



**Partnership for Observation of the Global Oceans**

**POGO-7 Meeting**

**Hyderabad Jan 18 - 20, 2006**

**Hosted by Indian National Centre for Ocean Information Services (INCOIS)**

**Venue: Hotel Fortune Katriya**

## **Draft Minutes**

**18 Jan, Wednesday, Morning**

### **Inauguration:**

The meeting began with a beautiful invocation in Sanskrit by Udaya Bhaskar. This was followed by a welcome address by Dr. B. R. Subramanian, Acting Director of the Indian National Centre for Ocean Information System (INCOIS), following by lighting of the ceremonial lamp by dignitaries. The Chairman of POGO, Prof. Jan de Leeuw, then made a few introductory remarks, especially thanking INCOIS for hosting the POGO-7 meeting, and for the wonderful arrangements made by the local organisers led by K. Srinivas. Dr. Harsh K. Gupta, Former Secretary, Department of Ocean Development, India, then welcomed the participants to India and to INCOIS. The inaugural session concluded with a vote of thanks by Shubha Sathyendranath, Executive Director of POGO.

### **Introductory Session: Chair: de Leeuw**

Introduction of New Participants/Members: Jan de Leeuw welcomed new members (Benguela Consortium and UK Met Office). He announced the sad news that Prof. Sergey Lappo, Director of Shirshov Institute had passed away recently. He had been an active member of POGO, and was planning to attend the POGO-7 meeting. He would be deeply missed at POGO meetings. The participants stood in silence to honour the memory of Academician Prof. Lappo. Jan de Leeuw then invited all participants to introduce themselves. After the introductions, he introduced the agenda, which was adopted without change. He drew his attention to the director's forum scheduled for the next day, and invited all POGO members to contribute actively to the session. Dr. Howard Roe also urged members to contribute to the session. Howard Roe said he would hand everyone a voting slip on which members could note the items that members thought were most important for POGO.

Jan de Leeuw then drew attention to the minutes of POGO-6, and the attached Action Items from the meeting. Most of the action items are completed, and others are in proposal stage. The minutes of the last meeting were adopted with minor changes.

Srinivas Kumar then made a few logistical announcements.

### **Statements of Motions**

**Cruise Information Sharing:** Shubha Sathyendranath reported on the follow-up activity to an action item from POGO-6, aimed at promoting sharing of information on past and future cruises.

At the POGO-6 meeting, the members recognised the need to improve on information sharing on pre-planned, planned, current and past cruises and related databases to enhance awareness of opportunities, to improve cost-effectiveness of cruises and to improve data mining. With respect to cruise planning and information sharing, it was recognised that the following steps had to be undertaken to improve cruise efficiency:

- Identify features needed in an ideal database of research cruises
- Determine how well existing databases fit the ideal, and how they would need to be changed to meet the needs of scientists
- Estimate the cost of modifying an existing database or creating a new one

- Request support from appropriate agencies to augment an existing database
- Work with existing efforts in the area, rather than re-invent the wheel

At a meeting sponsored by the Scientific Committee on Oceanic Research (SCOR) in September 2004, representatives of international marine research projects concluded that major benefits would be available to the research projects if a database of research cruises were available to them. The meeting recommended that SCOR investigate the available options.

Since the POGO and SCOR activities had the same goals, POGO suggested that a working group consisting of Marieke Rietveld (POGO, Royal NIOZ, Netherlands), Douglas White (U. Delaware), Ed Urban (SCOR), and Shubha Sathyendranath (POGO) investigate ways and means to implement these improvements. It was also suggested that Laurent D'Ozouville (Euroceans) and someone from IOC dealing with the VOS system be included in this working group, if possible. The timeframe for the operations of this group was one year, and the group was to report on actions and recommendations at POGO-7. Mike Johnson (NOAA) has also been included in these discussions. The group initiated discussions by e-mail, and Marieke Rietveld, Jan de Leeuw and Shubha Sathyendranath also met in NIOZ on the occasion of the N&I Planning Meeting, to discuss possible actions.

The working group met on December 13, 2005 at the NOAA Office of Global Programs in Silver Spring, Maryland. The participants reviewed the need for the website from various perspectives, including those of POGO, JCOMM and SCOR. Many potential benefits from an international cruise database were identified:

- Help scientists from different countries coordinate future funded research through information about research vessels of opportunity
- Aid in retrospective ability to find data in regions of interest
- Make it possible for projects to conduct joint work and to fill empty berths
- Create capacity-building and training opportunities
- Would aid in tracking and distributing data
- Would provide information to evaluate the benefit of observations from ships as part of GOOS
- Would make it possible for scientists and operational users from other projects to get instruments deployed and/or samples taken in hard-to-reach areas of the ocean (e.g. drifters, profiling floats, moored buoy servicing)
- Would allow cost sharing among institutions, projects, and nations
- Would make possible intercomparisons, intercalibrations, validation among different data types (CTD vs. Argo, in situ vs. remote sensing)

The present situation is that the University of Delaware already maintains a site that provides cruise information (past, present and future) and information about ship capabilities. Ideally, one would build on this, although an open call for tenders was supported also.

The following features were identified as essential for a first version of the proposed website:

1. The site will have free and easy access
2. Will contain information on past cruises and future cruises (location, time and types of observations made or planned, berths available, contact points for further information, links to research vessel's home page, and other relevant websites, if any)
3. Searchable and user-friendly: The starting point for any search for cruises on the website would be a world map (standard JCOMM format: equidistant, cylindrical projection, broken at 30 deg. E), see Fig. 1. Users should be able to search for cruises in selected areas on the map, by clicking and defining an area, and by selecting a time frame of interest (time resolution would be one month). The design will be versatile and flexible enough to allow for addition of more features in the future.
4. The ship location will be identified using a Marsden square grid (10 by 10 degree squares). All contributors to the website will be requested to provide information on ship locations in Marsden squares. Note that this coarse resolution is deemed sufficient for most applications envisaged, and will address security concerns. The choice was based on the fact that (a) JCOMM uses such grids to report the status of observing systems;

- and (b) IOC member nations are required to use Marsden squares when they make Cruise Summary Reports (CSR), formerly known as ROSCOP (Report of Observations/Samples collected by Oceanographic Programmes).
5. Old data in the Oceanic website will be retained in the U.S. Navy grid; but the new website will be flexible enough to deal with data in both Marsden squares and U.S. Navy grid cells.
  6. All contributors will be requested to submit the following information in a simple spreadsheet format:

Vessel Name (linked to ship's web page)  
Call Sign of Vessel  
Country  
Departure Port  
Arrival Port  
Departure Date  
Arrival Date  
Specific Area  
General Area (Pull down menu)  
Marsden Squares covered by cruise  
Specific Experiment  
General Discipline (Pull Down Menu)  
Chief Scientist (Pull Down Menu, additions possible)  
Funding Agency  
Proposal ID  
Major Project/s (Pull Down Menu, additions possible)  
Berths Available (Yes/No)  
Links to other relevant websites  
Notes

It was proposed that, initially, the database would focus on ships of length 60 m or greater. Information from other ships will be included if submitted, but initial efforts would focus on collecting information on cruises of large ships.

Once the desired characteristics of the website were agreed upon, the participants at the workshop then discussed the way forward. It was agreed that the tasks at hand could be divided into four parts:

1. Design of the new improved web page
2. Approach cruise planners (institutional and project) to provide information on cruises of large ships, starting with future cruises, and extending to past cruises wherever possible
3. Periodically update information on the website, to keep it current as new information on cruises become available
4. Actively search, transform and input additional information from other sources, where voluntary contributions are lacking.

The committee decided that the initial effort will focus on steps 1 to 3. Step 4 will be time consuming and costly, and is to be contemplated only as a last resort, after reviewing the results from steps 1 to 3.

The University of Delaware had submitted a letter of intent, outlining the work to be carried out to design the new website, and providing budget estimates for the steps identified above.

Shubha Sathyendranath stressed that this activity would not be a success unless POGO members were diligent in making cruise information available freely and in a timely manner. POGO members were requested to name a contact person who would be responsible for passing on cruise information to the website. It was also noted that the list of research vessels provided in the meeting report was not up to date. Help from POGO members was also requested to update this information. SCOR, JCOMM and ISOM had also offered to help obtain information on

appropriate contact persons. SCOR office had offered to contact project representatives for information about their cruises.

During the animated discussions that followed the presentation, Jesse Ausubel noted that the initiative was important for research and operations, and symbolically important for POGO. He was concerned that a single site operated by a single US University site might not have a truly international flavour. An international supervisory committee was needed. He volunteered to share 50% of costs needed for redesign of website, provided other organisations/institutions were willing to meet the other half. Members expressed their view that this was a very important action. Reservations were expressed on the limitations of the current Delaware site, and questions were raised on the technical merit and budget projections provided in the letter of intent from the University of Delaware. Many members were of the opinion that other options for the creation of the international website should be explored, and an open call for tenders was supported. Some suggested potential ways to raise funds for the initiative, including advertising. John Field remarked that he was sure that SCOR would wish to be associated with this initiative.

