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- NF-POGO Alumni Network for Oceans -

Volume 02, May 2012

NANO joint research projects ready to sail

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NF-POGO Alumni E-Newsletter – Volume 02, May 2012

From the editorial board

The Volume - 2 of "NANO News" is presented to you here with great pride and heart felt delight. The Editorial Board wishes to convey its gratitude and sincere thanks to alumni, "friends" and other well-wishers for sending positive notes and comments regarding the inaugural volume launched in September of 2011. It was a great encouragement for us to work even harder to get this volume of the newsletter out.

"NANO News" was launched with the primary intention to invite NF-POGO alumni to share their past and ongoing research work among the NANO community. If alumni start some collaborative research activities that develop through sharing and communicating their ideas and research plans using "NANO News", that would be the "best possible achievement" or a "dream come true" for all of us who work hard to put together this newsletter. Therefore, we request all alumni to keep that in your inquisitive minds when reading through the articles that follow.

This volume also contains interesting research work of individual alumni as well as of research groups. A valuable cruise experience gained by an alumnus is also shared through this newsletter, which we think adds another dimension to this volume. The editorial board encourages other alumni to report their special cruise experiences to NANO news as well and any other such research work in the field that may enlighten others. Also, such an article creates pleasant and interesting reading for all of us.

The Editorial Board conveys its deepest gratitude to the patrons, Trevor Platt, Shubha Sathyendranath and Sophie Seeyave for their continuing support and invaluable input throughout. Special thanks go to all leading authors for providing important articles and to those alumni for sharing their research activities in this newsletter.

With Very Best Wishes,

Kanthi K. A. S. Yapa

Editor-in-Chief

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NF-POGO Alumni E-Newsletter – Volume 02, May 2012

This Issue:

Cover: Sunset and the R/V Atlantic Explorer docked at the Bermuda Institute of Ocean Sciences. Photo by the alumnus Yuna Zayasu

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.

Ocean colour and climate change: on trends, stability and bias

Dr. Shubha Sathyendranath - Assistant Director /POGO, Scientist, Plymouth Marine Laboratory

Ocean colour is the only tool we currently have to observe the marine ecosystem at synoptic scales. It probes the marine ecosystem at the interface between light and life in the oceans: that is to say, it measures the variability in light absorption by phyto plankton pigments, which is the first step before marine photosynthesis can take place. Photosynthesis fuels the pelagic food web. The primary production by marine phytoplankton at the global scale is estimated to be about 50 GT of carbon per year, commensurate with terrestrial primary production. Phytoplankton are, therefore, an important component of the global carbon cycle. Most of the light absorbed by phytoplankton is dissipated as heat, modulating the distribution of solar heating in the water column. Phytoplankton thus influence two key processes which define our climate: the planetary heat budget and the global carbon cycle. They should be at the centre of all discussions on the Earth System dynamics.

Because they are such fundamental properties of the marine ecosystem, ocean colour and phytoplankton are recognized as Essential Climate Variables (ECVs) by the Global Climate Observation System (GCOS, http://www.wmo.int/pages/prog/gcos/index.php) . Given its global coverage, its potential for sustained observation over long periods, and its cost effectiveness, ocean colour is key to studying long-term variability in the marine ecosystem and any potential impact of climate change on the system. But there are many problems to be addressed before the full potential of ocean colour can be exploited in the climate-change context.

Let me introduce just one of them here. It is related to the duration over which we need sustained observations, to be able to detect change. Since oceans are subject to variability at multiple scales, some of them with periods as long as a decade, the ocean-colour time-series has to be multi-decade long if we are to detect change as a long-term trend, after subtracting long-term oscillations. But each satellite has a finite life span, say about ten years. So we need to stitch together data from multiple satellites in a seamless manner, to be able to create a multi-decadal time series. If there are any systematic differences between sensors, then the merged data set might show spurious trends, and if we are not careful, we might interpret them as climate change. Furthermore, each of the satellites should be well-calibrated for the entire duration of the mission to ensure stability of the signal. If not, we might interpret erroneous trends resulting from instrument drifts as evidence for climate change. Simple as it may seem initially, the analysis requires careful thinking about trend, bias and stability. Such thinking is essential not only for the use of ocean colour, but just about any tool for studying long-term trends. The European Space Agency has launched a new programme called the Climate Change Initiative, which looks at problems such as this, not just for ocean colour, but for a number of ECVs. If you are interested to learn more about the ocean-colour part of the programme, please visit http://www.esa-oceancolour-cci.org/ .

Since we have had uninterrupted ocean-colour data from space only since 1997, the accumulated data are really not sufficient to detect climate change with any certainty. But we have to think right now about how to interpret existing data, what can be done to improve the quality of the data and what our requirements are of future satellites.

So here is an invitation to think clearly about these things in the context of any data that you might be using in your research. Who would be willing to write an article for NANO, explaining trend, bias and stability? If you merge satellite data from two sensors with inter-sensor bias, can you think about how you might end up with an artificial or apparent trend in the merged data? Would you like to know more about ocean colour and climate change? Let the editorial board of NANO News know if discussions on such topics would be of interest to you, and if there is sufficient response, we could think about starting appropriate discussion forum in NANO News, or on NANO web.

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POGO Meetings – Past and Future

Dr. Sophie Seeyave – Scientific Coordinator POGO and NANO

This year's POGO Meeting was hosted by the School of Ocean and Earth Science and Technology (SOEST) of the University of Hawaii at Manoa, USA, from 9 to 11 January 2012. The meeting was well attended, with around 60 participants from 18 countries. 29 of the 37 POGO member institutions were represented, as well as key partner organisations.

In addition to reports and discussions on 2011 POGO activities, such as capacity building, support of the International Quiet Ocean Experiment and OceanSITES, and preparations for the Expo 2012 in Yeosu Korea, other programmes of relevance to POGO were discussed. These included international programmes for coordination of ocean observations, such as the Framework for Ocean Observing, the Southern Ocean Observing System (SOOS), which has recently published its Science Plan and set up a Project Office within the Institute for Marine and Antarctic Studies (IMAS), the Panel for Integrated Coastal Observations (PICO), which has also recently published its Implementation Plan, and the Global Alliance of CPR Surveys, a new initiative by the Sir Alister Hardy Foundation for Ocean Science (SAHFOS) to bring together existing Continuous Plankton Recorder Surveys and facilitate the establishment of new ones to provide a truly global coverage of this valuable time-series of plankton data.

One of the benefits of the POGO meetings is that POGO members can share information on their national research programmes and learn from one another, as well as identifying areas for international collaboration. Institutes from emerging countries had the opportunity to present recent developments in their ocean observing capabilities, and discuss challenges that are common to these countries (for example piracy). A session was dedicated to disaster mitigation and response, focussing on tsunamis and the Great Tohoku earthquake of March 2011.

Areas for collaboration between POGO, the Intergovernmental Oceanographic Commission (IOC), the International Oceanographic Data and information Exchange (IODE) and the Scientific Committee on Oceanic Research (SCOR) were explored, with presentations given by Wendy Watson-Wright (Executive Secretary, IOC), Peter Pissierssens (Head, IOC Project Office for IODE) and Ed Urban (Executive Director, SCOR).

A "Honolulu Declaration" (see http://ocean-partners.org/attachments/693_Honolulu-declaration.pdf) was issued as a result of the meeting, representing the latest statement of the issues of concern to POGO and the recommended priority actions in the face of these issues. The Declaration specifically mentions support of NANO as a priority action. This is very positive news for the Network and is a mark of the commitment of the POGO members towards the alumni, who represent to them the "future of POGO".

The election of the next POGO Chair took place on the last day, during which Prof. John Field, Director of the MArine REsearch Institute (MA-RE), University of Cape Town, South Africa, was elected by acclamation. Prof. Field will take over from Prof. Peter Herzig, current POGO Chair, in January 2013. Coincidentally, the next POGO Annual Meeting, POGO-14, will be hosted by MA-RE, from 22 to 24 January 2013.

