

PART FOUR

IPY Public Programs; Publishing and Archiving IPY; New Generation of Polar Scientists

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Introduction

Chapter 4.1 IPY Education Activities

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Chapter 4.3 Early Career Researcher Activities During IPY

Introduction

David Hik

Three critical aspects of the IPY 2007–2008 program that were identified early in the planning process (*Chapter 1.3*) included capturing the interest of educators, the public, government officials, and media; preserving the scientific and public records of all IPY related activities; and attracting and developing the next generation of polar scientists. The three chapters in this section provide a summary of the organizational approach that evolved during IPY for planning and managing these aspects of the overall program, and a brief overview of some related activities and events during IPY.

It is impossible to provide a complete inventory of all of the Education, Outreach and Communication (EOC) activities that took place during IPY, but *Chapter 4.1* describes how these efforts were planned and some of the main events that brought together teachers, students, researchers, artists, journalists, media officers, film-makers, book publishers, program managers and the public. Throughout IPY, barriers to public and formal science education, such as language, age and culture, were overcome by cooperation and enthusiasm. The EOC Subcommittee and its national counterparts (*Appendix 5*) provided a tremendous catalyst, but many other groups also 'adopted' IPY and conducted activities in classrooms, in communities, on the Internet, and in other public spaces that provided an outlet for sharing information about IPY and connections between the polar regions and the rest of the planet (Fig. 4.0-1).

Archiving and cataloguing IPY publications and products has been a critically important and continuing activity (*Chapter 4.2*). Since the full impact of IPY will not fully emerge for several more years, all IPY participants will need to be mindful of the need to submit their diverse contributions to the IPY Publications Database and IPY archives. Many records may have been lost already, both physical

and electronic; so, a sustained and committed effort to archive the IPY documentation will be essential in post-IPY years.

Early career scientists and students were particularly instrumental in the success of IPY (*Chapter 4.3*). The Association of Polar Early Career Scientists (APECS) emerged from IPY as a mature interdisciplinary organization for students, postdoctoral researchers, early faculty members, educators and mentors that could stimulate research collaborations and support the development of future leaders in polar research, education and outreach. The Polar Resource Book "*Polar Science and Global Climate: An International Resource for Education and Outreach*" (Kaiser, 2010), stands out as a major accomplishment of the IPY EOC Subcommittee and APECS. This volume will ensure that outreach and education efforts catalyzed by IPY will continue to inspire educators, students and both established and emerging polar researchers for years ahead.

The final assessment of IPY efforts in mobilizing knowledge and resources to strengthen international science for the benefit of society is still being completed. The International Council for Science (ICSU), in partnership with the International Arctic Science Committee (IASC) and the Scientific Committee on Antarctic Research (SCAR), are supporting APECS and other partners to conduct an inventory of IPY EOC activities and to assess the lessons learned about the effectiveness of EOC programming and networks during IPY (Fig. 4.0-2). Their report will be completed during 2011.

It is clear already that innovative ideas, creative and user-friendly tools of the digital era, extensive partnerships and considerable volunteer support allowed IPY to meet and even exceed many of the EOC, archiving and career development objectives that were articulated at the beginning of its planning phase in 2002–2003 (*Chapters 1.2 and 1.3*). It certainly



Fig. 4.0-1. Many Education, Outreach and Communication activities during IPY 2007–2008 provided opportunities to share information about changes in the polar regions. (a) High school students participating in the Students on Board program on-board CCGS *Amundsen* (Photo courtesy: 'Students on Board' project); (b) rest stop during Antarctic field course of the International Antarctic Institute (Photo: Patti Virtue); (c) polar bears in downtown Winnipeg, Canada (Photo: David Hik); (d) IPY International Program Office staff (David Carlson, Nicola Munro and Rhian Salmon) at the EOC Subcommittee meeting in Bremerhaven, October 2006 (Photo: Karen Edwards).





4.1 IPY Education Activities

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In June 2010, 114 teachers from twenty countries joined together in Norway at the Oslo IPY Science Conference. The teachers came to take part in a ground-breaking event – a conference that merged science and education in a unique way. After a two-day workshop in which they attended background science talks and participated in hands-on polar science activities, the teachers spent the rest of the week attending conference talks and poster sessions, giving oral or poster presentations, and interacting with scientists and other educators (Box 1).

The Oslo PolarTEACHERS Workshop was just one of the culminations of several years of hard work by a dedicated group of scientists, education and communication professionals, and the IPY International Programme Office (IPO) staff. By the end of the official observing period of IPY 2007–2008, there was an active

and engaged community of approximately 750 teachers, media officers, journalists, early career scientists and IPY national contacts from more than 30 countries. Many of these people served as hubs for further propagation across their own local and national networks.

IPY 2007–2008 also stimulated the active engagement of thousands of teachers, students and other citizens around the world in learning and communicating about the polar environment. This was accomplished through a combination of international collaboration, the cultivation of a global community of enthusiastic professional scientists and educators, and the creative use of free and low-cost technologies.

This chapter reviews a few of the many successful international education, outreach and communication (EOC) initiatives that took place during IPY 2007–2008. (Box 2)

Box 1 Quotes from participants in the two-day workshop

I have also been able to build collaborative relationships with other professional educators, but more importantly with scientists actively working in the field. There is now an open window to incorporate hands on interactive real-time science into my classroom, thank you.

J. Worssam, U.S.A.

Through the many posters and sessions, I have seen an incredible array of classroom applications relating to polar science – many of which I plan to have in place within the context of my own class for September start-up. I have a new-found network of educators and scientists with whom to collaborate as we inspire youth to become both curious and actively engaged with our planet.

J. Phillips, Canada

I also feel that the opportunity to experience a really professional, international, science conference has given me an insight as to what I should be helping students learn to do to make it in the critical world of the scientific research.

H. Demynchuk, U.S.A.

In our country, among the scientific community there is no harmony regarding global warming. The way education and outreach were recognized here, as equally important as science itself is not the case in our country!

D. Garasic, Croatia

Historical background and overview

When preparing the IPY program, the ICSU-WMO IPY 2007–2008 Joint Committee (JC) realised the value of public involvement in promoting an understanding of polar research and its importance. They also recognised that, to attract world-wide attention and to engage and develop a new generation of polar researchers, they needed to develop international cooperation and partnerships within the science community, as well as to engage all other sectors of society from school children to policy-makers.

The JC insisted that major IPY-endorsed projects have EOC embedded in their programs in order to give IPY a high profile and impact. All science projects were required to include the following:

- An education and outreach component
- The involvement of non-traditional polar nations
- A plan to leave a positive legacy
- An investment in the next generation of polar scientists.

EOC Subcommittee

At its first meeting in March 2005 in Paris, the JC (JC-1, *Chapter 1.5*) identified a need for an international EOC group to coordinate the communication of IPY science to the public on a global basis, as well as to give polar science greater visibility. They decided that this group should form an advisory Subcommittee to the JC that would serve as a focal point for developing international education, outreach and communication programs. By working with specialized education, outreach and communication institutions and centres dedicated to polar science, the Subcommittee would ‘identify, stimulate, and coordinate international opportunities to promote, support, and add value to IPY’.

The broad role of the EOC Subcommittee was to:

- coordinate international communication activities;
- formulate a broadly accepted framework for IPY 2007–2008 education, outreach and communication; and
- serve as a forum for the exchange of ideas to assist National Committees in their communication efforts.

The JC felt that the EOC framework should be adaptable to the business, language and cultural needs of each participant, while retaining a clear direction, identity and ‘voice’ for IPY 2007–2008.

Leading educators and professional communicators were invited to serve on this critical subcommittee.

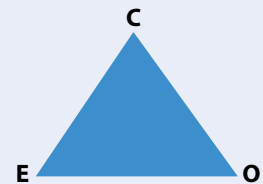
The EOC Subcommittee was also asked to work with the endorsed IPY projects to improve their EOC plans and to support their efforts to secure national or international funding to carry out their designated activities. In addition, the Subcommittee reviewed and approved endorsement of 59 proposed IPY 2007–2008 EOC projects that were independent of any specific IPY science projects.

The initial Subcommittee was composed of ten members from nine countries who were specialists in media relations, education (formal and informal), science-art partnerships and science communications. The committee membership was later expanded to 14, representing 11 countries. The committee was revamped again in late 2009 to prepare for the 2010 Oslo IPY Science Conference. At that time, there were 14 official members and 10 *ex officio* members from 14 countries (Box 3).

Several early workshops, most notably in Washington, D.C. (2004) and Boulder, Colorado (2005), contributed many good ideas to the early planning for IPY

Box 2

What is EOC?



Although not separate or mutually exclusive, the following working definitions were adopted for IPY:

Education refers to efforts designed to promote the development of programs, infrastructure and resources needed to improve knowledge of polar-focused science, technology and humanities. These formal educational efforts mainly occur within classrooms. Formal education is not necessarily limited to curricula, but ranges from teacher training to classroom science experiments.

Outreach, sometimes called informal education, is used here to refer to experiences for learning outside of formal classroom environments through stimulating media, exhibits and community-based programs. Examples of outreach activities include field trips, museums exhibits, zoo exhibits, lecture series, computer software, school competitions, quizzes and essay writing.

Communication is used here to identify interactions with the print, television, radio, internet and film media.

EOC activities. The first face-to-face meeting was held in January 2006 in Paris and was attended by the two Co-Chairs, (Jennifer Pink and Margarete Pauls), David Carlson, and two committee members (Lars Kullerud and Jean De Pomereu). While several other members of the Subcommittee managed *ad hoc* face-to-face meetings at venues of opportunity, most of the committee work during this period was conducted via conference calls.

During the period from January to June 2006, the Subcommittee reviewed 52 EOC proposals resulting from the 31 January 2006 deadline on Call for Proposals. A web design team was formed as part of the Subcommittee to develop a concept, a set of functions and prototype for the IPY website. Another team assumed responsibility of developing consistent media briefing materials for each IPY project. During this period, Rhian Salmon was hired as the Education Outreach Coordinator, a position that would work closely with the Subcommittee (*Chapter 1.6*).

The first meeting of the full EOC Subcommittee took place from 19-21 October 2006 in Bremerhaven, Germany with funding from the Alfred Wegner Institute and the British Antarctic Survey. During the meeting the group produced an Action Plan based on the goals and audiences envisioned in the IPY Framework document.

In this plan, they identified key messages and audiences, as well as organizations and communities who could become potential partners and collaborators. Based on the key question, *'Why are the polar regions and polar research important to all people on Earth'*, the Subcommittee suggested specific internationally-coordinated actions they felt could maximize the public impact of IPY.

After the Bremerhaven meeting, most of the Subcommittee work was carried out by conference calls and email contact, although there were also several face-to-face meetings that were sponsored by various IPY partners. These included meetings in Cambridge, U.K. (June 2007), Strasbourg, France (March 2008, Fig. 4.1-1), Geneva, Switzerland (February 2009) and Edmonton, Alberta, Canada (October 2009). These meetings were critical for maintaining enthusiasm among the Subcommittee members and for allowing extended time for reflection, review and planning for future events. Selected members of the working groups also

Box 3 EOC Subcommittee

2007

Margarete Pauls, *Germany* (Co-Chair)
Sandra Zicus, *Australia* (Co-Chair)
Linda Capper, *U.K.*
Jean de Pomereu, *France*
Edith Fanta, *Brazil*
Rachel Hazell, *U.K.*
Louise Huffman, *U.S.A.*
Tove Kolset, *Norway*
Lars Kullerud, *Norway*
Linda Mackey, *Canada*
Mark McCaffrey, *U.S.A.*
Birgit Kleist Pedersen, *Greenland*
Rodion Sulyandziga, *Russia*
Patricia Virtue, *Australia*

2009

Official members:

Margarete Pauls, *Germany*
Sandra Zicus, *Australia*
Miriam Almeida, *Brazil*
Rashmi Asthana, *India*
Jean de Pomereu, *France/Belgium*
Geoff Green, *Canada*
Rachel Hazell, *U.K.*
Louise Huffman, *U.S.A.*
Tove Kolset, *Norway*
Lars Kullerud, *Norway*
René Malherbe, *Netherlands*
Liz Murphy, *Australia*
Khadijah Abdul Rahman Sinclair, *Malaysia*
Elena Sparrow, *U.S.A.*

Ex officio:

Kristen Ulstein, *Norway*
Jenny Baeseman, *Norway* (APECS)
Dave Carlson, *U.K.* (IPY IPO)
Karen Edwards, *Canada* (Canadian IPY Secretariat)
Jacinta Legg, *France* (ICSU)
Jerónimo López-Martínez, *Spain* (JC)
Nicola Munro, *U.K.* (IPY IPO)
Mélianie Raymond, *Denmark* (APECS EOC)
Rhian Salmon, *U.K.* (IPY IPO)
Carine Van Maele, *Switzerland* (WMO)

attended one or more of these meetings to provide additional input and perspectives.

The EOC Action Plan

The EOC Action Plan called for a high-impact global campaign to increase polar awareness, targeted at key sectors with key messages. This plan served as the basis for EOC decisions and work throughout IPY 2007–2008, although it was modified and refined as time progressed and needs changed.

From the varied IPY themes and goals the Subcommittee eventually distilled one simple key message: *Polar Science - Global Impact*. This was further subdivided into three main priorities:

- Shrinking snow and ice: Rapid change in the polar regions
- Global linkages: Interactions between the poles and the rest of the Earth
- Neighbours in the North: Living in the Arctic, and human impacts in the polar regions

For target audiences, the Subcommittee decided to focus primarily on information providers who would transmit their learning on to others. These included:

- teachers in both formal and non-formal settings
- media officers and science journalists
- undergraduates, graduate students and early career polar scientists

- IPY researchers

The original Action Plan also included decision makers, tourists, Northern communities, artists and writers as important audiences. Due to limited resources (both financial and human), the Subcommittee had to set priorities and chose not to target these groups directly.

EOC Working Groups

The Bremerhaven meeting (2006) also provided the initial focus and energy for the establishment of effective working groups who would be responsible for carrying out specific tasks. The working groups included members of the EOC Subcommittee, as well as other interested educators, communicators, artists and researchers of the Association of Polar Early Career Scientists (APECS, *Chapter 4.3*). Working group membership was fluid and the groups continually evolved and changed throughout the IPY period in order to adapt to the varying needs and priorities. The groups kept in contact with each other through a combination of regular conference calls, Skype calls, emails and Google Groups.

Formal Education

This group included professionals from primary through tertiary education who would be responsible for the selection and promotion of educational



Fig. 4.1-1. Participants at the Strasbourg meeting.
(Photo: Karen Edwards)

resources, support for teachers, and development of opportunities for students. By the time of the launch of IPY, the formal education working group had split into two groups: one focusing on the needs and interests of teachers and the other on tertiary education. A natural evolution occurred as the tertiary education group eventually blended with the APECS group, which was focused on undergraduate students through up to five years post-doctorate.

Informal Education

Educators working in venues such as museums and science centres would focus on networking, sharing resources and promoting IPY events and activities internationally. This group eventually merged with the formal education group because members realised that most IPY activities could be incorporated into both formal and informal education settings and would serve the needs and interests of both.

Media

A group of media professionals would be responsible for information dissemination and networking, to develop an internationally coordinated media campaign, providing a framework for each IPY participant organization and building local campaigns, issuing press releases, and facilitating media visits to the poles.

Community Building

This working group was established to provide a direct link between the EOC Subcommittee and community-building activities occurring within the existing networks focused on youth, early career scientists, artists and Arctic communities. Working group members were charged with developing ideas that would benefit and support all of these networks, such as methods for communication and sharing of information. The group was intended to include representatives of each community as well as members of the EOC Subcommittee.

