Conference on Developing a Global Strategy for Capacity Building in the Ocean Sciences
Bremen, Germany
16-18 August 2010

Purpose of Meeting

The purpose of the meeting was to bring together representatives of organizations interested in capacity development (CD)[1] for ocean research and observations, to discuss their experiences with past and existing activities, to identify new activities, and to discuss how the organizations could work together to create a global strategy for capacity building for ocean research and observations (see Appendix I for list of participants). This was the first meeting to bring together representatives of the international organizations most active in CD for ocean sciences. The participants thank the University of Bremen's Center for Tropical Marine Ecology (ZMT) for providing local support and for the organizations that funded their own participants. The presentations made at the meeting are available online.

Summary of Meeting Results

Participants agreed that the meeting provided a helpful venue for sharing the CD activities of the major international ocean science organizations, as well as of national and regional activities of organizations not necessarily specific to the ocean. Meeting participants agreed to a common vision for CD for ocean research and observations, began to develop a set of descriptions of CD approaches (see Appendix II), and agreed that it would be useful to have these meetings on a regular basis, for example, biennially. The group agreed to this capacity development mission as a guiding statement for future cooperation:

> *Through international cooperative mechanisms, identify and address capacity-development needs to contribute to improved research, management and decision-making processes, sustainable development, and protection of the ocean and coasts.*

Introduction

The meeting was opened by participants introducing themselves and describing their interests and activities in capacity building for ocean science. Venu Ittekkot explained the activities of the ZMT and its interest in capacity development. The city state of Bremen has made science and technology one of its focal activities. The University of Bremen was founded in 1971 and three of the university's faculties devote themselves to aspects of marine science and education. There are also several university programs related to marine science, including ISATEC, which is a two-year international Master of Science study programme on tropical aquatic ecosystems, conducted in English. It is held at the University of Bremen and in collaboration with ZMT. There are four marine research centers in Bremen. ZMT was created in 1991 to support capacity

[1] Many organizations refer to "capacity building" rather than "capacity development". The two terms are used interchangeably in this report.

development for developing countries. ZMT was formed because most river input is in the tropics, biodiversity is a major feature in tropics, and most coastal cities at risk are in the tropics. ZMT has long-term projects in many parts of the world. ZMT works with a network of institutions in any country where it is active, for example, the Science for the Protection of Indonesian Coastal Ecosystems (SPICE) network in Indonesia. ZMT has created a network of German institutions interested in CD, and works with international organizations such as the Intergovernmental Oceanographic Commission (IOC) of UNESCO, the Scientific Committee on Oceanic Research (SCOR), and the International Ocean Institute (IOI). ZMT also hosts guest scientists from the Non-Aligned Movement (NAM) Science and Technology Center in India. ZMT activities have been effective in bringing capacity development to areas that are impossible to reach through normal channels. They have started to work with Eastern European countries and Russia, such as through the Russian-German Otto Schmidt Laboratory for Polar and Marine Research. Ittekkot described the process through which ZMT developed a partnership with Indonesia.

Ittekkot noted that this is the first time these groups have met on this topic and SCOR would like to repeat this meeting every two years or so. We need to understand the mandate of each organization and also look for gaps among the mandates. We can go to bigger sponsors, such as the World Bank or the Asian Development Bank, to fund our CD activities if we develop joint work.

Presentations from Participating Organizations

The meeting continued with a series of presentations about the CD activities of the participating organizations.

International Atomic Energy Agency (IAEA) Marine Environment Laboratories – ***Hartmut Nies***
Prince Albert established Monaco as a center of oceanography during his reign. The IAEA Marine Environment Laboratories were established in 1961 and will celebrate its 50th anniversary in 2011. They have facilities in Monaco for measuring low levels of radioactive material and to help develop monitoring programs for pollutants in IAEA member states. IAEA also produces reference materials for purchase by scientists making measurements of radioactive pollutants, organic pollutants, and trace metals. The lab does not have its own research vessel. Nies described the three parts of the Marine Laboratory, each of which has a significant training mission:

1. Radiometrics Laboratory (RML)—This laboratory focuses on radionuclides in the marine environment; reference materials; geochronology; ocean tracers; radio-chemistry, u/w detection; modeling; and training. This laboratory can train as many as 6 fellows per year (6 months of training) and up to 18 trainees per year in two-week training courses, in English or French. The main subjects of training are sampling and sample processing, radiochemical and radiometric analyses of marine samples (anthropogenic and natural radionuclides), sediment dating, marine radioactivity monitoring and assessment, radiological assessment, modeling of dispersion and transfer of radionuclides, and tracer applications in oceanography and pollution studies.

2. Radioecology Laboratory (REL): This laboratory focuses on radioecology; biological tracers; carbon export; ecotoxicity; harmful algal blooms (HAB); and training. This laboratory can accept up to 4 fellows per year (6-month fellowships) and up to 20 trainees for a two- to three-week course. The main subjects of training offered include marine radioecology and biogeochemical cycling of radionuclides, and applications to other contaminants and climate change investigations.
3. Marine Environmental Studies Laboratory (MESL): This laboratory focuses on organic micropollutants; heavy metals; long-lived radionuclides; reference materials; and survey and training in UN partnerships. This laboratory can host 4 fellows per year and as many as 32 trainees in a two- to three-week course each year. The main subjects of training offered include analytical techniques on trace metals, mercury speciation, organotin speciation, analytical techniques on petroleum hydrocarbons, analytical techniques for measurement of organochlorine pesticides and PCBs, and analytical techniques on PBDEs.

In terms of scientific topics, the IAEA laboratories have worked on submarine groundwater discharge, harmful algal blooms (training in nuclear techniques for food chain studies), CO_2 and pH effects on corals, and isotopic tools and models to study climate change. The IAEA Marine Information System (MARiS) is a relational database covering the distribution of radioactive and stable isotopes, and in the near future also other tracers (organic compounds, trace metals) in the marine environment.

IAEA supports capacity development, currently in the following regions:

- Mediterranean region (through the marine pollution assessment and control component of the Mediterranean Action Plan)—CD activities have included regional training courses in Monaco, inter-laboratory comparison exercises, proficiency tests, and expert visits.
- The ROPME Sea Area (the sea area surrounded by the eight Member States of ROPME: Bahrain, Iran, Iraq, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates)—CD activities have included regional training courses, joint pollution surveys, proficiency tests, and expert visits.
- Technical Cooperation for Africa (TC RAF)—CD activities have included regional training courses, procurement of instruments, fellowships, and expert visits.

Venu Ittekkot asked about how many weeks or months in advance they need to schedule a training course. Nies answered that it should normally be six months in advance, although it could be shorter. IAEA sends three people to staff training courses. They have funding in their budget to support such courses, but sometimes the local hosts can support these activities. IAEA can buy equipment and transport it to the member states. There are sometimes deficiencies in liquid nitrogen, electricity, and other logistical factors needed to conduct the kind of research and observations related to the training. The courses are normally designed to train agency personnel, but sometimes they also train students. The courses are not part of a university program, although they cooperate with universities. Course presentations are provided online. Jing Zhang mentioned that eastern Asian countries have good facilities for this kind of work; can IAEA help set up a regional capacity development network? Nies answered affirmatively. The courses in Monaco are readily accessible, but sometimes summer courses have trouble finding housing for

students because of the summer tourist influx in Monaco. Besides offering training, IAEA can help analyze samples; they could have a course in a region and analyze the samples in Monaco, for example.

Intergovernmental Oceanographic Commission (IOC) – ***Wendy Watson-Wright***
IOC was formed in 1960. Watson-Wright described the IOC CD principles and the self-assisted strategy that IOC uses, the elements (including relevance, ownership, sustainability), both research and operational capabilities, a holistic approach, costs as investments, efficiency, leveling the playing field, and focus. Sustainability of CD actions and impacts are important. Member states define their CD needs and actions. This ensures relevance of IOC activities to its member states and the states' ownership of the activities and outcomes. It is necessary to take into account the cultural and socioeconomic contexts of CD activities. IOC helps connect local, regional, and international activities. It is important to have peers at the different levels who can work together.

IOC works with institutions in developing countries, specifically with the directors of the institutions, so they can interact better with policymakers and society. They had a focus on institution strengthening through extramural funding in 2006-2009. By targeting institutions, the knowledge may be more likely to stay in the country. The IOC efforts achieved a high level of buy-in from the directors of the institutions and trained them in leadership and team building, proposal writing and fund raising, and decision-support tools. The alumni of IOC leadership training activities include individuals from about 120 institutions in 70 different countries. About 30% of trainees supported themselves to participate in the activities, demonstrating the relevance and value of the activities to participants. IOC has calculated that the fund-raising success of its training activities has resulted in a return of investment about five times the IOC contribution.

In Tanzania, IOC supported decision support for sustainable coastal livelihoods through the ReCoMAP project, which is empowering non-governmental institutions in Tanzania to plan for sustainable coastal livelihoods using decision-support tools. In Asia, they have conducted a Coast Map Indian Ocean CD project, aimed at countries affected by the 2004 Indian Ocean tsunami. In this project, IOC is helping to train about 120 specialists from 12 countries affected by the tsunami to produce inundation maps based on hydrographic surveys and bathymetric data. The Western Pacific IOC (WESTPAC) has started a regional CD effort, including a Regional Training and Research Center on Ocean Dynamics and Climate at the First Institute of Oceanography in China.

One topic of IOC training in Asia has been harmful algal blooms (HABs), for which IOC has organized more than 60 training program for about 800 trainees, over the past 10 years (see also presentation by Henrik Enevoldsen below). CD activities on HABs have been adapted to different levels:

- Courses for individual scientists and managers
- Institution/national infrastructure, curricula. Steps to strengthen national management have included prioritization of CD needs, increasing management and scientific capacity, and education
- Regional networks, workshops

- International manuals, guides, research

Another example is provided by the Global Sea Level Observing System (GLOSS), which was primarily designed to provide sea level data for international science programs, but has evolved to also contribute data streams for other needs, such as altimetry, tsunami and storm surge observations, as well as modeling and operational oceanography. GLOSS has utilized the Training, Education, and Mutual Assistance (TEMA) approach to fund development of manuals, technical visits, and provision of tide gauge hardware.

IOC has some collaborations on capacity development with other international and intergovernmental institutions, such as the International Hydrographic Organization (IHO), the International Maritime Organization (IMO), the World Meteorological Organization (WMO), and the Global Earth Observing System of Systems (GEOSS). These collaborations include exchange of information, sharing of lessons learned, and development of common priorities. The UN system is planning a CD meeting in October 2010, which could use some of the outputs of the Bremen meeting.

Examples from India, Brazil, Cuba, and Mozambique can be instructive in relation to how to create successful CD activities. India profited from the International Indian Ocean Expedition (started by SCOR and completed by IOC) because national scientists from the Indian Ocean region were involved, and there was an influential national champion (N.K. Pannikkar) and a visionary prime minister (J. Nehru) at the time. In the case of Brazil, it is developing its own technology, excelling in marine pharmaceuticals and deep sea technology for oil exploration. Cuba and Mozambique are examples of two economies under stress, with great self motivation, but which need encouragement from outside. Cuba produces top-notch research on bioactivity from marine molecules, maintaining a world-class aquarium, and creating consultancy skills in coastal erosion protection. Mozambique, recognizing the importance of its surrounding ocean, has created a center for marine research at Quilimane. The lessons from these experiences is that CD cannot be driven from outside. National initiatives need to flourish. Externally driven training programmes can distract from priorities and can be unsustainable. Self-drive and national ownership are the road to sustainability.

What is needed for a global strategy for capacity development for ocean sciences? Why are we doing this and what is needed? We need

- A clear and common vision of success
- A common definition
- Agreed principles
- Clear roles, responsibilities, and accountability
- Agreed measurements

Good ocean governance requires a foundation of good science. George Boehlert asked about whether IOC or the other participating organizations evaluate the effectiveness of their activities. Watson-Wright answered that the UN Development Programme (UNDP) is trying hard to do this (see *UNDP Primer for CB*). IOC can count the number of people trained and participating in various activities, the number of workshops, the number of publications, etc. but it is difficult to

assess the impact of IOC CD activities. Ed Urban added that this is also difficult for SCOR. Henrik Enevoldsen responded that the Danish International Development Agency (DANIDA) developed an assessment process for CD activities. Peter Pissierssens added that IODE keeps track of each student trained, through OceanExpert, to see if trainees have advanced. They can also determine through this approach whether the trainees have taken work outside of their home countries after their training. Jilan Su mentioned that other factors affect careers besides training, so it is sometimes hard to detect the career effects of training. Kurt Hanselmann reported on an alumni group for the ECODIM courses that helps them follow their trainees. Jing Zhang asked if there is coordination in Paris for IOC regional activities to take advantage of potential synergies among regions. IOC staff responded that the people in the different IOC regions do communicate and the IOC Deputy Executive Secretary will bear overall responsibility for IOC CD activities. IOC only helps with national CD when there is a donor for work in a specific country. IODE tries to respond to national needs, as well as countries in a region. If there are several countries in a region that request training, regional training activities can be developed.

International Oceanographic Data and Information Exchange (IODE) CB methodology such as OceanTeacher Academy – ***Peter Pissiersens***

At the first IOC meeting in 1961, a Working Group on Exchange of Oceanographic Data was established for "*the facilitating of exchange of oceanographic data, the standardization of forms for reporting and coding data, the encouragement of the preparation of data catalogues, and the assistance of development of national oceanographic data centres*." IODE's terms of reference (updated most recently in 2005) are

- to facilitate and promote the exchange of all marine data and information including metadata, products and information in real-time, near real time and delayed mode;
- to ensure the long-term archival, management and services of all marine data and information;
- to promote the use of international standards, and develop or help in the development of standards and methods for the global exchange of marine data and information, using the most appropriate information management and information technology;
- to assist Member States to acquire the necessary capacity to manage marine data and information and become partners in the IODE network; and
- to support international scientific and operational marine programmes of IOC and WMO and their sponsor organizations with advice and data management services.