Photo by alumnus W.N.C.Pryiadarshani

NANO joint research projects to kick off in 2012

Dr. Sophie Seeyave and Dr. Trevor Platt

A NANO meeting was held in Abingdon, UK, from 26 to 28 September 2011, to plan and write proposals for joint research projects to be carried out by the alumni. The meeting consisted of round-table discussions over three days, and was attended by selected NF-POGO alumni, by Mr. Ogiue of the Nippon Foundation (and his interpreter), personnel from the Secretariat, Dr. Tony Knap, the Director of the Centre of Excellence, and a couple of senior scientists who are "friends" of NANO (Prof. David Checkley, Scripps Institution of Oceanography and Prof. Howard Roe, a former Chairman of POGO).

Sophie Seeyave, Lilian Krug, Olga Shatova and Kanthi Yapa, who have been heavily involved in developing NANO, gave presentations on progress achieved to date. Between Feb and Sept 2011, 209 alumni were sent a questionnaire on their current education/employment, publications, conferences attended, projects and other aspects of their career development. As of Sept 2011, 128 out of 209 alumni had returned the questionnaire, with a much higher response rates for the alumni of the Bermuda CofE (100%), and for the regional CofEs in Brazil and Vietnam (77%), compared with the responses from earlier initiatives. The information provided by the alumni has been entered into an Access database, and also added to the NANO website (www.nf-pogo-alumni.org) along with general information about the Network, an electronic newsletter (launched in Sept 2011) and links to NANO "friends". These "friends" are senior scientists involved in capacity building and with strong links to POGO, who have agreed to support the network and the alumni where possible.

Attendees of the 2011 NANO Meeting in Abingdon.

The website statistics show that it receives on average 50 visitors per day, from 58 countries on 6 continents. One of the main goals of the network is to encourage and facilitate international collaboration and to set up joint research projects to be carried out by the alumni. This was the principal motivation behind the Network Meeting in Abingdon. The meeting was a substitute for one initially planned to take place in Tokyo and on a much larger scale. However due to the earthquake and tsunami that struck Japan in March 2011 plans had to be revised. In light of this tragedy, and because the Nippon Foundation has, understandably, shifted some of its priorities towards disaster relief, the projects to be undertaken and the budgets involved had to be down-scaled.

The group reviewed 20 proposal outlines submitted in advance by Alumni and classified by Region (Africa & Europe, East Asia, Indian Subcontinent and Latin America). The object was, for each region, to propose one joint initiative that might be funded by the NF in 2012. Over the second and third days of the meeting, small groups worked on preparing joint proposals for each of the four regions. They endeavoured, where possible, to merge together ideas from the individual pre-proposals that had been submitted. The four proposals submitted to NF were as follows:

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Indian Sub-Continent: Monitoring the coastal waters of India and Sri Lanka for the occurrence of Harmful Algal Blooms (HABs)

Objectives:
• Study of dinoflagellates community structure with reference to HAB species and dissolved phytotoxins in the coastal waters of the Indian and Sri Lankan subcontinent.
• Use of remote sensing and bio-optical properties to understand HABs in this region.

Latin America: Pigment analysis using HPLC in ANTARES Network coastal time series stations

Objectives:
• Quantify pigment concentrations using advanced High Performance Liquid Chromatography in five selected ANTARES stations as an initial step for the future implementation of Phytoplankton Functional Type studies.
• To complement HPLC studies with the use of remotely sensed ocean colour measurements.

North and West Africa: Monitoring coastal pollution and erosion

Objectives:
•Define the problems in the field of monitoring of chemical pollution and erosion in Northern and Western Africa.
• Develop common guidelines for monitoring erosion and pollution in coastal areas that will include basic measurements relevant to resources available in the region.
• Extend the techniques to 'Alumni countries' throughout Africa by involving more alumni in the project.
• Gather the available data on sediments and chemical pollutants in Tunisia, Ivory Coast, Ghana, Nigeria, Senegal and Burkina Faso with the prospect of adding data from other 'Alumni countries' where similar type of measurements are performed.
• Compare levels of coastal erosion and chemical pollution in these regions.

South-East Asia: Validation of a Harmful Algal Bloom Remote Sensing Model (RS-HAB) for SE Asian Region using time-series data from Vietnam

Objectives:
• Validate, refine and apply the RS-HAB model developed in the Philippines.
• Continuation of the Mekong Delta time-series.

The Nippon Foundation reviewed the proposals in early 2012 and have agreed to fund them, for one year initially, to a level of 125 K USD, to be divided between the four regions and the central administration. Through collaboration and hard work, NANO should strive to achieve good scientific and socially relevant results with these limited resources, and hope that on the basis of the first year's successes, we might aspire to increased funding from NF in the future. We also need to look into other funding sources, possibly with the help of NANO friends. The next few months will be very busy with the initial implementation of the projects and distribution of roles and resources.

We sincerely hope many of you will want to participate in these projects and contribute to making them a success. If you would like to get involved, please contact Sophie Seeyave at the POGO Secretariat (ssve@pml.ac.uk).

Capacity building for south east Asian Ocean Color Network

NF-POGO Centre of Excellence Regional Training in Vietnam

Tin Hoang C. and Son Tong P. H.

An international training course on "*The Application of Ocean Color Remote Sensing for Study of Marine and Coastal Processes and related Bio-Resources*" was held in 2011 in Vietnam. The main aims of the training course were (i) to promote Ocean Color Remote Sensing Science in South East Asia (SEA), (ii) to enhance the knowledge of oceanic optical properties related to the marine environment, (iii) to familiarize the trainees with the satellite data processing and (iv) to build up the budding satellite ocean science community in the SEA region. The regional training programme was held at the Institute of Oceanography (IO) in Nha Trang, Vietnam, from 19 September to 10 October 2011, as part of the activities of the NF-POGO Center of Excellence in Observational Oceanography (CofE) at the Bermuda Institute of Ocean Sciences (BIOS).

Attendees of the Regional CofE Vietnam *(Photo: Son Tong P.H.)*

World experts in ocean color remote sensing, working at high-ranking universities, were invited to the training course. Prof. Seiichi Saitoh, Dr Joji Ishizaka, Dr Satsuki Matsumura and Dr. Taka Hirata, came from different universities and institutes in Japan. Dr. Joo-Hyung Ryu and his assistant Dr. Jong Kuk Choi came from the Korean Ocean Research & Development Institute (KORDI). Dr Gerry Plumley, Deputy Director and Education Director of the Bermuda Institute of Ocean Sciences (BIOS) and Coordinator of the CofEOO, supervised the course, and provided the trainees with information on the capacity building activities of NF-POGO in observational oceanography.

Beside the six visiting professors, Mr. Son Tong P. H. from IO, with his assistants from Vietnam, also took part in the teaching activities to exchange information about ocean color remote sensing activities in Vietnam and to support the trainees in the practical exercises. The trainees were highly motivated to start studying ocean color remote sensing, knowing how interesting and important satellite information is. Most of the 22 trainees were from Vietnam: 10 were from IO and another 8 were from other institutions and national universities in Hue (2), Ho Chi Minh City (3), Haiphong (1), and Nha Trang (2). The rest were from the SEA region, i.e. Thailand (2), the Philippines (1) and Indonesia (1). Compared with previous courses, the educational level of the trainees in terms of remote sensing and ocean color was very high. Two of them have participated in the CofE in Bermuda (Mr. Tin Hoang C. and Ms. Thao Pham P.), some have attended previous training courses in the IO, and some had been using ocean color remote sensing for their research.

Professor Joji Ishizaka is working at Nagoya University, Japan. He attended as a key instructor of all previous NF-POGO training programmes in Vietnam (2006, 2007 and 2011): *"I was impressed by the improvement of the trainees' skill and knowledge. I think this series of training is very successful. I hope that I can collaborate closer on research and education in the Southeast Asia in the near future".*

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After attending the training, and returning to Indonesia, Miss Aninda Wisaksanti R., MSc. from Institute Pertanian Bogor (Bogor Agricultural University) wrote: *"For me, it was very good, very helpful, and useful for developing countries members, and excellent program. It helps me to get more understanding on the ocean sciences particularly in the topic of remote sensing and GIS for marine and fisheries. It's very important program, especially for me who came from Indonesia as a developing country and still need to learn a lot. Professors who gave us lecture were very kind to share knowledge and experiences from developed countries. Via that program we could also exchange information between developing countries so we could develop a network for marine and fisheries research further. Thus, the training program has broadened my mind, improved my skills. Just like a trigger, after completing the last training, I got many ideas for doing research. In addition, I learned not just about the training materials but also the culture of another country: very lovely".*

Participants followed a series of lectures from visiting professors, which covered various topics in ocean color remote sensing, satellite oceanography, marine-GIS, and their applications such as in marine fisheries, tidal flats, red tides, phytoplankton community structure, carbon circulation and primary productivity. The trainees also participated in a field trip in Nha Trang Bay, which was conducted for the trainees to become familiar with bio-optical instruments (PRR2600/2610) and measuring chlorophyll-a concentration (and estimating primary production) using a fluorometer (AU10 Turner Design). Water samples for measuring Chl-a and Total Suspended Solids (TSS) were also collected. Hydrological parameters such as temperature and salinity were also measured using a CTD instrument.