Products, Services, Events

This was a flexible working group to help create the IPY website, develop methods for branding of IPY products and work with different IPY partners depending on the nature of the product being developed.

Endorsed IPY EOC projects

The solicitation, evaluation and endorsement process for international EOC projects that were not connected to a specific science project was the same as that of the science projects. This process has been described in more detail in *Chapters 1.4* and *1.5*. Fifty-nine EOC projects were eventually endorsed by the JC (see IPY planning charts in *Appendix 6*), however, only about 30% of these were successful in getting funding. Some of the successful projects were aimed mainly at the scientific, research and government communities, while others focused more on the general public or students (primary school through university). A few of the success stories are briefly described.

International Polar Year Publications Database (IPYPD) (no. 51)

<http://nes.biblioline.com/scripts/login.dll>

The goal of the IPYPD was to identify and describe all publications that resulted from, or were about IPY 2007–2008, as well as the three previous IPYs. The IPYPD is part of the IPY Data and Information Service (IPYDIS) and was a joint project of the Arctic Science and Technology Information System (ASTIS), the Cold Regions Bibliography Project (CRBP), the Scott Polar Research Institute (SPRI) Library, the Discovery and Access of Historic Literature of the IPYs (DAHLI) project and NISC Export Services (NES). As of May 2010, the database contained 3992 records (*Chapter 4.2*).

The University of the Arctic: Providing Higher Education and Outreach Programs for the International Polar Year (no. 189)

www.uarctic.org

The University of the Arctic (UARctic) brings together more than 100 universities, colleges, indigenous organizations and other institutions in eight countries in the Circumpolar North for collaborative higher education and research.

The UARctic IPY education and outreach program included a cluster of different projects that reflected a continuum of learning as a lifelong process. The projects targeted different audiences and used different approaches: 1) primary and secondary students through teacher professional development workshops on science teaching and research; 2) undergraduate students via education and research experience; 3) graduate

students through integrated education and research; 4) early career scientists and university faculty via professional development; and 5) communities and the general public through formal and informal continuing education as well as adult education.

The UArctic IPY cluster included 21 different approved projects, of which 13 were eventually funded. The successful projects included:

- Arctic Lake Ice and Snow Observatory Network (ArLISON): Scientists, Schoolteachers and Students Pursuing Polar Science Together (*no. 006*)
- New Generation Polar Research (NGPR) Symposium (*no. 019*)
- Adapting SENCER to the Arctic: Improving Polar Science Education as a Legacy (*no. 036*)
- Indigenous Knowledge Systems, Science and K-12 Education (*no. 163*)
- International Sea Ice Summer School 2007 (*no. 164*)
- Monitoring Seasons Through Global Learning Communities Project also called 'Seasons & Biomes' (*no. 278*)
- UArctic Higher Education and Outreach Programs (*no. 404*)
- Resilience and Adaptation of Social-Ecological Systems: Global-Local Interactions in a Rapidly Changing North (*no. 509*)
- EarthSLOT: An Earth Science, Logistics and Outreach Terrainbase for the IPY (*no. 685*)
- Ice e-Mysteries: Global Student Polar e-books (*no. 1253*)
- Nutshimiu Atusseun: Opening Paradigms for Education in the North (OPEN) (*no. 1254*)
- International Polar Year IV: Context and Promise course (*no. 1260*)
- Muskwa-Kechika Artist Camp Collection: Online Repository and Virtual Gallery (*no. 1261*)

Arctic Energy Summit (no. 299)

www.arcticenergysummit.org

The Arctic Energy Summit was an initiative of the Arctic Council's Sustainable Development Working Group. A technology conference in Anchorage, Alaska in October 2007 brought together more than 300 researchers, academics, government leaders, industry representatives and residents from 14 countries for presentations of technical papers on significant Arctic energy research, panel discussions and keynote addresses on major policy areas

of concern or interest. The group also developed a bilingual (English and Russian) website with information about energy in the Arctic, and produced a series of newsletters.

Tectonic Map of the Earth's Polar Regions (TEMPORE) (no. 315)

The Commission for the Geological Map of the World (CGMW) TEMPORE project produced a new tectonic map of the Antarctic at 1:10,000,000 scale. The project was international in scope, involving earth scientists from many countries, although most of the preparatory activities were coordinated at VNIIOkeangeologia in Russia.

Global Snowflake Network (GSN) (no. 336)

<http://education.gsfc.nasa.gov/how/snowflake.html>

The Global Snowflake Network (GSN) is a NASA-funded program that involved the general public in collecting and 'classifying' falling snowflakes. The data are being compiled into a global database, along with satellite images, to help climatologists and others who study climate-related phenomena gain a better understanding of winter meteorology as they track various snowstorms around the globe. The project also provided thermochrons to classrooms to help students carry out winter research. The website includes videos and written information about the snowflake protocol, as well as downloadable data sheets.

Interpolar Transnational Art Science Constellation (I-TASC) (no. 417)

The Interpolar Transnational Art Science Constellation (I-TASC) is a non-profit organization supported by the South African National Antarctic Program (www.sanap.ac.za) and the South African National Energy Research Institute (www.saneri.org.za). It is a decentralized network of individuals and organisations working collaboratively in the fields of art, engineering, science and technology on interdisciplinary development and tactical deployment of renewable energy, waste recycling systems, sustainable architecture and open-format, open-source media.

I-TASC enabled collaborative research projects between artists, scientists and engineers in Antarctica during the 2008-2009 austral summer through the development of the Catabatic Experimental Platform for Antarctic Culture (ICEPAC). ICEPAC is a solar- and wind-powered mobile research station that can house

a six-person crew for up to 30 days.

The science centre Espace Mendes-France and Ellipse organised a series of events around the I-TASC project during IPY. An I-TASC terminal was installed in the Espace Mendes-France to provide real-time information on the activities of the I-TASC project and display environmental data collected by ICEPAC. The ICEPAC projects were also part of the second Bienal del Fin del Mundo, an art exhibition focused on weather, climate and Antarctica that took place from January through May 2009 in Rio de Janeiro and Sao Paulo in Brazil, the South African Antarctic base SANAE IV, and Ushuaia and El Calafate in Argentina.

Polar Books Collection (no. 440)

www.unep.org/Publications/PolarBooks/

The Polar Books Collection is a contribution from the United Nations Environment Programme (UNEP) to the legacy of IPY. It features a collection of books about the Arctic and Antarctica that reflect IPY themes and are internationally endorsed by IPY. The collection includes books on polar science, accounts of polar research and perspectives on the future of the Arctic and Antarctic, as well as storybooks and classroom activities, collections of tales and essays, and photographs of polar wildlife, landscapes and people.

The website, which is managed through UNEP/GRID-Arendal, also has an online Polar Resource Library with education and outreach materials, as well as materials developed by the IPO and the IPY EOC Subcommittee and working groups. Materials in this library include full books, book excerpts, posters, photos, artwork, teachers' guides and activity sheets. Contents of this virtual library can be used freely for education and outreach purposes.

Antarctic Environmental Legacy (no. 454)

The Antarctic Southern Ocean Coalition (ASOC) conducted a project with the goal of enhancing the environmental legacy of IPY by:

- raising the environmental awareness of scientists and visitors,
- assessing the environmental impacts of IPY and highlighting the needs for proper environmental management, and
- examining the global public's perception of Antarctica and its wilderness values.

International Action on Global Warming (IGLO) (no. 455)

IGLO was officially launched on 1 March 2007 to coincide with the start of IPY. IGLO is designed to raise worldwide public awareness about global warming and the particular ways that the polar regions influence Earth's climate, environments, ecosystems and human society. IGLO's communication and education materials include a toolkit that science centres and museums can use for their own IPY activities.

Ice Stories: Dispatches from Polar Scientists (no. 457)

<http://icestories.exploratorium.edu/dispatches/index.php>

In a project funded by the U.S. National Science Foundation, the Exploratorium in San Francisco gave polar scientists cameras and blogging tools, and asked them to document their field work. The Ice Stories project began in Antarctica in November 2007 with a series of webcasts from the South Pole and the McMurdo and Palmer research stations. It continued for two years, shifting to the Arctic in the northern summer of 2008 and back to the Antarctic for the 2008-2009 austral summer. The blog format allowed visitors to ask questions of the scientists and to post comments. The use of RSS feeds, Twitter, and video and audio presentations from the field added to the interactive nature of the project. Over a two-year period, more than 250 dispatches, 100 videos and 1,000 photos were posted on the ice stories website. Exploratorium staff also travelled to the Arctic and the Antarctic, where they spoke with scientists during live webcasts. The webcasts are also archived on the website.

Cape Farewell, Science, Education & Culture of Climate Change (no. 460)

www.capefarewell.com/home.html

This project brought artists, scientists and communicators together to stimulate the production of art founded in scientific research.

IPY Media initiatives

A focus on journalists and international media networks was a key way of getting information about IPY research into the public arena. By the March 2007 launch of IPY, a media group containing Press

Officers from most of the IPY-participating countries and agencies had been formed. A core media working group met approximately every fortnight by telephone conference and circulated notes to the larger group via a Google Group. The media working group identified their key objectives as:

- deliver high profile, highly engaging and effective media campaigns to promote IPY at local, national, regional and international levels;
- create, through media relations, unprecedented levels of awareness and engagement in polar science; and
- deliver the above with minimum financial resources.

The ICSU and WMO press offices agreed to take responsibility for IPY 'corporate' communications and media relations, such as sending out announcements for the international launch and other official IPY news. It was envisioned that the press offices for national polar operators, funding agencies and major IPY-endorsed projects would also develop their own media campaigns. In addition, the media working group requested that all participating press offices send copies of any press releases or media advisories to the IPO to be posted on the IPY website.

In the lead-up to the launch, working group discussions focused on the implementation of strategy surrounding the launch, development of press packs, availability of images and video footage, lists of journalists, and the broader dissemination of information.

The launch event catalyzed more than 20 national events that attracted the attention of local, national and international media. Media monitoring done by the British Antarctic Survey showed an average of 200-300 media mentions monthly over the first year after the launch, peaking around Polar Days and news releases about research.

Christine R uth, Margarete Pauls and Beatrice Dernbach also did a study of press releases and media reports from the period January 2007 to January 2008 in four countries that they felt represented a broad picture – Australia, Canada, Germany and India. They calculated that a total of 147 press releases had been issued by the IPY IPO, the Alfred Wegner Institute, and Canadian, Indian and Australian institutions during that time. Using the search terms 'International Polar Year', 'Antarctica' and 'Arctic', they found more than 2900 English-language media reports for the same

period. The vast majority of the media reports (more than 2200) were found in more than one country. The top news stories were about the shrinking Arctic summer sea ice, the IPY launch, the Intergovernmental Panel on Climate Change report, Al Gore winning the Nobel Peace Prize, Belgium's new Antarctic research station and the Census of Antarctic Marine Life.

In February 2009, the last official observing month of the IPY 2007–2008, daily news items about different IPY research were posted on the website, leading to another peak in media stories.

In addition to press releases, the international IPY EOC community used several other channels to spread the word about the research and its importance. For example, in July 2007, more than 100 journalists attended special IPY sessions at the World Conference of Science Journalists held in Melbourne, Australia. The IPY website was also an important conduit for media information and is discussed in more detail below.

International EOC Initiatives

IPY Website

The IPY.org main website was developed using an open-source Content Management System. The website went live at the beginning of January 2007 with six main categories: News, Calendar, Weblogs (IPY stories), Links and Resources, Projects, and General Information. The site was designed so that any member of the IPY community could promote their project within the appropriate category. It allowed access to the same material by discipline, or by specific area of interest of user (Educators, Participants and Press).

Over the IPY period, the website was a major channel of distribution for information about the various IPY science and social science projects, as well as general information about the polar regions.

In June 2009, the site was moved to the Arctic Portal for archiving purposes.

Launch of IPY 2007–2008

The Official Opening Ceremony to launch IPY 2007–2008 took place on 1 March 2007 at the Palais de la D couverte, a science museum in central Paris, France. The event was hosted by ICSU and the WMO.

In the lead-up to the launch, EOC Subcommittee and

working group members had fortnightly telephone discussions focused on media plans, the organization of resources, developing a launch activity for teachers around the world, building up a network of educators and connecting to already-existing educational programs and networks.

One of the main themes of IPY 2007–2008 was the study of Earth’s changing ice and snow, and its impact on the planet and people’s lives. The education working group chose this theme for the launch and developed an information flyer with two simple ice activities that could be done at schools, science centres, or homes. The flyer, *Breaking the Ice*, was translated into German, Italian, Spanish, French, Japanese, Portuguese and Inuktitut by EOC volunteers. It was posted on the IPY website with links to other related activities and resources. The IPY web team used a Google Earth map and a free on-line geobrowser tool called Tagzania (www.tagzania.com) to create a page where people around the world could launch a ‘virtual balloon’ showing their location and make comments about the ice experiments or their interest in IPY. On the day of the launch, 251 ‘balloons’ were launched from 31 different countries. The international launch also stimulated many national and regional events, a sample of which are described below.

Argentina

Argentina held a launch event in Ushuaia, Tierra del Fuego, at midnight on 28 February. Local artists provided dance and music performances; power point and video presentations showed images from both poles, and children in Ushuaia presented their demands for an environmentally sound future.

China

China produced a live television program of the international launch in Paris, as well as featuring the launch on China Weather Television and beginning the development of a six-part series about the Arctic. They also prepared an introduction about IPY and a short video that was posted on the China Meteorological Public Service Website.

Portugal

A one-day event took place at the Pavilion of Knowledge in Lisbon to open a new science exhibition,

The polar regions and their importance on Earth, highlighting the importance of the polar regions and the science already conducted by Portuguese polar scientists (Fig. 4.1-2). The event included a gathering of the Portuguese polar scientific community, science colleagues from the U.S.A. and the U.K., the Portuguese Minister of Science and Higher Education, and the President of the Foundation for Science and Technology of Portugal, and resulted in extensive national media coverage. The day’s events also included the launch of a book on Portugal’s strategy for IPY, and a presentation of the national education and outreach program, LATITUDE60!

Sweden

A two-day event in northernmost Sweden celebrated the start of IPY with the launch of a 1500-cubic meter IPY weather balloon. The balloon was a symbol of nations working together and was launched by Embassy representatives from the United States, Australia, the Netherlands and Germany. The program included scientific presentations, IPY stamp presentations and a cultural event at the Ice Hotel and Old Homestead restaurant. On the second day there was a tour of the Swedish Institute for Space Physics and the Swedish Space Centre at Esrange.

International Polar Days 2007–2008

The EOC community facilitated a successful sequence of eight quarterly Polar Days that engaged individuals and institutional partners from 50 countries in easy and fun polar activities. The Polar Days evolved out of the successful launch EOC activity. Over a two-year period, Polar Days involved nearly all of the funded IPY Projects in one or more of the quarterly focus areas (sea ice, ice sheets, changing earth, land and life, people, above the poles, and oceans). The Days were planned around the solstices and equinoxes to mark the changing solar cycle, which is most extreme in the polar regions.

For each of the Days, the working groups produced both a two-page science summary and a flyer with a simple educational activity related to the theme. The summaries and activity flyers were translated into many languages by volunteers before being posted on the IPY website and distributed to the EOC community through a variety of Google Groups. The media

Fig. 4.1-2. Students in Portugal took part in ice experiments at the Lisbon Pavilion of Knowledge for the launch of IPY.
(Photo: José Xavier)



working group prepared and distributed press releases. The tradition of a virtual 'balloon launch' on Tagzania was also continued for each of the Polar Days.

