such as a high proportion of zeaxanthin in cyanobacteria or a high proportion of fucoxanthin usually present in diatoms. The pigment signature generated was very much in agreement with the microscopic counts carried out. Pigments were detected with the help of a Dio-array Detector (DAD) at 445 nm and 665 nm wavelengths. The red wavelength (665 nm) is mainly used for quantifying Chl-a, divinyl Chl-a, chlorophyllide-a, pheophorbide and pheophytin, whereas all the carotenoids and xanthophylls are detected and quantified at 445 nm wavelength (method developed by Heukelem and Thomas 2001). Though HPLC has a wide variety of applications, here we are mainly focusing on separation of phytoplankton pigments, chlorophyll and carotenoids analytically.

Current experience:

After working for a period of 12 months in the biogeochemistry laboratory, I have developed my research plan towards new aspects of marine science. I have a strong interest in developing a basic understanding of remote sensing and ecosystem functioning. Special emphasis will be placed on phytoplankton, given the importance of primary production, and as the role of phytoplankton as a potential indicator of climate change. It would be an excellent opportunity for me to learn and work on this research topic. Ocean-colour remote sensing technology is an excellent tool to estimate phytoplankton availability and primary production. That is why I value the opportunity I had to participate in the NF-POGO training programme, which was very useful for my current work as well as for my future studies.

Future plans:

Currently, I am working on a project entitled “Monitoring of (harmful) algal blooms along east coast of India and development of predictive models and identification of algal cysts through field experiments” in which predictive modeling of phytoplankton blooms through remote sensing is one of the major parts. Our institution has been running a pilot project on Godavari estuary since 2010, and samples are collected on a regular basis for all the major physico-chemical and biological parameters. My training in ocean colour remote sensing will help me in the process of learning how to handle, and be able to interpret, this huge amount of data. The east coast of Bay of Bengal has not been extensively studied using remote sensing.

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Bay of Bengal is characterized by strong stratification, which makes it different from other water masses, and has a strong impact on primary productivity. If by using information from remote sensing we can predict primary production, and then use modeling to predict secondary production throughout the year, the project will be useful for society (due to the implications for sustaining fisheries). Using this method, we can predict HABs, which can cause serious damages for human society due to health issues (illness or even death caused by the consumption of toxins concentrated in filter-feeders), losses in aquaculture, and in some cases fish mortality.

Research communications - NF-POGO Alumni

Majambo Jarumani Gamoyo

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My current research projects involve monitoring of coral reefs using remotely sensed datasets. I participated in the development of an early warning system for bleaching alert over the Western Indian Ocean since 2007. This was done in partnership with the IUCN Climate Change and Coral Reefs (CCCR) working group.

The system is designed to monitor the status of thermal stress, conducive to coral bleaching, via the use of the NOAA suite of products which are tailored to a regional context. The Bleaching Alert system was developed by the CORDIO East Africa GIS and Remote sensing team as a tool for coral reef managers, scientists, and other interested people. Considering the costs and risks at stake, methods to accurately predict bleaching and quantification of uncertainties of these predictions are of great importance to policy makers, reef conservationists, managers of Marine Protected Areas and human populations who depend on reefs for their livelihood. I am currently in the process of assessing the quality of the bleaching alerts as the analysis can help in the assessment of specific strengths and weaknesses of forecasters or forecasting systems.

This analysis could be used together with observations, weather forecasts and climate models to better predict the reefs' response to climate change and identify reefs potentially more prone and more resistant to bleaching.

My areas of interests are mostly on issues regarding climate change, GIS and Remote Sensing, oceanography and marine meteorology. My future plans are to become a competent and resourceful person to address critical issues and help in better management of the marine ecosystem in this era of changing climate. Also I am aiming to keep a track on emerging information and technologies in climate change research.

Research communications - NF-POGO Alumni

Sana Ben Ismail Hamouda

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My research interests are the study of water masses properties, origin, scales of variability (mesoscale, seasonal, interannual) and its role in the dynamic of the Central Mediterranean Sea and along the Tunisian coasts. I participated in more than 14 oceanographic cruises in the Central Mediterranean (Sardinia and Sicily Channels and off shore along the Tunisian coast), using CTD to measure the physical properties of the water masses. I started my PhD in May 2007 at the Marine Environment Laboratory of the INSTM (Institut National des Sciences et Technologies de la Mer) and the Mechanics Laboratory of ENSTA- (Ecole Nationale des Sciences and Technologies Avancées). My PhD project is titled "Study of water circulation in the Sicily Strait and along the Tunisian coast using hydrological and Lagrangian measurements". It focuses on the *in situ* observations supplemented by comparison with numerical models. We aim to provide a flow pattern of water masses in the region, particularly along the Tunisian coast. This thesis deals with the production of a "new schema of circulation in the central Mediterranean" and mainly along the coast of Tunisia from hydrological and lagrangian data by studying dominant physical processes based on detailed observation and modeling.