As a means of keeping track of the career progression of the South East Asian members, the trainees were introduced to the NF-POGO Alumni Network for Oceans (NANO) by a Vietnamese alumnus (Mr. Tin Hoang). The aims of the network are to maximize the benefits to the alumni from the training they have received; and facilitate active contacts among the alumni and with the training faculty. The trainees and visiting professors also participated in cultural activities such as visiting scenic and cultural locations in Nha Trang and the vicinity.

On behalf of the trainees, Dr. Anukul Buranapratheprat from Burapha University, Thailand said: ***"The NF-POGO program at the Institute of Oceanography in Nha Trang, Vietnam provides not*** *only valuable knowledge but also practical training in ocean color remote sensing and GIS. I have got an experience in what I expect to know which are techniques on benthic habitat classification and fishing ground analysis. We have made friends among the trainees and the lecturers from several countries and institutions. I am quite sure this activity will initiate future collaborations in ocean remote sensing and GIS research among Southeast Asian countries and POGO members. Thanks to all people and organizations to make this great opportunity possible".*

The trainees worked on issues immediately relevant to their research, discussed these with their instructors and peers and presented final reports to the group using their new knowledge in satellite oceanography. The presentations indicated remarkable progress. They will be able to apply their new knowledge to their research after they return to their institutes and thus contribute to the development of an ocean color remote sensing group in SEA. In addition, a NANO (NF-POGO Alumni Network for Oceans) regional project has recently been funded by the Nippon Foundation for 2012, with participation by alumni and supervisors in the SEA region. This is an effective first step for developing collaborations in ocean color research in SEA.

On behalf of all trainees and the teaching group, we would like to thank the Nippon Foundation and POGO and the CofEOO, Bermuda, for providing this opportunity to South East Asia for developing science and technology related to satellite oceanography and coastal remote sensing.

About the writers

Tin Hoang C. is currently a PhD student at Curtin University of Technology, Australia. Previously, he worked at the Centre for Coastal Management and Development Studies, Hue University of Science, Vietnam. He received the BSc. degree in biology and MSc. degree in marine ecology from Hue University of Sciences, Vietnam.

Thanks to the Partnership for Observation of the Global Ocean's (POGO) and Nippon Foundation (NF) capacity training programs, he has attended several NF-POGO courses in ocean color remote sensing and observational oceanography, such as the Visiting Professorship programmes held in Vietnam in 2007 and 2011, and the second year (2009-2010) of the Centre of Excellence in Observational Oceanography at the Bermuda Institute of Ocean Sciences.

He has specialized knowledge in Marine Ecology. His research interests are aquatic sciences and their role in globally changing environments with a focus on the application of RS (Remote Sensing) and GIS (Geographic Information System) in research resource management, marine and coastal environments and marine habitat mapping. Mr. Tin has participated in several national and international research projects, in research and management of marine and coastal areas. He has taken part in many field trips with his colleagues and also has close relationships with local communities in the coastal areas of Vietnam.

Son Tong P. H**.** is head of the Marine Remote Sensing and GIS Department, Institute of Oceanography, Nha Trang, Vietnam. The main research field of Mr. Son is the application of Remote Sensing and GIS in management, planning, protection and sustainable utilization of marine resources. He has specialized in investigating and building databases for marine resources in central and southern regions of Vietnam. Mr. Son has been principal and co-principal investigator of several national and international projects funded by UNDP, UNEP, and JAXA for the assessment, planning, management, exploitation and utilization of marine resources and adaptation to climate change along the Vietnamese coast. He has coordinated several NF-POGO projects in capacity building for marine and coastal study by remote sensing and GIS in Vietnam and South East Asia (2006), the NF-POGO visiting professorship program (2007) and NF-POGO Centre of Excellence Regional Training (2011).


Photo: Aninda Wisaksanti R.

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Research activities carried out by NF-POGO alumni at the Central Institute of Fisheries Technology (CIFT), Cochin, Kerala, India

In situ Time Series measurement of bio-optical parameters:

CIFT is working on the Ocean Colour monitoring through in-situ time series measurements of key bio-optical parameters and the generated data is complimenting and supplementing remote sensing data with in-situ observations. The main objectives of the research are to create a data base of optical properties of optically active substances (OAS), development of satellite derived ocean colour products for the coastal regions and improvements of algorithms to retrieve the OAS through ocean colour data for the Coastal and Fisheries management. The main areas of research are the optically complex coastal, estuarine and poorly sampled regions of the ocean in respect of the bio-optical studies. Our major focus is on the coastal region of Kerala, Southern Ocean (SO) and other optically important regions of the Oceans.

Major bio-optical works doing at CIFT

- Studies on the dynamics of chlorophyll in marine/estuarine waters
- Studies on bio optical characteristics of pelagic fish shoal sighted regions
- Measurements of optical characteristics using Hyperspectral Radiometer
- Community structure of phytoplankton and its relation with productivity
- Evaluation of micro and macro nutrient status and its relation with productivity
- Production of synoptic fields of chlorophyll pigment
- Creation of a long term monitoring station for coastal waters to supplement the chlorophyll network

Our Team:

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Photo by alumnus W.N.C.Pryiadarshani

Phytoplankton productivity in sub-Antarctic waters: role of nutrients accumulated and recycled by seabirds

My PhD project and research trip to sub-Antarctic New Zealand

Olga Shatova - Ph.D. student at University of Otago, New Zealand

Cruise to the Snares, February 2012.

My first research cruise to the sub-Antarctic islands of New Zealand took place in February this year. Following a 2-week delay due to bad weather in a rough Southern Ocean, our team of 5 researchers and 3 crew members set off from Bluff, the very southern port of New Zealand. The biggest research vessel of our small department, the RV Polaris, is also rather small (~23 m long), but a very capable boat that has been in rough seas many times before. Therefore, we relied on its agility and experience of the crew. After a 2 days transfer in a 3 meters swell we successfully anchored in the wake of the Snares islands, a tiny group of islands located about 200 km south from the South Island of New Zealand.

At first sight, the Snares look like a little rock in the middle of the ocean. As we were approaching, it became clear that these small islands are a home for millions of seabirds, thousands of sea lions and seals. The Snares didn't experience any damage related to the era of active whaling and sealing in sub-Antarctica (19th century); the island remains pristine and retains rich wildlife. Presently, the island has the highest level of protection by New Zealand Department of Conservation. The access to the island is prohibited for the general public and can be allowed under special research permit only. I was lucky to be among those scientists who are permitted to land on the Snares.

On the island, my tasks included collection of samples of flora and fauna (seaweed, land vegetation, sea birds feathers and guano). However, things that at first seem to be easy, appeared to be hard in the wild environment of the Snares. The island is covered in shrubs and, therefore, is hardly passable. Besides, other 'live obstacles' like fur seals and sea lions were in our way. These marine mammals are usually peaceful, but sometimes they try to show 'who the boss is' by exposing their teeth and barking. Special survival suits that provide a certain level of protection must be worn during trips to the island. However, these suits are heavy, inflexible and restrain movements. All this made our sampling trips challenging, adventurous and rather exciting.