There are IODC data centers in almost all coastal countries. No formal academic degrees in oceanographic data management are offered from any universities anywhere. Data managers start as either (ocean) scientists or information technology specialists and acquire knowledge, expertise and experience on the job. IODE assists by providing visiting experts, internships, and training courses.

Technology has evolved substantially since IODE was created. NODCs in the developed world have been able to adapt to new technology to some extent, but the digital divide has become worse over time. IODE regional networks evolved into the Ocean Data and Information Network (ODIN) model:

1. **Linking training, equipment, operational support:** provide not only equipment but also training as well as some financial support to operate the equipment and develop products + secondments/internships + support to participate in conferences;
2. **Regional context:** focus on national requirements but also identify similar needs across a region and develop regional products and services that serve all participating countries in a region;
3. **Product and service oriented:** do not develop data centres as isolated facilities but ensure these centres provide services and products that are needed by users; and
4. **Multi-stakeholder approach:** ensure that the project is driven by stakeholders as representatives of users and involve these stakeholders as much as possible in the governance of the project.

A good example is ODINAFRICA. A phased and long-term approach has been used. In Phase 1, a sub-regional test bed of 7 countries tested the system. In Phase 2, 20 countries were helped to set up data centers and marine libraries; develop metadata and databases; and start development of products. Phase 3 involved 25 countries in constructing a Pan-African coastal observing system including a core network of tide gauges; data products (Atlas), and national and regional work plans. Finally, Phase 4 involves sharing multi-sectoral data and cooperation in OceanDataPortal. Data transfer became more common among countries as they became accustomed to working together.

The IODE approach puts national priorities first and is country-driven, with national databases, data products (national atlas, policy briefs), and public awareness products. But, it is also recognized that IODE needs to promote cooperation among countries and creation of regional and global products. Regional e-repositories should be developed, which will validate local research work. Regional atlases attract decision makers. Regional products can contribute to IODE through OceanDataPortal, for global applications. Developing countries should be able to work globally. Based on the success of ODIN Africa, IODE has expanded the approach to other regions, including Latin America (ODINCARSA), the Indian Ocean (ODINCINDIO), European countries in economic transition (ODINECET), the Western Pacific (ODINWESTPAC), and among Pacific marine libraries (ODIN-PIMRIS). However, there are differences among different regions, such as different development status, different educational status, different needs, and different cultures. The solution is to employ a participatory approach to assessment of CD needs and project development. There is a need to adapt to the region and each country in the region. What is built must be mainstreamed in national policies, which requires an approach to top levels of government, and national marine policies, including data policies. We cannot allow “empire building” by focal points and must achieve inter-sectoral cooperation and coordination. Ultimately, these goals will require national coordination committees.

OceanTeacher underpins the education and training element of all ODINs. The idea for OceanTeacher was born in 1997, in the form of an IODE Resource Kit (predecessor of OceanPC), which was a CD-ROM-based product with a range of marine data and information management material, including software, quality control and analysis strategies, training manuals, and relevant IOC documents. This was a comprehensive self-training and resource tool for newly established NODCs, and to assist managers and staff members to acquire the skills to set up and run new IODE centers. In 2001, this effort became OceanTeacher, which is an expert

and training resource for marine data and information management. It has multiple audiences, including beginning data and information managers, marine researchers, university students, and experienced data and information managers. OceanTeacher includes classroom courses plus distance education. OceanTeacher provides an Introduction to Marine Data for Young Scientists, an annual course, including shipboard training, from data collection to data products. This course is conducted in conjunction with Flanders Marine Institute (VLIZ), Belgium. The OceanTeacher Digital Library uses a Wiki approach, but content is provided by identified experts who have been selected based upon their expertise. Only registered editors can edit content. OceanTeacher is also using Moodle, which is an Open Source Course Management System (CMS), also known as a Learning Management System (LMS) or a Virtual Learning Environment (VLE). It has become very popular among educators around the world as a tool for creating online dynamic Web sites for their students.

As an example of the training courses available, the course calendar for 2010 includes:

Marine Information Management

- Training Course on Preservation and Archiving of Digital Media
- Literature and databases of the Marine Sciences
- Disaster Management and Recovery

Marine Data Management

- Introduction to Marine Data for Young Scientists
- Basic Marine Data Management: (i) ocean data collection development; (ii) intro to marine metadata; (iii) Ocean data products and synthesis
- Introduction to Marine GIS
- Marine and Coastal Atlas Development

The student selection process requires a (1) detailed CV, (2) a motivation letter from the applicant describing how the training would contribute to the applicant's career and to his/her employer institution, and (3) an endorsement letter from the employer. There are usually 20 participants in each 1-2 week course.

Distance learning is conducted by providing videos online. This approach is combined with classroom lectures and local trainers. Students use the OceanTeacher digital library and video courses to give lectures back home. Distant students can self-study and communicate with lecturers. More than 100 videos are available online (10-90 min). Their usability in different locations depends on the available bandwidth, but they are also available on DVD. Interaction between students and lecturers is important. Distance learning complements classroom lectures or assists local trainers to prepare lectures.

IODE is working toward a distributed training network, combining its ODINs with the activities of other organizations, such as the Partnership for Observation of the Global Oceans (POGO), the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT), the Joint WMO-IOC Technical Commission on Oceanography and Marine Meteorology (JCOMM), WMO, the U.S. National Oceanic and Atmospheric Administration (NOAA), the European Union, International Ocean Institute (IOI), SeaDataNet, and the Comision Permanente del Pacifico Sur (CPPS). IODE cooperates with POGO in teaching about ocean data management at

the Nippon Foundation-POGO Centre of Excellence in Observational Oceanography at the Bermuda Institute of Ocean Sciences.

Pissiersens presented his vision of the way forward for IODE:

- Need for regional training centers, closely linked to the Oostende IODE center. These regional centers would promote regional cooperation and networking, while utilizing the same training methodology. These efforts would be owned and resourced by the regions.
- Need to create more partnerships and embed courses in partner training programmes.
- Mainstreaming of data and information management and products in national policies
- Accreditation by universities
- Need more content providers and lecturers
- Translation of basic courses in other languages

Kurt Hanselmann asked if OceanTeacher can be used outside of IODE. Pissiersens responded yes, and that OceanTeacher could be used beyond data. Ed Urban mentioned that the IMBER project and IODE could usefully work together on data management training, as IMBER has made data management an integral activity related to its open science meetings.

Partnership for Observation of the Global Oceans (POGO) - ***Marie-Fanny Racault***
POGO's mission is "Building links worldwide among oceanographic institutions to promote long-term co-operation in comprehensive global ocean observations." The partnership exists to promote observations, improve scientific knowledge, interpret scientific results to policymakers, enhance public awareness of oceanic issues, and provide training and technology transfer. POGO includes 38 member institutes from 21 countries. POGO's perspective is global in scope and POGO's goal is global participation. Increasing involvement of developing countries is part of the POGO's strategy. POGO CD activities include the following.

POGO-SCOR Fellowship Programme—This program was initiated in 2001 (IOC provided support until 2005). The program supports visits to oceanographic laboratories for training. So far 118 fellowships have been awarded: 13 in 2001, 13 in 2002, 9 in 2003, 12 in 2004, 9 in 2005, 9 in 2006, 13 in 2007, 15 in 2008, 12 in 2009, and 13 in 2010. The program is in high demand; in some years, there are 8 times more applications than funding available. Feedback has been uniformly enthusiastic. The EAMNet project (led by the Plymouth Marine Laboratory, UK) has initiated fellowships along these lines for African countries, in a three-year project, which started in 2010. Ed Urban mentioned that many of the applications for POGO-SCOR fellowships are really for research, which shows there is a great need for a research training fellowship program.
POGO-AMT Fellowship Programme—This program was begun in 2008. It supports participation of one trainee in the Atlantic Meridional Transect (AMT) cruises from the UK to Antarctica. SCOR initially co-funded the program, but it is now a POGO-only program. Two fellowships have been awarded so far, one each in 2008 and 2009, to fellows from Uruguay (2008) and the Philippines (2009). Selection is in progress for 2010. The program provides for participation in cruise preparation (one month); participation in cruise itself; and participation in data analysis and interpretation (up to 2 months).
Universidad de Concepción Austral Summer Institute—The Austral Summer Institute is an initiative of the Universidad de Concepción, with international collaboration and funding support

from various sources (including a UNESCO Chair). The institute is organized as a series of short, intensive courses on various topics in ocean sciences. The institute features invited lecturers of international repute from around the world. The program was designed primarily for the benefit of students from Chile. POGO support allows participation of students from neighbouring countries (about 6-8 students each year). This is an example of a modest contribution from POGO with high impact.

University of Cape Town: POGO Bursary—This program started in 2008. It provides a bursary for an African student (from outside South Africa) to undertake graduate work at the University of Cape Town. It is seen as a vehicle for African countries to benefit from oceanographic expertise in South Africa and to develop the University of Cape Town as a regional centre of excellence in oceanography.

Nippon Foundation – POGO Visiting Professorship Programme (2004-2007)— This program provided a unique opportunity for capacity building through visits of eminent scientists to developing countries for training and building facilities. The program awarded 6 professorships:

- 2004: Prof. Trevor Platt (to NIO-Kochi, India) and Prof. Motoyasu Miyata (to USP, Fiji)
- 2005: Dr. Charitha Pattiaratchi (Australia) to NARA, Sri Lanka and Dr. Robert Frouin (USA) to INPE, Brazil
- 2006: Dr. Satsuki Matsumura (Japan) to IO, Vietnam and Prof. Vladimir G. Koutitonsky (Canada) to INSTM, Tunisia

The program has now been continued on a more modest scale as the POGO Visiting Professorship Programme.

Nippon Foundation – POGO Centre of Excellence—This activity provides a unique opportunity for training for one year at the Bermuda Institute of Ocean Sciences. The training includes specialized modules of 2-3 weeks each (including guest lecturers from around the world; on-board training on a research vessel; project work). Ten candidates are selected each year, primarily from developing countries, but also from developed countries (more than 110 applications were received in 2010). Networking is a priority for the program; an alumni meeting is being planned.

Nippon Foundation–POGO Regional Training Programme—This program is part of the activities of the NF-POGO Centre of Excellence in Bermuda. It uses previous trainees as a nucleus for regional programs. It is also a vehicle for identifying suitable candidates for other capacity-building initiatives. Each year, a regional training course is organized. In 2009-2010, the program was hosted in Brazil by Milton Kampel, in 2010-2011 in South Africa (host: Stewart Bernard) (planned), and in 2011-2012 in India (host: Srinivas Kumar) (planned).

POGO Visiting Professorship Programme—Initiated in 2009, this is a modest successor to NF-POGO Visiting Professorship Programme; it formalizes earlier ad hoc initiatives along these lines. In 2009, Prof. Stephen Hawkins (University of Bangor, UK) was sent to Argentina, hosted by Maria Gabriela Palomo, at the Museo Argentino de Ciencias Naturales “Bernardino Rivadavia”. The topic of the professorship was “Understanding climate driven change in marine biodiversity and ecosystems: observations, modelling and experiments”. In 2010, Profs. Lisa Levin and David Checkley (Scripps Institution of Oceanography, USA), will be hosted in Namibia and neighboring countries. Levin will be hosted by Anna Bronwen Currie of the Namibia Ministry of Fisheries and Marine Resources on the topic of “Understanding biodiversity

of oxygen minimum zone and methane seep environments". Checkley will be hosted by Anya Kreiner, National Information and Research Center on the topic of "Emerging Technologies for Ocean Observations: CUFES (Continuous Underway Fish Egg Sampler) and LOPC (Laser Optical Plankton Counter)". The fellowship provides travel support, honorarium, training costs (total not to exceed £5,000).

POGO also undertakes capacity building in a broader sense, such as through the São Paulo Declaration (2001), involvement in development of the Global Earth Observing System of Systems (GEOSS), the Chlorophyll Globally Integrated Network (ChloroGIN), GEONETCast applications for and by Developing Countries (DevCoCast), and Europe-Africa Marine Network (EAMNet).

POGO's strategic considerations for capacity development include

- Target capacity building to fill identified gaps in the ocean observing system;
- Target capacity building towards the service of societal needs;
- Identify centres in developing countries that have shown drive and initiative in providing training and education at regional levels, and promote their activities;
- Encourage north-south partnerships and initiatives where both the trainer and the trainee benefit from the effort;
- Encourage south-south partnerships to disseminate regional expertise;
- Facilitate the trainee to become a trainer in the region, so that the knowledge can reach a wider population;
- Focus the capacity building efforts on those institutes and centres that have a long-term vision to build on, and benefit from, capacity building efforts; and expect them to make some contribution to the effort, within reason;
- Encourage the developing countries to take the lead in deciding on the type of capacity building that best serve their needs, and work with them to realise their goals; and
- Make a long-term commitment.

Jilan Su asked about why the POGO-SCOR program is linked to observations and not more broadly to research. Ed Urban responded that focusing on observations fills an important gap and bests contributes to POGO's mission regarding global ocean observations. Venu asked if there is any measure that having a fellowship improves a recipient's position in the country. Ed suggested the IODE model for evaluations. Juliet added that she was a POGO-SCOR Fellow, which led her to increase her involvement in SCOR and POGO. A network of trainees is planned by POGO in the future.