Many of the Days also included 'live events' using various web-casting, video-conferencing and radio formats (Fig. 4.1-3). During the events, students and others could speak directly with IPY researchers and ask questions. Many of these events have been archived and can be accessed on the IPY website. The IPO and the EOC Subcommittee worked with different researchers, partners and collaborators on each of the Polar Days. The Days evolved into Polar Weeks due to their popularity and to incorporate multiple events and time zones. Highlights of each of the Polar Days are briefly described below.

Sea Ice – 21 September 2007

In September 2007, the National Snow and Ice Data Center announced that the Arctic summer minimum sea ice extent was at an all-time low. At this time, the German vessel *Polarstern* was in the Arctic on a sea ice research trip that was part of the DAMOCLES project. At the same time, the Australian-led SIPEX project was studying sea ice in the Antarctic. SIPEX was part of the larger IPY-endorsed ASPeCt sea ice research project. SIPEX involved 45 scientists from eight different

countries, as well as two teachers who developed educational activities and real-time opportunities for classrooms and media around the world. The sea ice Polar Day included a live radio interview with sea ice scientists on board the Australian research vessel *Aurora Australis*. Activities related to sea ice, posters, information about IPY sea ice projects, contact information for sea ice scientists and relevant links all were included on the IPY website. The activity flyer was posted in 18 different languages.

Ice Sheets – 13 December 2007

The December Polar Day focused on ice sheets to take advantage of several IPY Antarctic traverses that were taking place during the austral summer. Daily web updates were available from the Norwegian-U.S. Scientific Traverse of Antarctica, the U.S. International Trans-Antarctic Scientific Expedition and the Swedish-Japanese Traverse. The educational activity flyer was translated into 19 different languages.

Changing Earth, Past and Present – 12 March 2007

Changing Earth was based on IPY research into how the polar regions have changed and continue to change over a variety of timescales. This Polar Day

included four live events that participants could join via internet, telephone, or at participating science centres. The World Ocean Observatory (Liz Murphy) and ARCUS PolarTREC each hosted a web conference with participating IPY scientists. The IGLO project (described earlier in the chapter under 'Endorsed EOC Projects') teamed up with NASA to present two videoconferences. Science centres in Mexico, China, Australia, U.S.A., Wales, Portugal, Egypt and South Africa participated in the live videoconferences, and the material was also presented as a webcast for others to see at a time convenient to them. The activity flyer was produced in 19 languages.

Land and Life – 18 June 2008

IPY research related to polar landscapes and polar terrestrial ecosystems formed the basis for the fourth Polar Day. Three live events were held, two by the World Ocean Observatory and one by ARCUS PolarTREC, involving IPY scientists who were studying Arctic tundra dynamics, permafrost, Arctic coastal erosion and Arctic bird health. The World Ocean Observatory events have been archived and can be viewed at www.thew2o.net/events/polaryear/events.htm. The activity flyer was available in 17 languages.

People – 24 September 2008

The Canadian IPY Secretariat and the Canadian Federal Program Office took the lead in developing educational activities for the People Polar Day. The Day focused on people's perceptions of the polar regions. CKLB Radio, an independent Aboriginal community radio station based in Yellowknife, NWT, Canada, hosted a 24-hour internet radio stream. Researchers and community leaders gave presentations on the dynamics of life at the poles and answered questions from students around the world about polar environments, animals and local customs. There were three opportunities for students to speak live with researchers and the radio show announcers. These opportunities were timed to correspond with school hours for Europe, the Americas and Australasia.

Students and teachers were also encouraged to share their ideas globally in a Classroom Discussion and Gallery on a specially designed web forum <http://polarday.tiged.org> (the site was designed by TakingITGlobal). Twenty-one classes registered on the

website, posted artwork or PowerPoint presentations and discussed what life was like in the Arctic regions. All of these activities are archived at www.ipy.org. The activity flyer was translated into 36 languages.

Above the Poles – 4 December 2008

This Polar Day explored the regions above the snow in Antarctica and the Arctic. Two live events were held in conjunction with the International Year of Astronomy. The European event, called *Looking Up: Weather, Atmosphere, and Space* was hosted by Liz Murphy of Global Media. In this web-conference, participants interacted with a meteorologist in Antarctica, atmospheric scientists in the U.K., astronomers, and school classes gathered at the Scott Polar Research Institute in the U.K.

ARCUS PolarTREC hosted an event timed for the Americas: *Looking Out and In; Observations of, and from, the Polar Regions*. Participants explored polar astronomy and learned about ways to use publicly available satellite images to learn about the polar regions. There was also a live connection to South Pole Station in Antarctica. The activity flyer was available in 13 languages.

Polar Oceans and Marine Life – 17 to 26 March 2009

Polar Oceans Day was so popular that events such as live webcasts, public talks, radio programs, school visits and videoconferences were scheduled over an entire week. The different events involved participants in at least nine different countries including, Brazil, Canada, France, Germany, Malaysia, Mexico, Scotland (U.K.) and U.S.A.



Fig. 4.1-3. Connecting to a live event at the TUNZA UNEP conference in Stavanger, Norway during the June 2008 'Land and Life' Polar Day.

(Photo: José Xavier)

Two international events were specifically developed for teachers, members of the public and school classes around the world. The University of Alberta held a videoconference with live webcast and text chat, while ARCUS PolarTREC hosted a webinar.

Among other events of note was a public Polar Evening at the Musée (Cite des Sciences) at La Villette, for French and German speakers. This included an international panel of polar experts, a live connection to researchers in the Arctic and simultaneous translation into French and German.

In Manitoba, Canada, university postgraduate students simulated Arctic research activities with 150 middle school and high school students. In Malaysia, the University Information and Technology MARA (UiTM) organised and hosted a forum aimed at helping more than 100 university students from the UiTM Association of Environmental Law and the Science Association understand the effects of climate change on the polar regions and how it is affecting other parts of the world. This program included a live connection to Portuguese IPY researcher and APECS member José Xavier on a ship in the Antarctic.

CKLB radio in Canada also featured a special Polar Oceans Day broadcast from and to communities across the Arctic, which they streamed to the internet.

International Polar Weeks 2009-2010

In the second half of 2009, as the official IPY was winding down, the IPY EOC community decided to hold two Polar Weeks as a lead-up to the 2010 IPY Oslo Science Conference. Instead of continuing with narrow subject-based topics, the group decided to focus on the importance of the polar regions to the world as a whole under the theme *'What happens at the poles affects us all'*.

5-9 October 2009

Educational activities for the October 2009 Polar Week were chosen from the developing Polar Resource Book (see the next section) in order to get feedback to help with the book development and refinement process. The concepts behind the chosen activities were reinforced through two related live events:

CKLB Radio hosted a discussion on the future of the Arctic. Students had the opportunity to participate in

an in-class role play exercise (taken from the Polar Resource Book) to begin to understand the complexity of the situation in the Arctic and the conflicts of interest between economic, environmental and social issues. The students took on the roles of politicians, nongovernmental organizations, researchers and economists. These perspectives were represented by CKLB studio panellists. The students first did the activity in their classrooms and then presented the outcomes of their discussions either live on the radio or via pre-recorded statements and questions. Students from Canada, Brazil, Portugal, Norway and Greenland posed questions to the panelists. A podcast of the radio show is in the CKLB audio library (www.ncsnwt.com/audiolibrary.html, under 'Ends of the Earth', October 12, Show 38, Segments 1 & 2).

ARCUS PolarTREC hosted a real-time event called Live from IPY: Polar Bear Response to Sea Ice Loss. The speakers were part of a team who were studying polar bear response to sea ice loss in the Arctic Ocean, and included PolarTREC teacher, Cristina Galvan and University of Wyoming scientists led by Dr Merav Ben-David.

15-19 March 2010

The March 2010 Polar Week focused on local community-building activities and tried to stimulate global enthusiasm for the Oslo IPY Science Conference. It took place during the period of the State of the Arctic Conference and included live web streaming of that event. The web streaming allowed real-time video and text chat so that participants could make comments and ask questions. More activities from the Polar Resource Book were also trialled.

APECS encouraged universities and organizations around the world to host a public talk as part of an International Lecture Series.

Polar Resource Book

Overview

Polar Science and Global Climate: An International Resource for Education and Outreach (Kaiser, 2010) is an interdisciplinary educational resource book that was developed by Association of Polar Early Career Scientists (APECS) members and IPY EOC Subcommittee members, and coordinated by the IPY International Programme Office (IPO). The impetus

for the book arose from the success of the IPY Youth Steering Committee initiatives and the International Polar Day activities, as well as requests from teachers for additional resources. The success of Polar Days was largely due to the collaborative efforts of researchers and educators, so the book was planned to continue and strengthen this partnership.

The book is intended for both researchers and educators, and contains background information about IPY and polar research, activities that can be done in a classroom or other educational setting, descriptions of IPY education and outreach projects, examples of best practices stimulated by IPY, tips for scientists presenting their research to non-technical audiences, and an indigenous perspective on the importance of IPY for polar research in the Circumpolar North (Box 4).

The development process

In 2008, the possibility of doing a book was first brought to the attention of APECS by the Belgium Youth Steering Committee. After discussion with both APECS members and the EOC subcommittee, it was decided to make it a joint project of the two groups.

The groups worked together to develop a vision document and made their first contacts to potential publishers.

A global call was then circulated through IPY Google Groups and other IPY networks to both researchers and educators, asking for potential contributions to the book. Criteria for submissions included:

- Submissions should be either practical learning activities for the classroom or other learning environment (for *Chapter 1*), or outreach activities and programs inspired by IPY (for *Chapter 3*)
- Preference would be given to polar science education or outreach activities that were associated with IPY events and/or programs
- Submissions should be related to one of IPY research themes
- Activities could be classroom, laboratory, or field-based
- Activities needed to be scientifically accurate, flexible and easy to use in different learning environments.

After 142 submissions of intent were received from more than 18 countries, a Polar Resource Book (PRB) Development Working Group was formed to review

Box 4 The Polar Resource Book at a Glance

Prelude – Gives a history of previous International Polar Years and provides important background information about IPY 2007–2008 research and its relevance.

Chapter 1: Teaching Polar Science – Contains 29 reviewed and tested interdisciplinary education activities, produced from more than 80 international contributions. The activities can be used by both educators working in formal and informal settings, and scientists who want to share their science with the public through programs and presentations at schools or other education venues. The material within the chapter is organized in sub-sections by polar themes. Each of the six themes has an introduction to key concepts and important research questions and from three to six related activities. Supporting material such as extended activities, student handouts, web links and visuals are included on a supplementary CD-ROM.

Chapter 2: Tips and Tricks for Science Presentations – Brings together the expertise of scores of experienced

educators and communicators from around the world. It is intended for researchers who would like to improve their effectiveness at communicating their research to the public.

Chapter 3: Outreach Initiatives – Highlights

76 different education and outreach projects that arose from IPY programs around the world. The projects include student outreach programs, university-level initiatives and public programs.

Chapter 4: IPY and Local Competence Building – Presents an indigenous perspective from the Circumpolar North about the important role of traditional knowledge in climate change research in the Arctic.



the submissions. This group included members from Brazil, Malaysia, Germany, Australia, U.K., U.S.A., the Netherlands, New Zealand and Canada. The group communicated using web based mediums such as Skype, Dropbox, Google Groups and YouSendIt to work across time zones and continents.

In a three-week process, the working group reviewed the submissions based on the agreed-upon criteria and requested full submissions from selected contributors. The contributors were given a month to send in a completed activity or project description, including photographs, diagrams and other supporting materials. For *Chapter 1*, the working group also identified topic gaps in submissions and sent out a repeat call for education activities addressing specific topics.

The development process for *Chapter 1* also involved continual feedback and revision. These submissions were sent to the chapter editor, who added any needed background information and/or extra illustrations. Each of the activities was tested and instructions clarified where needed. After the submissions were edited to a standard format, the revised activities were sent back to the authors for approval. After author approval, the edited activities were sent to one or more science reviewers, who checked the accuracy of the concepts and the background information, and at least one education reviewer, who reviewed them for educational suitability and ease of use. The activities were revised again based on reviewers' comments and returned to the authors for final approval. A final chapter edit was done by the general editor to ensure standardization with the rest of the book.

Publication and distribution

Early in 2009, the IPO staff began searching for a publisher and funding to develop and print the book. In May 2009, Pearson Custom Publishing (Edexcel) in the U.K. agreed to publish the book. Funding for production was received from the IPO, the Canadian Federal IPY Program Office, the Canadian IPY Secretariat and U.S.A. National Academies.

A Polar Resource Book (PRB) team consisting of a general editor, a coordinator, two associate editors and a graphic designer was formed to create the final product. Bettina Kaiser (Germany) was hired as general editor for the book in June 2009. She worked together with the

IPO staff and the PRB Development Working Group to expand the overall concept and create a prototype to use when seeking funding for printing. Bettina also oversaw all aspects of the production, including liaising with the publisher, working on copyright issues, layout and design, final content and scheduling.

In September 2009, Sandra Zicus (Australia) and Becky Allen (U.K.) were hired to serve as editors for *Chapters 1 and 3* respectively. Karen Edwards (Canada) took on the role of overall project coordinator and Sandy Riel (Canada) was hired as graphic designer.

Design and layout decisions were partly based on the prototype, and then discussed at an EOC Subcommittee meeting in Edmonton, Alberta in October 2009. The final layout was created by Sandy Riel and Bettina Kaiser, based on the feedback from the Subcommittee members. Copyright was carefully negotiated to protect the rights of the contributors and allow users to reproduce sections for educational purposes, while still meeting the needs of the publisher.

Funding for the printing was a collaborative process with 15 different partners. Four thousand copies of the book were distributed free of charge to participants at the Oslo IPY Science Conference in Norway.

The book has also been approved for addition to the IPY Polar Books Collection (www.unep.org/Publications/PolarBooks/) and may be purchased through the Pearson website.

Oslo IPY Science Conference

The success of IPY 2007–2008 derived in part from a close connection between science and EOC. Since EOC had been a priority from the beginning of IPY, it was clear that the Oslo IPY Science Conference in June 2010 was an ideal place to showcase some of the collaborative accomplishments. The EOC Subcommittee worked closely with the conference organizers to build a strong program that included EOC presentations and posters, an international teacher workshop, a hands-on community polar event on the wharf, and a polar film festival.

EOC Theme 6: Polar Science Education, Outreach and Communication

Theme Committee: Louise Huffman, Chair (U.S.A.), Rene Malherbe (Netherlands), Jean de Pomereau (Belgium), Melianie Raymond (Denmark), Elena Sparrow (U.S.A.), Sandra Zicus (Australia)

Session Conveners: Margarete Pauls (Germany), Elena Sparrow (U.S.A.), Lucette Barber (Canada), Jean de Pomereau (Belgium), Stephanie Pfirman (U.S.A.),

Co-Conveners: Miriam Almeida (Brazil), Karl Thorstein Hetland (Norway), Rene Malherbe (Netherlands), Nathalie Morata (France), Allen Pope (U.S.A.), Walter Staveloz (U.S.A.), Kristin Timm (U.S.A.), Bego Vendrell (Spain), Janet Warburton (U.S.A.), Peter West (U.S.A.), Jose Xavier (Portugal)

The IPY EOC Subcommittee successfully lobbied the organisers of the Oslo IPY Science Conference to include an EOC theme for both oral presentations and posters in the conference that was equivalent and parallel to the other conference themes (*Chapter 5.6*).