The Snares fauna is unique and diverse. Despite the small size of the Snares (the biggest island in the group has approximate dimensions of 3 by 2.5 km), it is a home for few endemic species of birds (Snares Crested Penguin, Snares Snipe and Snares Tomtit). About thirty thousand pairs of Snares penguins live in colonies on the little island. We accessed the colonies sites in a molting season when penguins loose their plumage. Surprisingly, our presence didn't bother penguins; they remained unconcerned. However, some penguins were rather curious and readily walked around bashfully examining us. Another famous representative of seabirds breeding on the Snares is Southern Buller's Albatross (or Buller's Mallymawk), a gorgeous bird with a black patch around the eyes that seems to be a perfect 'make up'. Like most albatrosses, it's fairly large with an average body size of 80cm-1m. Albatrosses nest on steep rock shores and cliffs that make their nests hardly accessible.

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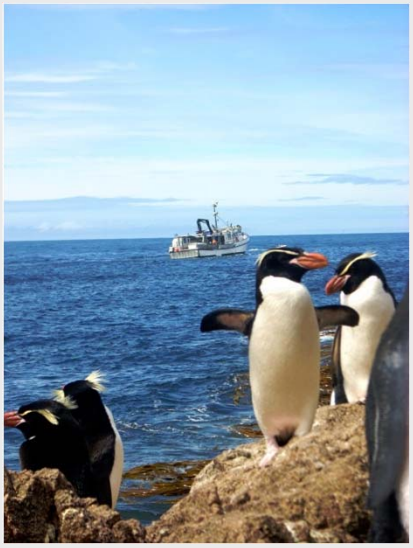
The second part of my work during the cruise was aboard the RV Polaris. While on boat, we collected water samples for nutrient analysis and measured physical properties of the water using a CTD. We also collected samples of particulate matter and representatives of the pelagic food web for isotopic analysis. This allows us to construct the food web structure in the vicinity of the island and to investigate the factors that influence food web productivity. I have also collected water for a phytoplankton incubation experiment that was finished in the laboratory after the cruise. The preliminary results from the cruise look promising; such an unforgettable trip, great experience, great memories!

The Snares islands. February 2012



Snares Crested Penguin and the Polaris

A short scientific introduction to the project:

Unexpected responses of coastal ecosystems to anthropogenic stressors arise from insufficient knowledge about food web, complex interactions and feedback loops. Therefore, it is imperative to better understand food web structures, mechanisms and functions. Recent studies of nutrient cycling in food webs that span the ocean-land interface show that land-based nutrients support food webs in the ocean. Seabird guano plays an important role in maintaining productivity of coastal ecosystems by delivering micro-nutrients to coastal zones. Iron is a limiting factor in the coastal waters of the sub-Antarctic islands in the Southern Ocean. Acquisition of iron by bacteria and biomagnifications of iron within the oceanic food web lead to high concentrations of iron in seabirds and their guano. Oceanic seabirds such as albatross and penguins congregate for breeding around the sub-Antarctic islands. This results in the delivery of large amounts of bio-available iron from the guano with potential to enhance productivity and support biodiversity in the region.

Main hypothesis:

We hypothesize that seabird guano, containing micro-nutrients in high concentrations, is an important mechanism to fuel primary and secondary production around sub-Antarctic islands.

I used the following approaches to test this hypothesis:
Phytoplankton incubation experiments with enrichment with nutrients derived from sea-bird guano.
Sampling of dominant components of pelagic communities, collection of water samples for nutrient analysis and measurements of physical conditions in the ocean.

Previous page (left to right): The RV Polaris in Ho Ho Bay; My supervisor Steve and me climbing the rocks to collect samples; Penguin Colony; Buller's Albatross in a nest.

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Research work carried out under the Masters degree :

Effects of La Plata river plume on chlorophyll estimations using ocean color algorithms

Spectral light reflectance and its magnitude have been commonly used to estimate chlorophyll-a concentration from ocean color sensors. Coastal waters are bio-optically complex and thus, ocean color varies with the presence of other optically active components besides chlorophyll-a. In the southern Brazilian waters, the dynamics of the La Plata River plume over the continental shelf are probably the major factor responsible for the variability of seawater reflectance. The present work aims to describe the variability of in situ remote sensing reflectance (R_{RS}) and evaluates the performance of existing operational chlorophyll algorithms. Reflectance and chlorophyll-a concentration data from three oceanographic cruises were used, in addition to an historical dataset of the region. The deviations between measured and estimated chlorophyll are studied as a function of salinity and turbidity of surface waters.

We observed that the seasonal variability of surface reflectance properties are strongly affected by La Plata River plume dynamics, due to the presence of high concentrations of both inorganic suspended solids and colored dissolved material. Moreover, the existing operational algorithms overestimate chlorophyll-a concentration, especially in waters of low salinity ($S < 33.5$) and high turbidity ($R_{RS}(670) > 0.0012\ sr^{-1}$). A new version of the regional empirical algorithm was also developed (OC2-LPv2, $r^2 = 0.8$, $N = 137$). The techniques presented under this study allow us to distinguish bio-optically different waters which require development of specific algorithms to be considered in ocean color studies for chlorophyll-a estimates.

Research Communications – NF-POGO Alumni

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Research interests: My research interests are to study origins of organic matter and the effects of its origin on organisms in aquatic ecosystems. I have conducted research in rivers, estuaries, and oceanic waters, using several analytical methods, such as pigment measurements, stoichiometry analysis and stable isotope analysis. Two such studies completed are presented below.

1. Origin of particulate organic matter in the Yura River, Japan

Riverine particulate organic matter (POM) discharges into estuaries. Some riverine POM is utilized by estuarine organisms such as bivalves and amphipods while other POM is decomposed by heterotrophic microorganisms in conjunction with oxygen consumption in estuaries. As the fate of riverine POM depends on its origin, understanding the sources of riverine POM is important for environmental conservation in estuaries. In this study, therefore, we focused on the elucidation of origins of POM in river waters. Our observations were conducted along the Yura River, which discharges into the Sea of Japan and is a typical

river in southwest Japan. The Yura River has a total length of 146 km and a total drainage area of 1882 km^2. Forest covers much of the watershed areas from upstream to midstream. From midstream to downstream the land usage is agricultural and urban.

Riverine POM samples were collected from 11 sites along the main stream of the Yura River in May and November 2006, and were analyzed for carbon and nitrogen stable isotopic compositions. Isotopic compositions and C/N ratios of POM suggested that riverine POM originated mainly from attached algae, phytoplankton and anthropogenic materials. Assuming that each POM source mixed conservatively, the fraction of each POM source can be estimated using a three source mixing model. POM was mainly dominated by attached algae in the upstream area, and phytoplankton and anthropogenic materials increased in the midstream area (including a dam) and in the downstream area, respectively, during both months. The calculated carbon and nitrogen concentrations of anthropogenic POM in river waters were positively correlated ($r^2 > 0.7$) with the population density. This suggests that the increase of those concentrations were due to the increase of population density. In May, phytoplankton-derived organic matter showed high concentrations at sites in the midstream and downstream areas. This may be caused by phytoplankton input from rice paddy fields. Our study indicates that human activities in the river watershed account for about 50% of the total POM input into the estuarine ecosystem.

2. Oligotrophic jelly-plankton blooms: implications for carbon cycling in the Sargasso Sea

Recent studies have indicated that jelly-plankton are increasing globally, and their blooms have a big impact on the socio-economics in the coastal areas, such as fisheries and power plants. It is also suggested that jelly-plankton are generally not favourable prey for higher trophic levels, and shunt carbon away from traditional food chains influenced by the microbial loop. However, their role in ecosystems and carbon cycles is still not well described, especially in open oceans, such as oligotrophic gyres. Salps, one type of jelly-plankton, feed on small particles, especially pico- and nano-phytoplankton, at high rates and exhibit one of the highest growth rates among animals, thus their grazing can have a huge impact on ecosystem and carbon cycling.

The objectives of the present study were 1) to estimate salp carbon consumption, and 2) to identify the environmental factors affecting salp biomass in the Sargasso Sea during spring when the highest primary production is observed. Salps from the spring zooplankton tows of the Bermuda Atlantic Time-series Study from 2002 to 2009 were identified and counted, and salp lengths were measured to estimate salp biomass. Salp carbon consumption was estimated based on maximum daily carbon consumption and salp daily filtration rate. For the analysis of the environmental factors controlling salp population, permutation tests between salp biomass and various environmental parameters, including physical and biological ones, were conducted. As a result, salps are estimated to consume normally < 1 % of primary production, but up to 25 % of primary production during large salp blooms. We also suggest that large salp blooms are supported by blooms of Synechococcus, which increase in the Sargasso Sea in spring. Therefore, a large fraction of primary production would be assimilated in salp biomass at that time.