Scientific Committee on Oceanic Research (SCOR) – ***Venu Ittekkot*** and ***Ed Urban***
Ed Urban introduced SCOR capacity building activities by reporting that SCOR was established in 1957 by the International Council of Scientific Unions to "promote international cooperation in marine science", in the midst of the International Geophysical Year (IGY). SCOR has been involved in capacity building for ocean science since 1960, when SCOR started the International Indian Ocean Expedition, which had a significant capacity-building component. SCOR capacity-building activities currently include

- Membership of developing country scientists on SCOR groups
- SCOR Committee on Capacity Building
- Travel Grants
- SCOR Visiting Scholars
- POGO-SCOR Visiting Fellowships for Oceanographic Observations
- Regional Graduate Networks of Oceanography
- Provision of free copies of selected SCOR reports to libraries in developing nations

The most important way that SCOR promotes capacity building is to involve developing country scientists in SCOR activities. 29% of countries with national SCOR committees are developing countries and another 6% are from countries with economies in transition. All dues-paying countries have the same rights in SCOR activities. SCOR ensures that there are scientists from developing countries and countries with economies in transition on all SCOR groups.

The SCOR Committee on Capacity Building is chaired by Venu Ittekkot. Its terms of reference are to

- Provide direction for all of SCOR's existing capacity-building activities.
- Guide and assist the SCOR Executive Director in development of new capacity-building activities, particularly the Regional Graduate Schools of Oceanography activity.
- Assist SCOR-sponsored projects in developing their capacity-building activities.
- Help SCOR arrange funding for existing and new capacity-building activities.
- Assist SCOR in interacting with regional and international groups related to capacity building in ocean sciences, such as the ICSU regional centers, START, IOC regional programs, etc.

SCOR has received funding from the U.S. National Science Foundation since 1984 to provide travel grants. Approximately $75,000 is awarded each year to 60-70 recipients from developing countries and countries with economies in transition (CIS, Eastern Europe). The SCOR Executive Committee responds to requests from meeting organizers, who nominate recipients of the travel grants. Preference is given to individuals who are making presentations at the meeting or who provide expertise or geographic representation that otherwise would not be available**.** Any organization is eligible to apply for the grants, although SCOR tries to use the awards to strengthen capacity building in its own activities through these grants. SCOR now requires meeting organizers to develop mentoring for the meetings it supports, but does not yet provide any guidance to meeting organizers about how to conduct mentoring. George Boehlert mentioned the ASLO undergraduate training program (see Appendix II, Funding for Participation in Science Meetings).

The SCOR Visiting Scholars program started in 2009, as a scaled-down version of the successful POGO program described earlier. The purpose of the program is for recipients to serve in a developing country for a few weeks to a few months, to teach classes and do training and mentoring. Three SCOR Visiting Scholars have been appointed so far, including two in 2010. The program is intended to provide airfare and subsistence, if needed, but intention is for local hosts to provide most or all of local lodging and meals. The SCOR program differs from the

POGO program in several ways, but one of the most important is that the SCOR program does not require applicants to have identified a host institution.

Urban referred to Marie-Fanny Racault's presentation already given in relation to the POGO-SCOR Visiting Fellowships for Oceanographic Observations.

The idea for regional graduate networks of oceanography was developed through a Team Residency at the Rockefeller Foundation Bellagio Center in 1998. The goal is to develop a networks of institutions within developing regions that would cooperate on education of graduate students in ocean sciences. Cooperation would take the form of shared faculty, physical resources, summer schools, etc., in a way that all participating institutions would consider fair. An advantage of this approach is that the training can focus on regional ocean science needs and capabilities and reduce the "brain drain" that occurs when students are trained in developing countries. A challenge and opportunity is the presence in each region of one or two dominant institutions that do not want to reduce their status in the region.

SCOR reports are often produced by commercial publishers, so they are expensive to purchase, and beyond reasonable cost for scientists in developing countries. SCOR distributes free copies of some of its reports to 43 libraries in 33 developing nations. SCOR has also asked working group chairs to explore the idea of publishers producing paperback or CD versions of reports for use in developing countries. A comment was made that students don't use libraries as much as they did in the past. They do more work online with electronic documents, so this should be considered. Peter Pissierssens noted that IODE and UNESCO provide free journals to developing countries. OceanDocs allows developing country scientists to put thesis, etc. online (it is a DSpace repository that "gets crawled" by Google). Ingrid Leemans added that the European Network of Agricultural Social Protection (ENASP) also provides free access to developing countries, but often just librarians are aware of this resource. Bandwidth is still a problem, but access to computers not so much.

Brazilian Capacity Building Activities and Brazil-Chile coordinating efforts – ***Kurt Hanselmann***

Kurt Hanselmann first reported on his discussions with individuals in Chile and Brazil about joining forces to broaden regional oceanography education to two locations. At this time, both countries want to do something on their own, which should be encouraged, although we should also encourage regional cooperation in the longer term. Often, the decision to have a capacity-building program is made because a university wants to build national and regional prestige and because other universities have had success with such programs. Hanselmann then related his experience with an institution-related summer school. The following questions should be considered before an institutional summer school-type program is developed:

- Why do I want to offer a capacity-building course through my university?
- Can it be embedded into the needs of my university (e.g., local graduate/postgraduate program)? Can it be counted for the partial fulfillment of a degree?
- Do we want to offer it to our own students only or possibly also to students from other universities (outreach, prestige)?

- Can we offer topics, knowledge, study sites, methods, etc. that are unique for the field of oceanography and attractive for students in the field?
- Do we have the academic capacity (team of experts or access to them) to launch such an activity and can we count on the willingness of our colleagues to contribute?
- In which form shall we offer the CB course, as a block course at a suitable location outside the university (intense focusing) or as a regular curriculum course outside of the teaching semester?
- Do we have the intention to develop the course into a sustainable CB program?
- Can we offer suitable course facilities to house and work with a group of students?
- How do we evaluate and follow up on the success of our activities?
- How can we assure funding for several years?

Hanselmann emphasized that countries should focus on topics different from other countries, on topics in which their institution specializes, based on special natural features of their region. Examples of summer schools include MBLWHOI courses, Bermuda course, GeoBio course (University of Southern California), microbiology (Univ. of Hawaii), and the Stanford University Hopkins Marine Station microbiology course. The American Academy of Microbiology is considering how to sustainably fund these kinds of courses. The group will develop strategies for how best to accomplish the following four goals:

- Innovate: How can existing courses become even better?
- Expand: How can the impact of the courses be maximized?
- Evaluate: What constitutes success and how do we measure it?
- Sustain: How do we demonstrate value to faculty, students, university administrators, and potential funders?

The outcome of the colloquium will be a report that describes the current situation, imagines ideal future possibilities, and provides near and long-term practical recommendations for getting from here to there.

Hanselmann summarized his Ecology and Diversity of Marine Microorganisms (ECODIM) experiences in marine microbiology as part of the Austral Summer Schools at the University of Concepción (Chile). ECODIM was established in 2000 and is offered every second year. The courses last for 3 weeks, with an emphasis on capacity building through research-guided learning. The course activities focus on the oxygen minimum zones in the upwelling region off the coasts of Chile and Peru. Course features include

- Sampling trips (field experiences)
- Lectures (syllabus that integrates various science fields)
- Instructed experiments (methodology, instrumentation)
- Computer-supported exercises and database searches (concepts, model design)
- Group research projects (discoveries, hands-on instruction based on field observations)
- Mini-symposia (outreach and front research, on Saturdays)
- Student reporting (oral presentations, poster designs)

What has been learned from these courses?

General concept

- The basic structure of the course is successful and it has improved with each course experience.

Mini-symposia

- are a means of introducing the students to cutting-edge research.

Research projects

- are activities during which the student gets practical experience and where he/she is learning by doing.
- molecular techniques were introduced into the course with the support of instrument manufacturers and reagent supply companies.

Colloquia

- The student is trained in how to search, evaluate and select the literature that is most important for his/her research (self-learning).
- Time spent on colloquia with student presentations improves scientific presentation and language skills.
- Workshop-type discussions about new technical developments and limitations of certain techniques (e.g., DNA sequencing) help students to chose proper experimental approaches for their own research.
- Familiarity with computer handling, which often still needs individual training, is a prerequisite for model building and access to databases.

Individual studies

- Independent study time is integrated into the program for reading and preparing discussions about key papers.
- Reading assignments and exam papers are offered by the staff or freely chosen by the student. Advice assures that the time is spent on analyzing and presenting relevant publications.

Lectures

- include discussions and student activity; and
- introduce basic microbiological concepts and knowledge and prepare the ground for focused research work, give context and overview before spiraling down into details.
- Lecture slides are made available on the course intranet for self-study and repetition.

Field trips

- expose the student to difficulties when working under harsh conditions,
- train in decision-making at the spot, and
- emphasize the importance of detailed preparation and considering options.

The training at the University of Concepción is being emulated in other South American countries. The problem is not merely in creating capacity, but also in maintaining capacity. There is a need to develop human resource and infrastructure in parallel. Maintaining human capacity depends on maintaining positions. In Chile, they have developed infrastructure as a result of the courses to be used by the university between summer schools.

The SysTEM for Analysis Research and Training (START): **A synopsis of START's current Capacity Building Actions (with emphasis on Coastal issues)**

– Isabelle Niang

Isabelle Niang is the Chair of the African committee for START. START works at the interface of science, policy, and development. It promotes application of scientific knowledge to reduce risks and inform policy responses. START achieves this through collaborative research and assessment at regional scales in the developing world; scientific capacity building (i.e., "research-driven" capacity building); networks and forums to share and disseminate information; and mobilization of financial, institutional, and human resources. START's regional centers are based mainly at universities. They serve as information and coordinating centers for START's networks of regional scientists and their collaborative projects. The regional centers manage and archive regional data and other information on global change research, including rosters of regional scientists and projects. They help identify needs for capacity building and provide facilities for training scientists and policymakers from the region. And they provide a multi-disciplinary setting within which the results gathered from various disciplines and regional institutions can be synthesized into a policy-relevant regional framework. There are three regional nodes in Africa, in Ghana, South Africa, and Kenya.

START's underlying principles of capacity building programs are

- Human capacity building is much more than training.
- CD should be research-driven.
- CD should emphasize active participation in long-term research initiatives with other scientists and international science programs.
- CD should seek the multiplier effect with early/mid-career scientists.

To address these principles, START uses the following approaches: regional science planning, collaborative research networks, research workshops, institutional development, support of attendance at international conferences, partnering organizations, short-term fellowships, visiting scientists, visiting lecturers, dissertation/long-term fellowships, small grants programs, overseas affiliations, and young scientist opportunities.

START has several different programs related to climate change. Niang provided specific examples from START's program on Coastal Cities at Risk and Adaptation to Climate and Coastal Change (ACCC) in West Africa. This Coastal Cities program is enhancing adaptive capacity for climate change in Asia's coastal cities by

- Reviewing science and projections regarding climate-related risks to coastal cities
- Examining potential vulnerabilities and current coping mechanisms
- Discussing actions—*in both the near and longer term*—to enhance capacity of cities to manage risks and vulnerabilities posed by climate change
- Investigating planning and governance mechanisms to better integrate science, planning, development, and disaster management
- Considering means for improving networking and communication

This program was launched with a workshop in Thailand in early 2009, which included more than 80 participants from 18 countries. Training was held in late August 2010, for which the objectives were development of capacity in climate change risk and vulnerability assessments, and application to urban development planning and governance; promotion of locally led risk and vulnerability research linked to user needs; and development of partnerships among researchers, planners, and policymakers that encourage "communities of knowledge". A "Cities at Risk II" conference will be held in early 2011. The program feeds into the Integrated Research for Disaster Risk **(**IRDR) program.

The ACCC program in West Africa is co-sponsored by the Global Environment Facility (GEF), UN Development Programme (UNDP), and IOC. It works at local, national (Mauritania, Senegal, Gambia, Cape Verde, Guinea Bissau) and subregional levels. National activities have included introducing climate change concepts (and effects in coastal areas) to the public, law makers, and managers of towns and national parks; mangrove restoration and dune afforestation; building of tourist camps; removal of invasive trees; turtle protection; and beach cleaning. At the regional level, activities have included training workshops on dune afforestation and SandWatch, and creation of a network of parlementarians and local decision makers for coastal states.

START sponsors workshops of young scientists to share their research experiences. Juliet Hermes co-organized the meeting at the IGBP Congress for START, but there was no follow-up afterward. AfricaNESS did not receive support from EU.

Jing Zhang asked if there is any joint effort among START regions. Niang answered no, because the needs and context are different in each region.

North Pacific Marine Sciences Organization (PICES) – ***George Boehlert***
George Boehlert reported that PICES was established in 1992 as an intergovernmental organization. Its member nations include Canada, Japan, People's Republic of China, Republic of Korea, Russian Federation, and the United States. The principal objectives of PICES are

- Promoting and coordinating marine research in the North Pacific and adjacent seas
- Advancing scientific knowledge in the region
- Promoting the collection and scientific exchange of information

Its CB strategy was developed by a study group in 2003. Essential components of this strategy are

- holding special conferences and schools on marine sciences;
- organizing methodological workshops and training courses;
- sharing methodologies, information and data;
- providing financial support for participation of students and early-career scientists in PICES Meetings and symposia; and
- maintaining an Intern Program with scientific as well as administrative assignments. The intern program in the PICES Secretariat has a one-year duration.

The PICES budget, with national contributions totaling less than $700,000 per year, is not sufficient to support an extensive CB program. Any significant CB initiative requires increased priority at the national level and extra-budgetary contributions from one or more member countries. Additional resources include collaborations with other international organizations/national agencies and grants from private foundations. PICES capacity building activities include the following:

ICES/PICES Early Career Scientist Conferences—The objective of these conferences is to create an opportunity for scientists at the beginning of their careers to meet colleagues from around the world and develop contacts and collaborations across international borders and disciplines that will persist for decades. Early career scientists form the steering committee to organize the events. The first event was held in 2007 in Baltimore, Maryland (USA) and the second event is planned for 2012 in Spain.