Actual position: My PhD dissertation is planned to be completed in January 2013; I'm presently working as INSTM Research Associate at the Marine Environment Laboratory.

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Research Interests:

I have done some research work around the typhoon induced subsurface phytoplankton bloom in the South China Sea. The related results have been submitted to the JGR-biogeosciences and selected figures from the article are presented below.

Current research:

My current research consists of: (1) using a satellite three component model to examine the spatial-temporal variability of phytoplankton size classes in the South China Sea; (2) finding the dominant cell size of phytoplankton after special physical phenomenon such as monsoon and tropical cyclones.

Future plans:

In the future, I would like to verify these results with *in situ* measurements and to get some experience working abroad.

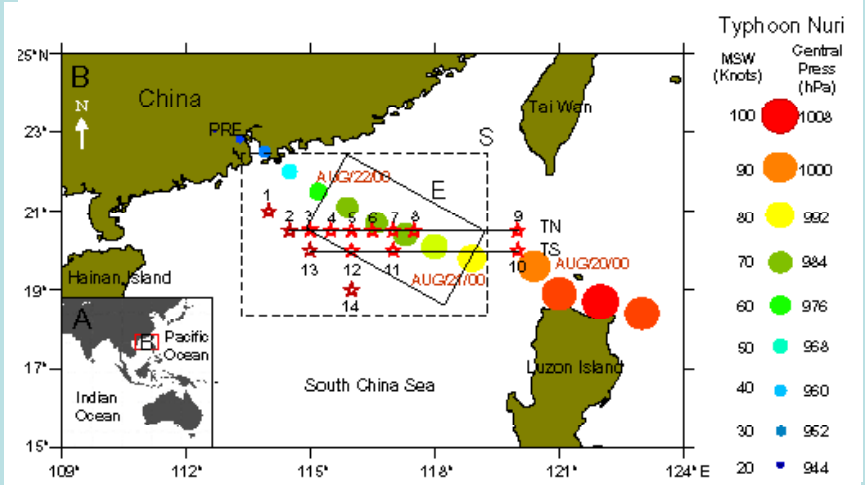

Figure 1: (A) Location of the South China Sea. (B) Study area (Box S) and the track of typhoon Nuri. The typhoon center positions every 6 hours are indicated by the coloured circles. The circle colour and size represent the central pressure [hPa] and the maximum sustained wind speeds [MSW, knots, 1 knot=0.514m s^{-1}], respectively. Box A is typhoon effect area (1.46×10^5 km^2; clockwise from the top, 116W-22.5N, 119.5W-20.5N, 118.5W-18.5N and 115W-20.5N); TN: Transect North (Stations 2-9); TS: Transect South (Stations 10-13); PRE: Pearl River Estuary. All times are in Coordinated Universal Time (UTC)

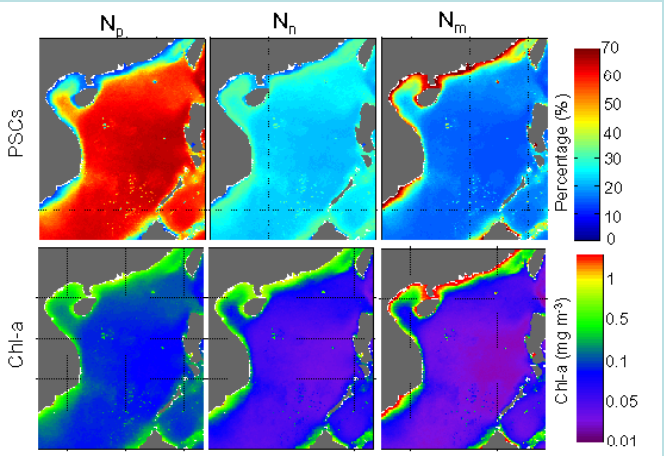

Figure 3: Climatology distribution of Phytoplankton Size Class (PSCs) and Chl-a concentration from January 1998 to December 2007. Np, Nn and Nm, where subscripts p, n and m denote pico-, nano- and microphytoplankton, and N denotes the contribution of the total Chl-a