Current research work

My current research work is about mysid population dynamics related to physical parameters, such as salinity, and origin of particulate organic matter and sedimentary organic matter as food sources for mysids in estuaries. In this work, we study the origin of organic matter using fatty acid analysis and stable isotope analysis.

Evgeniya Klimchuk

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Research interests: My research work was devoted to the North Atlantic ocean and subtropical gyre, and, in particular, to the Gulf Stream current. We aime to find trends in the mode of the Gulf Stream current by estimating water transport over a period of more than 50 years.

Seasonal and interannual variability of Gulf Stream current water and heat transport

Klimchuk E. I., Dzhiganshin G.F.

Monthly and ongoing annual averages of the Gulf Stream mass transport in the vicinity of 70°W for the period from 1950 to 2004 were calculated from contemporary oceanographic data series (World Ocean Data Base'05). It was estimated that the average annual water transport of the Gulf Stream near 70° W is nearly 90 Sverdrup (1 Sverdrup=10^6 m^3s^{-1}). Seasonal variations of the current water transport are effectively described by a superposition of two harmonics – annual and semiannual. Their combined contribution to the variance due to variations in average values is 69%.

Amplitudes of annual and semiannual harmonics of the Gulf Stream water transport are 1.8 Sverdrup and 0.8 Sverdrup, respectively, and the average amplitude of seasonal variation is about 2 Sverdrup. The Gulf Stream current flow maximum is shown to occur in spring (April-May) and is about 92 Sv, and minimum is observed in early autumn (August-September) and is approximately 85 Sv. Average annual heat transport by the Gulf Stream in the vicinity of 70°W is 1.5 PW (1 PW= 10^{15} Watt) (Minimum amount at the end of winter – early spring is about 1.4 PW and the maximum – in the autumn is about 1.6 PW).

The temporal variability (monthly and annual values) of Gulf Stream water and heat transport indicates presence of oscillations with an approximate periodicity of 10-15 years. The Gulf Stream interannual water transport variations starting from 1954 display a positive linear trend. During the study period, the Gulf Stream water flow increased by 3 Sverdrup. This result does not confirm statements about the Gulf Stream weakening, which appeared in some publications in the last decade.

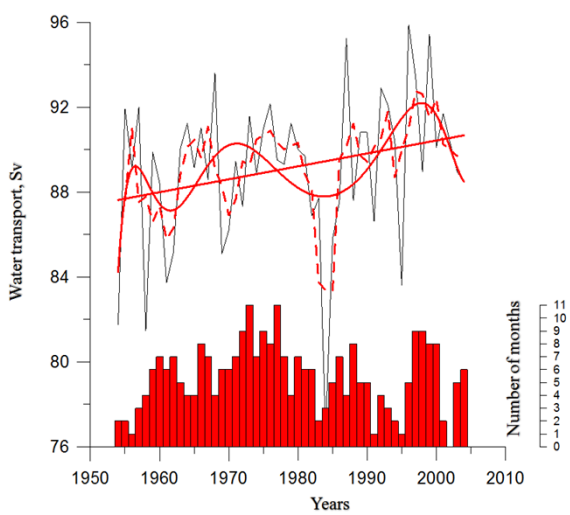

Fig.1 Annual averages of the Gulf Stream water transport for the vicinity of 70°W. Linear trend-solid red line, 3 month running average – dashed line, 9th degree polynomial approximation- red curly line.

My current research project is also devoted to the North Atlantic basin. In my PhD project I attempt to estimate a part of meridional transport - Sverdrup transport and calculate its annual and interannual variability with the help of different data sets e.g. Hellerman, NCEP reanalysis, etc. In the future, as a physical oceanographer, I would like to actively participate in international projects that involve students and scientists from different countries, and to become a part of global oceanographic community, as expected by the NF-POGO network.

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Long-term study of phytoplankton phenology and community structure in relation with hydro-climatic variability in the Bahía Blanca Estuary, Argentina

Coastal ecosystems emerge as important areas that are highly sensitive to human and climate change stressors. The growing need for the assessment of long-term changes at the base of their pelagic food webs and predicting their rate of change represents a current challenge in ecological studies. The ocean-atmosphere coupled system plays a major role in shaping the interannual variability of plankton, as climate governs hydrographic processes (e.g. vertical mixing/stratification) and thereby influences the functioning of the pelagic ecosystem (Fig. 1). In the particular case of estuaries, the continuous river-sea transition and the tidal influence are considered the main determining features of the phytoplankton biomass distribution. In addition, local physicochemical and biological factors such as water column depth, light availability, nutrient turnover, grazing pressure and species-specific interactions could highly affect phytoplankton development (Fig. 2). Based on this, at the land-sea interface it is difficult to disentangle the complex seasonal patterns of phytoplankton as local processes can mask the annual variability of plankton. Therefore, the analysis of long-term data series is essential to extract signals of climate modifications from phytoplankton observations in coastal ecosystems and separate global from local scale impacts.

The response of phytoplankton to climate change has been investigated more extensively in northern latitudes mainly because of the relative scarcity of long-term surveys in the Southern Hemisphere. In the Bahía Blanca Estuary, Argentina, a long-term monitoring program of phytoplankton and environmental variables has been carried out biweekly since 1978 and significant changes have been registered in the phenology of the phytoplankton linked to a shift in the hydro-climatic conditions around the mid 90's. In this article, the sampling activities carried out in the Bahía Blanca Estuary are briefly described together with the main findings from the analysis of the data series and the future perspectives of the current work.

Study area

The Bahía Blanca Estuary (38°42'-39°25'S, 61°50'-62°22'W) is located on the southwestern Atlantic coast in Argentina, in a temperate climate region. The estuary is mesotidal with a semidiurnal cycle, characteristically shallow, turbid and eutrophic. The water column is well mixed all year-round mainly affected by tides and wind stress. Yearly water temperature ranges from 4°C to 26°C and salinity ranges from about 17.3 to 41.9 with maximum values in summer. The estuary is characterized by low freshwater discharge and a smooth gradient of water density from the head towards the mouth. The Ingeniero White port, one of the most important ports in South America, the Bahía Blanca City and the industrial towns of General Cerri and Ingeniero White (350,000 inhab.) are located in the northern boundary of the estuary.

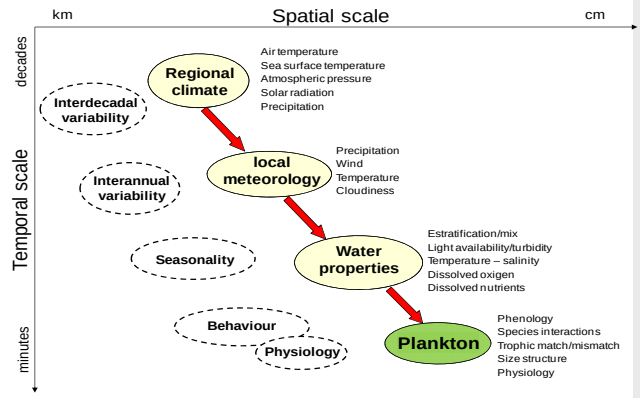

Figure 1: The close atmospheric-sea interaction modifies the pelagic environment and eventually induces variability in the plankton dynamics at different spatial and temporal scales.

Summary of the work being carried out

The monitoring program of the physicochemical and biological variables in the inner zone of the Bahía Blanca Estuary has been performed since 1978 on a fortnightly basis by the working group of the Laboratory of Marine Chemistry at the Instiuto Argentino de Oceanografía (IADO-CONICET) under the supervision of Dr. Jorge Marcovecchio and Dr. Hugo Freije. The sampling program consisted of (1) field measurements and water sample collection for the determination of water temperature, salinity, pH, turbidity, dissolved oxygen, light availability in the water column (PAR), dissolved inorganic nutrients, chlorophyll a concentration, particulate suspended matter concentration and phytoplankton species identification and enumeration; (2) analysis of local meteorology and regional climate variability and (3) modelling of the long-term data series to disentangle potential links between hydroclimatic modifications and phytoplankton patterns.