PICES Marine Science "Summer Schools"—The topics for the summer schools are developed by PICES Committees and Expert Groups. The locations depend on support of member countries. Participants are early career scientists from member and non-member countries. Lecturers are selected for expertise from the worldwide science community. Joint sponsorship with other organizations promotes broader participation. Boehlert reported that he has been involved recently in development of the summer schools. So far, the summer schools have included

- First CREAMS/PICES Summer School on *Ocean Circulation and Ecosystem Modeling,* University of Busan, Korea (2006)
- Second PICES Summer School on *Ecosystem-based Management,* Hokkaido University, Hakodate, Japan (2008)
- Third PICES Summer School on *Satellite Oceanography*, Seoul National University, Korea (2009)
- ClimECO2 Summer School, 8/23-27, 2010. PICES co-sponsors with Organizers IMBER, IUEM

PICES Methodological and Training Workshops—These workshops develop shared methods for data collection and modeling, and can result in special publications. The planners ensure participation of a diverse range of scientists, including early-career scientists. An example was the training workshop on *Techniques for building multi-trophic level marine ecosystem models, with special emphasis on NEMURO and NEMURO.FISH* for PhD-level scientists at the Centro de Investigaciones Biológicas del Noroeste (CIBNOR), La Paz, BCS (Mexico) in 2007. Other examples are provided by the PICES International Seafood Safety Project training classes held in Manila in January 2009 and in Guatemala City in February 2010.

PICES Intern Program—This program provides professional training in science and administration. Eleven individuals have been interns so far.

Some national programs have contributed to PICES goals. The Government of Canada has two primary options for providing capacity building for the conservation and management of fishery resources. For example, the Canadian International Development Agency (CIDA) is

country-driven. Support must be obtained through formal channels and often requires matching funding. The International Research Development Centre (IDRC) provides research-driven funding to individuals and groups, rather than to nations. The Centre for Training and Awards Program (CTAP) helps developing countries gain a critical mass of trained and experienced researchers. An example from the United States was a symposium held by the U.S. Department of State in 2004. The report from that meeting identifies concrete approaches to build international capacity, with a focus on mechanisms for U.S. contributions internationally. The report addresses concepts in the UNEP Global Program of Action and U.S. Commission on Ocean Policy, and stresses the need for evaluation and follow-up. This report was a foundation for a follow-up NAS/NRC Report: http://dels-old.nas.edu/oceans/report.shtml.

Jilan Su noted that development often outpaces knowledge. Middle-level bureaucrats are rewarded for development. Venu Ittekkot added that they used to complain about the people they trained being "lost" from marine science, but realized that we need patience as the countries develop and positions get filled. It is good to have people trained in marine science in national governments. It is important to have capacity building in government, people with training and connection with the scientific community. The programs where bureaucrats are trained should include some marine science training like the Sea Grant Marine Policy Fellows program in the United States. George mentioned the internationalization of the Sea Grant program. How could this apply to developing countries? Boehlert suggested adding a Research Experiences for Undergraduates (REU) program for students from developing countries to come to developed countries.

Integrated Marine Biogeochemistry and Ecosystem Research (IMBER) Project - ***Jing Zhang***
Jing Zhang gave an introduction to the IMBER project and its research themes. IMBER also has formed a Capacity Building Working Group. The new regional office at East China Normal University in Shanghai will have responsibility to support this group. The objectives of the IMBER CB Working Group include

- To enhance research capabilities in less developed countries, especially those geographically close to regions of interesting biogeochemical/ecosystem provinces for optimal implementation of the *IMBER Science Plan*.
- To enhance research capabilities globally in those IMBER activities that have few practitioners but are crucial for optimal implementation of the *IMBER Science Plan.*
- To strengthen graduate education in ocean sciences.

IMBER CD activities include summer schools and data management training. An example of IMBER-related summer schools are the ClimECO courses. The most recent course was entitled *ClimECO$_2$ - Oceans, Marine Ecosystems, and Society facing Climate Change - A multidisciplinary approach.* It was a 5-day training programme for 75 young scientists and students and included lectures and interactive discussions. The summer school provided participants with an overview of knowledge, methods, models, and approaches for analyzing the impact of climate change on marine ecosystems and the consequences for society. IMBER's regular open science meetings (Imbizos) have included training in data management. IMBER Imbizo II will include a hands-on "Dry Cruise" workshop, based on the IMBER Data Management Cookbook.

IMBER has learned that it is important when lecturers participate in summer schools that they stay around long enough to interact with the students. Funding sources must be extensively explored, especially when participants from developing countries are involved. CB activities benefit when regional experts are involved as they can help to promote the impacts. Themes and structure must be well designed at the beginning of CB development that target regional problems. Lectures and practical work should be combined and there is need to take different educational backgrounds into account. Active communication between lecturers and trainees, as well as among participants, is important.

IMBER is exploring the possibility of using a Japanese ship (from Hokkaido University) as a platform for capacity building in shipboard experience.

Zhang also mentioned the IOC/WESTPAC-CorReCAP Project in which he is involved, which has a goal for capacity building within the WESTPAC region in relation to coral reef research and education. This project is linked to other WESTPAC projects and to international research projects like IMBER. Another IOC/WESTPAC Training Course was held on "Impact of Sedimentary Dynamics and Biogeochemistry on Coral Reefs" in June 2010.

Surface Ocean – Lower Atmosphere Study (SOLAS) – ***Emilie Breviere***
The major SOLAS capacity building activity is the SOLAS Summer School series, which is aimed at Ph.D. and post-doctoral level scientists. The summer schools, of which there have been four so far, last two weeks. The sessions alternate between lectures (28 lectures covering basic and advanced SOLAS-related topics), student presentations (poster presentations and short oral presentations), and practical sessions (oral and written communication, modelling, gas exchange, atmospheric chemistry, laboratory work, research cruise). Typically, 70-75 students participate in each summer school, from 20-25 nations. About 25% of the participants in the past two years have been from developing countries. Funding is complicated; there were 53 different sponsors for the 2009 Summer School. The next one is scheduled for 2011. SOLAS put together a textbook from the previous schools to use in the future events. Breviere offered some lessons learned from the SOLAS Summer Schools so far:

- It is important to locate the summer school in a pleasant place that is relatively easy to reach.
- Nice lecturers should be selected, good communicators with good teaching abilities.
- Continuity is important; there have 283 students who have participated in the summer school so far and this is having a significant positive impact on the development of the community of SOLAS scientists.
- Funding every school is a challenge.
- For the future, SOLAS is trying to build a feeling of "belonging" to the air-sea exchange research network.

International Ocean Institute (IOI)-***Werner Ekau***
IOI is an international non-profit organization founded in 1972 to contribute to implementation of the UN Convention on the Law of the Sea (UNCLOS), to teach coastal countries how to benefit from UNCLOS. The IOI network includes 23 operational centers grouped into 5

geographical regions. IOI uses these centers to conduct small projects related to coastal issues. IOI's goals focus on ocean policy research and development, awareness and communication, and training and capacity building (conducted under the brand "OceanLearn").

Ekau described the IOI-Canada "Training Programme on Ocean Governance: Policy, Law and Management," which has been held for the past 30 years, with more than 600 alumni from 100 countries so far. It is an intensive, interdisciplinary, eight-week course conducted annually at Dalhousie University. The course is designed primarily for developing country professionals working in ocean and coastal-related fields. The typical class includes nine men and nine women from 15-18 countries. The format of the program includes lectures, exercises and simulations, individual and group presentations, an international roundtable, and field trips. The topics include key issues in ocean science, Law of the Sea, integrated coastal and ocean management, fisheries and aquaculture, marine transportation, maritime security, and energy and informatics. The program also includes skills-development sessions, on negotiation, project cycle management, disaster planning, media, and communications. As many as 80 local and international experts and practitioners contribute to each year's program. They are trying to organize an alumni organization, but this has been difficult to accomplish.

IOI conducts a second regular course on ocean governance, the "Training Course on Regional Ocean Governance for the Mediterranean and Eastern European Countries." This is a five-week intensive course that has been held in Malta annually since 2005. The course is accredited by the University of Malta, and targets participants from the Mediterranean, Black, Caspian and Baltic seas. The course features a strong faculty, with 10 foreign and 16 local individuals. It is supported by several sponsor organizations, including the EC. The course uses a holistic approach to ocean governance and the need to align practices to the evolving global environment in light of advances in science and technology. It builds on the legal framework and the linkages among the natural, social and economic sciences for the development of sustainable ocean governance in the regional seas adjacent to Europe. The course emphasizes support of technology to enable the realistic achievement of ocean management and sustainable development. It seeks to internationalize the EU Integrated Maritime Policy. The course has trained 100 mid-career professionals, a mix of lawyers, scientists, engineers, and managers. Participants gain a solid background on integrated regional ocean governance and marine affairs in general. They spread the ideas of good ocean governance as ambassadors of the ocean in their own countries and regions.

IOI also sponsors short courses, lasting one or two weeks, arranged by regional centers. IOI and ZMT have a joint program called ISATEC (International Studies in Aquatic Tropical Ecology). It is a 2-year international master course in Tropical Aquatic Ecology at the University of Bremen for foreign and German students that has been run since 1999. There is a long-term commitment of 10 scholarships from Deutscher Akademischer Austausch Dienst (DAAD), the German Academic Exchange Service. The program is accredited. Another project established a Diploma/Degree course in Fisheries. It is based on a fisheries development project by the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ). It aims to ensure sustainability in fisheries management in Papua New Guinea by developing capacity for fisheries catch and processing industry, administration, and management.

Ekau described the lessons learned from IOI and ZMT capacity-building activities:

- Long-term commitment is needed!
- There is also a need for short-term courses in specific areas, such as governance, conflict management, etc., and specific research fields
- Education needs to be strengthened in developing countries, for example, by supporting local universities/high schools as multipliers by sending experts for courses, etc., and by supporting development of curricula, and exchanging students between developed and developing countries.

South African Ocean Research and Observation Capacity Building ***- Juliet Hermes***
Juliet Hermes opened by saying that she has become passionate about capacity building in South Africa based on her experiences of being the object of misguided capacity-building activities, for example, inadequate use of local talent.

The South African Department of Science and Technology has put forward a Grand Challenge on Global Change: by 2018, for South Africa to be a world leader in climate science and the response to climate change in terms of mitigation and adaptation. "A co-ordinated suite of strategically focused Coastal, Oceanic, Atmospheric and Climate national research programmes is necessary to address the critical global change and marine biodiversity problems faced in South Africa". In order to achieve this Grand Challenge, it will be necessary to develop capacity; education and awareness are key factors in this process.

To address this Grand Challenge, the South African National Research Foundation set up the South African Environmental Observation Network (SAEON). SAEON is a facilitatory network, providing a platform for research, education and training; making data accessible and comprehendible. Hermes runs the marine component of SAEON, which has a capacity-building component:

- Relating marine science to school curricula
- Taking scientists to schools, to provide role models
- Taking learners on cruises
- Using international programs such as Argo and Ocean Teacher, as strong support from international organizations
- Working with schools from areas of abject poverty (in particular, coastal schools)

There is a strong thrust in South Africa to improve modeling and operational oceanography, which SAEON contributes to and which also provides a platform for capacity building for marine science. Most institutes have been working together, bottom up, to create a unified operational oceanography plan. The University of Cape Town (UCT) is building an integrated capability for marine observations and forecasting. Their vision is to deliver regular and systematic information on the state of the ocean that is of known quality and accuracy on open ocean to shelf scales. One example is the SimOcean initiative which is developing ocean modeling capacity in southern Africa to support both operational and research activities.

The MArine REsearch Institute (MA-RE) at UCT is based in the Oceanography Department, but involves other departments that are studying coastal and ocean areas. In addition to fostering and coordinating interdisciplinary and inter-departmental research, MA-RE has a capacity development mission, in coordination with other organizations. The main focus for MA-RE is on graduate students, but it also involves undergraduate and grade 11-12 students. The program includes outreach days for students and also bursaries for Master's and Ph.D. students, and for postdoctoral fellows. MA-RE also includes an 18-month applied science Master's degree program.

The Applied Center for Climate and Earth System Sciences (ACCESS) is also a response to the Grand Challenge, developed by George Philander. ACCESS is a multi-disciplinary, multi-institutional body facilitating Earth system science research, and capacity building and training. Like MA-RE, it includes outreach to schools, bursaries, and a Master's degree program, in Earth System Sciences.

Another route for capacity building in southern Africa is through the Large Marine Ecosystem (LME) programs, specifically the Benguela Current LME (BCLME) and the Agulhas-Somalia Current LME (ASCLME). The BCLME and related Benguela Environment Fisheries Interactions and Training (BENEFIT) program are focused on South Africa/Namibia/Angola. The Training Working Group (TWG) was established under BENEFIT. The BENEFIT Training Plan was initiated and completed with gaps and priorities identified. BENEFIT/BCLME ship-board training and workshops have been completed, for example, on fisheries stock assessment. The training was aimed at post-graduate studies and scientists at management agencies. A Strategic Action Programme Implementation Project (SAP-IMP)/Benguela Current Commission (BCC) project developed a prioritized list of courses showing the level, mode of delivery, and potential service providers for the SAP-IMP/BCC project. This list is useful for comparison with the other LME gap analyses, and possible initiation of training courses across LME boundaries, for example (already identified for both the ASCLME and BCC): aquaculture, resource economics, ecosystem-based fisheries management, integrated coastal zone management (ICZM), and invasive species.