More than 250 abstracts were submitted to this theme from people in more than 20 countries. The presentations and posters highlighted books, festivals, events, expeditions, classroom materials, films and other IPY science communication activities. The theme was divided into five related strands:

- *Learning together: The impacts of integrating education, outreach and research in IPY* – Tangible and identifiable impacts, from national, political, organizational, community and individual perspectives.
- *Incorporating polar science into formal education settings* – Examples and successes at primary, secondary and tertiary levels.
- *Adventures in the Field: Impacts of field programs for students, teachers, artists, writers and others* – Descriptions and assessments of research immersion and adventure learning programs.
- *Global learning: The impact of the media* – Analysis and lessons from IPY impact in print, film, television, radio and web-based technologies.
- *Informal initiatives and polar inspiration: IPY in museums, art, films, books and drama* – Documenting and assessing exhibitions, events (including polar days/weeks), performances and polar books, from the viewpoint of IPY and of partner organizations. Selection of abstracts and organization of the

sessions within the EOC theme were handled by IPY EOC members and others involved in the work of IPY. Abstracts of all of the accepted oral and poster presentations have been archived on the IPY Oslo Science Conference website (<http://ipy-osc.no/>).

PolarTEACHERS Workshop

Coordinator: Karl Torstein Hetland, Norwegian Centre for Science Education

Committee: Miriam Almeida (Brazil), Karen Edwards (Canada), Louise Huffman (U.S.A.), Khadijah Abdul-Raman Sinclair (Malaysia), Sandra Vanhove (Belgium) Sandra Zicus (Australia)

The teacher conference was developed to give teachers and other educators an opportunity to share their experiences and to interact with researchers and other educators from around the world. Thanks to generous funding from the Research Council of Norway, 114 teachers received a reduced conference registration fee, full accommodations, plus a special two-day workshop. Participants could also elect to receive two graduate-level credits from the University of Alaska-Fairbanks.

To apply for the workshop, teachers had to either submit an abstract for an oral presentation or poster to Theme 6, or write a statement indicating how they would use what they learned in an educational setting. The committee received 276 applications and selected participants based on the quality of their applications and geographical diversity, with priority given to educators who taught in primary or secondary schools.

The introductory part of the teacher conference took place at the University of Oslo on 6-7 June 2010. Prominent IPY researchers introduced the teachers to different aspects of polar science through a series of lectures. Alternating with the lectures were breakout groups where the teachers had the opportunity to try a variety of polar science experiments and activities discussed in the lectures (Figs. 4.1-4 and 4.1-5). Activities were taken from the newly published *Polar Science and Global Climate: An International Resource for Education and Outreach*. After the two-day workshop, the teachers attended science conference presentations and poster sessions, and had numerous gatherings for networking, sharing and international social interactions.

Fig. 4.1-4. (left) Teachers participating in albedo experiment at PolarTEACHERS workshop in Oslo, Norway.



Fig. 4.1-5. (right) Teachers participating in paleoenvironmental change experiment at PolarTEACHERS workshop in Oslo, Norway.



Together, scientists and teachers are a force to be reckoned with – powerful and determined. I have never met so many researchers and scientists who are so willing to provide information and make connections with classroom teachers and our students. From paleontology to reindeer husbandry, I believe the connections forged at this IPY Science Conference in Oslo will be strengthening my own and my students understanding of and concern for the polar regions and climate change. Excited, affirmed, connected – this is how I leave the IPY conference.

Caitlin Munroe
Teacher, Manaugh Elementary School,
Cortez, Colorado U.S.A.

PolarCINEMA

Coordinator: Mare Pit (Germany)

Committee: Rene Malherbe (Netherlands), Khadijah Abdul-Rahman Sinclair (Malaysia), Jennifer Bellman (Canada), Amy Lauren Lovecraft (U.S.A.), Erlend Hermansen (Norway)

The PolarCINEMA was a mixture of screenings, debates and open discussions with film makers, educators, scientists and the public on the success and impact of the medium in increasing our understanding of the Arctic and Antarctic and their relation to the rest of the globe. It showcased and celebrated productions that were inspired by the polar regions and that helped increase public awareness of their importance

The PolarCINEMA Committee received 90 applications from 17 different countries. Almost two-

thirds of the films were documentaries that were developed from IPY science projects. Sixty-nine productions, ranging from podcasts to feature films, were finally selected by the committee for official screening in Oslo. Half of them (38) made it to the large screen where 24 productions were shown in full and 12 in fragments used to illustrate a certain lecture or combined with a personal presentation. The PolarCINEMA was run by two committee members: one in the role of host and one as a practical assistant and organizer.

The films were well attended and provided unique viewpoints of science in extreme environments. The audience for the morning sessions varied between small to moderate (15-30), but was therefore very enthusiastic and participated in some great discussions. With the passing of the day the PolarCINEMA grew fuller and fuller. The late morning screenings attracted around 60-100 people and the afternoon sessions around 50-75. The full final screenings in the afternoon usual got at least 100 people in the cinema seats up to a full house of about 200. In almost every case, about 80% of the audience stayed at the sessions and screenings from beginning till end. All in all, the PolarCINEMA might have drawn the most varied and integrated public besides the plenary sessions.

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4.2 Publishing and Archiving IPY

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Introduction

Igor Krupnik

All earlier IPY/IGY initiatives produced abundant publications in various formats (including their own publication series) and created voluminous archival records. It comes as no surprise that all of the science bodies that steered the earlier IPY/IGY programs—International Polar Commission in IPY-1, Commission for the Polar Year in IPY-2 and CSAGI in IGY 1957-1958—addressed the issues of the publishing and archiving of their materials. The IPY-2 and IGY governing committees initiated and produced major reference bibliographies of their respective ventures (Laursen, 1951; Beynon, 1971); they also launched monumental publication series, with substantial supervision by specially appointed publication committees (*Chapter 1.1*). Also, IPY-1 and IPY-2 established centralized depositories for all generated publications and archival records (in St. Petersburg and Copenhagen, respectively). IGY organizers, instead, opted for the system of several coordinated World Data Centers (WDC), in addition to several archives that amassed substantial documentary collections (*Chapter 1.1*).

Therefore, it was clear to the organizers of IPY 2007–2008 that their venture should also develop a consistent publication and archival policy. Unlike in the previous IPY/IGYs, in IPY 2007–2008 those tasks were split and have been addressed by different actors and at different time. The plans to create a working system to track IPY 2007–2008 publications were discussed as early as December 2004 and by summer 2005 a proposal to establish the IPY Publications Database (IPYPD) became an endorsed IPY project no. 51 (see below). Roughly at the same time several proposals were submitted for the 'IPY Publication series' and for series of popular books about IPY and the polar regions.

Some of them also became official IPY projects (nos. 79, 244, 440), and the first 'IPY books' were available in print as early as in 2007-2009.¹ All these activities took place with a blessing, but no direct intervention, from the ICSU-WMO Joint Committee.

The process of 'archiving IPY' had a very different trajectory. It was literally initiated by the Joint Committee at the JC-6 meeting in Quebec City, Canada in October 2007, six months after the official start of IPY. By that time, voluminous records related to the origination and early planning for IPY in 2002-2005 had been already accumulated at the IPO, on the IPY official website <http://classic.ipy.org/index.php>, at some national IPY committees' offices, and in personal collections of some of the early IPY champions. No centralized policy, however, existed with regard to the storing, cataloguing and preserving (archiving) these materials. The JC was justly poised to take the lead in that field.

The plans for 'archival policy' for IPY 2007–2008 were discussed at the JC-6 meeting on two occasions: in conjunction with the IPY data policy (agenda item 9.6) and the forthcoming 'IPY publications' (agenda item 7.6 - *Chapter 1.5, Appendix 3*). During the meeting the idea was floated about establishing a *centralized* archival depository for all IPY-related documentary materials under the auspices of the IPO and JC (as had happened in IPY-1 and IPY-2). The name of the venerable Scott Polar Research Institute (SPRI) in Cambridge, U.K. was mentioned as prospective partner for such a critical task.

Fortuitously, another IPY-related development following the JC-6 meeting helped advance these initial plans. In November 2007, an international

conference, 'Making Science Global: Reconsidering the Social and Intellectual Implications of the International Polar and Geophysical Years' (Fleming, 2007) was held at the Smithsonian Institution in Washington, DC. Several IPY scientists (Cornelia Lüdecke, Sverker Sörlin, Fae Korsmo) and other scholars prominent in IPY/IGY historical research were speakers at the conference (Launius et al., 2010); Igor Krupnik attended the meeting as a JC observer. The message from many papers and statements at the conference was clear. Science historians were expecting IPY organizers to secure the documentation pertaining to the origination and implementation of IPY 2007–2008, including the internal paperwork and JC session minutes, in the same way as it was done for the previous IPY/IGYs. Full access to this organized documentation would be viewed by science historians as an indicator of the obvious success of IPY 2007–2008 in the interests of researchers, students, science writers and the planners of the next IPY.

Following the 'Making Science Global' conference, communication intensified among several interested parties in JC, IPO and the Scott Polar Research Institute. In February 2008, Igor Krupnik forwarded a special memo, 'IPY 2007–2008 Legacy and Documentation Records' addressed to the JC Co-Chairs and other critical players on the Joint Committee (Krupnik, 2008). The memo outlined critical steps needed to establish the IPY documentation and archival depository; to produce a concise historical narrative on the origination and early planning for IPY (*Chapters 1.2, 1.3, 1.4*); and to launch a special IPY publication series, with several volumes dedicated to the early history of IPY 2007–2008 and the proceedings of the JC and other important meetings. The latter proposal followed in the footsteps of the *Annals of the International Geophysical Year 1957-1958* (particularly its volumes I, IIa, IIb, IX, X, etc.); it was discussed at the JC-7 meeting in St. Petersburg, Russia in July 2008, but did not materialize during the JC tenure, except partly in certain chapters of this Report (*1.5, 1.6, 1.7*).

The second section of this Chapter explores at length how the efforts to 'archive' IPY 2007–2008 were eventually implemented following the initial impulse from JC. At the time of writing, both the IPY Publication Database (IPYPD) and the emerging centralized archival collection at the Scott Polar Research Institute

remain 'work in progress,' work which will continue for many years following the official close of IPY in June 2010. Both ventures will require special attention from any future body to succeed the ICSU-WMO Joint Committee and, obviously, some additional funding during the post-IPY era.

Tracking IPY 2007–2008 Publications

Ross Goodwin²

The data gathered during the IPY 2007–2008 observational period will be used to conduct research and publish results for many years to come. It is difficult to estimate at this time how many publications will result from this IPY. The most recent similar research program was the 1957-1958 International Geophysical Year (IGY). The final IGY bibliography (Beynon, 1970) contained almost 6000 references and was completed twelve years after the end of the IGY. The earlier bibliography prepared for IPY-2 contained about 1000 entries and took almost 18 years to accomplish after the official end of IPY-2 (Laursen, 1951). It is probably reasonable to assume that IPY 2007–2008 will eventually result in about 20,000 publications.

A bibliographic database of the publications that result from IPY 2007–2008 will be of great benefit to polar researchers, managers of polar programs, and to those working in polar education, outreach and communication activities. Many IPY publications will be listed in discipline-oriented databases, but such databases are often unknown to researchers in other disciplines. Social science publications and grey literature are often not listed in any of the discipline-oriented databases. Without an IPY bibliographic database, obtaining an inter-disciplinary view of IPY outcomes, or a view of results by geographic region, would require searching many databases and would naturally miss many publications. An IPY bibliographic database will be of even greater value if its design ensures that IPY publications are also included in all appropriate ongoing polar bibliographic databases, so that IPY publications remain accessible in the distant future when users no longer think to search the IPY database itself.

Building the IPY Publications Database

In December 2004 the Arctic Science and Technology Information System (ASTIS) at the Arctic Institute of North America, University of Calgary, submitted an Expression of Intent (no. 462) to the IPY Joint Committee for a Canadian IPY Publications Database. Upon learning that the Joint Committee would endorse only multi-country projects, ASTIS began looking for partners for an international IPY publications database. By spring 2005, four organizations had agreed to work together to create a combined IPY Publications Database (IPYPD). Such a combined database would attempt to identify and describe all publications resulting from, or about, IPY 2007–2008 and the three previous IPY/IGYs. The Cold Regions Bibliography Project (CRBP) at the American Geological Institute in Alexandria, VA (U.S.A.) maintains the Bibliography on Cold Regions Science and Technology and the Antarctic Bibliography. The Scott Polar Research Institute (SPRI) Library at the University of Cambridge in U.K. produces the SPRILIB databases and assists the CRBP with the Antarctic Bibliography. The Arctic Science and Technology Information System (ASTIS) at the Arctic Institute of North America, University of Calgary, produces Canadas national northern database and other specialized databases. National Information Services Corporation (NISC) in Andhra Pradesh, India was, at that time, combining these databases and others to produce the Arctic and Antarctic Regions (AAR) database describing more than one million publications related to polar regions.

These four organizations established an informal consortium and prepared a joint proposal to create the IPYPD as part of the IPY Data and Information Service (IPYDIS), which was led by the U.S. National Snow and Ice Data Center (NSIDC) at the University of Colorado. The IPY Joint Committee endorsed the proposal (IPY no. 51)³ in August 2005. During 2006 the members of the consortium began creating new records for IPY publications, as well as identifying existing IPY/IGY publication records in their databases. Beginning in September 2006, programmers at NISC's related company, NISC Export Services Pvt. Ltd. (NES), used ideas and feedback from the other members of the consortium to create the IPYPD database and website. In early 2007 the Discovery and Access of Historic Literature of the IPYs (DAHLI) project at the

U.S. National Snow and Ice Data Center joined the IPYPD consortium to provide coverage of publications it collected from the first three IPY/IGYs (IPY 1882-1883, IPY 1932-1933 and IGY 1957-1958).

The IPYPD was made available online at www.nisc.com/ipy on 1 March, 2007, the first day of IPY 2007–2008.

NISC has since been purchased by EBSCO Publishing, which began producing AAR in-house in summer 2009. Because EBSCO does not have the ability to accept records from the many polar libraries and databases that were contributing records to AAR, no records from those sources, or from the IPYPD, have been added to AAR since that time. NES was not purchased by EBSCO, and continues to make the IPYPD available.

Aspects of the Database Design

As described in more detail elsewhere (Goodwin et al., 2007; Goodwin et al., 2010a; 2010b), the IPYPD makes use of the existing system for indexing polar literature. Depending on their subject and geographic scope, IPY 2007–2008 publications are reported to ASTIS, CRBP or the SPRI Library. Simplified somewhat, the rule that researchers are requested to follow is that publications about northern Canada are reported to ASTIS, about the Antarctic and about non-living things to CRBP, and about biological and human research to SPRI. The number of indexing organizations was deliberately limited to three in order to avoid making this reporting rule more complicated. The three organizations prepare records in their usual ways for use in their existing databases, but tag IPY records so that they can be identified and sent to NES quarterly for inclusion in the IPYPD.

Publications from the first three IPY/IGYs are identified, indexed and digitized by the DAHLI project, as that project's resources allow. In addition, the other three indexing organizations are identifying publications from previous IPYs that are already in their databases, and doing some new indexing of publications from previous IPY/IGYs. Records from the first three IPY/IGYs are tagged for inclusion in the IPYPD in the same manner as records for IPY 2007–2008 publications. The IPYPD Basic search page allows users to restrict their searches to any of the four IPY/IGYs by using the "IPY" menu, as shown in Fig. 4.2-1.