**Biodiversity Observations:** Jesse Ausubel then spoke about Census of Marine Life (CoML): Vision 2010 and Beyond. He noted that many POGO institutions contribute to, and lead, many CoML initiatives. CoML is very much involved with many of these institutions. He provided an update on CoML, along with links to GEO and GOOS. It was a decade-long (2000 – 2010) programme to assess and explain the diversity, distribution, and abundance of marine organisms. The focus was on marine diversity at the species level. The approach was through both research and exploration. It was a collaborative international programme (with SCOR, IABO, IOC, FAO, ICES, PICES, GBIF, IGBP, GOOS, POGO). Second programme summit was planned for late 2006. CoML was a programme with a schedule and benchmarks. First workshops started in 1995, and Pilots in 2000.

The programme was organised around four questions: What did live in the oceans? What does live in the oceans? What will live in the oceans? How to access and visualise data on living marine resources? CoML had evolved 14 cooperative international ocean-realm field projects including those dedicated to coral reefs, Pacific Ocean shelf tracking, ecosystems of continental margins, diversity of abyssal marine life, chemosynthetic ecosystems, seamounts and ridge ecosystems.

In relation to GOOS and GEO, CoML prototype technologies that could become part of GOOS included acoustic shelf observing systems; horizontal sonar; and tagged mammals that provide ARGO-like data. He then provided examples from Pacific Ocean Shelf Tracking (POST) from Baja California to Bering Sea. Under Tagging of Pacific Pelagics (TOPP) some 2700 animals had been tagged. There had been rapid development in technology and organisation of tagging marine animals. POST might evolve to Ocean Shelf Tracking and Physics Array by 2010 by creating key North American Acoustic Curtains for GOOS. In 2005 discussions took place with scientists from other regions of the world to implement POST-line acoustic screening projects elsewhere in the world.

He showed a promotional video to highlight the point that we had not been effective in communicating to the outside world what the ocean was like. We had a collective responsibility to communicate visually what the system was like. He mentioned the ocean acoustic waveguide remote sensing as a revolutionary, simple system that would improve acoustic tagging dramatically. The system in the Gulf of Maine could monitor 10,000 square kilometres at one time, which was half of the Gulf of Maine. The system could cover 150,000 square km in the future. There were implications for fisheries management.

He showed results of the project tracking Pacific pelagic fish. Some 9000 temperature-depth profiles were now generated in 6 months. Elephant seals were tracked across ocean basins using this method, which provided additional information on physical properties. He showed an example of thermal and chlorophyll profile data from tagged tuna.

He then mentioned examples of DNA techniques including DNA digital bar-coding to identify species. A small portion of mitochondrial DNA can be used to identify species. The success rate so far was 88.8%. The inter-specific variation was 10-20 times as great as intra-specific

variations. The cost of analysis was very low: between \$ 2 and 6 per sample. The goal was to create 10 million records (5 per species). Pilot study had been carried out to identify Australian fishes through DNA barcodes. The technique could be applied to identify fish that were marketed. Progress was also reported for fungi and protists. Bar-code analysis had revealed many new species which remained in taxonomic limbo until they were completely identified. The goal was to have a library for all known marine species. This could serve the need for GOOS for monitoring marine biodiversity.

OBIS was a 21<sup>st</sup> Century informatics system that would have a life beyond that of CoML. The system must be designed as a digital object that could be queried, explored, and visualised in ways that users help determine. There was a need to work with Google Seas. CoML was very concerned with the need to develop common protocols and formats for several disciplines. CoML welcomed more interactions with POGO, GOOS, and GEO.

Howard Roe asked for a clarification on the capabilities of DNA analyser for species identification. Mike Meredith noted that tagged marine animals provided many times more information in ice-covered regions than Argo, even though the quality was not as good as that of Argo. It was important to ensure that this kind of work was continued in the future. Jesse Ausubel responded that Argo and marine animal tagging were complementary ways for monitoring the marine world. The need to integrate various types of data was very high.

Jan de Leeuw then followed with a presentation on ICoMM focusing on how POGO directors could help with 'Globalisation' of ICoMM. He provided a brief overview of the international Census of Marine Microbes (ICoMM). The task was less straightforward than might appear initially. Bar-codes were being developed and used for eukaryotes, but worked less well for prokaryotes. Prokaryotes, though invisible to the naked eye, made up 82% of total marine biomass. Our understanding of marine biodiversity was increasing rapidly. From 1980 to now, many more divisions have been identified than were known before.

The questions that drive IOCoMM were: how does microbial diversity relate to function and ecosystem processes and to biogeochemical cycles? How does the choice of gene influence diversity assessments and inference about presence or absence of functional groups in a complex community? What scales of heterogeneity are most appropriate for the census?

Many pilot studies had been launched, including new DNA sequencing methods. Eight samples from the Atlantic and from thermal vents had been analysed thus far and the results were staggering: the microbial biodiversity seemed to be phenomenal. Some 20 water samples from different biogeochemical provinces had been filtered and stored during the AMT cruise from Southampton to the Falklands and awaited further analysis. Attempts were being made to analyse microbial DNA in old and recent CPR samples. Construction of a microbial lipid data base to reconstruct marine paleo-biodiversity was envisaged. The data management node for ICoMM was the MicroBIS. The uniqueness of the data base was that DNA and species information would be coupled with environmental information.

**POGO and GEO:** Shubha Sathyendranath then made a presentation on GEO activities and on POGO involvement in these activities. In 2005 GEO had transitioned from an ad hoc body to a regular body with its secretariat at the WMO premises in Geneva. POGO continued to be a member of the new GEO. POGO had been represented at GEO plenary meetings in 2005.

Charlie Kennel had arranged a meeting in San Diego with Dr. José Achache, the new Executive Director of GEO, Shubha Sathyendranath and Lisa Shaffer. The meeting was very fruitful, and served to discuss links between POGO and GEO and how the two organisations could best serve each other. During the discussions, the importance of incorporating *in situ* observations into GEOSS was noted. The need to increase the visibility of GOOS within GEO was highlighted.

The GEO meeting in February in Brussels was used an opportunity by Jan de Leeuw to have a side meeting with Patricio Bernal and other POGO members present to discuss ways to improve coordination of post-tsunami activities in the ocean community. The POGO Secretariat had provided to IOC, on their request, a summary of post-tsunami activities in which POGO member institutions were involved.

POGO had coordinated response from the ocean community to the draft versions of the GEO Work Plan for 2006. The comments were taken into consideration in the revisions, which had increased references to POGO and GOOS.

During the GEO meeting in Geneva in December 2005, POGO initiated a side meeting of representatives of international organisations which participated in GEO that had an ocean mandate. The goal of the side meeting was to coordinate responses from the ocean community to GEO, to speak with a common voice within GEO, and to share GEO tasks. The response to the idea was very positive, and the group was christened Ocean United by Jan de Leeuw, and it was decided that IOC would be the spokesperson for Ocean United within GEO. Ocean United was initiated by POGO, IOC, GOOS, I-GOOS and JCOMM, but it was recognised that other groups would be invited to participate in Ocean United, to enhance the ocean involvement within GEO.

**Introduction of Budget:** Jan de Leeuw then presented the POGO budget. The budget for the Nippon Foundation – POGO Visiting Professorship Programme was healthy. It was maintained as a separate account. The total projected expenses compared with the projected income for 2005 led to a projected negative balance of about \$10,000 US. The projected deficit for 2006 is greater: about \$32 K. The recommendation from the Exec was that the members would agree to an increase in membership dues of about 10%. Other suggestions were welcomed from members to balance the budget.

**18 Jan, Wed. Afternoon:**

#### **Visit to INCOIS and Joint Session with Argo Science Team**

After lunch, the participants of POGO meeting and the members of the Argo Science Team visited INCOIS, the host for both events.

**INCOIS and its activities, including tsunami warning system:** Dr. B. R. Subramaniam, acting Director of INCOIS, welcomed participants to INCOIS, and gave a brief introduction to INCOIS and its activities, including those related to tsunami warning system. Using temperature and chlorophyll data from satellites, potential fisheries advisories were generated by INCOIS and transmitted to local fishermen in local languages. Integrated Potential Fishing Zone (PFZ) incorporated SST and chlorophyll information. The satellite data were transformed into maps showing locations of potentially high fishing zones, based on zones of high gradients. The fisheries information was then transformed into simple messages that were provided through faxes and internet. Search time was reduced by 30 to 70%, and improved catch per unit effort. Savings in fuel costs were achieved. Challenges included R&D to improve forecast, and to generate different forecasts for different types of fish.

Another initiative was to provide wave forecast for the open ocean. Models had been developed and implemented, which were yet to be tested. Plans were to extend the model to the coastal areas. The ocean observation system being implemented by India included a number of *in situ* observing elements. Research vessel *Sagar Sampada* and other research vessels were available to the Department of Ocean Development, and additional research vessels were planned for the near future. Network of 20 moored ocean data buoys that were indigenously developed had been deployed in the Indian Ocean. Some 12 buoys were transmitting data at present. The buoys gave valuable information for tracking cyclones. He also mentioned the drifting buoys and current meter arrays that were deployed by India. India was one of the regional Argo centres, and it was hosted at INCOIS.

There were two “tsunamigenic” zones that could affect the Indian coasts. The plan was to detect large earthquakes in tsunamigenic zones (interconnected seismic stations); observe change in water level near the source (bottom pressure recorders), choose relevant scenarios from model outputs, and monitor progress of tsunami wave (coastal radars, tide gauges). According to plan, all the information collected by the tsunami warning system would be transmitted through Indian satellites, and forecasts provided to potentially affected areas in India and in neighbouring countries. The seismic network for tsunami warning was to be implemented by mid 2006. INSAT

communication was expected to be ready by March 2006. In the first phase, 8 bottom pressure recorders were to be deployed. Tsunami and storm surge modellings were undertaken by INCOIS.