BCLME and BENEFIT did a lot of training, mostly not research-based training, more technical, in terms of observations. ASCLME has had ship-board training and short courses. Each country has had a national training plan, which are fed into the LME focal point. The ASCLME acts as a focal point in the western Indian Ocean for a lot of CD activities. The ASCLME involves South Africa, Mozambique, Seychelles, Madagascar, Mauritius, Kenya, Somalia, Tanzania, and the Comoros Islands. Technical training is a key priority, for example, quantitative modeling in fisheries. ASCLME received support for a week-long modeling course from START. There is a need for more mentoring of young African scientists who are being fast-tracked. The French Institut de recherche pour le développement (IRD) does capacity building by sending their scientists to work in South Africa. ASCLME has learned from BCLME, and has built on the successful shipboard training and short course activities initiated by the BCLME. They have emulated the Training Plan initiative from BENEFIT to identify training gaps and priorities for the ASCLME region and set up a coordination group, with representatives from all ASCLME countries. ASCLME provides a substantial budget for this group, and allows the members to develop training activities for the ASCLME, and the compilation of National Training Plans, as a

precursor to identifying regional gaps. ASCLME is working closely with other regional initiatives, for example, in gathering information for training requirements for ICZM. Draft Training Plans are currently under review. Some key challenges are already apparent, for example, training for ocean governance and the translation of science into practical management. ASCLME ran a training course in April 2010 at the Mauritius Oceanographic Institute. The course focused on the use and maintenance of oceanographic equipment (for data collection and monitoring) for representatives from all ASCLME countries. Basic oceanographic equipment was distributed to each ASCLME country to collect inshore baseline oceanographic data, including a YSI Multi-meter (salinity, temperature, depth and space available for either O_2/pH/ chlorophyll) with 200 m depth capability, a GPS linked to the Multi-meter, and a 5 L Niskin bottle and 200 m rope to collect water samples. Additional training workshops were conducted this year on ATLAS (buoys?), deployment of oceanographic equipment, and fish identification. ASCLME has documented technical training as one of its top priority training areas, because there is a serious shortage in the region of trained oceanographic technicians and electronic technicians familiar with the design, maintenance, and repair of marine electronic equipment. It has been recognized that technical training is particularly needed in the following fields: oceanography, fisheries biology (in particular, quantitative modeling in fisheries and other fisheries management-related aspects), aquaculture, data management, numeracy, software applications, and conservation management.

Hermes indicated the general barriers to capacity building and training in southern Africa: political instability, government commitment (national, regional and local), lack of institutional infrastructure and capacity, ensuring continuity of training, retention of built capacity, and language differences. Hermes also offered some recommendations:

- Ensure CONTINUITY of training initiatives through adopting a business planning approach to course development, correct placement of courses, and long-term funding.
- Where appropriate, set up regional centers of excellence for LME training.
- Develop distance learning for regional courses adopting accepted international training standards – using CD-based initiatives where the Internet is not a practical tool.
- Make use of international centers of excellence where African expertise is not available, but ensure practical training for African situations!
- Support national training requirements where interventions are critical to LME management goals.
- Concentrate on developing mechanisms for the translation of science into practical governance.
- Promote a Monitoring, Compliance, Surveillance (MCS) Training network.

Other suggestions:

- Use local expertise where possible.
- Sustainability and maintaining support are important.
- Identify what skills are lacking and what skills are present.
- What facilities will be available (e.g., computing, software, equipment)?

- What training has the participant done before?
- Coordinate training courses, don't duplicate.
- Language of participants needs to be considered, as well as visas.
- What will the participant do on completion of the training?
- It is essential that skills learned are used after the course.
- If completing further studies, will a participant return to his/her home country or will it be a case of 'brain drain'?
- Good scientists may become overcommitted and management is often a more attractive career. South Africa has introduced "occupational service dispensation" to ensure scientists can work on a similar pay structure to managers
- Ensure, if necessary and relevant, that opportunities are well advertised, to avoid "empire building" (keeping the information just within a small group of potential applicants)
- Under-representation is still a problem, due to a lack of role models, in terms of mid-career scientists.
- Why build capacity in ocean sciences, if no jobs are available?
- Bursaries are needed at the undergraduate level.
- High-quality science in developing countries should be recognized. For example, PhDs from some developing country institutions are of international standards and should be accepted as such!
- Projects requesting funding for work within developing country regions should include developing country scientists.
- Tailored CD programs are needed, that ensure that the students are well matched to what the trainers can offer. That means that the students need to be selected very carefully and likewise the trainers need to have realistic expectations.

George Boehlert asked about evaluation of CB efforts. Juliet responded that follow-up is key.

Center for Science and Technology of the Non-aligned and Other Developing Countries – ***Venu Ittekkot***

Venu Ittekkot presented slides provided by Arun Kulshreshtha. The Center for Science and Technology of the Non-aligned and Other Developing Countries (NAM) was established in 1989, in New Delhi, India. It includes 44 member countries, many of which are coastal states. Their primary goal is to promote cooperation among developing countries, through workshops (5-6 per year), training programs, etc. They award fellowships to centers of excellence. They have developed books, monographs, and handbooks, in cooperation with people from developed countries. In 2004, the organization began to discuss coastal marine environments. The *Asian Journal of Water, Environment and Pollution* is a product of the center. NAM Research Fellowships provide airfare from one member country to another. ZMT handles 5 fellowships per year, where a fellow develops a project with a ZMT scientist. NAM's international linkages do not include many of the organizations that could be relevant. Peter Pissierssens asked whether the journal could not be made more accessible to developing country scientists. Ittekkot responded that they had to strike a balance between access and visibility. Member nations get the publication for free.

Research, capacity building activities and regional networking in oceanography at the Institute of Marine Sciences, Dokuz Eylul University (DEU-IMST), Izmir, Turkey - ***Huseyin Avni***
Turkish scientists are interested in the seas in the region near Turkey (Black, Caspian, Red, and Mediterranean seas), as well as the Indian Ocean. The Institute of Marine Sciences' mission is to

- conduct monitoring and scientific research on all major disciplines in oceanography;
- create, maintain, and improve the national capacity in marine sciences;
- conduct engineering surveys as expert services for coastal development and marine resource exploitation activities;
- establish international collaboration and cooperation opportunities in order to exchange information, knowledge, and expertise; and
- provide expertise in developing strategies in the context of the national interests related with naval rights, marine sovereignty, and jurisdiction.

The institute offers M.Sc. and Ph.D. programs in most of the traditional oceanographic disciplines and in areas of marine technology. DEU-IMST hosts the Inter-Islamic Science & Technology Network on Oceanography (INOC), which is an inter-governmental, nonpolitical and non-profit, autonomous body linked to "Organization of Islamic Conference (OIC) Standing Committee on Scientific & Technological Cooperation (COMSTECH), having international legal status. INOC currently has 23 active member countries. The objectives of INOC are

- to facilitate the exchange of scientific data and information and the transfer of knowledge resulting from marine scientific research and maintain continuing dialogue with member states on the development of ocean services;
- to set-up and maintain a data bank on the developments in the marine sciences and related fields, taking into account national interests of the subscribing countries;
- to collaborate and cooperate in areas of common interest with a view to helping each other in building up the national capabilities of its member states in the development of the exploration and exploitation of the marine resources;
- to initiate joint research programmes and other activities, promote capacity building and recycling of operators in the fields and provide consultancy and advisory services to the member countries; and
- to promote networking and develop partnerships with other similar regional and international organizations.

A major purpose of INOC is to create capacity in the member countries and to exchange data and information. It conducts its work through workshops; conferences; training courses; promoting, proposing and planning research; surveys; and organizing exchange programs for scientists and post-graduate students. Examples of workshops organized include

- International Workshop on "Mediterranean Vermetid Terraces and the Status of Lessespian Migration", INOC-National Centre of Marine Science of Batroun, Beirut, Lebanon, 19-21 December 2002;
- International Workshop on "Marine Pollution and the Impacts of Seawater desalination plants on the coastal environment", Dubai, UAE, 1-3 December 2003;

- International Workshop on “Marine & Coastal Protected Areas”, INOC-University of Meknes, Meknes, Morocco; 23-25 March 2005; and
- International Workshop on “Integrated Coastal Zone Management”, INOC-Marine Institute of Marine Science & Technology/ Dokuz Eylul University, Izmir, Turkey, 20-22 October 2009.

Conferences have included

- International Conference on “Coastal Oceanography and Marine Aquaculture: Confluence Synergy”, INOC-Borneo Marine Research Centre/University Malaysia Sabah, Kota Kinabalu, Sabah, Malaysia, 2-4 May 2006;
- International Seminar on “International on coastal water management & sustainable use of marine resources”, INOC–Centre de Recherche Oceanographique de Dakar-Thiaroye Dakar, Senegal, 14-16 November 2006;
- International Conference on “Rapid urbanization and land use conflicts in coastal cities”, INOC-Universities of Jordan & Yarmouk, Aqaba, Jordan, 30 October-1 November 2007;
- International Conference on “Modeling and Monitoring of Marine Pollution, INOC-Iranian National Center for Oceanography (INCO), Kish Island, Iran, 1-3 December 2008.

INOC has conducted training courses related to harmful algal blooms and to marine taxonomy. They are coordinating a project on “Observing and assessing ECOsystem changes in the Eastern Mediterranean Coasts (ECO-EMC)”. The objective of this project is to understand and elaborate changes in structure and functioning of the ecosystems in the eastern Mediterranean Sea along the coasts of Turkey, Syria, Lebanon, Northern Cyprus, and Egypt. The project will include 40 cruise days in 2011 and 40 more days in 2012. The project creates a platform that strengthens dialogue and co-operation on marine research and maritime affairs among countries in the region. It mobilizes the scientific potential of countries in the region to carry out, for the first time, a coordinated and cooperative research effort. The project will organize two multidisciplinary oceanographic surveys to investigate various problems and processes at the ecosystem level. The project will contribute to effective management of coastal ecosystems and their living resources through development of science-based remediation measures and thus stimulate sustainable development of the region. It will allow refinement of the design of monitoring and assessing ecosystem changes for the near future. The project will conduct capacity building in the area by providing training and educational opportunities to a broad audience, from school children to the public, to government administrators in the area. Young researchers and students will be involved. Graduate and post-graduate students will be trained using data collected within the project activities. The cruise will stop in each country to hold summer schools, workshops, and outreach to the general public. Twelve berths are available, with a new crew for each country.

International Foundation for Science - ***Ingrid Leemans***

Ingrid Leemans explained that the International Foundation for Science (IFS) was founded in 1972 and Roger Revelle was one of its founders, as he was for SCOR and IOC. The mission of IFS is to promote science for sustainable development: new technology underpinned by science is the basis for sustainable development. Such technology should be knowledge-intensive and

location specific, and it requires interaction among scientists, innovators, entrepreneurs, and users. Leemans described the research landscape in less developed countries as being characterized by a positive attitude toward science, expansion of universities and post-graduate programs, creation of regional research networks, and large cohorts of M.Sc. and M.A. graduates. The challenge is how to encourage the new generation of academics to choose a scientific career and how to transform academic degree holders into creative scientists. Donors must decide where to invest their resources: university department, research institute, faculty, university, regional research network, international consortium, and/or individual scientist. IFS focuses its efforts at the individual scientist level. Why? Intellectual capital is stored in individuals and science progresses through innovative thinking and creative interaction among individual scientists. Since the IFS focus is on individual scientists, how can an academic degree holder be transformed into an innovative scientist? Young scientists in developing countries face several predicaments. Universities concentrate on teaching and the research tradition is short in many of these countries. There is slow and insufficient access to scientific information and a lack of research funds. There is limited encouragement by superiors, an insecure career path, and unattractive salaries. Women academics are especially vulnerable. What kind of support is needed? Competitive grants and targeted support can help individuals make the transition from a degree holder into a fully fledged scientist. Acquiring a grant on competitive terms boosts a young scientist's research drive and morale. IFS fills a function here. IFS helps institutions to transform their degree holders to scientists who are competent, creative, innovative, and independent, through a competitive research grant scheme and a supporting package adding value to the grant.

IFS funds research projects addressing the sustainable management of biological and water resources. It has 1,000 scientific advisers and 130 affiliated organizations, including science academies. Close to 7,000 grants have been made in more than 100 developing countries. The IFS strategy is to identify young promising researchers, provide competitive grants awarded through a careful screening process, support researchers' early career, and support them at home. The research grants are relatively small, maximum US$12,000, that can be used for scientific equipment, supplies, literature, and fieldwork, but not salaries. This funding can also be used for supporting services, such as workshops, networking, and mentorship. The funded research projects last 1-3 years and the grants can be renewed twice. IFS follows up on its grantees through questionnaires and other means to assess the effectiveness of their grants. They have found that

- IFS grantees remain active researchers in their own country.
- IFS grantees publish more frequently and more often in mainstream journals.
- Many grantees' careers become internationalized.
- Grants lead to increased collaboration with other scientists.
- Grantees have success accessing additional funding from other sources.

The grants have different age limits in different countries. For example, the limit is 30 years old for China and 40 years for Sub-Saharan Africa. Receiving an IFS grant leads to a level of recognition that can help open other opportunities for grantees. IFS will focus more on the more scientifically weak countries in its next five-year program.

Funding mechanisms of the European Union for research and education - ***Barbara Hasenmüller***
Barbara Hasenmüller presented EU funding mechanisms in education and research. *Erasmus Mundus* promotes cooperation and mobility programs for the enhancement of quality in European higher education, the promotion of the European Union as a centre of excellence in learning around the world, and the promotion of intercultural understanding through cooperation with Third Countries as well as for the development of Third Countries in the field of higher education. *Erasmus Mundus* includes several Actions. Action 1 is the creation of joint MA and Ph.D. programs, which must include at least three different European universities from three different countries. Beyond this number, the consortia may include universities from other parts of the world. Students in the program must attend at least one other university besides their home institution. Ph.D. students are supported for the period they spend abroad. Masters students are funded for their full time. Action 2 involves establishment of cooperation partnerships between European and Third Countries' higher education institutions (HEIs) in a specific region to organize structured individual mobility. These consortia must include a minimum of five European HEIs from at least 3 EU countries and a minimum of one HEI from each country in the target area. The maximum number of partners in these consortia is 20. Scholarships of various lengths (3 months to 3 years) are awarded, in various disciplines. Scholarships are awarded for all levels (BA, MA, PhD, Postdoctoral fellows and HEI staff). Special attention is given to disadvantaged groups.