Using NES's BibliLine software and the existing infrastructure for the AAR database allowed the IPYPD consortium to create its database at a very low cost. Because of NES's automatic duplicate detection there is no problem if more than one of the indexing organizations indexes the same IPY publication. NES's COMPARE technology identifies duplicate bibliographic records, no matter in which format or publication type they arrive. This technology merges similar records provided by more than one contributor into a composite record that binds index terms and abstracts from all the merged records. The BibliLine software provides Basic, Advanced and Expert search modes, with many powerful search and display capabilities.

As shown in Fig. 4.2-2, the records in the IPYPD include citations, detailed subject and geographic indexing terms, and, in most cases, abstracts. Most IPY 2007–2008 publications are available online, and the records describing these publications contain DOIs or URLs linking to PDF files of the publications. Some of the publications from the previous IPY/IGYs were also

already available online, and others are being digitized by the DAHLI project.

The IPYPD considers IPY publications prepared for education, outreach and communication (EOC) purposes to be equal in importance to research publications, and provides a method to search for just EOC publications using the "Audience" menu, as shown in Fig. 4.2-1. Most EOC publications that describe IPY 2007–2008 activities are being created by IPY projects, but it was decided to also include in the IPYPD those publications about IPY 2007–2008 activities that are being created by non-IPY organizations such as general-interest magazines.

The "Reporting Your Publications" page of the IPYPD website tells researchers how to determine to which organization an IPY publication should be reported, describes what information researchers should send when reporting a publication, and defines what is meant by IPY publications.

One of the objectives of the IPYPD project was to index a publication once and then to use the resulting bibliographic record in many ways. In addition to

Fig. 4.2-2. Sample IPYPD record

Fig. 4.2-1. IPYPD Basic search page



being available in the IPYPD itself, all IPYPD records created up to June 2009 are available in the AAR database, which is widely used by polar research organizations. (Records created since that date may also eventually appear in AAR, if EBSCO is successful in developing the capability to accept external records.) The IPY records prepared by each of the indexing organizations also appear in those organizations' main databases: the Bibliography on Cold Regions Science and Technology, the Antarctic Bibliography, the SPRILIB database and the ASTIS database. Some of the indexing organizations also make their IPY records available in other databases, as described in a later section. Users of all of these databases will learn of IPY publications that are relevant to their needs, even if they are unaware of the IPYPD or of the IPY/IGYs. The IPYPD will leave a legacy of records in many databases describing IPY publications, thus ensuring that the results of the IPY/IGYs are always available and accessible.

Current Database Contents

As of June, 2010 the IPYPD listed 3992 publications from all *four* IPY/IGYs: IPY-1, IPY-2, IGY and IPY 2007–2008. The distribution of publications by IPY is shown in Table 4.2-1. Because some publications are about more than one IPY, the sum of the numbers of publications is greater than 3992.⁴ Note that at present there are more IGY publications in the database than IPY 2007–2008 publications. Also note that the database lists only 27% of the approximately 1000 known IPY-2 publications, and only 33% of the approximately 6000 known IGY publications.

International Polar Year 1882-1883	444
International Polar Year 1932-1933	272
International Geophysical Year 1957-1958	1960
International Polar Year 2007-2008	1439

Table 4.2-1.
Distribution of
publications by IPY
(June 2010)

The distribution of IPYPD publications by year of publication is shown in Fig. 4.2-3. Publications

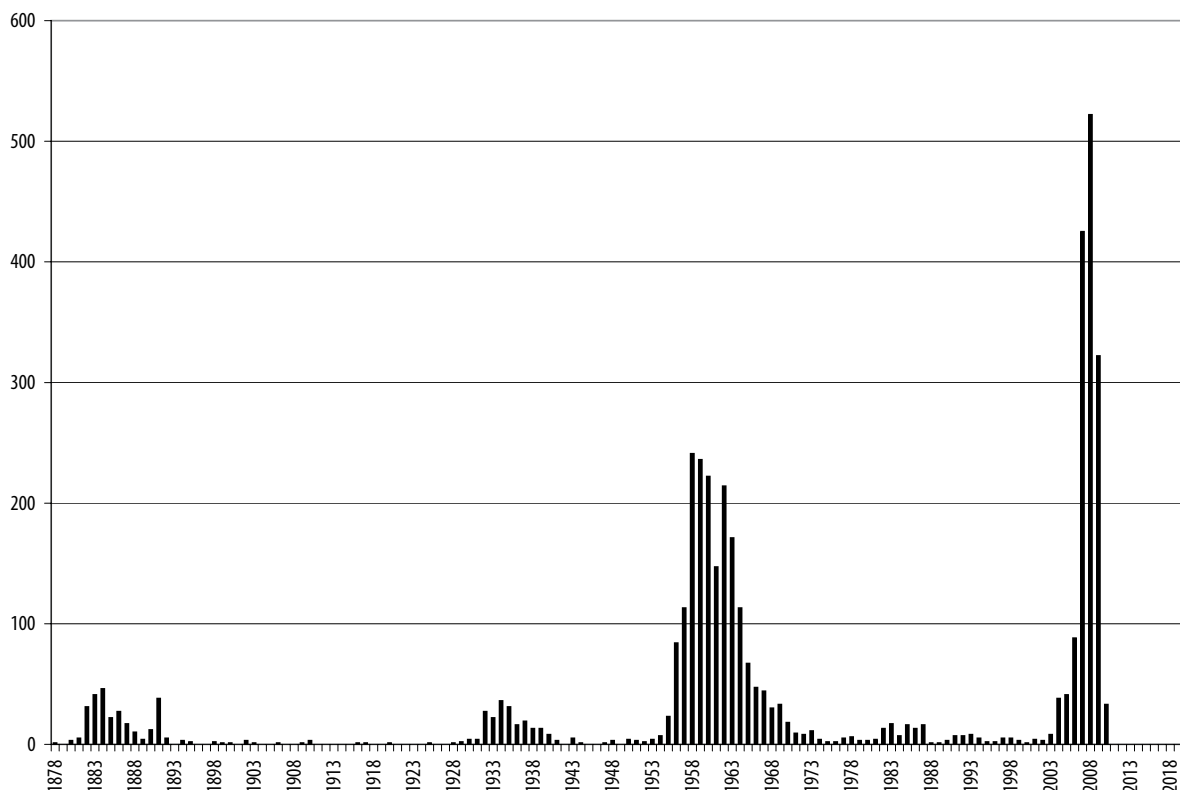


Fig. 4.2-3. IPYPD
publications by
publication year, 3992
publications, June
2010

produced to commemorate the 100th anniversary of the first IPY caused the small peak in publications during the 1980's. If the IPYPD consortium is successful in identifying and creating records for almost all IPY-2 and IGY publications the area under the IPY-2 peak will eventually be four times as large as it is now, and under the IGY peak will eventually be three times as large. If the estimate that IPY 2007–2008 will result in 20,000 publications is correct, and if the IPYPD consortium is successful in creating records for almost all of them, the area under the IPY 2007–2008 publications peak will eventually be fourteen times as large as it is now.

IGY publications peaked in 1958, the second observational year of IGY. It will be interesting to see in which year IPY 2007–2008 publications peak. The IPYPD consortium's guess is that it will be in 2010 or 2011.

The distribution of IPYPD publications by audience is shown in Table 4.2-2. Education, outreach and communication (EOC) publications are those that were written for members of the public or for K-12 students. Surprisingly, IPY-1 has the highest proportion of EOC publications. This is because of the many accounts of IPY-1 expeditions, especially the disastrous Greely expedition to Ellesmere Island, which have been written for the general reader (including those produced many decades after IPY-1). IPY 2007–2008 EOC publications have almost ceased, while the production of research publications has yet to peak.

three IPY/IGYs and has created records for all Canadian IPY publications that were found.

Because of their importance to Canadian IPY researchers and funding agencies, ASTIS has chosen to include published conference abstracts in the Canadian IPY Publications Database, even though conference abstracts are not included in the IPYPD. Of the 1447 IPY 2007–2008 publications in the Canadian database, 703 are conference abstracts. Another unique feature of the Canadian database is that in addition to tagging records by IPY, ASTIS is also tagging them by individual research project. A large menu lists about 140 projects, subprojects and expeditions, including 113 IPY 2007–2008 projects.

ASTIS uses Canadian IPY records in its many subset databases, all of which are accessible from http://arctic.ucalgary.ca/index.php?page=astis_database. These databases include the Yukon Biodiversity Database, the Inuvialuit Settlement Region Database, the Nunavut Database, the Nunavik Bibliography, the Circumpolar Health Bibliographic Database, the Kluane Lake Research Station Bibliography, etc.

Cold Regions Bibliography Project (CRBP). The CRBP, produced by the American Geological Institute (AGI), is attempting to document IPY publications in the areas of physical science and engineering for the Arctic region and in all sciences for Antarctica. An online list of current IPY publications is maintained at www.coldregions.org/ipypubs.htm. These publication references are derived from either the Bibliography on Cold Regions Science and Technology or the Antarctic Bibliography. The list is arranged alphabetically by author surname and currently contains 346 references. The list is now long enough that the CRBP is considering revising the format to allow easier access. Initially, these references were primarily to publications about planning for IPY. Scientific research results have been appearing slowly and, with the exception of lists provided by a few national programs, large numbers of publications have not yet been reported to the CRBP.

In addition to IPY 2007–2008 publications, the CRBP has begun to identify and tag references from the first three IPY/IGYs that are contained within the Bibliography on Cold Regions Science and Technology or the Antarctic Bibliography. As of June 2010, the CRBP had tagged 1224 references across all of the

Table 4.2-2.
Distribution of
publications by
audience

Audience	IPY-1	IPY-2	IGY	IPY 2007–2008
Researchers	261	199	1519	915
Public or K-12	251	98	537	591

IPY Bibliographic Activities by Individual IPYPD Participants

Arctic Science and Technology Information System (ASTIS). ASTIS has created the bilingual Canadian IPY Publications Database at www.aina.ucalgary.ca/ipy, which describes publications from Canadian IPY projects, as well as publications from foreign IPY projects that have studied northern Canada. As of June 2010, this database described 1926 publications, of which 1447 are from IPY 2007–2008 and the remainder are from the previous IPY/IGYs. ASTIS has examined the available bibliographies for the first

IPY/IGYs. The 16-volume *Arctic Bibliography* (1954–1975), a collection of more than 114,000 references spanning the time periods of the first three IPY/IGYs, has also been examined by the CRBP. 341 records have been identified as of June 2010. To identify and tag these records, the CRBP has depended primarily on data contained within the references themselves. Comparison of the CRBP databases to bibliographies for the various IPYs has not been attempted to any great degree and is not currently funded.

Scott Polar Research Institute (SPRI) Library. The broad remit of SPRI's collecting policy has meant a considerable overlap with that of the other IPYPD participants. SPRI is primarily responsible for recording publications from IPY projects concerned with the biological, medical, social and human sciences, and about IPY in general (e.g., publications about the organization and operation of the entire IPY; education, outreach and communication publications that discuss the entire IPY rather than focusing on a particular subject or geographic region). Until the closure in 2010 of the International Programme Office of IPY, also based in Cambridge, material was regularly deposited by the IPO. The IPO has been instrumental in ensuring the collection of much ephemeral material which might otherwise go unrecorded.

SPRI's IPY records also appear in the SPRILIB databases at www.spri.cam.ac.uk/resources/sprilib and monographic records in the University of Cambridge Newton catalogue at www.lib.cam.ac.uk/newton. They are also included in the Institute's serial publication, *Polar and Glaciological Abstracts*, issued three times per year. As an adjunct to the project, library staff have also begun to tag published material from the first three IPY/IGYs.

Discovery and Access of Historic Literature of the IPYs (DAHLI). NOAA's Climate Data Modernization Program (CDMP) is funding DAHLI's digitization activities. Materials in the Carnegie Institute's holdings have been digitized, in addition to materials at the University of Colorado library. Current digitization efforts include seven boxes of materials from the University Corporation for Atmospheric Research (UCAR). DAHLI's records related to IPY-1, IPY-2, and IGY (several hundred total) currently appear on the

DAHLI Bibliography page at <http://nsidc.org/dahli/bibliography.html>.

Two Problems

Identifying IPY 2007–2008 Publications. The *International Polar Year 2007–2008 Data Policy* (IPY Joint Committee, 2008) and the *IPY 2007–2008 Scholarly Publications Policy* (IPY International Programme Office, 2008) both require that all IPY 2007–2008 publications be reported to the IPYPD. When the consortium members began work on the IPYPD in 2005 they naively assumed that this requirement would make it relatively easy to identify IPY publications. Discussions with IPY researchers have revealed that while researchers are very attentive to the wishes of the organizations that fund their research, they are much less attentive to the wishes of the IPY Joint Committee, which provides no funding. The IPYPD consortium suspects that many IPY researchers will never even visit the international IPY website, let alone read the policy documents that are available there.

This should not be a problem in the case of researchers funded by national programs established specifically to provide funding for IPY projects, since such programs will hopefully enforce the reporting requirements on the projects that they have funded. For example, the Government of Canada Program for IPY has its own *Canadian IPY 2007–2008 Data Policy* (Canadian IPY Data Management Subcommittee, 2009) which requires the reporting of publications to the IPYPD via ASTIS. The Program forwards to ASTIS the lists of references from researchers' annual reports. It appears that, because of this, the IPYPD coverage of Canadian IPY publications is currently more complete than its coverage of IPY publications from other countries. Of the 1439 IPY 2007–2008 publications in the IPYPD as of June 2010, 52% are Canadian IPY publications indexed by ASTIS.

The members of the IPYPD consortium have taken several actions to encourage the reporting of IPY publications. Frequent announcements are made in polar research e-mail lists, newsletters and multidisciplinary journals, and on the consortium members' websites. Conference presentations about the IPYPD are made as frequently as time and money allow. In April 2010 the Director of the IPY International Programme Office made a personal appeal to all of the IPY 2007–2008

Google Groups to report their publications, and asked national IPY contacts to forward his e-mail to all of the IPY researchers in their countries.

In spite of these measures, the number of IPY publications being reported is much lower than expected, and is certainly significantly lower than the number being published. This is a serious problem, since without better reporting it will be impossible to measure the overall publication 'footprint' of IPY 2007–2008, the productivity of individual international IPY projects (that often produce publications in different languages), as well as the rate of publication 'success' in different IPY research fields and areas. Solving this reporting problem is an important challenge facing any successor body to the ICSU-WMO Joint Committee, IPY historians and polar librarians.

Finding, or Creating, Records for Publications from the First Three IPY/IGYs. Fundraising for the IPYPD has, for the most part, been quite successful. The Acknowledgments section below lists the seven organizations that have provided funding so far. However, it has been difficult to find funding for the database's coverage of the first three IPY/IGYs.

The DAHLI project was unsuccessful in obtaining funding from the National Science Foundation for the majority of its planned work. As mentioned previously, both the CRBP and SPRI are attempting to identify records that are already in their databases for publications from the first three IPY/IGYs. Ideally, this would involve searching their databases for every publication listed in the bibliographies of both the IPY-2 and the IGY. No funding is currently available for this task.

Conclusion

The IPYPD consortium has been very successful in creating a cost-effective system for indexing and abstracting IPY publications, and for making the resulting records and their linked PDF files readily available in the IPYPD and other polar databases. However, as discussed in the previous section, it is not at all clear that the IPYPD consortium will succeed at the more important task of identifying, and creating records for, all of the publications of all four IPY/IGYs.