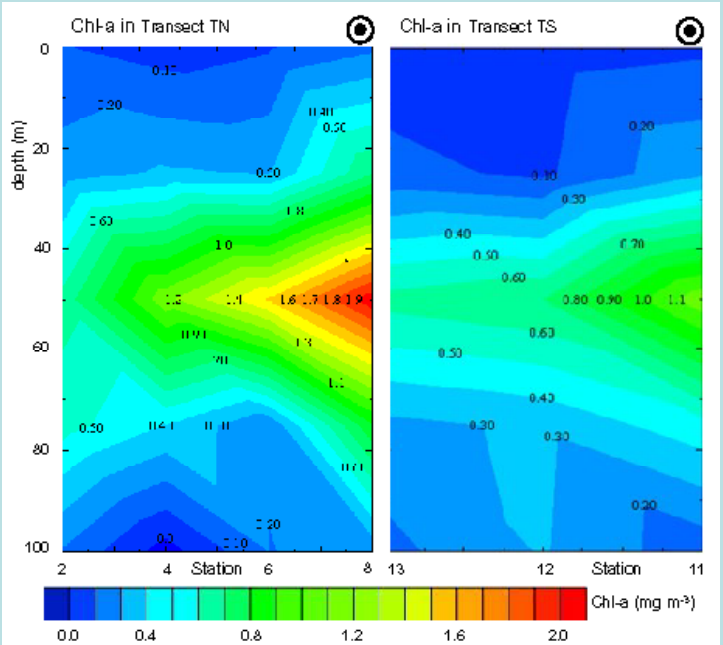

Figure 2: The vertical distribution of Chl-a at transect TN (Stations 2, 4, 6 and 8) and transect TS (Stations 11-13) after the passage of typhoon. The black circles in top of each figure indicate the locations of typhoon

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In the past year, after I obtained my PhD working on ecology of ichthyoplankton and estuarine fronts as a member of the Fisheries Ecology Project of the marine environment program of the National Institute for Fishery Research and Development (INIDEP) in Mar del Plata, Argentina, I went to Bermuda for the NF-POGO Center of Excellence training in Observational Oceanography. I have learned so many things from the academic, personal and social backgrounds, which are very difficult to summarize in a few lines.

For my thesis, I studied bio-physical relationships of fish larvae in the Plata estuary, one of the main estuarine environments of South-America. *Micropogonias furnieri* (a croaker) is the main target of the coastal Argentine fishery. I studied the distribution and characterization of larvae habitat, retention and settlement related processes (changes in morphology, diet, growth). This fish spawns in the estuarine saline front. I worked with oceanographic information (temperature, salinity, turbidity), plankton samples (most of which I collected myself on cruises), abundance estimations and spatial distribution. My main objective was to draw a conceptual model about the early life history of this croaker, giving special attention to the planktonic (larvae)/benthic (juveniles) transition, defining ecological meaning intervals and the associated oceanographic processes in both habitats. I found that this frontal system acts as a retention area for croaker larvae, which remain in the plankton for ca. 30 days. Settlement process is reflected in otoliths (check marks), and morphological and diet changes. Finally, my research was compiled in a PhD thesis called “Early life history of whitemouth croaker (*Micropogonias furnieri*, Sciaenidae) in the Rio de la Plata Estuary” (http://www.oceandocs.org/handle/1834/4187) and a paper, so far. The results of my work will be useful for management of coastal species (fully exploited), especially in this heavily impacted estuary (fishery, pollution, maritime traffic), and in the context of global change.