Considerable computer facilities were available at INCOIS, and there were plans to expand further. India was an active participant in the GOOS programme through Argo. INCOIS had a separate group dealing with ocean modelling and satellite oceanography. India was the founder chair of Indian Ocean GOOS (IOGOOS). The IOGOOS secretariat was maintained at INCOIS, with K. Srinivas as Secretary.

**Update on Argo:** John Gould then made a presentation on the achievements, status and prospects of Argo. Argo Steering group had just had their 7<sup>th</sup> meeting. It was a good opportunity to update POGO on the status of Argo, and it was also an opportunity for asking questions of the Argo Science Team. Argo was based on technology developed in WOCE during 1990-1998. Following WOCE, two documents were produced which were then used to develop the strategy outlined at OceanObs99, followed by lobbying at national levels. First Argo floats were deployed in 2000. Some 10 countries deployed 294 floats in 2001. Array was now 75% complete. Density of floats was global in major ice-free oceans, but there were still some gaps. Technology dictated how deep the floats could go. Floats drifted at 1000 m, but profiled from 2000 m to surface. The aim was to go as deep as possible. The goal was to provide data in real time (within 24 hours). About a third of data had been subjected to DMQC. Retaining calibration of sensors over the lifetime of the floats was a major challenge. Calibration therefore relied on ship-based reference data bases. Argo had become the dominant source of temperature and salinity data. Comparison with the distribution of XBT data clearly showed that Argo data were distributed more uniformly in space. As a comparison, he noted that CTD data for 1995 showed some 3,000 profiles, with seasonal and regional bias, limitations that did not affect Argo. Technology had improved over the lifetime of the Argo programme which had led to enhanced life expectancy of Argo. The customers were operational ocean scientists as well as the research community. Evaluating Argo required that we evaluate operational applications leading to societal benefits. For the research stream, one looked for quality research publications. Some examples were shown indicating improved performance of operational products when Argo data are incorporated. Research publications using Argo data had increased tremendously over the years. Argo linked to GEO benefit areas of climate, weather, water, health, energy and disasters. Links were through improved ability to monitor the subsurface oceans, improved ability to predict ocean state and hence climate, and better warning of rapid change if it occurred. Potential developments included study of cyclone generation, monitoring ocean carbon (using proven oxygen capability), acoustic wind and rainfall gauges, integration of Argo with other observing systems such as gliders and times series observations and Iridium communications. The challenges included demonstration of Argo's value by operational centres, working with GODAE. Argo funding was national, but supporting case was international. Infrastructure funding was critical.

Gould said that POGO, with IOC, could work to enlist the GEO mechanism to ensure support for those fundamental observing streams that were mature (e.g., altimeter, scatterometer, sea-level, XBT, ship-based observations, drifters, Argo). POGO could help to lobby for funding for Argo and its infrastructure, internationally by POGO, and nationally by POGO Directors. Another way to help the Argo programme was by ensuring quick release by PI's of ship-based CTD data for Argo calibration. POGO could help celebrate completion of the Argo array in early 2007. Argo was no longer a pilot programme; it had come of age, even though it was still incomplete.

After the presentation, Dean Roemmich presented a certificate to Ravichandran for his contributions to Argo. The first Indian member of Argo ST was Dr. K. Radhakrishnan. His special contributions were also recognised. Jan de Leeuw then expressed the gratitude of POGO for all the efforts by INCOIS to prepare the POGO meeting. Arrangements had been wonderful, and in acknowledgement of all the work, gifts from POGO were handed over to Dr. B. R. Subramanian.

This was followed by a question-and-answer session on Argo. Howard Roe raised the issue of a cost-benefit analysis. John Gould responded that it would take time to develop demonstrations since the array had got close to being complete only about a year ago. Time scale from that to evaluating models and then taking it to applications was such that the task could not be accomplished quickly. The AST asked for the system to be sustained for sufficiently long to make

it possible to deliver demonstrations. Moving too quickly held the danger of unrealistic evaluations. Dean Roemmich added that similar questions might have been raised about a year ago regarding tsunami warning systems. Argo was a climate warning system, which had already demonstrated the value for monitoring long-term changes.

Ed Hill asked for a clarification: If Argo was no longer a pilot project, then how was it labelled now? John Gould and Howard Freeland replied that the discussion of this was fairly new. The conclusion was arrived at during the last AST session that Argo was an integral part of GOOS, similar to the GLOSS system, since it was the dominant source of ocean climate data today. Jan de Leeuw asked about calibration, which was admittedly critical. The example that John Gould had used showed no research vessels in the Pacific in 1995. He wondered where the data were, and what the problems were to making the data available retrospectively. Sylvie Pouliquen replied that research vessels, if they provided data more rapidly, would be most helpful.

Jesse Ausubel asked what the range of bids would be, if a bid were solicited for Argo operation. He enquired if it would be possible to outsource the entire operation to places such as India. The Argo Science Team answered that the annual cost was about \$25 million. It was truly an international collaborative effort that had become a seamless unit. It would be difficult to hand it over to any single country. Passing it on to private enterprises might actually be a lot more expensive. Furthermore, deployment required regional expertise. Operations might reach significant simplification within the next 10 years.

Mike Meredith raised the issue of obtaining data from ice-covered regions. John Gould opined that data collection was not so much the issue as data transmission during the ice-covered periods. Solution was data storage and then transmission, but it was very expensive. Gliders might provide an alternate source of data under ice-covered areas. Sylvie Pouliquen added that another solution was to use tagged animals. There were already experiments to merge the data from the two types of data.

John Gould remarked that Argo delivered data to scientists. Argo was a wonderful opportunity to tell the public about the excitement of oceans. Interesting displays could be developed around Argo, for use in museums and aquaria. Kim Marshall agreed that there was a lot of interest in Argo floats. But the novelty of the array was waning. We now needed stories that show how Argo provided information that was of practical use to the general public.

Ed Harrison asked a question about what was meant by "operational". Roemmich responded that "operational" system did not mean that the system was frozen in time. It would evolve with time, with technological improvement and in response to user needs.

Discussions followed on the need for CTD data to calibrate the Argo floats. Some clarity was required as to what was the quality of data required; what was the acceptable time delay; and on restrictions on the use of the data, to protect the interests of the data collector.

Howard Freeland expressed the need to have information on future cruises for planning deployment of Argo floats. It would be enormously useful if POGO could develop such a data base. Jan de Leeuw reported briefly on the discussions at the POGO meeting in the morning regarding the development of a data base and website to provide cruise information. John Gould added that research vessels should be regarded as part of ocean observing system, and not just as a research tool.

The discussions were followed by a reception, and a guided tour of INCOIS. The participants then returned to Hotel Fortune Katriya, where INCOIS had arranged for cultural entertainment for POGO and AST participants, followed by dinner hosted by INCOIS. During dinner Dr. Nick Owens gave a thought-provoking talk on the Acidification of the Oceans and the potential implications for marine biota.

**19 Jan, Thursday, Morning**

**Directors' Forum: Chair: Howard Roe**



A good part of the morning was devoted to a discussion among the member directors of POGO on matters that they considered most important, from their institutional perspectives. These minutes are not an exhaustive list of the issues raised by the directors, rather a collection of some of the issues that emerged, to give a flavour of the forum. Howard Roe chaired the session. He began the session with expressions of warm thanks for the wonderful cultural performance and the dinner hosted by INCOIS on the previous night. He also thanked Nick Owens on the wonderful talk on ocean acidification that he gave at the dinner. He again reminded POGO members to think about what actions the members wished to carry forward.

Charlie Kennel spoke next. He noted that the formation of a system of systems for Earth Observations was a profound event in recent years. In this context, UCSD had been successful in setting up a new Centre for Earth Observations and Applications, of which John Orcutt was the Director. At the opening symposium of the Centre, the main topic was the role of research in Earth Observations. In the oceans, much of the ocean observation responsibility lay with the research community. Other conferences on this topic were needed. Alliance for Earth Observations (an industry group) was also planning to meet in La Jolla in the near future to discuss the role of industry in GEOSS. In this context, Ocean United was a major breakthrough. POGO had been very successful in coordinating various view points on ocean observations. He suggested that POGO should take the lead in promoting this common voice for oceans.

Another important issue was the promotion of biological observations. A new centre was being developed at UCSD for environmental genomics. POGO recognised that biology was lagging behind physical observations, and took the lead in promoting biological observations. A related issue was information management. Development of mutually acceptable data formats for marine ecosystems, including the marine microbial ecosystem, and addressing important issues such as ocean acidification were also on his mind.

The third point he raised was that it was important for POGO to maintain its commitment and advocacy for improving ocean observations and capacity building in the Southern Hemisphere. Filling observational gaps in the south and building capacity in the South are essential for the success of the whole GEOSS enterprise.