With the exception of Canada, the reporting rate for IPY 2007–2008 publications is poor. The IPYPD consortium requires more help from the IPY Joint

Committee (or its successor body), national IPY committees and programs (many of them defunct as of summer 2010), funding agencies, and IPY researchers to identify the large numbers of IPY 2007–2008 publications that have so far gone unreported. Work on the IPYPD will continue for at least the next ten years, and this help from the broad IPY community must continue as well.

The IPYPD presents a unique opportunity to create a common publication database for all four IPY/IGYs. At present the IPYPD contains only about 27% of the publications in the IPY-2 bibliography and 33% of the publications in the IGY bibliography. Many of the missing publications are in the CRBP and SPRI databases, but there is no funding available to find them. Once all of the existing records have been found, additional funding will be required to create new records for the remaining publications in the IPY-2 and IGY bibliographies.

The members of the IPYPD consortium call on the IPY community for help in completing the task of preparing a comprehensive bibliographic database of all four IPY/IGYs.

Archiving IPY 2007–2008

Heather Lane

As stated earlier (see *Introduction*), concrete plans to archive the IPY 2007–2008 documentary records were first discussed at the JC-6 meeting in October 2007. As the Committee discussed future IPY publication and archiving, Igor Krupnik, one of the JC members, suggested that the Scott Polar Research Institute (SPRI) at the University of Cambridge, which has the oldest and one of the largest polar libraries in the world, should be approached as the prospective 'primary depository' for the IPY documentary records and copies of all IPY-generated publications. The suggestion was favourably received by most of the JC members and in November 2007 an informal enquiry was made as to whether the SPRI Library was willing to serve as the main repository of all IPY 2007–2008 publications.

A positive response from SPRI Librarian, Heather Lane, regarding the Library's position and potential resources to serve as the IPY publication depository, enabled Igor Krupnik to advance the issue with David

Carlson, the Director of the IPY Office in Cambridge, and the two IPY sponsors, ICSU and WMO. This also led to the discussions about the possibility of SPRI eventually receiving IPY 2007–2008 documentary archives and, in particular, the planning documents from 2002–2004 onwards. Lane had already held preliminary discussions on this subject with Rhian Salmon in the IPO, prompted by the IPY Joint Committee meeting in October 2007, and had agreed, subject to approval by the JC, to be the central international source for any material arising from IPY and gathered by the IPO itself. In fact, the first batch of published materials and ephemeral or grey literature had already been received from the IPO and added to the IPY Publications Database (IPYPD) under the terms of the agreement set up in early 2005. Krupnik then instigated the actions to be taken by the Joint Committee and the IPY Program Office to ensure that deposit of archival material at SPRI should become the official policy and to prompt its wider advertisement to members of the JC.

The first *ad hoc* meeting for those interested in the question of the IPY planning archive was held in

Cambridge in March 2008, involving Karen Edwards from the Canadian IPY Secretariat, University of Alberta, Heather Lane and Paul Berkman from SPRI, Rhian Salmon and David Carlson from the IPO and Igor Krupnik from the JC. These participants formed what was informally known as the IPY ‘archiving committee.’ Further meetings were held that year, culminating in a Memorandum of Understanding between SPRI and the IPO to establish an archive for planning and implementation documentation/materials relating to International Polar Year 2007–2008. This set out the preliminary structure for the catalogue of the IPY 2007–2008 archival collection (Box 1) and identified the potential depositors.

The intention of this agreement was to facilitate secure and professional archiving of these materials and make them openly available for future researchers.

SPRI and the IPO undertook to cooperate in applying for funding to support those activities relating to the establishment of a managed archive and to help facilitate the future maintenance of the IPY archive. Igor Krupnik was recognised as the official represen-

Box 1 Preliminary Structure (Catalogue) of the IPY 2007–2008 Archival Collection: 1997–2012

(Prepared by Igor Krupnik, March 2008)

1. Early planning for IPY 2007–2008: 1997–2002
2. ICSU files related to IPY planning (*to be requested as copies*)
3. WMO files related to IPY planning (*to be requested as copies*)
4. Other agencies active in IPY planning and implementation: SCAR, ATCM, AOSB, IASC, Arctic Council, IASSA (*requests should be sent for copies of materials related to IPY*)
5. ICSU Planning Group, 2003–2004
6. IPY Joint Committee: Minutes of the JC meetings, correspondence, ‘Open Forums’
7. International Programme Office (IPO) and IPY Subcommittees on Data, Observations, and Education: *to be transferred from the IPO*
8. Personal files: JC members, PG members
9. Individual project files
10. IPY-associated public events (IPY opening, press conferences, other public venues):
11. IPY memorabilia
12. IPY-related websites and other electronic formats
13. National IPY Committees: *only if offered to the main collection, no special solicitation.*
14. IPY ‘mid-term’ conference: St. Petersburg, 2008
15. IPY science conference: Oslo, 2010
16. IPY 2007–2008 Public Policy Conference: Canada, 2012
17. Other major science meetings associated with IPY, 2002–2012: *if offered to the main collection.*
18. National Committee Meeting documentation, national planning, funding related information, etc. (*to be requested as copies*)

tative/liaison for the IPY 2007–2008 Joint Committee with regard to IPY archiving. The agreement specifically excluded the research and scholarly data of IPY, which is being managed separately by various national and international data repositories. The IPY Data and Information Service (IPY-DIS) has responsibility for overseeing the management of these data.

The archive proposed under the agreement was to focus on documentation and materials relating to the planning and implementation of the IPY 2007–2008 programme, assembled both from sources within the international organisation of International Polar Year (including the IPY Planning Group, 2003–2004; the IPY Joint Committee and its subcommittees, and the International Programme Office) and, where practicable, from the national bodies involved in IPY.

A pilot study was proposed to identify the issues arising from archiving of a sample set of readily available material. It was envisaged that the pilot study would run for six months and be undertaken at SPRI under the supervision of Heather Lane with advice, assessment and comment from the *ad hoc* IPY Archiving Advisory Group, comprising Heather Lane (chair) and Paul Berkman (SPRI), Rhian Salmon and Cynan Ellis-Evans (IPY IPO) and Igor Krupnik (IPY JC). However, the required funding was not forthcoming and the study had to be postponed.

Archiving and Access

SPRI then proposed the use of the highly secure DSpace@Cambridge, the digital repository of the University of Cambridge, as a reliable host for the digital elements of the archive (the vast majority). Non-digital materials would be held in an appropriate storage facility within SPRI. Metadata would be established, where necessary, for both digital and non-digital data to ensure appropriate management of the materials.

The archive would be made openly available to future researchers and students and would meet the accessibility requirements for all IPY data and information acceded to by all IPY projects and described in the IPY Data Policy document. All Intellectual Property Rights would remain associated with the relevant person or persons who created the material(s) and to be acknowledged in any subsequent publication or exploitation of the materials.

Development of the Project

During 2008 the participants continued to formulate plans for the archive by email. A further meeting was held at SPRI on 18 November, 2008. In attendance were Heather Lane (SPRI), Elin Stangeland (DSpace@Cambridge project), Cynan Ellis-Evans and Rhian Salmon (IPY IPO) and David Hik (IPY Canada, IPY DiTRL, University of Alberta). It was recognised that an important legacy of IPY 2007–2008 is the collection and storage of IPY related materials in an organized and retrievable format. To accomplish this task, the IPY International Program Office (IPY IPO), Scott Polar Research Institute (SPRI), Canadian IPY Secretariat and DSpace@Cambridge agreed to collaborate to create and maintain two electronic databases as well as a central hard copy repository. At this meeting emerged the concept of the use of the IPY-DiTRL (IPY Digital Resource Library), hosted by the University of Alberta, as a means of enabling holders of relevant electronic files (including email, word-processed documents and Powerpoint presentations) to upload them directly into a central database. It was agreed that the Memorandum of Understanding would be modified by David Hik to include signatories from SPRI, IPY IPO, and IPY-DiTRL.

The International Polar Year Digital Resource Library (Fig. 4.2-4) is an online database containing digital media that have been submitted by IPY researchers, students and other partners. The media are generally in the form of animations, power point presentations, video and audio clips, and PDF files. This digital library is complementary to the various IPY data catalogues (e.g. www.polardata.ca) and the IPYPD publications database (www.nisc.com/ipy). DSpace@Cambridge is a mirror archive that contains copies of all IPY files uploaded to IPY-DiTRL. It was established in 2003 to facilitate the deposit of digital content of a scholarly or heritage nature, allowing the sharing and preservation of this content in a managed environment. Hard copies of materials and access to restricted files are managed by SPRI.

All submissions would occur via DiTRL. There would then be a transfer of this information to DSpace@Cambridge. Setting up DSpace and DiTRL as mirror sites was seen to be good both for the preservation of the archive and for long-term funding. Like DSpace@Cambridge, the University of Alberta system will also be maintained in the long term. Plans already in place



Fig. 4.2-4. Browse screen from IPY-DiTRL.

for DiTRL to develop a more user-friendly querying system were seen to be of benefit, but in late 2008, with the closure of the IPO likely to happen in March 2009 (later postponed until September 2010), having a working system was a great advantage. At this stage, the priority was collecting the information, rather than accessing it. It was envisaged that once the information had been collected it would become easier to obtain funding to develop access.

Electronic Records and Metadata

The IPY “archiving committee” acknowledged that most individual depositors would not wish to upload on an individual file level, as this would be too time consuming. It was decided to suggest that material be uploaded at folder level, e.g. emails sorted by date or files by topics. The folders could be zipped, thus creating one file associated with one set of metadata (cataloguing information). In addition, fields such as creator, date, title, filename, etc., associated with item level cataloguing (i.e. for individual files) occur to a great extent electronically as part of the file and might be extracted automatically to facilitate indexing.

The DiTRL metadata requirements in use at this time asked for some information such as audience, event type and discipline not required for this dataset. A truncated list of fields, to be completed by the person submitting the data, was devised to include:

- Provenance Information (input level information from the depositor, including name, role within IPY and dates of involvement, institution(s) and contact details)
- Filename
- Document Title
- Project number (to be supplemented by the addition of new fields based on chronological development of IPY stages)
- Creator
- Description
- Country/ies
- Keywords
- Start and end dates (for a collection)
- Accessibility: open or closed archives

As submissions through the DiTRL interface commit the depositor to the terms of a click through agreement, a statement on the accessibility of the

material had to be devised. This was especially important for bulk-submissions. Depositors needed to be made aware that all information submitted to the IPY Archive would be available for research purposes upon request to the Scott Polar Research Institute, Cambridge (and/or the University of Alberta). Unless otherwise specified, all information and metadata would be made publicly available through a web interface. If specified, (e.g. by selecting CLOSED in the accessibility field), all metadata would be publicly available, but the information itself would only be available upon personal request to the Scott Polar Research Institute. Researchers requiring access to closed information not published on the web would need to request permission from the SPRI Archives. Differences between D-Space and DiTRL created a need for transparency and consistency and the front page of the DiTRL portal was reworded to reflect the collaboration and to provide a common description of the project in terms of capture, archiving and access. A cooperative deposit agreement was also drawn up with the assistance of Elin Stangeland and David Hik.

The committee also recommended that a set of guidance notes should be developed and circulated with the instructions for depositors, covering topics such as:

- Zip collections of files according to date/topic
- Identify documents of special interest individually so that they have their own unique set of metadata and can be easily found. (The same file could appear both within a zipped collection, and as an individual entry.)
- Ask national polar libraries for help/support in the process
- Include as much as possible - the broader the picture, the more valuable the collection as a whole.
- Sort emails and correspondence by date, and in metadata include what was occurring in that time period. Sub-categorize by topic if necessary.
- Do not include material that will also be listed in the publications database – i.e. published material (both print and electronic) reported to the IPYDP www.nisc.com/ipy under the provisions of the IPY Data Policy.

Full instructions were added to the www.ipy.org website (Public_IPY-DiTRL_Upload_Instructions[1].PDF). Files could either be uploaded individually on

the DiTRL web interface, or, for larger collections, uploaded by batch submission. For the latter, depositors were asked to store files on a CD or DVD, or transfer them by FTP to the University of Alberta for uploading. They were also asked to complete a simple spreadsheet detailing an overview of the material and could choose to compress multiple files or folders into single zip files to hasten the process.

Plans were in place by January 2009 to begin the collection phase by an open call, but also by targeting individuals, e.g. JC members, planning group and national committees. Hard copy materials would go to SPRI or to national libraries and the IPO was to help by contacting individuals and the wider IPY Community. Using the Polar Libraries Colloquy's established international network, it was envisaged that libraries, archives and depositors could work together at a national level.

Conclusion

Through 2009-2010 work on amassing archival materials related to IPY 2007–2008 has continued steadily. The final transmission of the IPO files from the headquarters at the British Antarctic Survey took place at the end of March 2010, several months prior to the official closure of IPO (*Chapter 1.6*). Among those files transferred to SPRI were 27 folders with correspondence to and from Chris Rapley (who had been Chair of IPY Planning Group) during the early IPY planning in 2002-2005, the largest and the most valuable collection of its kind (Figs. 4.2-5, 4.2-6). A further three boxes of material were also deposited by the IPO. The cataloguing of these and other deposited materials is currently in progress. However, it is already apparent that it may be too late to retrieve the bulk of the electronic files related to IPY 2007–2008 from some national offices, as e-mails from 2003-2006 and even later may be cleaned up automatically via regular computer upgrade and file migration. We may already be facing the routine, if unintentional, destruction/expiration of IPY-related electronic documentation for a major proportion of the planning phase. Those concerned are urged to collect and deposit any materials of relevance as a matter of urgency.

The intention is to manage the digital materials as binary large objects in relation to contributors, organizations and events with the appropriate

metadata in a DSpace environment. If funding can be found, future knowledge discovery solutions are being planned for the end-users, rather than the programmers, to select the objects; define and implement the granularity of the objects based on their inherent structural features, and to query the resulting collection of granules to identify relationships within and between the objects. This digital archival process, which departs from the notion of structured and unstructured information, will provide quantitative results from otherwise qualitative sources. Results of the IPY archival program will be invaluable for polar historians and instructive for the development of other international programs in the future.

It remains only to encourage all those involved in the planning and implementation of IPY 2007–2008 to ensure that their individual and project-related archival collections are notified to SPRI (archives@spri.cam.ac.uk) or uploaded as electronic files to the IPY-DiTRL repository. As the IPY 2007–2008 central archival depository keeps growing, in time it will become an invaluable resource for future historians, IPY students, and for the planning of the next International Polar Year.

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Fig. 4.2-6. The physical IPY archive being moved into storage at SPRI by Archivist, Naomi Boneham.

(Photo: R.D. Smith, courtesy SPRI)

Fig. 4.2-5. The first deposit of IPY archival material at SPRI.

(Photo: R.D. Smith courtesy SPRI)



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Notes

- ¹ For example: Andreev et al., 2007; Arnestad Foote, 2009; Krupnik et al., 2009.
- ² This section is based on Goodwin et al., 2010b.
- ³ See <http://classic.ipy.org/development/eoi/proposal-details.php?id=51>
- ⁴ As of August 2010, the total number of entries in the IPYPD was 4164, including 1607 related to IPY 2007–2008.
- ⁵ The IPY Publications Database can be found at <http://nes.biblioline.com/scripts/login.dll>



4.3 Early Career Researcher Activities During IPY

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Stimulating the Current and Future Generations of Polar Researchers

The fourth IPY occurred fifty years after the International Geophysical Year. During that time span, the research landscape evolved dramatically: the start of the fourth IPY occurred shortly after the birth of the internet, catalyzing the undertaking of science as a bottom-up process and embracing the notion of “science for society”, all important concepts to the research community. Young researchers were often at the forefront of these changes, piloting evolution of or introducing new concepts to the way science was conducted or the means by which it was discussed and shared. Young researchers involved in the fourth IPY injected enthusiasm, energy, creativity and the ability to see things from a fresh perspective, which was appreciated by many, if not most, of the senior researchers leading the various projects. They also had an inherent desire to work across national and disciplinary boundaries that helped to stimulate new research directions and collaborations, which was crucial to the success of IPY.