At BIOS, as part of the NF-POGO program I chose to learn about the effects of Ocean Acidification (OA) on coral reefs. So I dove into the chemistry of the ocean and I found another interesting world away from fish science (at first sight). As part of the BEACON (BErmuda ocean Acidification and COral reef iNvestigation) program of BIOS my duty was to test the effect of OA on coral growth rates (calcification) in a long-term aquarium experiment (8 months) that was conducted with two species (*Diplorialabyrinthiformis* and *Poritesastreoides*) from Bermuda reefs. Three pH treatments were achieved by pCO_2 bubbling resembling actual and future conditions, while attempting to control other environmental variables across treatments. A lot needed to be done in this research, from day-by-day monitoring the environmental variables (including pH) and taking water samples for chemical analyses, to weighing the corals and analyzing their growth and performing data management and statistical analyses. As I was part of a program, soon I became a hand of it, so we were able to do extra field work in an *in situ* experiment on the reef. Here, not only I learned more skills about managing live organisms and experiments, doing underwater work in the reef (scientific diving) and managing the time to analyze the data. For the first time I felt I was doing team-work, discussing the next steps among the members of the program, splitting the work or doing it together and discussing the results. My advisor, Samantha de Putron, was responsible for this team. During the project I felt I was being listened to and I could share my ideas with her. I was surprised, and at the same time happy, that all members of the team were asked for suggestions to improve the experiments, and to work better as scientists; which I think is a great quality for a leader. The ability of this team to change according to unexpected situations made me feel I was in the right place to learn. At the end, I was able to talk about the process of acidification in the ocean in relation to coral reefs and to understand how well a group of people could work if they built a good environment around them.

Summary of the report for NF-POGO. Future publication.

Does ocean acidification affect the calcification of corals off Bermuda? Response of calcifying corals to experimental acidification

Mara Braverman, Samantha de Putron, Andreas Andersson, Andrew Collins, Scott McNaught

Ocean acidification (OA), caused by increased atmospheric CO_2 gas being absorbed by the oceans, can potentially impact many calcifying marine biota as the decrease in [CO_3^{2-}] lowers the saturation state of carbonate minerals (aragonite and calcite). The average surface water pH, which has fallen by nearly 0.1 units since preindustrial times, is expected to decrease further to ca. 0.3-0.5 pH units in the next 100 years. To test the effect of OA on coral growth rates (calcification), a long-term aquarium experiment (8 months) was conducted with two species (*Diploria labyrinthiformis* and *Porites astreoides*) from Bermuda reefs. Three pH treatments were achieved by pCO_2 bubbling resembling actual and future conditions, while attempting to control other environmental variables across treatments. Growth rates per tank were assessed and environmental variables (pH, temperature, salinity, dissolved oxygen and light) were measured over 10 growth periods. Temperature was the variable that better explained coral growth rates during the growth periods, although pH had a weak effect on *P. astreoides* colonies. A comparison between this aquarium and an *in situ* experiment (in Bermuda reefs) showed that corals colonies grew slower in the former. The study constitutes a potential indication that OA does not always have a negative effect on coral growth and calcification. This could be suggesting that sub-tropical corals would not respond in the same way to OA as tropical species.

After finishing the NF-POGO training, I managed to stay longer during the Bermudan summer in a project that would be the beginning of a new challenge for me.

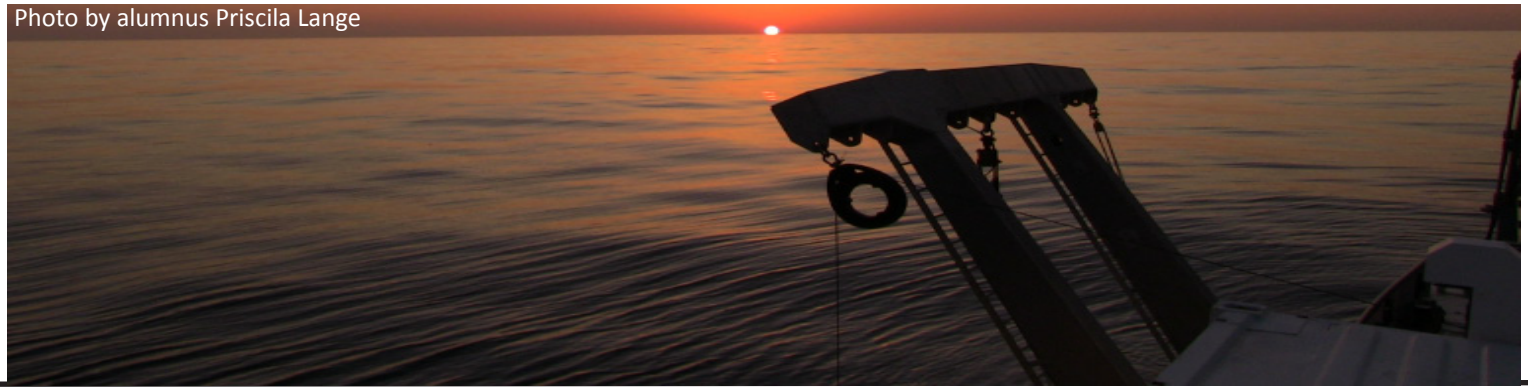
June – July 2012 - BIOS Grant-In-Aid

Building a bridge between research and education: studying the effect of ocean acidification on coral growth and sharing the research techniques with future scientists.