The African, Caribbean and Pacific Group of States (ACP) Science and Technology Programme (www.acp-st.eu) supports trans-Atlantic degree projects. It objectives are to

- support ACP countries in formulating and implementing S&T policies that lead to sustainable development and poverty reduction
- strengthen S&T capacity of ACP countries at institutional, administrative and policy-making levels
- Cooperation in applied research
- Set-up and development of common research instruments
- Management of research activities
- Transfer of knowledge, Capacity Building (no research per se, as this is covered by FP7)

The academic fields included under ACP are quality health care, environmental research activities, renewable energy, transport, agriculture and agro-industry, and sustainable trade.

EU Cooperation with Industrialized Countries—Includes trans-Atlantic Degree Projects (implementing double or joint degree programmes, including student and faculty mobility), Excellence in Mobility Projects (international curriculum development and short-term transatlantic mobility scheme, and Policy-oriented Measures (activities designed to enhance collaboration in higher education and training). There are specific joint programs with the United States (EU-USA ATLANTIS Programme), Canada (EU-CANADA Programme), and with major countries of the Pacific Rim (EU-ICI ECP: Australia, Japan, New Zealand and Republic of Korea).

Framework Programme 7—FP7 is the largest international research program worldwide. It is open to (almost) all countries in the world, and is open for universities, public and private

research institutions, as well as industry. FP7 includes 5 programs: Cooperation (2/3 of total budget), Ideas, People, Capacities, and Nuclear Research. The Cooperation program is the largest, of which environment (including climate change) is one key thematic area. Funding schemes within FP7 include collaborative projects, networks of excellence, support for training and career development of researchers, coordination and support actions, research for the benefit of specific groups (in particular, small-to-medium enterprises (SMEs)), and individual projects. The Cooperation Programme is a top-down funding programme with 10 thematic priorities. It annually publishes calls for proposals. Topics are integrated in annual work programs. The main funding instruments in the Cooperation Program are Collaborative Projects (large-scale or small/medium-scale projects), Networks of Excellence, and Coordination and Support Actions.

The question was raised as to whether *Erasmus Mundus* is driven mainly by research or capacity building. Hasenmüller answered that it is a combination, to build the European research effort and make it visible outside Europe. How do they work out requirements for joint degrees? Ed Urban noted that this will be an issue with any regional networks. It is difficult, but the process has been worked out. There is one coordinator at each institution who takes care of administrative problems. The grant will not be awarded until these details are worked out. Is there a mechanism for evaluating the programs? The EU evaluates the programs on an annual basis. There are documents that describe how to solve various problems. What is the sustainability of the program? The consortia are expected to run the programs on their own after a certain period. The undergraduate program is very popular. Are there many programs that begin with undergraduates from developing countries? This is a bit of a problem. Boehlert mentioned the REU system in the United States, which objective is to increase diversity in marine science. Talented undergraduates are brought to a university other than their own for 10 weeks in the summer. DAAD has a specific program for U.S. undergraduates at German institutions to recruit for masters programs. How should the EU be approached to propose a summer school course of 5-6 weeks in marine science? It would be difficult to not tie it to specific universities, but this might work under the partner program of *Erasmus Mundus*. Undergraduate education is more homogeneous, so maybe it works better there than for graduate school. Isabel Niang noted that European funds are difficult to access from developing countries.

<u>IOC Harmful Algal Bloom Training – Henrik Enevoldsen</u>

Over the past 20 years the IOC has by itself or with partners organised more than 60 training courses in species identification, toxicity testing and monitoring and management strategies for harmful algal blooms, with approximately 800 trainees. Emphasis has been in the regions most unprepared to meet HAB impacts, such as southeast Asia and Latin America, but the need for upgraded skills has been global and systematic. The training is designed as capacity building for people on the job. It is recognized that capacity building must address different levels: individual researcher or manager, institution/nation, region, and international, and that the capacity development interventions must be tailored for each level. It is important to work with partners in organization and implementation in the entire lifecycle of a CD activity. Cooperative efforts can contribute to a higher degree of serving national needs as more sectors of society become stakeholders in the design of an activity, leading to increased impact, participation of institutions regardless of their sector affiliation (science, management, health, food, etc.), and co-funding. The IOC HAB training program has worked with a large range of regional and international

intergovernmental organizations, as well as with the major professional society related to HABs, the International Society for the Study of Harmful Algae (ISSHA).

Partners are very significant in the CB lifecycle. They provide co-funding, sustainability, and outreach to affected sectors, which are not normally represented in IOC circles. Development of networks of trainees is important, based on questionnaires from training workshops. It is important to mix trainees with different backgrounds. Proper selection of the trainees is a major challenge. Having letters of recommendation is not enough. Sometimes poor selection of trainees is responsible for the failure of a program. It is good to ask a recipient's institution to provide some co-funding for the trainee's travel. We lack indicators for evaluating success. Lessons learned include

- Too often interventions at different levels are not coordinated or stand alone.
- There are strong synergies from a programmatic approach recognizing capacity development at different levels.
- Relations and networks arising from post-training interactions of individuals having attended training together has been shown essential to trainees.
- Partnerships in organization of CD is insufficient at all levels from ONE UN context to cooperation UN-bilateral CD activities.

This long-term endeavor has offered all the classical challenges of capacity development provided by international organizations:

- How can the appropriate selection of trainees be ensured? Who are the trainees?
- How can institutional commitment be ensured?
- How can training that is acknowledged and gives competences be provided?
- How can impact be measured?
- How can donors be convinced that capacity building is a long-term endeavor?

The combination of correctly identified issue + good strategy + adequate funding + good trainers + wrong trainees is too common.

Subsequent attempts to assess impact may then lead to the false conclusion that the issue, strategy, or trainers were wrong. Is the main beneficiary the recipient nation or the institution that happens to be focal point? If formal recruitment mechanisms are not giving the sought-after impact, alternative approaches to announcement and recruitment may be needed:

- What is asked for in the application form?
- Well-defined selection criteria are needed.
- Consolidate chosen trainees.
- Regional and professional networks are key.
- Using more involved approaches can be time consuming, but are worthwhile.

How can institutional commitment be assured?

- Course fees – stipends in combination
- More commitment
- Better networks
- Better courses
- MoUs as basis for cooperative research/TTR where partner institution commit to contribute

How can training be provided that is acknowledged and gives competences?

- Use e-learning in combination with hands-on methods to increase levels of training and to make training interactive
- Trainees should only be accepted if they are well prepared and are equipped with more equal background knowledge
- Very positive feedback from trainers to trainees
- Introduce accreditation by examination. This has changed courses fundamentally, has increased acknowledgement, and has become a reference in national accreditation of labs conducting regulatory monitoring and training.

How can the impact of CD activities be measured?

In principle, we want to design capacity development interventions that have enduring long-term impacts. We wish to measure impact to know if we are using appropriate approaches, to document to constituency and donors. How can we do this?

- Focus on the output of institutions
- Analytical identification of causal linkages between output changes and multiple factors inside and outside institutions
- No assumptions about efficiency of CD initiatives compared to other factors that may cause capacity changes
- Integrate the political realities and constraints for CD inside and outside organizations, including those related to the manner in which agencies/donors provide support/opportunities.

There are several challenges to measuring long-term impacts:

- Capacity and competencies are dynamic, not static, over time.
- When is competence or capacity lost?
- Adjustment of impact expectations to reality
- Cost of doing assessment

We lack standardized indicators or frameworks for assessing impacts of capacity development interventions. However, there is a community working on this issue. For example

Danish Institute for International Studies: *Evaluation of capacity development- a Learning Approach*, Capacity Development Evaluation, Step 1: Contributions to an Analytical Framework. Nils Boesen, Peter F. Christensen, Ole Therkildsen, 2002.

provides a systematic framework for describing and understanding why observed organizational capacity changes have taken place during a given period of time. The guidelines identify four major stages in the (qualitative!) evaluation process:

1. Organize the evaluation process with the target institutions for support (to enhance acceptance and learning aspects from evaluation).
2. Get the facts: **what** has changed from T0 to T1?
3. Begin analyzing: **how** have changes occurred? (What is the relative importance of relevant CD support activities from all sources compared to other internal and external factors that have influenced institutional capacity?)
4. Reach conclusions: **why** have changes occurred, what can be learned? (Assess the degree to which observed capacity and output changes can be attributed to support; assess its effectiveness and relevance, draw lessons).

How can donors and stakeholders be convinced that capacity building is a long-term endeavor?

- Analytical impacts assessment a help?
- Donor preference for projects rather than programmes is a challenge to longer term CD. Should a coordinated donor approach be used?
- If investment in CD is not medium to long term it is probably not important as most CD needs are not "fixed" and do not go away.

Breakout Groups

Two breakout groups were formed. One group was tasked with developing a global CD vision and a global CD strategy that the organizations involved in the meeting could adopt or participating organizations could work toward. The second group was tasked with identifying issues in CD and potential solutions to address these issues.

Global Vision of Capacity Building for Ocean Research and Observations—Capacity in ocean science, observations, and applications needs to be developed and maintained in all coastal countries of the world to make it possible for each country to use its resources and protect its ocean environment in a sustainable way. In more developed countries, human resources, physical infrastructure, and financial support were developed in the past and these resources have been maintained. In developing countries, the capacity to study the ocean, observe it, and apply the results of research and observations has not yet been developed sufficiently to make environmental protection and wise resource use achievable goals. The extent of help needed by different countries, the kind of assistance, and the key topics, differs among different developing countries. Provision of help to increase capacity has been termed capacity building or capacity development. Definitions include

"**S**pecifically, capacity building encompasses the country's human, scientific, technological, organizational, institutional and resource capabilities. A fundamental goal of capacity building is to enhance the ability to evaluate and address the crucial questions related to policy choices and modes of implementation among development options, based on an understanding of environment potentials and limits and of needs perceived by the people of the country concerned". *Capacity Building - Agenda 21's definition (Chapter 37, UNCED, 1992.)*

UNDP defines capacity development as the process through which individuals, organizations and societies obtain, strengthen and maintain the capabilities to set and achieve their own development objectives over time.

OECD defines capacity development as the process by which individuals, groups and organisations, institutions and countries develop, enhance and organise their systems, resources and knowledge; all reflected in their abilities, individually and collectively, to perform functions, solve problems and achieve objectives. (Glossary of Statistical Terms, downloaded, April 2009)

GTZ defines capacity development the process of strengthening the abilities or capacities of individuals, organisations and societies to make effective and efficient use of resources, in order to achieve their own goals on a sustainable basis. (GTZ, downloaded, 16 April 2009)

JICA defines capacity development as the ongoing process of enhancing the problem-solving abilities of developing countries by taking into account all the factors at the individual, organizational, and societal levels. (JICA, November 2007)

When applied to ocean science, capacity development includes increases in capability for research, observations, and institutional management. It can focus on individual, institution, national, regional, and international levels. Capacity building can increase the science basis of management and management skill, and scientific awareness. Another goal is increasing gender, national, and ethnic diversity, and participation of under-represented groups in ocean research and observations. Serious efforts at capacity development benefit both the donor and recipient countries and benefit ocean science worldwide. Capacity building rests on a series of pillars:

1. Communication—access to scientific knowledge/databases and transfer to policymakers
2. Training, education, and human networking (in research, observations, data management)
3. Equipment, engineering, and technical support (equipment can come from equipment manufacturers).
4. Operational support (computers, seed money to make research possible, access to advanced equipment in developed countries, application of the national facility idea internationally, ship time)
5. Follow-up and evaluation
6. Funding and other incentives

Approaches to Build the Pillars

- Scientific participants from developing countries should be involved in cruises in their EEZs. Different countries handle access permissions and requirements in different ways. It can be helpful to have a regional expert on each cruise. For example, Germany is helping set up a sustained observation capability run by the Cape Verdians. Whether it is useful to have a scientist from the local country may vary by country and the topic of the cruise.

Capacity Development is much more than training and includes the following:

- **Human resource development**, the process of equipping individuals with the understanding, skills and access to information, knowledge and training that enables them to perform effectively.
- **Organizational development**, the elaboration of management structures, processes and procedures, not only within organizations but also the management of relationships between the different organizations and sectors (public, private and community).
- **Institutional and legal framework development**, making legal and regulatory changes to enable organizations, institutions and agencies at all levels and in all sectors to enhance their capacities.

External support is no longer seen as the sole vehicle through which capacity development takes place.

The meeting participants adopted the following **Capacity Development Mission**:

> *"through international cooperative mechanisms, identify and address capacity-development needs to contribute to improved research, management and decision-making processes, sustainable development, and protection of the ocean and coasts"*

Capacity development is seen as a long-term effort that needs to be embedded in broader change processes that are owned and driven by those involved, that are context-specific and that are as much about changing values and mindsets through incentives, as they are about acquiring new skills and knowledge. (UNDP, 2009)

It is essential to undertake needs assessments at national and regional levels. These have been carried out occasionally by individual programmes like IOC/HAB and IODE. Needs are also expressed by IOC regional subsidiary bodies and IOC governing bodies. Meeting participants recommended that assessments be undertaken systematically prior to planning CD activities. Participants noted that collaboration among the organizations participating in this meeting may lead to more coherent and detailed needs assessment as well as more engagement of different stakeholder communities addressed by these organizations.

Capacity Development Strategy—The strategy for capacity development for ocean research and observations has several important elements: partnerships, relevance and sustainability, awareness raising, assessment of effectiveness, and funding.