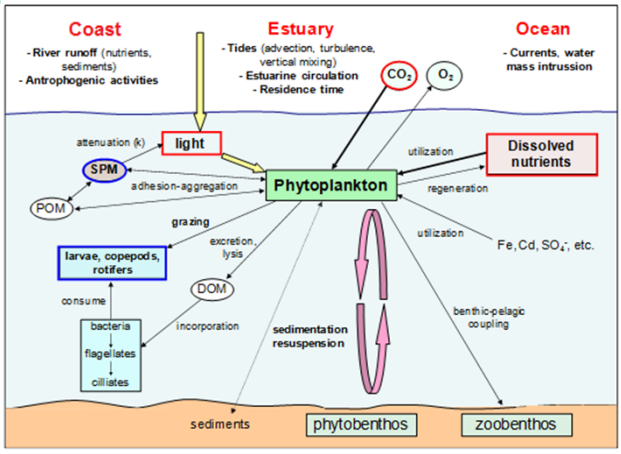

Figure 2: Physical, chemical and biological variables affecting phytoplankton community structure in an estuary. SPM: suspended particulate matter, POM and DOM: particulate and dissolved organic matter, respectively.

Phytoplankton species identification and quantification have been done by Dr. Ana María Gayoso from 1978 to 1992, by Dr. Cecilia Popovich during 1992-1994 and 2002-2003 and by Dr. Valeria Guinder since 2006. In 2008, a collaborative project was set up with the working group of the Laboratory of Experimental Ecology at the IFM-GEOMAR, in Kiel, Germany headed by Dr. Prof. Ulrich Sommer. From this group, Dr. Juan Carlos Molinero has been collaborating in the statistical modelling of the long-term data series.

Main findings in phytoplankton variability

The phytoplankton annual pattern during 1978-2002 has been characterized by a recurrent winter-early spring diatom bloom as the most important yearly biomass event (up to 12.7 million cells l^{-1} and 54 µg l^{-1} of chlorophyll concentration). The dominant blooming genera were *Thalassiosira* and *Chaetoceros*, *Thalassiosira curviseriata* being the dominant species over the winter period (up to 90% of the total phytoplankton abundance). The occurrence of the winter bloom was attributed to low zooplankton activity due to low water temperatures and high nutrient concentrations caused by precipitations in autumn and intense remineralisation processes. The collapse of the bloom was related to nutrient depletion owing to phytoplankton consumption and high grazing pressure, mostly by the copepod *Acartia tonsa* and some ciliates. Nevertheless, in recent years, the phytoplankton annual cycle has shifted from the unimodal pattern dominated by the winter bloom, to a bimodal pattern characterized by both winter and summer blooms.

The modifications in phytoplankton dynamics include changes in the timing of the typical winter bloom which moved forward ca. 1 month and its reduction in magnitude and duration together with shifts in the size-structure of the community towards smaller species. The phytoplankton composition has been restructured as novel blooming species such as *Cyclotella* sp. (5-12 µm) in winter and *Thalassiosira minima* (5-15 µm) in summer have become dominant. The substantial increase in the summer phytoplankton biomass (up to 53% of the mean summer value) due to *T. minima* outburst (up to 85% of the total phytoplankton abundance) suggests that this species has germinated in the pelagic habitat promoted by environmental stimuli after resuspension of resting spores from bottom sediments.

These changes in the phenology and composition of the phytoplankton community appeared to be driven

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by atmospheric modifications evidenced in recent years in the Bahía Blanca area towards warmer and drier weather conditions. Changing climate has likely modified the hydrological characteristics in the estuary (i.e. water density, turbidity, light availability and dissolved nutrient concentrations) and eventually triggered the reorganization of the phytoplankton community. Further studies should be performed to assess the direct (e.g. changes in the cells physiology and species-specific interactions) and indirect effects (e.g. changes in nutrient ratios and trophic interactions) on phytoplankton ecology that are modelling the community structure. It is noteworthy that over the last three decades, human settlements have markedly developed in the coastal area which has derived in higher loads of nutrients and organic matter into the estuary. Such anthropogenic disturbances may have significantly affected the water quality and consequently phytoplankton growth.

This long-term study provides evidence of species-specific and structural changes at the bottom of the pelagic food web in a temperature estuary of the southwestern Atlantic. Such an intense and continuous monitoring program is of major importance for tracking the shifts that coastal marine systems are experiencing worldwide under the synergistic effects of climate modifications and eutrophication processes.

Future perspectives

Our main goal is to continue the monitoring program of phytoplankton and environmental variables in the Bahía Blanca Estuary to characterize this coastal system in terms of productivity, species richness and diversity. Moreover, we are planning empirical investigations (e.g. autoecology, species-specific interactions) with the emerging key species in the phytoplankton community, to evaluate their ecological niches and potential use as indicators of ecosystem state. In addition, we aim to evaluate how changes in timing and magnitude of the phytoplankton blooms and reduction in cell sizes affect the energy transfer through the pelagic food chain.

From a more general perspective, we attempt to compare the phytoplankton succession in the Bahía Blanca Estuary with other coastal systems from different latitudes to find patterns and tendencies under global change scenarios and the increasing human influence on coastal areas. Further, we intend to predict plankton interannual variability in order to improve the utilization of aquatic resources. By participating actively in the NF-POGO Alumni Network we would like to discuss with other scientists our results and expand our knowledge of the underlying mechanisms affecting plankton ecology in the Bahía Blanca Estuary. Through this international Network we expect to establish close contacts with other groups working on coastal ecosystems and develop collaborations in the near future among research institutes from all over the World.

This work was supported by a grant funded by Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET-Argentina). Additional financial support was given by Ministerio de Ciencia, Técnica e Innovación Productiva (MINCYT- Argentina) and the Deutscher Akademischer Austausch Dienst (DAAD- Germany) trough the project 50467312. This work was part of the PhD Thesis of V. A. Guinder and her current Postdoctoral Research Project.

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Research interests: Biogeochemistry with special emphasis on phytoplankton blooms and its relation with biogenic trace gas production; HPLC and LCMS analysis of phytoplankton pigments and algal toxins.

Personal Information and background: I have a Ph.D in Marine Sciences from Goa University, India and am presently working as a CSIR Research Associate in the Chemical Oceanography Division, NIO, Goa. My doctoral research was on "Influence of phytoplankton community structure on the abundance and emission of volatile halogenated organic carbon in the Arabian Sea"

I have received a US Fulbright post doctoral award for the year 2011-2012 and working at present at Woods Hole Oceanographic Lab, MA as a post doc fellow.

Highlights of present research:

Biogenic halocarbons produced by phytoplankton in the ocean are the major source of organic halogens to the atmosphere and these play a vital role in tropospheric photochemistry. As a part of my research I have used HPLC pigment approach to understand the seasonal changes in phytoplankton community structure in the coastal eastern Arabian Sea and its influence on the distribution of chloroform, carbon tetrachloride, dibromomethane and bromoform in this region. I have also studied phytoplankton blooms to understand their role in biogenic halocarbon emission.

Abstract:

Eukaryotic phytoplankton such as diatoms and prymnesiophytes are known to produce biogenic halocarbons in the ocean that serve as important sources of chlorine and bromine to the atmosphere, but the role of cyanobacteria in halocarbon production is not well established. We studied distributions of chloroform ($CHCl_3$), carbon tetrachloride (CCl_4), methylene bromide (CH_2Br_2) and bromoform ($CHBr_3$) in relation to phytoplankton composition, determined from pigment analysis complemented by microscopic examination, for one month in coastal waters of the eastern Arabian sea that experienced a *Trichodesmium* bloom which typically occurs during the Spring Inter-monsoon season. High concentrations of zeaxanthin (23 µg l^{-1}), alpha beta betacarotene (6 µg l^{-1}) and chlorophyll *a* (67 µg l^{-1}) were found within the bloom whereas the marker pigment concentrations were low outside the bloom. $CHCl_3$ and CCl_4 occurred in relatively high concentrations in surface waters whereas CH_2Br_2 and $CHBr_3$ were restricted to the subsurface layer. Chlorinated halocarbons were positively correlated among themselves and with $CHBr_3$. The observed spatial and temporal trends in brominated compounds seem to be related to the abundance of *Trichodesmium* even though correlations between concentrations of brominated compounds with various marker pigments were poor and statistically insignificant. The results support the existence of multiple sources and sinks of halogenated compounds, which might mask the relationship between halocarbons and phytoplankton composition.