Mara Braverman, Samantha de Putron, John Paul Skinner

The purpose of this two-month internship was helping with two different aspects of the activities of the Bermuda Institute of Ocean Sciences (BIOS), regarding science and education. I continued research with the BEACON program, in particular the mesocosm experiments studying environmental and carbonate chemistry factors affecting the growth of corals in Bermuda. I also assisted with the preparation and the daily running of the Waterstart program and Marine Science Internship summer programs, including supervision of students, leadership of some field trip activities, and teaching of portions of the program.

Photo by alumnus Priscila Lange



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Research interests:

- Estuarine and coastal biogeochemistry
- Phytoplankton community dynamics and succession (pigment chemo-taxonomy and ocean colour remote sensing)
- Physiological response of estuarine phytoplankton against various stressors
- Climate change and anthropogenic impact on ecosystem
- Food web dynamics in estuaries and coasts

Research highlights:

1) Intensification of phytoplankton bloom due to reduced discharge in Godavari river estuary:

Our daily observations over three years revealed that a decrease in precipitation over the Indian subcontinent from 2007 to 2009 resulted in the lowering of the mean annual discharge in Godavari estuary from 748.63 m^3s^{-1} in 2007 to 218.40 m^3s^{-1} in 2009. The reduced water discharge slowed the flushing of the estuary from 1.2 days in 2007 to 6.3 days in 2009. The consequent increase in stability of the water column and reduced suspended material load gave rise to intense phytoplankton blooms (Chl-(a) 18 µg l^{-1} in 2007 to 28 µg l^{-1} in 2009).

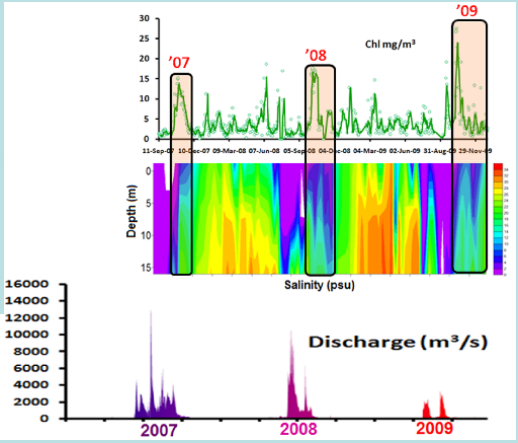

Figure 1: Inter-annual variability of Chl-(a) with respect to river discharge which controls stratification and flushing time in Godavari estuary

2) Responses of natural phytoplankton community to increasing carbon dioxide from the Godavari river estuary, east coast of India (in vitro experiment):

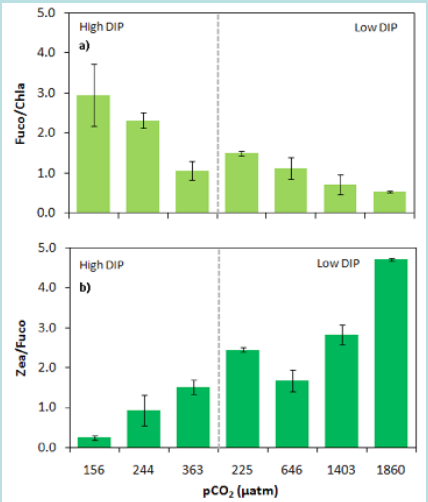

Figure: 2.1. Ratio of Fucoxanthin to Chlorophyll-a (a) and Zeaxanthin to Fucoxanthin (b) in relation to different CO_2 levels. The experimental results of May and June are separated by the dashed vertical line