PARTNERSHIPS

1. The meeting recommended **complementary and/or joint activities among the partners (international and regional organizations)**.
2. Promote **cooperation with regional organizations, consortia, legal bodies, projects** etc.
3. Promote **intersectoral cooperation** at the national level (cooperation between governmental departments + other stakeholders such as private sector, academic) + engagement

RELEVANCE AND SUSTAINABILITY

1. **Needs assessment** – Promote self-identification of needs for research, observations, data management, and application of science on national and regional levels. Offer CD activities that address identified needs (see http://www.thegef.org/gef/node/1291).
2. **Evaluation of results** – Where possible, design our CD approaches in ways that their effectiveness can be evaluated after the action.
3. Human CD interventions should, as a priority, have an **institutional context;** that is, trained staff should be able to apply the acquired expertise and knowledge. This includes having the required institutional and operational resources (equipment, operational budget) as well as ensuring that the acquired expertise addresses institutional and national priorities. If the required resources are not available at the national level then resource mobilization efforts (e.g., donors) should be undertaken (e.g., IODE ODIN).

AWARENESS RAISING

1. **Awareness raising** (all layers of society) including promotion of engagement of decision makers.
2. This may also include encouraging scientists to identify unique research needs.

ASSESSMENT OF EFFECTIVENESS

1. **Apply up-to-date training methodologies** to maximize reach and impact.
2. Promote and assist with **access to data and research findings** (including access to literature and data by developing country scientists (in collaboration with INASP, FAO, publishers, societies, Open Science Directory (http://www.opensciencedirectory.net/); Online Access to Research in the Environment (http://www.oaresciences.org/en/), International Network for Availability of Scientific Publications (http://www.inasp.info/), AuthorAid (http://www.authoraid.info/).
3. Assist scientists to publish research findings and share data; consider financial, cultural and language issues). Make international scientists aware of regional journals.
4. Networking?

FUNDING

1. Funding for capacity development, including funding for assessment.

Issues and Solutions—Capacity development needs can be defined in terms of "top down" approaches (e.g., IOC),"bottom up" approaches (e.g., SCOR), and director-driven approaches (e.g., POGO). We need to differentiate among these; which one of these we are dealing with will affect the issues and the solutions. The focus of this group was primarily on training and mentoring approaches.

Issue:
Evaluation of outcomes and overall impact of programs (necessary for funders). We lack standardized indicators or frameworks for assessing impact of capacity development interventions. There are two aspects of this evaluation: (1) outcome and impacts of the course and (2) assessment of the quality of the course/program content and instructors. These two types of evaluation need to be considered separately.

Solutions:
a. Joint effort to obtain funding for evaluation of the capacity development courses, for example, search foundations that might be interested in marine sciences but not necessarily in funding capacity development, perhaps approach the Nippon Foundation.
b. After returning home, students should give a presentation/report/newsletter and then send feedback to course organizers.
c. Find out during the course whether students attending the course heard about it from previous course attendees.
d. A follow-up to the course should be considered, such as creating a network.
e. An example of post-course surveys include those done by NSF-supported internships (REU-research experience for undergraduates) (Centers for Ocean Science Education Excellence COSEE). Appendix III contains the questionnaire used by the IOC Science and Communication Center on Harmful Algae for the courses they run. Also frameworks that have been developed in bilateral contexts may be useful (although may be more suited to large programs). European evaluation society (offering training opportunities to evaluate capacity building programs). UNDP also provides methodologies.
f. How could we make alumni groups work and are they needed? Perhaps using social network pages. For summer schools, perhaps identify a student who can organize a report back on what trainees are doing after the course is completed. This might not be successful as things tend to drop off after the course, also this wouldn't work for smaller courses. Contact previous students (alumni) attending conferences and ask them to organise some kind of event for alumni, such as a dinner. Or create a list of examples of follow-up that they can do in the future and give to them at the course. Ensure a 'permanent' email address is included.
g. Provide some sort of recognition to alumni or some incentive (e.g., t-shirt!) to keep them involved. Make lectures available on line.
h. Universal criteria for evaluation

Issue:
Selection of candidates/trainees for fellowships, summer schools, and other training. Some projects, such as IMBER and SOLAS, have good examples of candidate selection.

Solutions:
a. An example of an application form is given in Appendix IV

b. List criteria for selection - can't be too specific
c. Participant diversity (e.g., gender and geographic diversity) is one criterion, how much weight should be on this?
d. Wide/appropriate distribution of announcement (but still maintaining the correct political channels when dealing with, for example, intergovernmental organisations)
e. When making the selection, institutional commitment should be considered. Consider institutional context
f. Request recommendations/references
g. Ask different organisations for their experiences and create a database with this information

Issue:
Coordination among the courses and summer schools of different organizations

Solutions:
a. Identify training gaps, for example, the role of social science in capacity development in ocean sciences (LOICZ might be a good example of this). The availability of the IODE portal to summer schools will help identify the gaps. IODE sends out a list of courses to alumni and past courses and suggestions from lecturers and asks them what courses they would like to see/attend and then decide on courses for next year.
b. Identify diversity of courses
c. What is the value-added benefit of a new course?

Issue:
Sustainability of Training

Solutions:
a. Long-term funding commitments are a necessity.
b. Trainer selection—For example, regional trainers and using regional knowledge to ensure sustainability
c. The issue of brain drain (through leaving the country/region) is more of an issue in developing countries because fewer scientists, and also the brain drain by promotion after having received a better qualification (moved to a higher salary with more administrative work than science)
d. One solution would be to allow the same trainees to attend sequential courses, with the course advancing each year (i.e., an ongoing commitment and support to the trainees who would progress through stages of a course). This approach would be more suitable for some kinds of courses than for others.

Issue:
Mentoring (at all levels)

Solutions:
a. Learning from SOLAS
    i. Selection process of mentors was not done in the best way.
    ii. Follow up was not completed

iii. Condition of travel grant was to provide a report on the mentoring, yet this was not received.

b. What type/definition of mentoring (e.g., conference mentoring), scientific mentoring (e.g., help writing paper when English is not the author's first language)
c. How do you monitor/evaluate the success of mentoring? Should there be a follow up of each trainee? Can they contact the mentor at any time after they have been mentored, which would imply a big commitment for the mentors?
d. Level of trainee (PhD or post-doctoral fellow)
e. Create a mentor volunteer list - Handbook of mentors, include a "job description of mentor responsibilities". Could SCOR create this from different working groups or would this list be too broad? Problem if expertise is very narrow.
f. Perhaps we could go along the procedural lines of the visiting scholar/professor programs of SCOR and POGO, and thus get a list of interested people to take up mentoring work. Raise this in conferences with special sessions. Ensure that institutions around the world have the opportunity to have mentors (developed and developing countries).
g. There may be volunteers to be mentors, but linking them with the right candidates can be difficult.

Issue:
Using developing country scientists within courses as lecturers and reviewers, etc. Maintain diversity within the organizing group.

Solutions:
a. This way information can also be more widely distributed.
b. This links back to the mentoring (developing country scientists learning from being involved in course organizations).

Issue:
Involving young scientists/developing country scientists in meetings through rapporteuring, etc. Have a young scientist sit in on a working group (from the region where group is meeting).

Issue:
Institutional commitment/buy-in is desirable but not a necessity/pre-requisite. NB this depends on context - course/institute/applicant. See example of IODE application form.

Solution:
a. Institute has to remain responsible to the funders.
b. Employer/employee relationships
c. Co-funding by institute (e.g., course fees) – stipends in combination (e.g., for IMBER course, PICES covers accommodation but institute has to cover some of the costs)
    i. More commitment
    ii. Better networks
    iii. Better courses
    iv. MoUs as the basis for cooperative research/TTR where partner institution commit to contribute

Issue:
Local support of trainee on return from ‘course’

Solutions:
a. Job availability/security
b. Management support
c. Funding requirements
d. Logistics of home country
e. Will they use training
f. Can this be monitored/evaluated

Notes
Training within a regional project
UNESCO chairs in oceanography (e.g., UNESCO IOC hosted St. Petersburg)
Making students aware of opportunities (e.g., Marie Curie fellowships etc)
United Nations Train-Sea-Coast Program - enhance national regional capacity development on training through transboundary issues who have developed criteria for evaluation.
GEF has a page on capacity building and self assessments
Dalhousie program (IOI)

Table 1. Capacity-development approaches used by organizations represented at the meeting.

	IAEA	IFS	INOC	IOC	IOI	NAM	PICES	POGO	SCOR	START
Grants to attend meetings	X	X		X			X		X	X
Grants for short-term training in ocean obs	X		X					X	X	
Grants for short-term training in ocean research			X			X				
Grants for training in data and information mgmt			X	X						
Summer Schools			X	X		X	X		X	
Training for professionals	X	X	X	X			X			
Training through research	X	X	X	X						X
Ship-board experience			X	X				X	X	
Visiting Professorships								X	X	X
Centers of Excellence in oceanography training				X				X	X	
Leadership training				X	X					X
Distance Learning				X						
Internships in International Secretariat				X			X			
Assistance with Publications?										

WIOMSA, LMEs, ICES, IGBP, APEC, APN, IAI, South Pacific Forum, South Pacific Commission, and other regional organizations and/or projects also are involved in capacity development activities related to ocean science and should be queried for information relevant to this table and report. See Appendix II for detailed descriptions of these approaches.

Appendix I - Participants List

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Appendix II - Summary of Approaches

Participants began to summarize information on the approaches used for capacity development by various organizations, as guides to these approaches that might be used by others. Following are descriptions for funding for participation in science meetings, grants for short-term training in ocean observations, summer schools, ship-board experience, visiting professorships, centers of excellence in oceanography training, and internships in international secretariats.

Yet to be compiled are descriptions for grants for short-term training in ocean research, grants for training in data and information management, training for professionals, training through research, leadership training, distance learning, and assistance in publishing.

Approach: Funding for Participation in Science Meetings

Description: Students, scientists, professionals from university and government institutions are provided with full or partial support to attend international ocean science meetings.

Used by: IAEA, IFS, IOC, PICES, SCOR, START

Advantages:

1. Helps recipients from developing countries network with colleagues from other countries and get up to date on the latest scientific information in their field(s) of interest.
2. Helps publicize science that may not be well-known outside the recipients' countries, though poster and oral presentations.
3. Can bring new scientists into international projects and establish new collaborations.
4. IFS uses its travel grants to leverage its program of small grants to developing country scientists.

Considerations for Implementation:

1. Determine who will make the selections. For maximum impact, the selection process should involve active scientists who are involved in planning the meeting, including someone representing the local host.
2. Decide eligibility: age, education level, professional status, countries (level of development, membership in granting organization, etc.), requirement to make a presentation.
3. Decide whether full or partial support will be offered. Recipients from countries with higher OECD/World Bank ratings may be able to use the funds from the international organizations to leverage local funding, so they would need only partial funding support. Ability to raise some local funds can be a sign of the interest of local sources and their ability to capitalize on the recipient's experience when s/he returns.
4. What kind of networking assistance is needed by participants? This will depend in part on the age and professional level of the recipients. For example, students will typically need more assistance than established scientists. See networking assistance information below.
5. Will the travel support program be imbedded in a larger program for all students/early career scientists? Many of the steps described below could be helpful for young scientists from all countries, not only developing countries.
6. Need to evaluate the outcomes of the participation.

Networking Assistance

1. After selections are made, determine level of networking assistance that may be necessary/helpful. If the recipients are senior scientists known to the organizers, they may not need any networking assistance. If the recipients are younger scientists or unknown to the organizers, assess level of networking assisstance needed.
    a. Has the recipient participated in an international scientific meeting previously?

    b. Does the recipient know anyone else attending the meeting, such as a co-worker, advisor, or someone else from their country or institution?
    c. Would the recipient like to be assigned an established scientist with whom they could have contact before the meeting, at the meeting, and after the meeting?
    d. Would the recipient like to have an opportunity to meet with other recipients at the meeting?
2. Determine what form the networking assistance will take, based on the assistance needed. At a minimum, there should be some contact between the mentor and recipient before the meeting, several contacts at the meeting, and at least one contact afterward, to help assess the benefits of the experience. Many meetings have some kind of event—a reception, meal together, special session, etc.—to bring the mentors and recipients together at a pre-determined time and location. Some smaller meetings that do not have contributed oral presentations may have a short presentation by each student at some point in the meeting. Mentors can advise recipients in preparation of such presentations.
3. Recruit established scientists who will be attending the meeting to serve as mentors. This should be done through open requests for help and more specific requests to individuals. (It is sometimes hard to get people to volunteer for this responsibility, but most who take it on say that it was a positive experience.) Some individuals are well-known for their passion for capacity development and teaching, and could be especially targeted to serve as mentors. Some meetings prohibit pairings of people who have had previous contact.
4. Match mentors with same-gender recipients, with some common research interests. Ability to communicate well in a language that both recipient and mentor can speak is useful.
5. The mentor should introduce the recipient to other meeting participants (especially those that the recipient has identified that they want to meet) and should give them feedback on any presentation they make at the meeting.
6. Monitor the process to ensure the steps are being followed.
7. Evaluate the success of the activity after the meeting, through an email questionnaire, "exit interview", page on FaceBook, etc. Response rates can be very low if not in person. Stress the importance of each recipient's input to evolve the program for future recipients.

ASLO Meeting Mentoring—The American Society of Limnology and Oceanography has developed the following description of its mentoring program.

"Mentoring students or junior scientists is an important part of capacity building. Mentoring by an experienced scientist at scientific meetings can greatly enhance the meeting experience for a student or young scientist, and introduce them to an important part of a scientific career. Best practices assure positive outcomes for the meeting experience for the student. Consider some of the following activities that have proven to be beneficial in the mentoring process:

- The mentor should contact the "mentee" prior to the meeting via email for initial introductions and to arrange an initial meeting at the meeting.
- At the initial meeting, get to know them, and go over the meeting agenda. Decide on times when you will meet, and select papers that you will both hear and later discuss.