Jan de Leeuw was invited to present his thoughts next. He raised the following issues as priority from the Royal NIOZ perspective:

1. Sharing of ships and large sea-going instruments. This could lead to significant reduction in transit time of ships, which becomes particularly important in the context of the high cost of oil and the high cost of ship operations. Sharing of facilities also promoted on-deck exchange of technical expertise and knowledge and stimulated new ideas and collaboration. A very good example already existed in the consortium formed by UK, France, Germany, Spain and Netherlands for sharing ship facilities.
2. The possibility to monitor the open oceans continuously and in a sustained fashion by cabled networks was a new opportunity that merited the attention of POGO.
3. Sustained capacity building in South Africa and Mozambique was important from the NIOZ perspective, since NIOZ had long-term research focus on the Indian Ocean. It was planned that *RV Pelagia* would go around Africa in 2008 and 2009. The plan was to establish more sustained collaboration with S. Africa and Mozambique.
4. Data and sample sharing was another area that merited attention. Institutes should promote sharing of ship data as well as taking of samples for each other, in particular for biological observations: e.g., through SAHFOS (CPR programme) and CoML programmes.
5. To develop high-quality new instruments at relatively low cost, institutes could share the burden of developing new instruments.

Nick Owens commented that he was pretty confident that SAHFOS would be delighted to put instruments on other ships provided there were additional funds for the initiative, since it was not a zero-cost activity. Carina Lange clarified that costs were associated with processing of the

samples. John Field added that the use of commercial vessels generated good time series of samples.

Kiyoshi Suyehiro began his presentation with a figure of an elephant, evoking the parable of the elephant and the blind men. POGO was trying to remedy that type of situation. He raised three issues, more related to POGO than apparent at first.

1. Cross-cultural synergy aided by information technology (interdisciplinary, international, inter-institutional) was really very important.
2. Effective, stable and quality operation: JAMSTEC was not a routine-observations institution, but they did have long time series observations. Starting in the current year, JAMSTEC was planning to operate the new drilling platform under the international drilling project. Budget was not increasing, even though major new projects (e.g. seismological observations South of Japan) were being initiated.
3. Inspiring innovation of the future
  - a. Sharing the vision
  - b. Encouraging young minds
  - c. Discovering hidden gems

Charlie Kennel supported these ideas, adding that POGO should promote the involvement of IT in ocean observations.

Mike Meredith then presented a couple of current ocean issues at British Antarctic Survey.

1. Ocean science and the IPY
  - a. Trying to build integration of a southern-ocean-scale view, linking climate, physics, biogeochemistry, ecosystems, etc. (International Climate Change and Ecosystem Dynamics Project)
  - b. How much of this can be delivered through IPY with international collaboration?
  - c. How do we sustain it afterwards?

These issues were of importance to BAS. He added that POGO's help to promote observations in Southern Ocean under ice would be very welcome.

He also spoke of the importance of remote measurements and time series observations. There were very few monitoring activities in the Southern Ocean (RaTS, tide gauges, Argo, etc., were a few examples). There was marked paucity of sustained time series observations. He raised a number of related questions: How best to use remote telemetry to ships? How do we coordinate our activities internationally? How to establish a Southern Ocean observatory system? How to progress SEaOS? Tagging of marine mammals was yielding a lot of useful data under ice. The data were not of the same high quality as Argo, but were available in real time, and invaluable for operational oceanography. Long-term funding was a real issue. There was a need for international, circumpolar effort to develop Southern Ocean Monitoring systems and sites. Argo was a help in filling observational gaps, but more was needed.

Kiyoshi Suyehiro enquired about geophysical observations in the Southern Ocean. Mike Meredith replied that BAS had done seabed mapping and other geological work, but it had been scaled down. Kiyoshi Suyehiro added that if one had observatories in the ocean looking up, then one should do the same with systems looking down. Mike Meredith responded that there was a proposal for such work, but funding was a problem, but one could revisit the issue.

Howard Roe commented that the central problem was sustaining long-term observations with short-term funding mechanisms. This was a universal problem.

Carina Lange was the next speaker. She reported that availability of ship was a prime problem for Chile: only one ship was available at present, belonging to the Navy. Attempts to get Maurice Ewing had failed. Opportunity from Bermuda to obtain a second-hand ship was being pursued. An idea being pursued was that a UNOLS (University-National Oceanographic Laboratories System) ship could act as international platform for studies in the Eastern South Pacific.

Discussions with UNOLS were in the preliminary stage. POGO members could help advance the discussion.

She then added that POGO Fellowships were very useful, since it helped increase trained technicians and scientists in laboratories worldwide. She said they had a wish list for support for graduate students (e.g. IAI) for the entire period of graduate studies (4 years).

The presentation for the Shirshov Institute was made by Sergey Shapovalov. The talk had been planned to be given by the late Academician Sergey Lappo. First issue was tsunami-related activities. One of the important seismic gaps in the world ocean was close to the Russian coast. Model results of a tsunami from an earthquake at the gap were shown. In September the previous year, two institutions of Russia implemented an expedition to this region, which recommended establishing observations there as part of the early warning system in the Pacific.

In an earlier POGO meeting, Academician Lappo had talked about the MERIDIAN project and invited POGO members to support the MERIDIAN project and to participate in it. The project was expected to continue till 2010. A wide range of measurements including carbon measurements were being made on MERIDIAN cruises. There was a plan to put information on MERIDIAN cruises on the website. CLIVAR website also provided information on the cruises.

Nick Owens remarked that MERIDIAN cruises were very similar to AMT cruises. He added that something had to be done to build bridges between AMT and MERIDIAN.

Tony Haymet then presented a perspective from Australia. He noted that the POGO Secretariat worked a lot on GEO issues. This was a good thing: words through POGO had made it to GEO documents, whereas similar efforts through Australian government had not been as successful. He said that ocean acidity was a serious issue, which was aggravated by lack of data in the Southern Ocean and the Indian Ocean. Another issue was the war on fish: Incredible technologies were being developed to find fish, and to follow them with tags. Illegal fishing was a serious problem. He also identified that vessel operating costs associated with rising fuel costs was a serious problem. Oil prices were not likely to go down. There was a need for more efficient use of research vessels.

Recently, cool, fresh, deep waters in the Southern Ocean were observed. The absolute change was small, but it was a very significant change in relative terms. Was it climate change, or was it decadal change? More observations were essential to address such question. There was frustration in not being able to follow up on such exciting discoveries.

Charlie Kennel commented that four coral island systems in the Pacific were studied by a Scripps team, which found unusual trophic structures. Taking the large predators out of the system profoundly altered the entire ecosystem. John Field added that a component of GLOBEC looked at the problem of removal of large predators and its impact on the ecosystem, and also on the links between the environment and the biota. Mike Meredith concurred that repeat visits were important; it was also important to have moored instrumentation.

Stan Wilson then spoke, focusing on the issue of continuity of fundamental ocean satellite observations with timely access and no restrictions on use. Transition from research to operations was a related, important issue. NASA support for altimetry was not expected to continue beyond 2008. A partnership had to be established to maintain continuity of operations. There were issues related to quality and continuity of scatterometer data. Similar problems existed for ocean colour. He invited POGO to take a broad look at satellite issues. Overall message for POGO was that satellite observations impacted all institutional activities. There was a need to be creative in how we moved towards sustained funding.

Nick Hardman-Mountford added that SST continuity had also emerged as a problem at a recent GCOS-Oceans meeting. Ed Harrison commented that a common theme was the need to make highest quality observations and to do it for a long time. Even 10 or 20 years of data might not be enough to make robust conclusions. POGO could influence establishment of long-term sustained, high-quality observations.

Lesley Staegeman stated in her presentation that she was representing South African, Namibian and Angolan members of POGO. She gave the background of a common programme, the Benguela Current Large Marine Ecosystem (BCLME) programme, shared by the three countries. BCLME Programme goal was integrated management and sustainable development of marine ecosystem. It was funded to the tune of \$15 Million over 5 years, and the implementing agency was UNDP. The area of interest was the Benguela upwelling system. The area suffered from huge mortality of fish stocks due to hypoxia. There were four different offices for the project (in Namibia, S. Africa, Angola and Rwanda). Focus of activities included productivity and fisheries. It was planned to extend the PIRATA network eastward. An array of five tide gauges was being installed, and would be extended over time. South Africa Data Centre for Oceanography existed for addressing data management issues. They were looking for partnerships to improve the activities being undertaken as part of the BCLME programme.

Dunxin Hu, in his presentation, made the suggestion that the relationship of POGO with ESSP (Earth Science System Partnership) be promoted. He recommended that a regular study of the connection between the western Pacific and the eastern Indian Ocean be undertaken. It was a most important choke point in global circulation, and there were big gaps in the observations. In China, discussions were on-going on the initiation of a national programme covering East Indian Ocean and West Pacific. Long cruises were planned under this programme to the study area.

Stan Wilson remarked that it was unfortunate that there was no one there from Indonesia. Tsunami tragedy had led to a change in attitude with regard to real-time access to data from tide gauges. USA and Germany were working to establish a network of tide gauges around Indonesia and Philippines. This would give some baseline data for studying Indian Ocean through flow. It would be good to have Indonesia involved in POGO.