At the time this chapter was written, the total number of young researchers involved in IPY was not known, however, it was estimated that for each senior researcher on a science project there were one to two graduate students or postdoctoral fellow, indicating that indeed, the science projects of IPY were undertaken by more young researchers than senior, a first for an event of that magnitude. Many talented young scientists were drawn to polar research by a combination of its increasingly innovative, intellectually stimulating and socially relevant nature and its strong connections with polar environments. Nevertheless, these early career researchers faced a number of challenges, including:

1. the emphasis put on increased international/multinational cooperation and the difficulty

to comply with this in a system dominated by national research systems;

2. the need for integrated and interdisciplinary research and the inherent challenges in communicating with researchers from other fields of science;
3. the necessity to stay abreast of technological advances, especially in the context of interdisciplinary research, miniaturisation and computerization;
4. the strong focus on communicating scientific results to decision makers and the public; and
5. the undertaking of research in unique and challenging research sites in remote and/or culturally sensitive regions.

The need for innovative, international and interdisciplinary polar researchers evolved dramatically between the third and fourth International Polar Year. Most research projects involved graduate student training, giving a prominent role to young scientists in the research performed over 2007-2009. Nevertheless, few research projects made the professional development tools needed to meet the demands of a career in polar science a central part of their activities. In many ways, the challenges mentioned above were often left to the graduate students to sort out on their own.

In an era newly dominated by electronic communication, the excitement for activities in education, outreach and professional development unexpectedly and spontaneously developed in a coordinated manner at the international level to address these early career challenges. It is this organic growth of projects dedicated to the very central issues faced by young researchers that we outline in this chapter. We first present a few highlights from projects formed by or for early career researchers during IPY and then focus on the formation of the Association of Polar Early Career Scientists (APECS), a major legacy of IPY.

Highlights from Selected IPY Projects

PAN-AME and the Young Scientists Forum

Stig Falk-Petersen

The PAN-arctic cluster for climate forcing of the Arctic Marine Ecosystem was a large network headed by Stig Falk-Petersen of the Norwegian Polar Institute/ ARCTOS and Dave Barber of the University of Manitoba/ ArcticNet (IPY Project no. 26). As part of this project, approximately 100 PhD students have participated in the ARCTOS PhD-school (www.arctosresearch.net) and the Young Scientist Forum. By providing optimal conditions for young researchers to develop and grow, professionally and personally, these two activities included networking, cultural exchanges, the development of research collaborations and interactions with artists and the maritime industry. As a key component of these projects, more than ten young artists have joined Arctic research cruises together with the young scientists during IPY, creating a meeting place between art and science. The artistic outcome from these cruises was presented at the PolArt exhibition held in January each year in connection with the Arctic Frontiers Conference (www.arctic-frontiers.com).

An example of this type of partnership is exemplified by Svetlana Murzina, one of the students who took part in the Young Scientist Forum and defended her Doctoral thesis on 25 February 2010 at the Institute of Biology Karelian Research Centre of the Russian Academy of Science in Petrozavodsk (thesis title: Ecology and biochemistry of key Arctic fish species *Leptoclinus maculatus*). Svetlana attended a cruise together with the young artist Eirin Støen and they have since been working closely together to show science through art. One of the artistic photos of Svetlana, taken by Eirin on an IPY cruise to the Arctic, was shown as part of several exhibitions in Europe.

New Generation of Polar Researchers Symposium

Sheldon Drobot, Susan Weiler and Jenny Baeseman

From 4-11 May 2008, the New Generation of Polar Researchers (NGPR) Symposium brought together a select group of 35 early career polar researchers from 14 countries with various personal and professional backgrounds across the spectrum of social, biological and physical sciences (Fig. 4.3-1). This diverse and

ambitious group spent an intensive week learning from each other and from mentors about past, current and future polar research; IPY history and planning; communication and outreach; and development of successful careers in interdisciplinary and international research. Thirty-four early career polar scholars were selected through a competitive application process. A select group of mentors was also invited to share insights, stories and expertise in overcoming obstacles young researchers face, including comparisons of polar research from the 1st IPY (1882-1883) through the IGY to the most recent IPY. This provided a continuum of polar science knowledge and a sense of history that will carry these young leaders forward to the next IPY. More details are available at the conference webpage (<http://apecs.is/workshops/ngpr>).

Permafrost Young Researchers Network

Hugues Lantuit

The Permafrost Young Researchers Network (PYRN, www.pyrn.org) was established as an IPY education and outreach activity of the International Permafrost Association (IPA) in November 2005 by Hugues Lantuit, Margareta Johansson and Oliver Frauenfeld. The network's main objective was to offer a platform for young permafrost researchers to exchange knowledge and experience through a web 2.0 platform provided by the World Association of Young Scientists featuring blogs, podcasts, videos, galleries, a list of senior scientists, national groups, etc. The network was led and managed entirely by young researchers and constantly grew to reach a total 800 members from 40 countries in April 2010.

With growing success and expectations, the network rapidly evolved to organize much larger activities. It organized a kick-off workshop in Abisko in February 2007 and two workshops on scientific methods in partnership with the Association of Polar Early Career Scientists (APECS) in 2007 and 2008 at the Otto-Schmidt Laboratory in St. Petersburg. These three workshops brought together more than 150 young researchers. In addition, PYRN launched the successfully funded PYRN-TSP (Thermal State of Permafrost) project. The project was conducted in partnership with the IPA and its officially endorsed IPY TSP project. Small teams of young scientists equipped with lightweight drills travelled to understudied areas

of the Arctic, Antarctic and mountainous regions, and drilled boreholes to establish temperature monitoring. Results were presented at the major IPY conferences in 2008 and 2010. PYRN also initiated the PYRN bibliography (PYRN-Bib) that inventoried over 1000 theses and dissertations completed since the early 1950s by permafrost scientists and engineers. A special issue of the journal *Permafrost and Periglacial Processes* was organized by PYRN and was successfully released in December 2009 (Christiansen et al., 2007; Lewkowicz, 2009; Bonnaventure et al., 2009). Finally, PYRN organized a series of happenings around the Ninth International Conference on Permafrost in 2008 in partnership with the United States Permafrost Association; the meeting included social events, panels and awards. PYRN was acknowledged as an outstanding component of the IPY legacy of the IPA.

ArcticNet Student Association

Brent Else, ASA

The ArcticNet Student Association (ASA; www.arcticnet.ulaval.ca/students/asa.php) was formed as the student organization of the ArcticNet Network of Centres of Excellence in Canada. One of the major goals of the ASA was to provide training to young Arctic researchers and to provide opportunities for networking. During IPY, the ASA organized the following networking and training events:

- **ArcticNet Seminar Series** – This annual series was offered from January-April at the University of Manitoba (Winnipeg, MB). The seminar featured weekly presentations by invited Arctic scientists from a broad range of disciplines and also provided a forum for students to present their research in a friendly and constructive interdisciplinary atmosphere.
- **Northern Perspectives Workshop** – This workshop was organized on 28 May 2008 at Université Laval (Québec, QC). The workshop focused on introducing students to how ArcticNet functions as an international research network and also explored Arctic research from an anthropological perspective.
- **Student Day 2008** – Each year the ASA organized a meeting of ArcticNet students and also encouraged students from outside of the network (including international students) to attend. The 2008 Student Day (9 December, Québec, QC) was organized

in conjunction with the Arctic Change 2008 conference. More than 400 students, government representatives and researchers (including 26 students from northern communities) participated in plenary talks and breakout sessions aimed at fostering information exchange and building research skills.

- **Inuit Culture Workshop** – This workshop was held on 22 May 2008 at Université Laval (Québec, QC) and was attended by more than 40 students from four universities. The focus on the workshop was to introduce students to Inuit culture and language and was lead by experts in this field.
- **Student Day 2009** – The 2009 ASA Student Day was held on 8 December in Victoria, BC in conjunction with the IPY Early Career Researcher Symposium. The day was once again well attended by international students and featured plenary presentations and training workshops focused on the theme of the day “The Future of Polar Research”.

University of the Arctic IPY Higher Education Office

Elena B. Sparrow

A very rich network for higher education and outreach during the fourth IPY existed through the University of the Arctic (www.uarctic.org), a collaborative consortium of more than 90 institutions (e.g. universities, colleges and other organizations) committed to higher education and research in the North, as well as 18 other projects submitted as Expressions of Intent to the IPY Joint Committee, which formed an IPY cluster (www.uarctic.org/singleArticle.aspx?m=135&amid=364).

The coordination office for the UArctic IPY education outreach efforts (www.uaf.edu) was located at the University of Alaska Fairbanks (www.alaska.edu/ipy). At the core of the cluster were UArctic and the International Antarctic Institute (IAI; www.iai.utas.edu.au/). The education outreach programs, including indigenous peoples’ knowledge and approaches, reflected a continuum of learning as a lifelong process that targeted different audiences: 1) primary and secondary students through teacher professional development workshops on science teaching and research; 2) undergraduate students via education and research experience; 3) graduate

students through integrated education and research and interdisciplinary programs; 4) early career scientists, university faculty via professional development; and 5) communities/general public via continuing education/adult education either through formal or informal ways conducted by cluster members.

Likewise, UArctic's collaborative higher education and outreach programs hosted in member institutions in Arctic countries were many and varied, providing rich learning opportunities for northerners and the greater global community: 1) the Circumpolar Studies Program used academic and indigenous knowledge as well as multi-method delivery in teaching about the North via courses held around the world in the classroom, in the field and online; 2) the UArctic Field School program composed of short, thematic, field-based courses, provided experiential learning in northern locations; 3) the GoNorth program provided the opportunity for non-Arctic residents to go north to the Arctic to learn about the Arctic; 4) the north2north program was a multilateral exchange program that facilitates student mobility in circum-arctic higher education; 5) the Northern Research Forum (www.nrf.is) promoted and enabled open discussion among policymakers, business people and other interest groups, the international community, and the research community; 6) the Open Learning program addressed the need for short-term skills training needed by northern residents; and 7) the Graduate Networks facilitated the education of young researchers through sharing experience and knowledge to promote regional cooperation and identity, build an academic community and develop opportunities for education and communication with policy-makers.

UArctic's education programs together with the other IPY Higher Education and Outreach cluster projects had global linkages and reach, creating a unique network for higher education and outreach during the IPY and beyond.

University of Alaska IPY Postdocs Program and the Young Researcher Network

Jenn Wagaman

As a contribution to the fourth IPY, the University of Alaska (UA) sponsored eleven postdoctoral researchers. Each of the scholars spent two years at

a UA campus researching and contributing to the global goals of IPY. They were partnered with top UA scientists and, during their tenure, made important advancements in their fields. UA IPY scholars produced numerous publications, made international contacts through their research and accessed the Arctic from their doorsteps. Nearly half of the scholars have gone on to tenure-track faculty positions, while others continue their research or are serving communities through their research interests.

The UA also provided seed money to begin the University's first Young Researcher Network. Through this project, graduate students from a variety of disciplines conducted outreach in the Fairbanks and outlying communities, including elementary school science projects, community lecture series and hands-on science at several community events.

International Collaboration and Coordination of Early Career Activities

To meet the IPY's goal of including the next generation of polar researchers and the world's youth, an early-IPY grassroots effort by young scientists led by Amber Church and Tyler Kuhn from Canada, was formed under the name of the IPY Youth Steering Committee (YSC), IPY Project no. 168 in 2005. The YSC largely aimed to involve school children and young adults in polar literacy projects and strengthen the communication between students and young researchers. Under the YSC umbrella, national committees were established and, in some cases, gained support from senior colleagues and national science programmes, which were exemplified by the creation of the U.K. Polar Network (UKPN) in 2007. The YSC's scope, however, was limited in time since its main focus was to create activities during IPY.

Progressively, a need for a broader, more encompassing international effort specifically geared towards early career scientists arose; discussions on IPY education and outreach internet forums, similar initiatives in other scientific realms and encounters between like-minded people highlighted the awareness of this need. It also became clear that, these efforts should not only focus on science and career development, but serve and remain driven by early career researchers.

To address these needs, Hugues Lantuit (Germany),

Jenny Baeseman (U.S.A.) and Rhian Salmon (U.K.) laid the groundwork for the rationale, structure, connections and future activities of a group to address these efforts on a continual basis in the autumn of 2006. The Association of Polar Early Career Scientists (APECS) was launched on a massive scale in early 2007, at the start of IPY with Jenny Baeseman and Hugues Lantuit as co-directors. A contributing factor to the success of APECS, at its inception and during IPY, was strong support from the IPY International Program Office (IPO), based in Cambridge U.K., which ensured that the goals of APECS would be shared with the community of senior researchers.

The initial group quickly grew through the coordination of disciplinarily-focused groups of young researchers who sought more substantial career development activities and a stronger connection to the senior leaders in their fields. In March 2007, discussions were initiated by the APECS directors with the International Arctic Science Committee (IASC) and the Scientific Committee on Antarctic Research (SCAR) to offer APECS' services to help assure the involvement of early career researchers in major international polar science activities. This early version of APECS started evolving to better serve the needs of early career researchers interested in the polar regions and the wider cryosphere, while including the senior research community to help ensure a continuum of knowledge was created.

The need to ensure the continuation of successful initiatives and activities after IPY led to brainstorming on post-IPY legacy. At the same time, the increase in young researcher initiatives in polar science started to create some confusion in the scientific community, leading to questions of the structure, coordination and even the relevance of such organizations.

Key Steps in the Formation of the Association of Polar Early Career Scientists

To address these issues, a meeting was organized at Sanga Saby outside Stockholm, Sweden in September 2007 to bring together all of these groups and to prepare some long-term sustainable plans. Representatives from APECS and other young researcher groups, such as the Permafrost Young Researchers Network, U.K. Polar Network and the YSC National Committees, met thanks to the sponsorship of the Swedish company

Serla, the IPY IPO and other international polar science entities (Fig. 4.3-1). The key outcome of this meeting was the decision to merge these groups into one organization, under the name of APECS, because at this time, APECS had already garnered much support from the senior science community. As part of this merger, APECS adapted its structure to better reflect the multifaceted nature of its increased membership, to include a stronger focus on education and outreach, and to form national committees and representations of other already established young researcher groups (e.g. the ArcticNet Student Association, the Northern Research Forum Young Scientists Network and others). This established APECS as a legacy of the YSC and other IPY projects focused on young researchers. A new structure was launched at the end of the meeting, which included working groups, an advisory committee, an interim Council of the 24 attending participants and an interim Executive Committee elected by the council. Kriss Rokkan Iversen (Norway) received unanimous support as the first APECS President. Jenny Baeseman was appointed as the interim director and was financially supported part-time through the cooperation of the International Arctic Research Center and the Arctic Research Consortium of the United States, both located in Fairbanks, Alaska.

The Executive Committee (including the Director) was charged with establishing the official procedures and documentation for the organization over the next 6-12 months. Most of the communication among the group was conducted using Skype and Google Groups, but it became clear that an in-person meeting was necessary to move things forward more efficiently. Thanks to the coordination by Halldór Jóhannsson and support from the University and City of Akureyri, the Northern Research Forum and the Arctic Portal, the Executive Committee met in March 2008 in Akureyri, Iceland to address strategic planning for APECS and draft the documents that help sustain the organization for years to come; the Terms of Reference (ToR) and the Rules of Procedure (RoP).