My future research objectives:

Photosynthetic production of oxygen, influenced by several environmental factors keep the water column well oxygenated. However it is increasingly evident that anthropogenic activities have resulted in changes in the nutrient cycling in the coastal environment leading to abnormal phytoplankton succession, coastal eutrophication and hypoxia. Such succession has often been associated with harmful algal blooms (HABs) and formation of dead zones throughout the world, including the Gulf of Mexico and coastal Arabian Sea during summer monsoon. My future career and research goals are to study the algal toxins produced during harmful algal blooms in the Arabian Sea and Bay of Bengal. This has become a huge socio-economic problem and there is increasing evidence that frequency of these harmful algal blooms are on the rise due to global climate change.

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Marine Biodiversity Threats in Western and Southern Coast of Sri Lanka due to Coastal Pollution

Sri Lanka is an island in the Indian Ocean located just south of India. The coastal region of the country accommodates about 4.6 million people, which is about one fourth of the total population. This has resulted in the concentration of a large share of urban growth and development activities within coastal areas. Further, most popular tourist hotspots are coastal regions such as recreational beaches, mangrove forests, coral reefs etc. Therefore, proper management of these unique ecosystems is most important for their sustainable utilization. The National Aquatic Resources Research and development Agency (NARA) carried out many studies during the last two decades and has been involved in developing many management guidelines.

In this article, I would like to highlight some research findings, carried out in the recent past, of particular coastal ecosystems which need proper attention towards protecting valuable resources that are under tremendous pressure. According to the studies done, most of the coastal ecosystems were damaged due to lack of proper management and over exploitation of those resources for various purposes. Those studies were done to assess the magnitude of the damages in selected ecosystems in particular area. According to the study carried out at Hikkaduwa National Park (Marine Sanctuary) in 2006-2008, parameters like Total Suspended Solids (TSS), Temperature, Biological Oxygen Demand (BOD) and level of nutrients recorded were higher than those corresponding to optimal levels of coral growth. During the study period, it was reported that severe damages were observed during unusually rainy weather conditions, due to the supply of huge amount of debris and nutrients. As a result, nearly 35% of coral diversity has been lost in the Hikkaduwa National Park. This is mainly due to poor catchment management of nearby water bodies. Further, near shore current patterns have also changed due to the construction of a fishing harbour and this is one of the main reasons for sand deposition on the coral bed, which is responsible for suppressing the growth of new coral beds.

Further to this study, a marine litter survey was conducted in selected locations on the western and southern coasts of Sri Lanka. Marine litter causes marine environmental, economic, health and aesthetic problems, including possible transfer of toxic substances and invasive species, destruction of marine habitats and loss of biodiversity. It also threatens marine life through entanglement, suffocation and ingestion as well as posing a risk to human health and life.

The objective of the survey was to identify sources and impacts associated with marine litter and recommend a proper management plan for mitigation of environmental impacts. Selected sampling sites included fisheries harbours, recreational beaches, tourist areas, coastal religious places, and undisturbed beaches. Data collection was carried out in monthly intervals during 2008. The method of sample collection was counting the litter found in randomly identified 100 m beach stretches in each sampling location. Field observations such as method of accumulation, means of transport, origin of the material and method of removal were also recorded.

Figure 1: Underwater pictures of destroyed coral bed by polythene bags and invasion of calcareous algae (Photo: A. Rajasuriya)

According to data analysis, near shore waters receive untreated sewage, sludge in the form of kitchen and laundry wastewater, and solid waste including mainly plastics, and other non degradable materials. Out of the fisheries harbours selected for the study, Mirissa showed the highest amount of waste materials whereas the fishing harbour at Galle and most fish landing sites recorded the minimum amount of solid waste dumping.

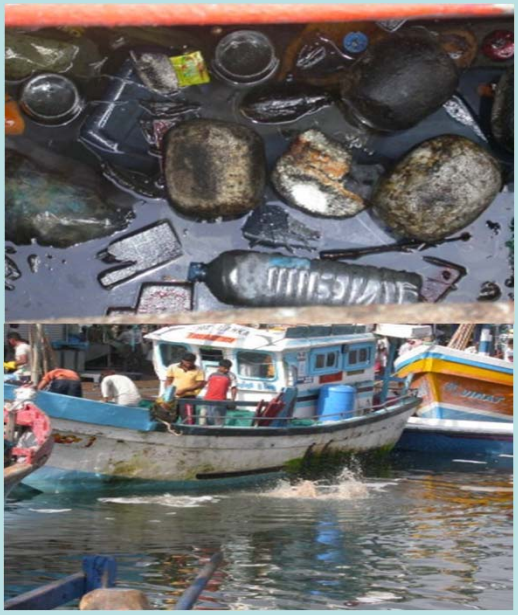

Figure 2:Marine litter accumulation in fisheries harbours

Coastal stretches of river outfalls such as Kelani, Kalu, and Benthara showed the highest amount of plastic and other non-degradable debries. Especially during the southwest monsoon period, overseas manufactured brands of plastic containers and tetra-packs were found along the coast as they are coming in from the Indian Ocean. According to the information on the label, the possible sources are ships traveling along the southern coast and some materials coming with the current action during the monsoon. This study concludes that land based materials transported by inland water bodies and commercial and fishing vessels traveling near the southern coast are contributing equally to coastal pollution on the western and southern coasts of Sri Lanka. Therefore, proper waste disposal mechanisms and raising awareness within the general public are vital to reduce the pressure on valuable ecosystems.

Photo by alumnus Yuna Zayasu

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Regional contribution of tropical storms and hurricanes to annual new production in th

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The world is waking up to global warming. The major contribution is through emission of green house gases, mainly carbon dioxide. Oceanic phytoplankton constitute almost half of the photosynthesis on Earth which is a major sinking flux of carbon dioxide from the atmosphere.

Hurricane induced forcing causes a decrease in SST by enhanced vertical mixing and upwelling. Vertical mixing brings colder, nutrient rich waters into the surface layer and thus may stimulate biological production. Increases in phytoplankton biomass and primary production have been observed in the Atlantic coastal waters after a hurricane. This production due to mixing is termed "new production" as the nutrients are being entrained from deeper water. Various studies have been undertaken to understand the biogeochemical changes in the water column caused by hurricanes and storms.

For calculating and understanding the change in primary production due to storms we need to have a large set of in-situ data and also satellite data in a region which is prone to storms. The comprehensive in-situ measurements made at Bermuda Atlantic Time Series Study (BATS) provide the appropriate data to conduct such a study. Hence, we chose our region of study in the Sargasso Sea with the box limits from 26ºN to 36ºN and 66ºW to 56ºW.

In 2010, hurricane IGOR was the strongest among all; it was a category-4 hurricane on Saffir-Simpson Hurricane Wind Scale (with maximum speed of 250 km h^{-1}). It formed on 8th September southeast of Cape Verde Islands and dissipated on 21st September south of Newfoundland crossing Bermuda during 18th to 21st September. We chose this hurricane for our study and the study period was taken from 5th of September to 5th of October to understand the biogeochemical responses to the hurricane.
Several models have been developed for calculation of primary production. In this project we compute primary production using the model by Platt and Sathyendranath (1988). The model uses in-situ and satellite data to give estimates of primary production on large spatial scales.

Table 1: Input and output variables for the model dwcpn (daily, water-column production by numerical integration of a spectral model)

Input	Output
Latitude	Latitude
Longitude	Longitude
Day number	Day number
Initial slope α^B	Daily water-column production, P_{ZT}
Assimilation number $P_m{}^B$	
Depth of phytoplankton maximum, z_m	
Background biomass, B_0	
Gaussian height parameter, h	
Gaussian scale parameter, σ	

In-situ data:
A Gaussian profile is used to describe the vertical distribution of chlorophyll biomass in the ocean. This data was available from Bermuda Bio-Optics Project. Normalized method of interpolation was used to obtain the profile parameters for the region. Photosynthesis-Light Curve data [p-i] was obtained from Biochem database project by Fisheries and Oceans Canada archives data for North Atlantic from 1921 till present. Nearest-Neighbour Method of interpolation is used for p-i parameters for the region.