Ed Hill began his presentation by noting that the main issues in his mind were related to the organisation of marine science in the UK. The underlying rationale was to rise to the scientific challenge of the day. NOCS was a partnership between NERC and University of Southampton. The paper by Harry Bryden published recently reported on observed change in the meridional overturning circulation in the Atlantic: a 30% reduction in the cool return flow over a 50-year period was reported. The punch line of the paper was that it was still unclear whether it was change or decadal scale oscillation. More observations were needed to address the uncertainty. Regarding infrastructure, a new state-of-the-art research vessel, *James Cook*, was being built in Gdansk. It was going to be more expensive to run than the current vessel. Process had also begun to replace *Discovery*. Running costs would be a major issue in the design of the new ship. He spoke of "Oceans 25", in which 7 institutions in the UK came together to plan ocean science and observational strategy for the next 2 decades. The plan had ten strategic science themes. He invited comments from POGO members on Oceans 25.

During the discussions that followed, Jan de Leeuw commented that long-term observations were an important part of the Oceans 25 strategy; yet funding was in 5-year cycles. Ed Hill responded that funding would continue in principle, but it was only confirmed in 5 year intervals. A government interagency committee was involved in the next funding round, and there was discussion on the possibility of putting certain long-term observations on a different cycle than the 5-year cycle.

Suk Moon Sik then spoke on behalf of KORDI. He noted that GEO/GEOSS target was near real-time data exchange in a global sense; POGO was also concerned with global-scale issues. Argo was launched in 2001; 75% of target was achieved now. Argo had demonstrated successfully what GEO/GEOSS wished to accomplish, which was near real-time data exchange in a global sense. He believed that POGO recognised that the Argo programme should turn in its next phase into a sustained system. POGO support was essential for renewing national Argo programmes. He recommended that POGO write letters of support to each of the nations involved in Argo, for continued support of the Argo programme.

Nick Owens said his presentation was about issues that kept him awake at night: Oceans 2025 was essential for the continued health and survival of the institutes. Among issues relevant to POGO were the AMT programme and the coastal observatories. In Plymouth there was the Plymouth Marine Sciences Partnership – MBA, SAHFOS (CPR), University of Plymouth, and the

National Marine Aquarium (POGO at a smaller scale). SAHFOS existed to do long-term CPR observations. In 1989, CPR support was stopped. All the people involved were made redundant: SAHFOS rose phoenix-like from the chaos. The new and exciting results that were now coming out of CPR data were the result of some 60 years of observations. The aquarium provided excellent outreach to the public. Talking about exploitation and commercialisation of scientific results, Nick Owens mentioned that excellent results from PML had led to the creation of 2 spin-out companies, but it was hard work. An alternate approach to long-term support might be commercialisation. PML was also host to CASIX: a centre of excellence for ocean observations in climate-related variables (mainly CO<sub>2</sub>). CASIX provided a good demonstration of what we could do: it was a virtual centre with many partners, with focus on air-sea fluxes and climate. To reduce uncertainty in our understanding, observations were completely integrated with models. An issue was the paucity of *in situ* observations, but that was changing. pCO<sub>2</sub> systems are being run in underway mode on ships, with 5 new systems for UK research vessels coming on board this year. Traditionally they required a lot of maintenance. The latest version, however, developed in partnership with an engineering company, was much easier to maintain. Comments from POGO members on the approach that was being taken with respect to Oceans 2025 would be helpful.

Satish Shetye then spoke, referring first to POGO's role in teaching ocean sciences. Last year, NIO hosted the NF-POGO professorship in one of the regional centers in Kochi. Trevor Platt, the Visiting Professor, conducted a three-month course on primary production, ecosystems and remote sensing. Trevor Platt did a great service by conducting the three months of training in NIO-Kochi, which was very much appreciated. A couple of dozen young researchers were trained on the use of remote sensing, ecosystem analysis etc. It was a very positive step, very essential for NIO and India. Sustained global observations were not going to be sustained unless there was expertise globally to exploit those observations. India did not have a school of marine science that was at par with others elsewhere. He saw a need to bring in world experts to maintain a programme in marine science education in India. Such partnerships were at the backbone of other successful schools in India for higher education.

The Indian Ocean Biological Sorting Centre was established over 40 years ago. The centre was repository for biological samples, starting with the International Indian Ocean Expedition. Some 1600 of these samples were still in the regional centre at Kochi. They were in reasonably good condition. An issue was: what was the best thing to do with them? Information technology could be the solution. Should samples be photographed and displayed on the web? Should there be a repeat programme now to see what changes had taken place? These were some of the questions on his mind. If no action were taken immediately, the samples might deteriorate, decreasing their value.

Carina Lange remarked that there were many old samples at Scripps Institute also. Long time series data were studied there to evaluate environmental changes over time. Jesse Ausubel reminded participants that on the previous day, he had talked about the "barcode of life" initiative: a global catalogue of barcode of life was envisaged. POGO members should contribute to this initiative. Biodiversity Heritage Alliance was involved in this programme.

Andrew Wilmott raised two issues: POL housed the permanent service for sea level data (contribution to GLOSS). It was the repository of global sea level data (along with the University of Hawaii). The data showed enormous variability in sea level change. Unravelling causes of these changes was a huge challenge facing the scientific community. POL maintained tide gauges in the Southern Hemisphere and provided training to maintain them.

The Arctic was an area of most dramatic climate change signal. In partnership with other countries, including Canada, POL would like to see more data to help improve our understanding of water masses and circulation in the Arctic.

Maso Fukasawa in his presentation drew attention to the São Paulo Declaration which emerged from POGO-2. Following this declaration, JAMSTEC organised the BEAGLE 2003 expedition with help from many POGO member institutes. Some 17 POGO trainees plus an additional 12 young scientists from Southern hemisphere countries participated in the cruise. BEAGLE 2003

data were released in 2005. Results suggested a decrease of 10% in the Antarctic overturning system. The data on CD's were distributed to all participants.

Chris Gordon noted that a major issue from his perspective was the use of observations to validate models quantitatively. This was rather difficult to do in practice. No recent progress was reported in reducing uncertainties in ocean models, largely because of lack of high-quality, long-term, sustained observations. This provided additional argument for ocean observations and for continuation of the Argo programme. Data were also needed to initialise models: decadal variability and issues related to it were just as important as issues related to climate change. The two had somewhat different requirements.

Silvio Pantoja mentioned the need to educate the public to gain support for ocean observations. General public were not aware of these issues related to oceans. POGO web had some very useful material that was helpful in this context.

Howard Roe then summarised the session by recalling what POGO could do. These included:

- Advocacy in GEO;
- Development of new technology and innovation;
- Reduce costs of infrastructure and operations through sharing of facilities and operations;
- Address difficulty with sustaining long-term observations;
- Continue contributions to capacity building;
- Enhance observations, especially in the Southern Hemisphere, Indonesian region and the Arctic;
- Share data and make it more commonly available;
- Address sustainability of satellite observations;
- Support continuity of Argo (e.g., through letters to participating nations as appropriate);
- and
- Communicate to the world at large the importance of ocean observations.

He asked members to think about, and write down proposed actions for POGO.

The Director's forum was closed at this point, and was followed by a presentation on sharing of data from research vessels.

**Data from Research Vessels for Operational Use:** Yves Desaubies had prepared the report and the presentation, but could not unfortunately be present at the meeting. So the presentation was made by Sylvie Pouliquen. She pointed out that the proposed action was worthwhile, easy and cost-effective: Most research vessels were equipped with thermosalinographs, XBT launchers, and some vessels with VM-ADCP and pCO<sub>2</sub> sensors. Research vessels also had skilled technical staff on board. Physical measurements were often made on non-physical oceanographic cruises. XBT data from fisheries cruises, for example, were often lost. At Ifremer, they were collecting data from fisheries cruises.

Turning to the international context, she noted that several converging international initiatives existed: SAMOS (Shipboard automated Meteorological and Oceanographic Systems); GOSUD (Global Ocean Surface Underway Data); WMO: SOOP (mostly merchant vessels); VOS (mostly meteorology); and GTSP (Global Temperature Salinity Profile Project). Furthermore, effective data centres for processing were also in existence (e.g. Coriolis, FSU, MEDS, etc.). In this context, it was important that research vessels improve the reporting of data. Some 150 research vessels were listed in inventories, but many of them were not reporting data. Research vessels provided complimentary data to data from merchant ships that reported data from repeat sampling lines. Infrastructure was in place to make it easy to report data from research vessels, though real-time reporting involved a small added cost for transmission. It was necessary to advocate an open data policy to serve the operational community. Examples from French and European efforts in operational oceanography were presented. She noted that political decisions were sometimes essential to ensure data transmission.

She noted that POGO institutions either operated research vessels or were in direct contact with ship operators. Therefore POGO could take appropriate action to increase collection and timely reporting of surface data of the highest quality.

After the presentation, Dean Roemmich clarified that the needs for data were different for different applications: the need from the operational applications side was for real-time data, but the quality requirement was not high. The data for Argo calibration had to be of high-quality, but delayed mode would be acceptable. Jesse Ausubel commented that it was important to make a beginning, to set a precedent in sharing data. Jan de Leeuw picked up on discussions from previous day and asked for clarification on what were the boundaries of data quality. In response, John Gould offered to prepare a briefing note from Argo to POGO on what was needed, what were the safeguards, and what were the benefits. Chris Gordon noted that climate-quality reanalysis was envisaged for atmospheric data. High quality of data was important.

### **19 Jan, Thursday, Afternoon:**

#### **POGO Activities in Capacity Building / Southern Hemisphere: Chair: Kiyoshi Suyehiro**

The afternoon of 19 January was devoted to capacity building activities and observations from the Southern Hemisphere.