- Mentors should plan to spend some time with the students almost every day of the meeting. It is important to make very formal arrangements as to where and when you will meet, because casual approach often fail. Spend some time in sessions sitting with them. In the ASLO Multicultural Program, the students are required to critique two talks and two posters and have work-books to facilitate this, and discussion of good and bad papers you have both heard is beneficial in this effort.
- A very important task for the mentor is to introduce the students to your colleagues. It is not easy for the student to break-in to the network, and your help in this regard is essential. Examples include the following:
    - go with them to poster sessions and introduce them to colleagues standing their poster.
    - Learn the scientists that they would like to meet and work to introduce them for discussions.
    - If the student has a talk or poster, be sure to recruit colleagues who might have interest in their topic, and be sure that you hear the talk or visit the poster as well.
    - Spend at least some time with your student at social events in the meeting. This presents a good opportunity to introduce them to a range of scientists and make them feel more comfortable in the meeting.
- Follow-up is likewise important. The student should feel comfortable in communicating with you via email after the meeting."

Approach: Grants for short-term training in ocean observations

Description: Students, young scientists, and technicians are provided travel and per diem support to learn techniques related to ocean observations. POGO and SCOR have supported a joint program since 2001 and have provided training opportunities for about 100 individuals. The program is specifically designed for individuals from developing countries to obtain training relevant to the Global Ocean Observing System. IAEA's conducts both short-term training in developing regions and longer-term training conducted at the Marine Environment Laboratories in Monaco.

Used by: IAEA, INOC, POGO, SCOR

Advantages: These programs provide an opportunity for individuals from a developing country to spend an extended period of time to learn techniques related to ocean observations, such as how to prepare and deploy Argo floats, use remote sensing data and models, conduct fixed-point time series observations, techniques for measuring environmental pollutants, etc.

Considerations for Implementation:

1. It is important to have an evaluation process that favors scientists that will be in a position to train others at their home institution after they return.
2. The training should be restricted to techniques and equipment that are either already available in the home institution or can be expected to be available in the near future.
3. It is important to make a distinction between observations for operational oceanography and research purposes.

Approach: Summer Schools

Description: Graduate students/early-career scientists are brought together for 1-2 weeks, usually, to focus on specific topics or areas or study, with classroom lectures and often with hands-on lab sessions, shipboard time, modeling experience, etc. Research projects sponsored by SCOR have used this approach effectively to bring students together to cross the boundaries of atmospheric and ocean science (the Surface Ocean-Lower Atmosphere Study) and the boundaries of ocean biogeochemistry and ecosystem research (the Integrated Marine Biogeochemistry and Ecosystem Research project). The Ocean Sciences Division of the U.S. National Science Foundation uses a version of the summer school concept to bring together the top Ph.D. graduates (or near graduates) in specific oceanographic disciplines for a few days to help them network. PICES member nations host summer schools developed by PICES Committees and Expert Groups for early career scientists from member and non-member countries. IODE has developed a portal to ocean summer schools (see http://www.oceansummerschools.org/).

Used by: INOC, IOC, NAM, PICES, SCOR

Advantages: This approach has the benefit of focused attention of students on a specific topic in an intensive setting. The summer schools are often interdisciplinary and can be used to develop a community of young scientists working across traditional disciplinary boundaries. The networking achieved through summer schools can be important in career development for participating young scientists and to develop future research collaborations.

Considerations for Implementation:

1. It is important to locate the summer school in a pleasant place that is relatively easy to reach.
2. Nice lecturers should be selected, good communicators with good teaching abilities
3. Continuity and tracking of summer school graduates is important, to determine the impact of the program on the field of research, and maintain support and funding for the schools.
4. Funding every school is a challenge.

The following questions should be considered before an institutional summer school-type program is developed:

- Why do I want to offer a capacity-building course through my university?
- Can it be embedded into the needs of my university (e.g., local graduate/postgraduate program)? Can it be counted for the partial fulfillment of a degree?
- Do we want to offer it to our own students only or possibly also to students from other universities (outreach, prestige)?
- Can we offer topics, knowledge, study sites, methods, etc. that are unique for the field of oceanography and attractive for students in the field?
- Do we have the academic capacity (team of experts or access to them) to launch such an activity and can we count on the willingness of our colleagues to contribute?

- In which form shall we offer the CB course, as a block course at a suitable location outside the university (intense focusing) or as a regular curriculum course outside of the teaching semester?
- Do we have the intention to develop the course into a sustainable CB program?
- Can we offer suitable course facilities to house and work with a group of students?
- How do we evaluate and follow up on the success of our activities?
- How can we assure funding for a number of years?

Approach: Ship-board experience

Description: Trainees participate in ship-board science activities. The POGO Visiting Fellowship Programme for on-board training on an Atlantic Meridional Transect cruise offers the opportunity for a scientist from a developing country to participate in cruise preparation and planning, to help make hydrological, biological, and ecological observations on board the ship, and to analyze and statistically interpret the results after the cruise. SCOR occasionally provides support for travel of scientists from developing countries to and from research cruises that have offered their empty berths for training, in relation to SCOR-supported projects.

Used by: INOC, IOC, POGO, SCOR

Advantages: This approach provides first-hand experience for trainees about what is involved in conducting ocean science from ships.

Considerations for Implementation:

1. The best practice is to have the trainee at the host institution for a period before and after the cruise for extended preparation and analysis of samples/data, but this is not always possible.
2. It is especially important with this approach that trainees will be able to take advantage of their shipboard experience when they return home, that is, that their institution/country has access to a research vessel on which the trainee's new skills can be used.

Approach: Visiting Professorships

Description: Professors or other scientists from one country go to a developing country to teach, mentor, do joint research, and conduct other activities to help train students and scientists, and to develop new research partnerships.

Used by: POGO, SCOR, START

Advantages: This approach allows the training of a larger number of scientists than bringing developing country scientists to meetings or training in developed countries one by one. It also is more likely to provide training that is relevant to the context of research questions of interest in the region, and using techniques and equipment relevant to the region. Finally, this approach gives an opportunity for extended contact between the trainer and trainees, over weeks to months.

Considerations for Implementation:

1. In some cases, hosts and visiting professors will self associate; in other cases, hosts and potential visiting professors will need help with matching.
2. Local hosts should provide some level of local support.
3. Visiting professors may be provided an honorarium to help support their expenses.
4. It is important that visiting professors make recommendations to the sponsoring organization(s) regarding the potential and needs for future CD work with that institution/country.
5. Consideration should be given as to whether to provide one-time professorships open to all developing country institutions, to create a sustained partnership with a few institutions, or to use a combination of both approaches.

Approach: Centers of Excellence in oceanography training

Description: Actual or virtual centers of excellence may be developed to bring together teaching expertise with students from a region or globally. The POGO approach, funded by the Nippon Foundation, has been bringing students to the Bermuda Institute of Ocean Sciences (BIOS) since 2008. The Centre offers a 10-month programme of study to 10 students every year. The SCOR concept has yet to be implemented, for lack of funding, but the general idea is to form virtual networks of ocean science institutions in developing regions to bring together a critical mass of expertise and resources to train students in ocean science, with classes, cruise experience, summer schools, etc. rotating among institutions in the region.

Used by: IOC, POGO, SCOR

Advantages: The approach enables students to be trained in a wide range of techniques for ocean science over an extended period. It provides the advantages in terms of networking mentioned also for summer schools.

Considerations for Implementation:

1. For shared regional centers, the perception of fairness among participating institutions is crucial.
2. There must be a system for transfer of academic credits among participating institutions and perhaps a waiver of some fees.
3. Arrangements in each region may differ, based on the institutions involved. At the same time, different centers of excellence should be able to learn from each other.
4. Management oversight of the centers should be done by a committee of the institutions involved, but an outside "committee of visitors" could be helpful in terms of both providing independent advice and helping suggest funding sources.

Approach: Internships in International Secretariat

Description: At least two international organizations host scientists as interns in their secretariats to train them in project/program management. Internships can be an important tool in capacity development, providing "on the job" training.

Used by: IOC, PICES

Advantages: Internship programs are a good way to prepare scientists for project/program management. Many permanent positions in management require some experience and most international secretariats have long experience in successful operation that could benefit interns and the organizations they eventually will serve in. Connections between an international office and its constituents can be strengthened through internships.

Considerations for Implementation: PICES has developed an Intern Program that allows individuals from PICES member countries to gain experience in operations of intergovernmental scientific organizations and coordination of multidisciplinary international ecosystem research programs by working in the PICES secretariat for periods of up to one year. The PICES Secretariat hosts up to one intern at any time. This program benefits both the PICES Secretariat and PICES member states. Under the supervision of Secretariat staff, interns work on projects of the Secretariat relevant to their professional interests and development needs, including ESL (English as a Second Language) training if required. Interns may be given a wide variety of tasks, such as to assist in preparing information for and providing secretarial support to PICES Working Groups and Scientific and Technical Committees; organizing scientific meetings; organizing and editing various PICES publications; coordinating international cooperative programs in marine science; and coordinating PICES activities with efforts to other relevant organizations. Applicants must be staff of the academic or government sector of PICES member countries, have a university degree (M.Sc. or Ph.D. will be an asset), the ability to read, write, and speak English (taking into consideration whether English is the candidate's native language), the ability to use computers and the Internet, and demonstrated personal initiative. The selection process ensures balanced distribution of internships among member countries over time. PICES interns are provided a stipend of CDN $2,000 per month by the Secretariat. Travel costs for the intern to and from the place of residence and the location of the Secretariat are normally borne by the individual's home country. Travel expenses associated with the intern's work in the Secretariat are covered by PICES. Since the intern will continue to be an employee with his home institution while at the Secretariat, his/her medical insurance and all other benefits remain the responsibility of the intern's home country.

Appendix III

IOC SCIENCE AND COMMUNICATION CENTRE ON HARMFUL ALGAE

QUESTIONNAIRE FOR ASSESSMENT BY TRAINEES

The purpose of this questionnaire is to collect information for overall assessment of the training course and to improve future training and related activities.

Please check the boxes as appropriate and write your comments and suggestions:

Please be frank and direct in your comments!

Like this:	1	2	3	4	5

poor.....excellent

1. Were the objectives of the Course well specified?

	1	2	3	4	5

Have they been successfully met?

	1	2	3	4	5

Comments:

2. Were the lectures given by the instructors and practical exercises adequate to meet the objective?

	1	2	3	4	5

Comments:

3. Do you think the course programme was too advanced, just adequate or too low?

Too advanced ..... Adequate ..... Too low.....

Comments: (did the course meet your expectations as standard is concerned?)

4. Was the course useful to you? Did you learn anything that is new and useful to you?

	1	2	3	4	5

Comments (if so, what?)

5. Was the duration of the course adequate?

Too short ..... Adequate..... Too long.....

Comments:

6. Do you feel a need for modification of the course programme?

Yes ..... No.....

Comments: (if so, please specify the need, what additional areas should be covered?)

7. Any other comments and suggestions regarding the course including:

a. Did you have adequate opportunity to work in specific areas or obtain specialized help?

Yes ..... No .....

b. Do you think there is a need for more training courses on other aspects of harmful algae in your region? If yes, which topics?

c. Other comments if any.

8. What do you think of the instructors and lecturers?

We would like to know what you think about the lecturers you have met during the course, please tick off according to your views:

Name	Was the level of the lectures			Did you understand what the Lecturer said? (English)		
	too low	OK	too high	Yes	no	partly
Jacob Larsen						
Helene Annadotter						
Øjvind Moestrup						
Nina Lundholm						

9. How do you rate this course?

unacceptable	
poor	
adequate	
good	
very good	
outstanding	

Your name: (if you want).....

Appendix IV

APPLICATION FORM

IOC Training Course and Certification on Identification/Enumeration of Harmful Marine Microalgae, 2009

I apply for:
1. Identification training course and cerftification:..... Certification only:.....
2. Enumeration workshop and certification:.....
Nationality:..... Female:..... Male:..... Age:.....
Family name: First name:
.....
MAILING ADDRESS:
.....
.....
.....
.....
Telephone:.....
Fax:.....
E-mail:.....
PRESENT POSITION:
Title or post:..... Years of service:.....
Name and address of employer:
.....
.....
.....
.....
EDUCATION:
University attended: Dates: Degree(s):
....
....
Describe shortly and relevant studies abroad:

List any regional training activities attended:

THEORETICAL EXPERIENCE:
I have a basic knowledge of microalgae taxonomy: Yes:..... No:.....
PRACTICAL EXPERIENCE:
How many years of practical experience in taxonomy identification of microalgae:.....
Do you have practical experience in use of light microscope: Yes:.....No:....., use of electron microscope: Yes:..... No:.....
DESCRIBE <u>YOUR</u> CURRENT RESEARCH AND/OR MONITORING ACTIVITIES:
Please use seperate sheet of paper, 1/2 to 1 page, to answer the following:

What are your area of expertise and interest?
What are your current research projects?
Are you participating in a monitoring programme in your country? If so, please describe your function.
How could this course contribute to your on-going and future research activities?
Have you participated in any regional research initiatives? If so, please describe.
Please list your relevant publications.
TEACHING:
Are yourself responsible for teaching in algal taxonomy, Yes:... No:.... and for how many years:.....
LANGUAGES: (The language at the course will be English. It is very important that you are very sincere concerning your level)
Mother tongue:.....

English ability:	**Good**	**Average**	**Poor**
Understand	**.....**	**.....**	**.....**
Read	**.....**	**.....**	**.....**
Speak	**.....**	**.....**	**.....**
Write	**.....**	**.....**	**.....**

Signature of Applicant: **Date:**

..... **.....**
ENDORSEMENT AND RECOMMENDATION OF INSTITUTION:
Name, title and signature of official: **Date:**

....

Completed form should be submitted to: *the IOC Science and Communication Centre on Harmful Algae*, University of Copenhagen, Øster Farimagsgade 2D, DK-1353 Copenhagen K., Denmark, Fax.: + 45 33 13 44 47, with a second copy to the applicant's National IOC Action Address.