Satellite data:
MODIS – Aqua level 2 data products are available at the NASA GSFC ocean color website with a spatial resolution of 1x1 km^2. Daily Sea Surface Temperature (SST) and Chlorophyll (Chl) was obtained for the study region (26-36°N and 66-56°W) and for the study period (5th Sep – 5th Oct). Daily png images and ascii files were created using the SeaWiFS Data Analysis System (SeaDAS) software of NASA GSFC and scripting in UNIX bash shell.
Several model simulations were run in order to see the effect of change in certain parameters due to hurricane or storm on production. Results obtained were analysed and several conclusions were drawn.

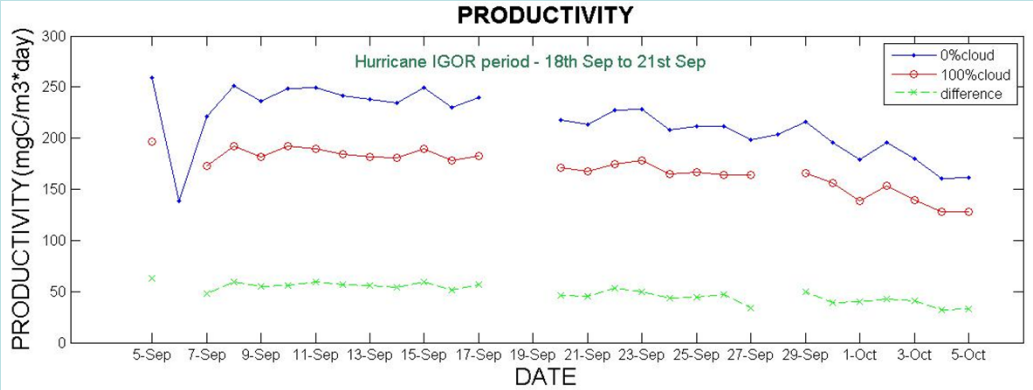

Figure 1 - Productivity from model results for different cloud cover.

The approach used above provides a way to investigate changes in productivity due to storms. A similar approach could be used with different models and data. But, there are several questions related to the reliability of the in situ data of photosynthesis-light parameters, the nearest-neighbor approach methodology of imputation may have some problems and there is a need to investigate different method of interpolation for p-i parameters. It can also be concluded that more storms need to be studied in order to understand whether the effects observed on productivity are realistic or if there is some problem with the in-situ data. Maybe there is a need to combine data and results from multiple storms and also to examine the methodology to do so because each storm is different.

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NF-POGO training at the Center of Excellence in Bermuda:
During my NF-POGO training, I studied the influence of upper ocean physical conditions, especially, the effect of mesoscale eddies (cyclonic, anticyclonic and mode water eddies) on zooplankton dynamics. I used zooplankton biomass data from the Bermuda Atlantic Time-series Study (BATS), acoustic backscattering strength data from an ADCP deployed on the Bermuda Testbed Mooring (BTM) and deep sea sediment traps content from the Oceanic Flux Program (OFP) for that study. These features appear to enhance zooplankton abundance substantially depending on the life stage of the eddy (spin-up or spin-down phases) and on the sampled regions in the eddy (core or periphery).

Current Research work:
Since January 2011 as part of my Ph.D. work, I have been involved in the NECTALIS project; an interdisciplinary research program carried out by the Institute of Research for the Development (IRD, France) and the Secretariat of the Pacific Community (SPC, New Caledonia) to investigate Albacore tuna environment and their feeding behavior with the goal to understand their distribution in New Caledonia's exclusive economic zone (EEZ) in the south-western Pacific.

A corner stone of the project is the mid-trophic levels of the pelagic ecosystem: zooplankton and micronekton (indicated in the figure). These organisms are the articulation that links environmental factors (physics/chemistry) and primary producers to top predators (Albacore tuna in our study) that feed on them. In two interdisciplinary cruises conducted in the EEZ in July and December 2011, we sampled zooplankton and micronekton by traditional net tows and also using a variety of acoustic instruments (S-ADCP, L-ADCP, TAPS, Scientific Echo Sounder). In addition to these cruises, the project benefits from a 10+ year-long data base with high temporal resolution of acoustic backscattering strength from a ship-born ADCP that could provide invaluable information on zooplankton abundance and distribution in the upper ocean throughout the EEZ. These in situ observations are complemented with remotely sensed Sea Surface Temperature (SST), Sea Surface Height (SSH) and chlorophyll concentration.

Initial results from the ADCP acoustic backscattering strength and net-tow data show that zooplankton abundance and biomass are strongly impacted by physical features such as eddies and density fronts where zooplankton aggregation could occur. It was indicated in previous studies done in the north-western Atlantic near Bermuda and in the central Pacific near Hawaii as well. We also observed an increase of zooplankton abundance at the sampling stations in shelf waters.

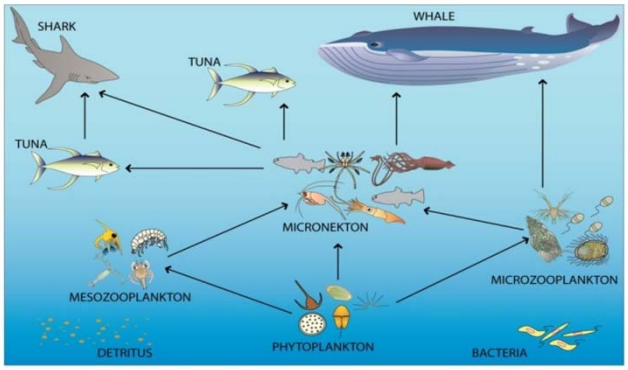

Figure: A typical structure of the pelagic ecosystem off New Caledonia (source: SPC, C. Collier)

The NECTALIS project is funded by the Caledonian program ZONECO and by the French national program INSU/LEFE/CYBER.

More details about this program and the research cruises can be found on the website:
http://www.spc.int/OceanFish/en/ofpsection/ema/biological-research/nectalis/345-nectalis

Meeting Announcements

Oceans and Society: the Blue Planet

We are pleased to inform you that a kickoff symposium for the new Group on Earth Observations (GEO) Task SB-01 "Oceans and Society: the Blue Planet" will be held at the Itapemar Hotel, Ilhabela (http://www.itapemar.com.br/english), São Paulo, Brazil, from Nov 19 to 21, 2012. The symposium takes place just prior to the GEO- IX Plenary, to be held in Foz do Iguaçu, Brazil (Nov 22-23).

The Blue Planet Task has four main components:
C1 Global Ocean Information Coordination and Access;
C2 Operational Systems for Monitoring of Marine and Coastal Ecosystems;
C3 A Global Operational Ocean Forecasting Network;
C4 Applications of Earth Observations and Information to Sustainable Fishery and Aquaculture Management.

The Symposium will highlight each of these components through special sessions on their programme elements. For example, there will be sessions on GOOS and the Framework for Ocean Observing, GEOBON (marine), SAFARI, ChloroGIN, OceanSITES, Capacity Building, Operational Oceanography in Brazilian Regional Waters. The full program will be finalized in the next few months and suggestions are welcome.
For those already engaged in the Blue Planet Task, the symposium will offer an opportunity to become familiar with the full scope of its activities, to help develop synergies and linkages, and to plan future involvement. For those not yet engaged, it is a chance to see where you might fit in to participate in the exciting expansion of GEO into the marine sphere. We very much hope that some NANO members will be able to attend. Please send initial expressions of interest to Trevor Platt (tplatt@dal.ca), with a copy to Li Zhai (Li.Zhai@phys.ocean.dal.ca).

12th International Coastal Symposium

Call for abstracts for the 12th International Coastal Symposium, Plymouth University (UK), 8-12 April 2013. DL: Call for 1-page abstracts: 12 March 2012 and Close of Call for Abstracts: 1 June 2012. More at: http://www.ics2013.org/default.asp?page=submit

International Conference on "Land-Sea Interactions in the Coastal Zone"

The conference will take place in Byblos- LEBANON from 06 to 08 November 2012. If you plan to submit an abstract and paper, please fill and send the registration available at NANO Opportunities page by mail to the address a.chouikhi@deu.edu.tr

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.

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