**Antares; related GOOS and GEO Initiatives:** The session began with a presentation by Vivian Lutz on Antares. The initiative began at an IOCCG-sponsored training programme (co-sponsored by POGO). This was followed by a workshop to discuss joint action. The main outcome of the first workshop was the establishment of a collaborative network to study bio-optics around South America. The goal of the network was to study long-term variability, and the approach adopted was to build on existing initiatives in different countries in the Americas, both in the remote sensing area and for *in situ* observations.

The main societal benefits envisaged were: filling gaps in information in the Southern Hemisphere; integrating continental-scale satellite images with the knowledge gained from *in situ* time series studies; and developing the science required for coastal ecosystem management. It had the direct benefit of promoting long-term cooperation among South American countries, and improving north-south dialogue. The main Antares centres were in Venezuela, Chile, Antarctica and Brazil. Antares was linked to IOCCG and POGO. New links were also forged with GOOS and GEO, through POGO. The Antares had put together a project called "CESAR", which was sponsored by IAI. The South Florida model was adopted for the entire network. The website <http://ww.antares.ws> was multilingual: English, Spanish and Portuguese. The website provided satellite data as images and as digital information. Antares website was being visited by different countries. It was being used by scientists outside of Antares as well as by school children for a science project. She also gave an overview of the *in situ* time series stations that were part of the Antares Network. She then outlined some of the future activities planned for Antares, which included strengthening *in situ* time series stations; standardisation of a core set of measurements to create a common database; integration of remote-sensing data with field data to show comparison at the different stations; inclusion of new time series stations to gain understanding of the system on a continental-scale. The second Antares workshop was held in Margarita Island (Venezuela) in January 2005, sponsored by POGO.

During discussions, Trevor Platt commented that there was an undeniable need for capacity building in this field. Furthermore, all around the world there existed capacity in expertise, but there was a lack of resources to operate. A modest investment of funds would make a big difference with regard to under-utilisation of existing capacity. John Field remarked that links to Large Marine Ecosystems might help obtain resources.

**On-board training during AMT cruises:** Nick Owens brought to the attention of POGO members a specific proposal to help train oceanographers from developing countries. The proposal built on the successful BEAGLE training programme. AMT (the Atlantic Meridional Transect) programme, was begun in 1995. It utilised the passage of the British vessel *James Ross* to the Antarctic. The AMT programme provided an excellent training opportunity because it occupied a north-south transect repeatedly, and it would constitute a significant enhancement of

southern hemisphere observation and capability. SCOR had agreed to come in as a 50% partner on the training programme.

**POGO-IOC-SCOR Fellowship Programme:** Shubha Sathyendranath reported on the fellowship programme. It had been a consistently successful programme. Details of the activities in 2005 were provided in the written report to participants. Funding issues were anticipated in the implementation of the programme in 2006, since IOC had withdrawn its support for the programme. Instead, IOC, through Ehrlich Desa, had suggested that POGO work with IOC to launch a new capacity building programme, aimed at the heads of institutions rather than at the working scientist.

The proposal from IOC was tabled by Howard Roe. He mentioned that IOC would like to foster interactions between directors rather than between working scientists through the new proposal. He then summarised the details of the proposal provided in the written document in the handout. Many of the directors present pointed out some of the difficulties with the proposal, which included the practical difficulties associated with a director shadowing another director for extended periods of time, and also concerns regarding the transferability of experience gained in one system to another system. Neither the members from developing countries nor those from developed countries thought the programme was viable or beneficial.

**University of Concepción Activities:** Silvio Pantoja then spoke about initiatives for capacity building run by UdeC. The Austral Summer Institute was funded by the Andes Foundation, and the International Graduate Course Series in Oceanography was funded by IOC/UNESCO. They had trained over 180 students over the last five years. In 2006, they were organising courses in microbial oceanography, on coastal sediments and on physical processes. The participants were 66% Chilean and 34% non-Chilean. Supplementary funding was provided by POGO and others. POGO funds were used uniquely to bring in students from outside Chile to the programme, which would not be possible with the other sources of funding. To evaluate impact through survey and follow up was difficult. In a survey that was conducted, 50% of the trainees responded that the contribution of the UdeC training to getting a better education was good; the remaining 50% thought it was outstanding. University of Concepción had obtained a 3-year grant for consolidating advanced research and higher education in ocean sciences at the University. The WHOI-UdeC agreement supported ASI, student exchange, faculty exchange, participation in joint oceanographic cruises as well as instrumentation. Another initiative was the Latin American – European Project for training and capacity building.

**Ocean observations in the eastern South Pacific:** Carina Lange followed with a presentation on ocean observations in the eastern Pacific that are carried out by the Center for Oceanographic Research in the eastern South Pacific (COPAS). Efforts of interest to POGO included programmes on drifters, Argo floats, moorings and time-series observations. Moorings had current meters, and some also had sediment traps. She highlighted some of the important results from the current meter moorings. Time series observations were along a transect off Chile. They had initiated joint projects with JAMSTEC (Masao Fukasawa) as a result of the *Mirai* BEAGLE expedition. COPAS also benefited from the POGO Fellowship programme which allowed one of their trainees to visit JAMSTEC for analyses of samples. University of Concepción was planning to host a workshop on oxygen minimum systems in the ocean: distribution, diversity and dynamics of such systems would be covered. The workshop was to be held on October 24-26, 2006. During the SCOR general meeting, there would also be a workshop on capacity building. A new center for research in Patagonian ecosystems was created in 2005 to study climate change impact on southern Chilean Patagonia. An integrated terrestrial and aquatic approach was proposed. Related information was also provided in COPAS newsletters.

**Bio-optical Results from BEAGLE Expedition:** Trevor Platt was the final speaker in the session, and he presented the first bio-optical results from the BEAGLE expedition. There was a small add-on bio-optical programme to the BEAGLE expedition, organised in response to a proposal that was submitted to JAMSTEC by Shubha Sathyendranath and Trevor Platt. The programme was executed by one bio-optical specialist per leg, aided by trainees on board. There were many participants in the programme, and he was speaking as their ambassador. In addition to the Canadian investigators, the programme had co-investigators from Chile, Argentina, South Africa, Australia, UK and USA. The expedition took place in a region that was highly undersampled from



a biological perspective. The sampling was mostly confined to the surface, with measurements of phytoplankton absorption, pigment composition using HPLC (High Performance Liquid Chromatography) technique, flow cytometric analysis for cell size and community structure, photosynthesis – irradiance parameters and genetic analysis of ecotypes of *Prochlorococcus*, the smallest member of the phytoplankton community. The results showed basin-scale structure in phytoplankton community structure in the Indian, Pacific and Atlantic basins in the Southern Hemisphere. It had been previously known that the distribution of *Prochlorococcus* ecotypes in the vertical dimension was influenced by the light regime experienced by the phytoplankton. A novel result from the BEAGLE expedition was that it had been possible to demonstrate that the same processes of mixing and light adaptation determined the horizontal distribution of *Prochlorococcus* ecotypes at basin scales. The incremental cost for adding the bio-optical programme to the BEAGLE expedition had been modest; but it had made a huge impact on filling a bio-optical observational gap in the Southern Hemisphere. JAMSTEC had set an example to show that a biological observational element could easily be added to a WOCE type observational programme. Openness of JAMTEC to incorporate a capacity building programme had proven to be very effective. Japan had set an outstanding example for the rest of the world to follow.

### **Nippon Foundation Project: Chair: J.H Xiang**

The session after coffee was devoted to the Nippon Foundation – POGO Visiting Professorship Programme.

Shubha Sathyendranath began the session with a short introduction. This was a very important programme in capacity building in partnership with the Nippon Foundation. It allowed for two eminent scientists to visit oceanographic labs in developing countries for periods of 3 to 6 months for education and training, as well as initiating small research programmes. The main players from Year 1 and Year 2 of the programme were invited to POGO-7, to promote a network of people involved, to increase their interactions with POGO, and to provide an opportunity for them to learn from each other's experience. The activities of Year 1 of the programme had been very well received by the Nippon Foundation. Year 2 activities were about to begin. With respect to Year 3, she mentioned that a proposal had been already submitted to the Nippon Foundation. Details were provided in the background material included in the handout.

Satish Shetye followed with a few comments, providing a perspective from NIO-Kochi, which was one of the host Institutions in 2005. He noted that NIO had hosted the first Visiting professorship. Some two dozen fellows were trained, 3 from outside India, about 10 from NIO and the others from other Indian institutions. As follow up, two national level proposals had been prepared, and were likely to be funded. The initial proposal was for three years. A follow-up meeting of trainees was also organised, and was scheduled to take place soon after the POGO-7 meeting.

Trevor Platt, the Nippon Foundation – POGO Visiting Professor to Kochi, then spoke about his experience and impressions. He was overwhelmingly convinced that there was a need for such training. These days, the people in the young age group were skilled at finding information on the web, but it was clear that the personal interactions were also important, and transcended the technical information. Additional interaction was needed on preparation of proposals, writing of manuscripts, and dealing with peer reviews, as well as for overcoming inhibitions about the use of mathematics. Along with the training, if there was a research component, then it opened the door for addressing the kind of issues mentioned earlier. Having someone to help, who knew the local system, culture and language was very beneficial. Shubha Sathyendranath provided such support. It helped to enlist the participation of local experts. It was important to establish a close working relationship with the local director. The visiting professor had to be prepared for dealing with all types of questions from the students.