An *in vitro* experiment was performed during the dry period to understand the behaviour and shift in community composition of local phytoplankton community of Godavari estuary when they are exposed to artificially enhanced CO_2 levels. The initial phytoplankton pigment analysis indicated a diatom-dominated community with higher abundance of Fucoxanthin over Zeaxanthin. However, after five days of incubation HPLC pigment distribution showed a significant change in phytoplankton community following the change from low to high CO_2, with a dominance of cyanobacteria over diatoms. Noticeable reduction was observed in the Fucoxanthin content, accompanied by an increase in Zeaxanthin from low to high CO_2 (Figure 2 (a), (b)). Thus, the Zeaxanthin/Fucoxanthin ratio showed an increasing trend from low to high pCO_2. Such a shift in phytoplankton community structure was attributed to the higher efficiency in nutrient uptake of cyanobacteria over diatoms. Silica limitation for diatoms during the sampling period and severe competition for PO_4 from bacteria were other factors contributing to this change in the community.

3) Impact of salinity on phytoplankton communities in fresh water counter part of Godavari river estuary (*In vitro* experiment):

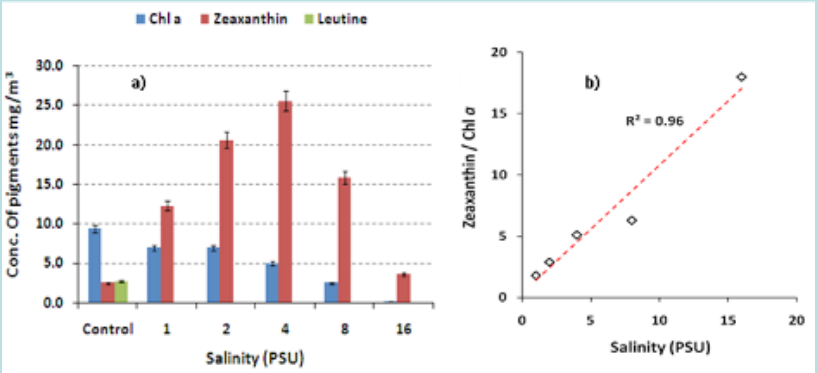

Figure 3: (a) Variation in Chl-(a), Zeaxanthin and Lutein concentrations obtained from phytoplankton in the Godavari River at different salinity shock; (b) Variation in Zeaxanthin / Chl-(a) at different salinity shock.

An in vitro study was carried out to understand the effects of salinity shock on phytoplankton communities in the freshwater system of the Godavari River. Subtle changes in salinity of the freshwater by one practical salinity unit (PSU) completely removed green algae from the system and allowed the cyanobacteria to dominate (Figure 3.1a). The cyanobacteria were found to tolerate higher osmotic stress until the salinity reached 16. The higher salinity tolerance range of the cyanobacteria was attributed to the enhanced synthesis of Zeaxanthin (Figure 3b) as protective Xanthophylls against osmotic stress. The energy cost associated with Zeaxanthin synthesis is probably balanced by the adaptability of cyanobacteria to tolerate a higher degree of salinity fluctuation, which helps them to occupy the niche left by the green algae. However, the increase in Zeaxanthin concentration by cyanobacteria is not indefinite and after a certain salinity threshold (16PSU, in this study) the population cannot tolerate the stress and it crashes.

4) Stress and toxicity of biologically important transition metals (Co, Ni, Cu and Zn) on natural phytoplankton communities in the fresh water section of the Godavari river estuary (In vitro experiment):

Bioavailability of metals determines what fraction of the metal would be available to be utilised as a nutrient or to act as a toxicant. We conducted a laboratory based incubation experiment to understand how four biologically important transition metals (Co, Ni, Cu and Zn) impart stress and toxicity on natural phytoplankton assemblages inhabiting in the estuarine head. All metals acted as a nutrient when 1 x 10^{-7} M of metals was added to the system. The variation in phytoplankton biomass of the freshwater system under exposure to different metals at concentrations of 1 x 10^{-7} M indicates that they are using the metals as a nutrient in following order:

Cu > Co > Ni > Zn.