During an online APECS Council Meeting on 21 May 2008, sponsored by Liz Murphy Global Media, the new organizational documents were approved. The RoP and ToR included a revision from the interim APECS structure to an open Council, who elects an Executive

Fig. 4.3-1. Participants of the meeting in Stockholm, Sweden, a key moment in the development of APECS.
(Courtesy: APECS)



Committee. The Council controls issues related to APECS governance and structure, and are expected to act on time scales of months to years. The Council mandates the Executive Committee and Director with shorter time-scale decision making and running APECS on a day-to-day basis.

In addition to the TOR and ROP, key progress during this early period included forming an international Advisory Committee of senior researchers and science administrators to provide guidance and support. A website was developed through in-kind support from the Iceland-based Arctic Portal. The website quickly established a virtual home for APECS and, among other features, includes study and job opportunities, meetings, news updates and a discussion forum.

By mid-2008, the increase in APECS members and activities (detailed below) was recognized officially at the SCAR/IASC Open Science Conference in St. Petersburg, Russia where SCAR, IASC and APECS signed a Memorandum of Understanding recognizing APECS as the preeminent organization for polar early-career scientists. This agreement assured the inclusion of young researchers on all SCAR and IASC committees and activities, and paved the way for APECS to continue its efforts with other international organizations.

As APECS continued to grow, it was necessary to establish a more permanent office with a full-time

paid coordinator for the association. Attempts were made to try to secure funding in Alaska, but were not successful. Through concerted efforts by Kris Rokken Iversen, Aase Tveito and Olav Orheim, an International APECS Directorate office, lead by Jenny Baeseman, was officially established in January 2009 at the University of Tromsø, Norway. This provided APECS with a solid foundation that helped to consolidate and coordinate APECS's activities and continue to develop the organization well into the future. The support of the IPY IPO and the Joint Committee of IPY were crucial for maintaining such momentum.

Major APECS Achievements from 2007-2009

The phenomenal level of energy and volunteer efforts of talented young researchers and the support of senior mentors around the globe led to the success of APECS on many fronts. A complete list of APECS activities can be found in the APECS IPY Final Report (available at <http://apecs.is/publications>). A few activities are highlighted below.

International Leadership

Aside from the MoU with SCAR and IASC, APECS has helped to provide many opportunities for young researchers to be involved in interdisciplinary and international science and policy bodies, such as the ICSU Earth System Visioning Committee, SCAR/IASC

BiPolar Action Group, SCAR Scientific and Standing Committees, as well as representatives on many conference organizing committees. Indeed, APECS's motto was to provide a continuum of leadership and to link its activities to established international institutions rather than to act in isolation.

In addition, one of the keys to the success of APECS is the ability to tie other groups together and act as an umbrella organization for international young polar researchers. For example, the APECS Council was made up of representatives from other polar young researcher organizations, such as the ArcticNet Student Association, the Permafrost Young Researchers Network, APECS National Committee Representatives and members at large.

One of the biggest assets of APECS was the number of national committees that work internationally to promote polar research, education and outreach, and play an active role in organizing events and recruiting new APECS members, particularly in countries with emerging polar science programs. APECS has formal National Committees organized in Brazil, Chile, Germany, Italy, Norway, Portugal, Russia, Sweden, South Africa and the United Kingdom (as the U.K. Polar Network).

Education and Outreach

Young researchers around the world have participated in many outreach efforts through classroom visits, public lectures, live connections from the field, blogs and mentoring to name a few (Fig. 4.3-2). These efforts were aided by the coordination of the IPY International Polar Days/Weeks (*Chapter 4.1*). The level of interest and desire to participate in outreach by the current generation of young polar researchers shows a bright future of the incorporation of outreach into all research projects.

Perhaps the major tangible highlight of outreach came from efforts initiated by Mieke Sterken, Melanie Raymond and the APECS Education and Outreach Committee. This group developed the concept of a guide for young researchers to use when conducting outreach. The IPY IPO led an effort to bring the APECS concept together with the IPY Teachers Network to create "Polar Science and Global Climate: An International Resource Guide for Teachers and Researchers" (Kaiser, 2010). This book draws on the

experience and expertise of educators and scientists who participated in the global collaboration for education and outreach during IPY and targets those who are interested in engaging students and communities with polar issues beyond IPY. It is particularly aimed at teachers, university students, young scientists and polar researchers who wish to bring polar science into classrooms and other learning environments in a practical and accessible way.

Virtual Tools to Enhance Collaboration

The APECS Website was an important tool for the organization as it served to strengthen communication between APECS members. Throughout IPY, considerable efforts were put into improving the APECS website, which was hosted through in-kind support from the Arctic Portal in Iceland. The APECS website was an invaluable resource for young researchers and anyone interested in polar research. Below is a summary of some of the resources available to APECS members through the website.

On-line Literature Discussion Forum

APECS has created an online polar literature discussion platform (<http://apecs.is/literature>) where researchers share results, carry on discussions, get



Fig. 4.3-2. Presenting their work at conferences is essential for the development of early career scientists. (Courtesy: APECS)

feedback from senior researchers, develop better communication skills and find new collaborators.

Virtual Poster Session

Sponsored by a grant from the Nordic Council of Ministers, the virtual poster session (<http://apecs.is/virtual-poster-session>) was an initiative aimed at bringing the poster presentation beyond the walls of the conference hall and creating an online database of polar research poster publications open to the public. This initiative has given communities, academics and the wider public easy and free access to research results. It has also enabled APECS members to discuss their results in a collegial manner during on-line calls, receive feedback from peers, improve their presentation skills and establish new collaborations.

Online Monthly Newsletter

APECS has produced and distributed a monthly newsletter, which has offered a means for polar scientists to keep abreast of current news and events in all fields of research. Components of the newsletter include news and updates, featured research sites, news from partner organizations, new topics from the literature discussion, upcoming

meetings and workshops, available polar-related jobs, announcement of APECS activities and welcome words for new members. The newsletter content has been distributed widely through many websites, newsletters and information list-servers.

Various Online Resources

In addition to the above, the website has also featured an interactive membership directory where members could search for potential collaborators, meet new colleagues and find members in their region or in a place that they plan to visit. There was a constantly growing list of polar institutions, organizations and universities offering polar-related courses with each entry including a description, logo and website details. Additionally, a photo gallery with pictures of APECS events as well as from field expeditions of members has been included. An archive of career development presentations, podcasts and videos has also been implemented.

Career Development and Mentoring

A key focus of APECS's activities has been to help early-career scientists network and obtain advice from more experienced researchers and polar professionals.



Fig. 4.3-3. Early career scientists attending an APECS mentoring session.

(Courtesy: APECS)

This helped to enhance the careers of young people more quickly than their predecessors, increasing the level of competency of these new researchers when beginning their careers. Examples of the different ways APECS has helped to create a continuum of polar knowledge and leadership are listed below.

Mentorship Programme

The mentorship programme (<http://apecs.is/mentors>) has provided an unprecedented opportunity for experienced polar researchers and professionals to network with early-career researchers (Fig. 4.3-3). As part of this programme, APECS has created an online database of mentors who are willing to share their knowledge with and offer guidance to talented early-career researchers. While each mentor decided on their level of involvement, activities included meeting students at conferences, participating in APECS mentor panels and providing general career guidance for young scientists.

Mentor Panels at International Conferences

Over 20 panel discussions have been hosted at major international conferences throughout the IPY period. These were often held as lunchtime seminars and were organized by APECS members. Invited panellists were generally senior researchers and polar professionals, and the sessions were often given a theme to shape and guide the discussion.

Career Development Workshops

APECS has initiated a number of interdisciplinary workshops, facilitating networking among early-career researchers and senior mentors across a wide range of disciplines. The workshops encouraged the sharing of ideas, concerns and expectations and, through a series of devoted presentations and practical sessions, helped early-career researchers gain valuable insight from more experienced colleagues. In an evaluation of a latest workshop held in December 2009 in Victoria, Canada, participants indicated that these workshops were critical to their professional development because they received <20% of this type of training during the course of their graduate education.

Some of the workshops coordinated by APECS during 2007-2010 period are outlined below.

SCAR/IASC IPY Open Science Conference: Polar Research Arctic and Antarctic Perspectives in the International Polar Year St Petersburg, Russia, 8 – 11 July 2008

An APECS Career Development Workshop was hosted in collaboration with SCAR and IASC. This workshop was attended by more than 100 young researchers as well as representatives from funding agencies and research councils, including the U.S. National Science Foundation (NSF), the U.K. Natural Environment Research Council (NERC), Antarctica New Zealand, IASC, and SCAR. These agencies and councils provided early-career researchers the unique opportunity to interview potential reviewers and employers about succeeding in polar science. Sessions and panel discussions focused on key skills in proposal writing, conducting remote and logistically complex fieldwork, communicating science and methods to improve research productivity. Funding for the workshop was provided by SCAR, and APECS worked with the International Glaciological Society (IGS), the World Meteorological Organization (WMO) and IASC to help provide travel funding for some participants.

APECS also held a meeting and reception sponsored by the Otto-Schmidt Laboratory, SCAR, IASC and the WCRP Climate and the Cryosphere (CliC) Programme. At this reception, over 250 young researchers and senior mentors shared ideas and developed collaborations.

IPY International Early Career Researcher Symposium

Victoria, BC Canada, 4 – 8 December 2009

Thanks to the generous support of the Canadian Federal IPY Programme Office, APECS together with the Northern Research Forum, the ArcticNet Student Association and the Canadian Polar Commission hosted a career development symposium for 70 international young researchers prior to the ArcticNet Annual Meeting (<http://apecs.is/workshops/victoria09>). The goal was to bring early-career polar researchers together for a series of career development training sessions to enhance professional skills, to work with senior mentors and to form international and interdisciplinary collaborations. The workshop focused on seven themes: community-based research, funding your ideas, working with policy makers, communicating your research, getting started in science, data management and time

management. The training sessions gave concrete and useful advice, insights and skills to help early-career researchers meet the demands of polar science. Senior researchers and polar professionals moderated the sessions, shared advice and mentored the participants.

U.K. Polar Network Career Development Workshop Series, 2009-2011

Beginning in 2009, the UKPN started holding career development workshops for its members, primarily aimed at master, doctoral and post-doctoral levels. These events had the goal of promoting not only scientific progress and acquiring new skills, but also career development, networking and outreach. To ensure a high level of interaction, participants were encouraged to present a poster as well as to get involved with organizing the workshop (e.g. chairing a session).

Enhancing Interdisciplinary Research Training

A major focus of IPY was to look at research questions with a multidisciplinary perspective. This was needed to enhance the understanding of rapidly changing polar regions. To help prepare young researchers to work in these interdisciplinary environments, APECS participated in the organization of various activities to help members enhance their interdisciplinary research skill set. Below are a few highlights over the IPY years.

IMPETUS 2008 – Polar Ocean Observation and Monitoring

St. Petersburg, Russia, 19 – 22 November 2008

This techniques-oriented workshop was jointly organized by the Otto-Schmidt Laboratory for Polar and Marine Research in Saint-Petersburg (OSL), APECS and the Permafrost Young Researchers Network (PYRN) and attended by 85 young researchers from 20 countries. Financial support was received from the German Federal Ministry of Education and Research, the Arctic Ocean Science Board (AOSB), the U.S. Arctic Research Commission (USARC), the Gordon & Betty Moore Foundation (GBMF), the British Antarctic Survey (BAS), the Leibniz Institute for Marine Science (IFM-GEOMAR), Alfred-Wegener-Institute for Polar and Marine Research, the Integrated School of Ocean Sciences (ISOS), IASC, SCAR, CliC and Aanderaa Instruments. This event followed a 2007 IMPETUS workshop on permafrost also organized by the same groups.

APECS/UNIS/UArctic Interdisciplinary IPY Polar Field School

University Center on Svalbard (UNIS), 15 June – 3 July 2009

This three-week course, hosted by UNIS, APECS, IPY Norway and the University of the Arctic, brought together 24 talented undergraduate and masters students from 11 nations that were selected from nearly 300 applicants (<http://apecs.is/field-schools/apecs-schools/past-field-schools>). The interdisciplinary polar experience in the high Arctic focused on the IPY themes and covered topics including climatology, glaciology, marine and terrestrial biology, geology, oceanography, permafrost and the human dimension. The Field School combined lectures, seminars, field excursions and project work, and gave the students valuable experiences in all aspects of polar research from the practical to the theoretical.

Similar field schools have been planned for June/July 2010 and 2011. This has been made possible thanks to additional funding from the Norwegian Ministry of Foreign Affairs and support received from UArctic, IPY Norway and UNIS. APECS was again an important contributor in the execution and organizing of this IPY Field School in Svalbard in 2010 and 2011 (<http://apecs.is/field-schools/apecs-schools/svalbard2010>).

APECS/IARC International Field School Bellingshausen Station, Antarctica, 10 – 26 January 2010

This field school took place at the Russian Bellingshausen Station on King George Island, South Shetlands, Antarctica in January, 2010. International and interdisciplinary, the field school exposed participants to different Antarctic research techniques necessary for understanding one of the world's regions that is most affected by climate change. Fieldwork and trips were complemented with lectures at the station. To avoid excessive disturbance to the wildlife and respecting the protected areas, all field trips were in permitted areas and were guided by experienced scientists. When weather conditions did not permit outdoor activities, the participants gave interdisciplinary lectures, with subjects varying from social, natural and physical science.

APECS Polar Policy Essay Contest International, February and March 2009

APECS, together with the organizers of the Antarctic Treaty Summit, invited young researchers to share their thoughts and opinions in an essay contest focusing on how to better integrate science and policy, and on the needs for new policy dealing with current issues in the Antarctic as well as the Arctic. The winner of this essay contest received a fellowship covering travel costs and conference fees to represent the new generation of polar researchers at the Antarctic Treaty Summit and presented her work at this meeting.

Summary

Most research projects rely on the efforts of graduate students and postdoctoral researchers and in the past this 'training' was considered to be all that was needed to keep the continuum of science moving forward. The IPY provided the opportunity and the encouragement for enhancing the role early career professionals play in research and gave them a mechanism through which they could gain the additional skills needed for successful careers. The mentoring from senior polar professionals to the thousands of young researchers involved in IPY was a major contributing factor to the success of these programmes.

IPY undoubtedly stimulated students and youth around the world to pursue science careers. A sustained effort will be necessary to retain the young scientists that were involved in the IPY and provide resources for future researchers to develop their careers. Efforts, such as the activities, events, collaborations, conferences and exchanges, highlighted in this chapter should be sustained and further developed to continue the international and interdisciplinary momentum of IPY (Fig. 4.3-4).

The authors of this chapter encourage other research disciplines and programmes to follow the lead of the polar community in developing the careers of young researchers.

Acknowledgements

The sheer volume of activities for young researchers during IPY, which we only touch on in this chapter, were made possible mostly by talented young researchers who volunteered their time to help each other. We thank them and their advisors for being patient as they worked to become well-rounded professionals, focused on not only their research, but also on service to their community. All of these activities also show the engagement of senior researchers and polar professionals in fostering the next generation of polar researchers. We thank the, literally, hundreds of more established colleagues for helping nurture the brilliant young researchers that were part of the fourth IPY.

There are many individuals and organizations whose support and encouragement went above and beyond to help establish APECS and to incorporate young researchers into science planning.

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Fig. 4.3-4. During IPY early career researchers were engaged in numerous activities including (a,b) outreach in school classrooms, (c) field courses, and (d) conferences. (Photos: courtesy APECS)