Nick Owens quoted TS Eliot "What knowledge we lose through information!" He commented that the duration of the course was long, which limited the number of people who could take up the professorship.

Motoyasu Miyata, who was also a Visiting Professor to University of South Pacific from Tokyo then thanked POGO for the chance to share his experience with POGO. What he did during the

training was explained in detail in the POGO background documents. In addition, he distributed an additional document with supplementary information. The University of South Pacific had about 16,000 students in 2004. It served 12 countries, which were island countries spread over the South Pacific. The basic statistics showed how important the oceans were for those small island countries: the sea areas within their jurisdiction were on average over 200 times larger than their land areas. In his case, he had taught students who were already at the university, but in intensive courses.

He narrated an interesting personal experience. He was supervising a graduate student on beach erosion. He proposed a visit to the beach to make the measurements. She explained that there were many villages along the way, and these were considered as independent villages over which the national govt had only limited rights. Each village had its own chief, and so it was not possible to make measurements in villages without permission from the chief. He had to participate in some ritual ceremonies to obtain permission to make observations.

The University of South Pacific was the only place in the South Pacific islands where ocean research was carried out. He found that this marine science department did not have a single current meter. It was possible to buy two current meters through the NF-POGO programme. Some experiments were carried out with those instruments. Overall the programme was extremely helpful. It was undoubtedly a great success. After he came back, he had been communicating with his student, and he had the feeling that something was missing. It was important to continue with a follow-up programme, to be sure that the programme had been successful in the long term. He recommended that the visiting professor should have the opportunity to return to the host institution periodically. Criteria for evaluation of success included high quality of teaching; it was meant to be a sustained exercise over a long period that created a close link between host institute and the visiting professor. One of the criteria would be successful follow up activities, such as new projects.

Kanapathipilli Arulanandan from NARA, which was a host institution in 2006, spoke next. The National Aquatic Resources Research and Development Agency (NARA) was responsible for both marine and freshwater research for living and non-living resources. The EEZ of Sri Lanka was about 8 times larger than its land area: it would soon become 23 times larger. A third of the population depended on the sea for their livelihood. The mandate of NARA included carrying out and coordinating research, development and management activities. It had nine different divisions including oceanography, marine biological resources division, inland aquatic resources division, hydrographic office, and environmental studies. NARA was a focal point of the Intergovernmental Oceanographic Commission, and was involved in many of its activities.

Main oceanographic activities were divided into coastal oceanography, offshore oceanography and data management. NARA was now gearing up to enhance open-ocean work. In December 2004, NARA was badly inundated, resulting in loss of equipment and facilities costing about US \$ 3 million, because of the tsunami. It took them some three months to recover from the damage. They had just established a new permanent sea-level station, in addition to the one that had been operational when the tsunami hit. Rehabilitation of sensitive habitats had begun. The constraints for embarking on offshore oceanographic research were inadequate human resources, inadequate financial resources and lack of ocean-going fisheries and oceanographic research vessels. To address the first problem they had applied for the Visiting Professorship, and were grateful to be awarded the professorship. They had received funding from Germany to start rebuilding NARA, and the government of Sri Lanka to repair the research vessel. Future planned programmes included fisheries resources assessment, forecasting of potential fishing zone, and monitoring of the marine environment. POGO assistance was sought for making available experts for calibration and minor repairs of oceanographic instruments (Autosal, CTD, ADCP, etc.). He also pointed out that sustained, long-term training was needed to maintain human resources.

Stan Wilson thanked NARA personally for providing real-time access to tide gauge data for international scientists, and for help with the Argo programme.

Milton Kampel from INPE (Brazil) spoke then about their plans for NF-POGO Visiting Professorship. They were hosts for a visiting professorship in 2006. He thanked POGO for the

opportunity. His new director was unable to attend. As a potential new member of POGO, he provided some background on their new institute. It was a new institute, created in 1971. During the eighties, INPE started developing priority programmes such as the complete Brazilian Space Mission, China-Brazil Earth Resources Satellite and the Amazonia Research programme. They did not have an ocean-colour satellite yet. This year, they were hosts to a Visiting Professorship, with Dr. Robert Frouin as the main professor. The subject was interpretation and analysis of ocean-colour data. The proposed programme was closely related to the Antares network, and it was designed to benefit all members of Antares, not just Brazilian scientists.

Robert Frouin from Scripps Institution then spoke of his plans for training in INPE and South America under the Visiting Professorship. He provided some background information on satellite ocean-colour data: current programmes to evaluate ocean-colour data and algorithms were limited. The ongoing collaborative evaluation programme between the Scripps Institute and the University of Lille (France) was based on ships of opportunity and instruments known as SIMBAD and SIMBADA radiometers. They provided information on the basic ocean-colour variables, namely aerosol optical thickness and marine reflectance, in typical spectral bands of satellite ocean-colour sensors. He was interested in extending such studies to South America. Argentina and Brazil had launched or were planning to launch sensors with ocean-colour capabilities. There was a convergence of needs and interests. This convergence guaranteed long-term interactions between institutions of host and visiting professor.

Charita Pattiaratchi from the University of Western Australia was the final speaker in the session, and he outlined his plans as the Visiting Professor to NARA. A population equivalent to that of Australia lived in Sri Lanka, which was the size of Tasmania. It had no formal academic programme in oceanography. Subsequent to the tsunami, two universities were planning undergraduate courses based on guest lecturers. When the training opportunity provided by the Visiting Professorship was advertised, a total of 35 applications were received. Accepted applicants included oceanographers from Tanzania, Mauritius, Yemen, Pakistan, Bangladesh and India, in addition to those from Sri Lanka. Applicants from some nine Sri Lankan organisations other than NARA were also among the selected trainees.

The course was planned in two parts. Special 1-day workshop was planned for 30 January with 50-60 participants on long waves. NF-POGO had also funded a graphical interface to analyse tidal data. Planned group projects included analysis of Argo data; surface drifter data analysis; analysis of water mass characteristics around Sri Lanka; sea level variability, and analysis of meteorological data.

The chairman summed up the session by remarking on the importance of the NF-POGO Visiting Professorship, on the excellent quality of all the presentations, and thanked the speakers for their participation.

Before close of day, Jesse Ausubel showed a 5 minute movie on the oceans.

## **20 Jan, Friday**

### **GEO: Towards implementation: Chair: Charlie Kennel**

The first session on the last day of POGO-7 was devoted to GEO, and coordination of GEO-related activities in international organisations with an ocean mandate.

**GEO from GOOS perspective:** John Field began his presentation with an acknowledgement of the great efforts by POGO to raise the profile of oceans within GEO. Without the POGO efforts, oceans would be mostly absent in GEOSS and in the GEO process.

Updating the participants on GOOS activities, he said that the open-ocean GOOS was in good hands under the leadership of Ed Harrison (OOPC/GCOS). GODAE pilot project on data assimilation was well underway. Coastal GOOS was new, and was in the process of incorporating non-physical observations.

Mapping of GOOS on to GEO societal benefit areas was not straightforward. Communities of Practice being promoted by the User Interface Committee of GEO were to include one on coastal observations. Coastal GOOS was planning to discuss the proposal for a coastal community of practice and POGO could help with this. GOOS was planning to initiate a chlorophyll pilot study under the leadership of Trevor Platt, and the first planning meeting for the pilot study was scheduled to take place immediately after the POGO-7 meeting, with supplementary funding and organisational support from POGO. He mentioned that there was the potential to fund GOOS activities in developing countries through GEF (Global Environmental Fund), and felt that this possibility was not well known. A meeting of African LME programmes was planned for Nov. 2006. This was to be followed by a meeting of GOOS Africa, and the GOOS Regional Forum, all in Cape Town, South Africa.

He then turned his attention to some lessons learned from the Benguela forecasting workshop: First of all, it was important that users get incorporated into each GOOS Regional Alliance. Research was needed to identify suitable indicators for various applications. Indicators were needed for pollution risk, state of ecosystem, state of fish stocks, etc. Typically, multiple indicators would be needed. They had to be realistic, in the sense that the observational needs had to match the state of development and needs of each region.

In conclusion, he noted that GOOS needed POGO (IOC budget had been cut by 40%), especially to address challenges in getting coastal GOOS started. The chlorophyll pilot study was a good first pilot project. He requested further that POGO continue to take lead in Ocean United and promoting oceans within GEO. If POGO did not do it, it would not get done.

Jesse Ausubel commented that GOOS needed to put out more persuasive, compelling documents that inspired people to get involved.

**GEO from GCOS perspective:** Ed Harrison then began his presentation, with a GCOS perspective on GEO. Ocean community plan for integrated initial sustained observing system was in the GEO 10 year plan and in the 2006 Work Plan. It was also accepted by UNFCCC and the Parties to the Convention were requested to implement, and report routinely on national enhancements to the observing system. These did not however, add up to financial commitments. Some activities planned for 2006 included the CEOS/GCOS satellite document – CEOS was to develop an implementation plan in response to the GCOS Implementation Plan. Version 2 of the IGOS-P Ocean Theme report was to be completed in 2006. GCOS was to revise a reporting framework for UNFCCC for monitoring national implementation progress. There was an opportunity for national sign-up to the GEO 2006 Action Plan. An interdisciplinary Sea Level Workshop was also planned for June 2006.