On the other hand, when the phytoplankton community was exposed to different metals at concentrations of 1 x 10^{-6} M the metals seem to act as toxicant in the following order:

Cu > Co > Zn > Ni

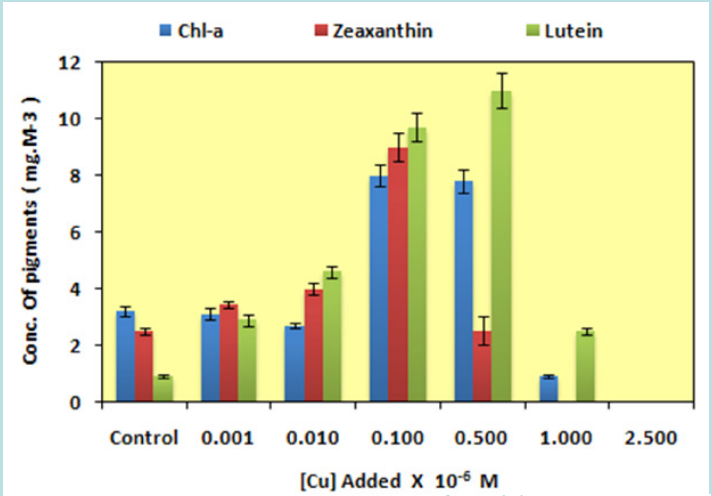

Figure 4.1: Variation in concentrations of Chl-(a), zeaxanthin and lutein in Godavari River with respect to the varying concentrations of Cu

In general it was found that phytoplankton communities in the Godavari River station have different tolerance for different metals. Cu and Zn were found to be lethal at high concentrations. Cyanobacteria were found to be very sensitive to slight variations in Ni concentrations, and Co was found to be less toxic than Cu but more toxic than Zn at high concentrations.

Future research objectives:

In my PhD I studied phytoplankton community dynamics in the Godavari estuary and coastal Bay of Bengal by means of *in situ* measurements of taxonomically important phytoplankton pigments (HPLC). Recently I got an opportunity to visit the remote sensing group at Plymouth Marine Laboratory (PML- UK) to work for 4 months (potentially extendable to 2 more months). There I will be working under the supervision of Dr. Shubha Sathyendranath and Prof. Trevor Platt on the application of OCM-II (Indian Ocean Colour Satellite) data, which will be highly useful in understanding phytoplankton biomass variability and its relation to physical and biogeochemical processes in the Indian Ocean. This training, therefore, will not only complement my PhD studies but also add to my expertise for the ongoing programme at NIO which aims to identify potential marine living resources by finding the links among different Trophic levels (phytoplankton to fish) in the Indian coastal waters.

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Meeting announcements

The 45th International Liege Colloquium on Ocean Dynamics
University of Liège - Belgium
13 to 17 May 2013

The 45th International Liege Colloquium on Ocean Dynamics will investigate new insights related to the evaluation of primary production and the study of the dynamics between physical forcing and ocean productivity responses at various physical and temporal scales. Particular attention will be focused on the variability at the synoptic to seasonal scales and how it complicates our ability to sample primary production and derive large-scale, climate-driven primary production budgets.

The variability of primary production in the ocean: from the synoptic to the global scale.
Deadlines
15th January 2013: submission of abstracts (Late Contributions may still be considered as a poster)
1st March 2013: decision of the Scientific organizing committee of accepted abstracts
31 March 2013: preliminary program will be sent to registered participants

12th International NCCR Climate Summer School - "From Climate Reconstructions to Climate Predictions"
1 to 6 September 2013, Grindelwald, Switzerland

The NCCR Climate, Switzerland's Centre of Excellence in Climate and Climate Impact Research, invites young scientists to join leading climate researchers in the scenic Swiss Alpine village of Grindelwald for keynote lectures, workshops and poster sessions on the occasion of the 12th NCCR Climate Summer School 2013.

The 12th International NCCR Climate Summer School specific topics to be addressed include:
- Climate variability of the past two millennia and the next century
- Calibrating proxies, modeling past climate, data - model comparison, detection and attribution
- Rapid climate change and feedbacks, tipping points
- Decadal predictability: theory and processes

The summer school is open to young researchers (PhD students and Post-Docs) worldwide. Participation is highly competitive and will be limited to a maximum of 70. The registration fee (1400 CHF) includes full board accommodation, excursion and teaching material. A small number of grants will be available for students from developing countries.

Deadline for applications: 20 December 2012

14th POGO Annual Meeting
Marine Research Institute, Cape Town, South Africa
22 to 24 January 2013

The next POGO Annual Meeting, POGO-14, will be hosted by the MArine REsearch Institute (MA-RE), Cape Town, South Africa from 22 to 24 January 2013.

For more information visit *http://www.ocean-partners.org/meetings-and-workshops/meetings-and-workshops/1046-pogo-14*

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.

Photo by alumnus Sanjiba Baliarsingh

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