He suggested that POGO members could take a hand in responding to the GEO 2006 Work Plan Action Item concerning national/regional leadership in integrating national/regional ocean observing planning, observations and products. POGO could advocate for the entire integrated ocean system, and must explain interdependence of elements. POGO could also coordinate the message to governments as well as sponsors regarding ocean observations. He also suggested that the community could agree on a new language that all could use when dealing with climate or ecosystem or warning systems. He asked if the ocean community needed a label such as World Ocean Watch.

He then spoke of decadal variability, which was a strong argument why we needed sustained, long-term ocean observations and services. It was difficult to respond to criticism that what was being done was mindless monitoring. Coastal and global ocean connections needed to be made. He emphasised that the community had to keep explaining that physical, chemical, biological and ecosystem elements were interconnected, and had to move towards a single advocacy for the whole system.

He further argued that we needed to promote acceptance that research community was a core implementer of the global system, in addition to its other roles. We had to continue to foster discussions on the advantages of real-time transmission of research cruise observations. There was a need for interesting routinely-made products, not just research publications. The global *in*

*situ* system appeared to be at 55% of the recommended initial system. There had been steady progress in the last few years, but the plans for the next couple of years were less optimistic.

Observations showed that ENSO conditions were largely neutral over equatorial Pacific for most of 2005. Cool anomalies appeared in eastern cold tongue in Oct 2005. Arctic Sea Ice data suggested a steady decrease in Arctic ice cover over the last few decades. However, different analyses from different laboratories yield somewhat contradictory results. With respect to decadal-scale variability, he noted that some results showing 50 year temperature trends in the upper ocean showed complex spatial patterns and amplitudes. Patterns at 100 m were quite different from those at the surface. Strong regional variations were also seen in 20-year means. Results highlighted paucity of data and caution in interpretation of results. Observations had to be sustained for much longer than we had, to arrive at robust conclusions. The observations would yield climate-change information as a side benefit. He showed an example where a paper in *Science* reported a decreasing trend in the Faroe-Bank Channel overflow. But the trend appeared to reverse soon after the paper was published. He requested POGO to continue its current activities on cruise data base and data sharing/data system; to expand advocacy to include a plan for the entire integrated initial system; and to explore feasibility of national/regional POGO consortia. A handout was given, which covered additional material not covered in the talk.

After the presentation, a general discussion followed on GEO actions which POGO could offer to lead, or participate in. Charlie Kennel summarised the discussions by noting that some of the actions recommended that POGO should play a unifying role in Ocean United. This did not mean that POGO would do all the work. GOOS and GCOS would be actively involved in Ocean United. Many of the other proposed actions that emerged could be taken up within Ocean United, such as advocacy for the whole system, developing a new, simple, user-friendly language, helping develop GEO work plan, mapping GOOS benefits on to GEO societal benefits, etc. He agreed that the role of the research community in sustaining observations had to be highlighted.

Before coffee break, Jan de Leeuw revisited the budget issues.

**News and Information Group:** The first session after coffee was devoted to the News and Information Group. Jan Boon made the presentation on behalf of the Group. Some recommended actions from the News and Information meeting at NIOZ had been completed. This included creation of an executive structure for the News and Information Group that mirrored that of the POGO plenary. An immediate response web-page had been created for timely events (called the "Ocean News" page) on the POGO website. A contact list of all POGO News and Information members had been created and posted on the POGO website. The group had also followed up on the recommendations regarding Argo. The POGO website had been improved, but could be improved further; but this might require additional funds. A 'why ocean observations' page had been created on the POGO website (it had been constructed, but it needed additional content). The group also shared job postings *via* the POGO website. A draft brochure had been created to commemorate the Beagle Expedition. There were also plans to create monthly news updates for distribution and to create and distribute mid-year progress report of POGO activities. He requested the support of member directors to realise many of the projected activities.

There were many contributions and benefits that flowed from the News and Information Group. These included providing information for the POGO ocean news webpage; assisting with brochures by advising, proofing, creating (as budgets permit). Examples were the brochures dealing with the BEAGLE Expedition and OceanSITES. The group could also share resources by establishing an effective network.

A common remark was that "POGO is doing a lot of good work, but it is not always visible enough", and that "The primary goal of POGO is to intensify the network of institutional directors", and that "we live in a bubble". Dealing with uncertainty was a scientific reality, but the very reality was that the public wanted certainty. He asked if we really wanted to increase POGO visibility, and if so, what could be done about it. Potential actions included coordination of "Ocean United" messages which not only warned of gloomy changes in water level and acidity, but took it one step further and also described a realistic future scenario.

Discussions followed on focus and scope of the activities of the group and financial implications.

Recommended tasks included making a press release or communiqué of POGO meetings, improving internal communications among POGO members, and becoming communicators of issues related to Ocean United. The members endorsed the activities of the group.

Jan Boon then presented a proposal from Taco de Bruin regarding coordination of management of data from the southern hemisphere. Mike Meredith provided some clarifications on the proposal. It was decided that the proposal would be sent to all members for comments, along with additional clarifications and background provided by Mike Meredith.

Before the lunch break, Tony Haymet distributed draft action items summarising discussions and proposals.

Jan de Leeuw then revisited the budget issues. The UK delegation said they would revise their contributions to bring them more in line with institutional contributions from other countries. This would be before any decision was made regarding general adjustments to membership dues to compensate for inflation and shifts in foreign exchange rates.

**Adoption of Action Items:** After lunch, Tony Haymet led a discussion on action items to be adopted at the meeting. The agreed-upon action items are provided as Appendix 1 to the minutes.

A request from Bill Erb (IOC-Perth) for funding support for SEREAD activities was noted. It was decided that the Executive Committee would look into all requests for capacity building support received by 28 February, and decide on action in the light of budgetary constraints.

#### **POGO Business: Chair: Carina Lange**

After coffee, Prof. J-H Xiang made a formal presentation highlighted with a video show on behalf of the Institute of Oceanology of the Chinese Academy of Sciences (IOCAS), inviting POGO to meet in Qingdao in January 2007 for POGO-8. The invitation was gratefully accepted by the members. It was noted that BBRS (Bermuda) and COPAS (Chile) had offered to hold POGO-9 and POGO-10 respectively.

All participants signed a letter of condolence on the sad demise of Prof. Sergey Lappo before dispersing.

The meeting closed with formal expression of thanks by Chairman Jan de Leeuw to the hosts, to the speakers, to all participants and to the POGO Secretariat.

## **Appendix 1**

### **Action Items from POGO-7**

#### **Cruise Track Metadata Base and Website**

1. POGO Members endorse the assembly, distribution and maintenance of a database of future cruises, and its extension to include past cruises when possible.
2. The POGO members authorise the Executive to find the most efficient way to implement Action Item 1 with partners, bearing in mind (a) the need of International oversight, and (b) the kind offer from the Sloan Foundation (Jesse Ausubel), which is gratefully acknowledged.

#### **Ship Data**

3. POGO members implement where possible the five action items proposed in the position paper of ship data submitted by Dean Roemmich et al. The proposed actions from the position paper are reproduced below:
  1. Adhere to, and implement, the Pogo Data Management Principles
  2. Identify and designate a contact person for follow up on the following actions :
  3. CTD data : to be submitted to the CLIVAR Global Hydrography and Carbon Data Centre immediately following cruise completion;
  4. Real time CTD and XBT : transmit XBT and CTD (subset, decimated data) in real-time while at sea -either through the GTS or specialized data centres;
  5. Underway measurements to be systematically collected and made available (either in real time or at end of cruise), whenever the ships are at sea. Ensure proper maintenance of the TSG and the collection of water samples for calibration.

#### **Infrastructure**

4. POGO endorses the principle that members seek avenues to share ship and other infrastructure where possible.

#### **Biological and Chemical Oceanography**

5. The POGO members endorse the recommendation to make available, where possible, the opportunity to collect appropriate biological and chemical samples on cruises.

#### **GEO Activities**

6. POGO members endorse the position that POGO seek to act as the unifying ocean voice in GEO.

#### **Capacity Building**

7. POGO endorses the proposal to create a school of excellence in oceanography in India through networking with national and international institutions.
8. POGO Executive Committee to write, where requested, to each of the participating countries of the current Argo programme, urging continuity of the programme.
9. POGO members endorse a small fund for supporting capacity building on board vessels, and authorise the POGO executive to solicit proposals from members by 28 Feb 2006.

#### **Fellowship**

10. POGO members confirm their agreement not to pursue the IOC Visiting Directorship programme.
11. POGO members continue to endorse the Fellowship programme as a highly successful capacity building activity and ask the Executive to re-approach the current partners.

#### **News and Information Group**

12. POGO members endorse the request of the News and Information Group that each member nominates a News and Information Group representative, who where possible, will seek to attend the annual POGO meetings.
13. POGO members endorse recommendations of the News and Information Group to coordinate efforts to improve communications by (a) issuing a communiqué after each POGO meeting, (b) fostering internal communication among POGO members, and (c) exploring the outreach communication capacity of other Ocean United members (members).

**Budget**

14. POGO members endorse the increase of the dues by 10%.
15. POGO members authorise the POGO Executive to balance the budget after IOC's final position is known.