Photo credit: Sergey Primakov

THE PACIFIC ARCTIC GROUP (PAG) MEETING

Meeting Minutes

April 14, 2013
Kraków, Poland

PACIFIC ARCTIC GROUP (PAG) SPRING MEETING
April 14, 2013
Arctic Science Summit Week
Krakow, Poland

April 14, 2013 (Sunday) (Note that all presentations are in the documents folder on the Pacific Arctic Group (PAG) website (http://pag.arcticportal.org/).

1. INTRODUCTION (ppt1)

Jackie Grebmeier, PAG chair (University of Maryland Center for Environmental Sciences) opened the meeting, reviewed the agenda (Appendix A: Final agenda, PAGApr2013_AgendaPDF (PAGAgendaASSW13_FINAL)), and facilitated introductions by the meeting participants. After some logistical statements, she opened the meeting to national country reports on recent activities in he Pacific Arctic region.

2. COUNTRY REPORTS

a. Canada (ppt2) Chukchi Sea/Canada Basin Physical Oceanographic Research

Bill Williams of the Institute of Ocean Sciences/Fisheries and Oceans Canada gave a presentation for the Canadian delegation. He discussed the Canada's Three Oceans (C30) program, that will be undertaken on both the CCGS Louis S. St-Laurent (LSSL) and the CCGS Sir Wilfrid Laurier (SWL). The LSSL will sail from St. John's, Canada to Kugluktuk, Canada (Figure 1) and sampling is planned to include XCTDs (deployed from the stern), underway seawater sampling and bird/mammal observations.

The SWL will sail from Victoria, Canada to Barrow, Alaska, USA (Figure 2) and underway sampling is planned to include UCTD and XCTDs deployed from stern, underway seawater sampling, bird observations and deployment of Argo floats. Sediment samples will be collected using VanVeen grabs and a Happs corer at stations in the Bering and Chukchi Seas. CTD data, geochemical samples (rosette) and plankton samples (vertical bongos) are also planned to be collected. Recovery and deployment of physical-bio-geochemical moorings for JAMSTEC is also planned.

As part of the AON (Arctic Observing Network) and JOIS (Joint Ocean Ice Studies) studies the Louis S. St-Laurent, SWL plans to transit from Kugluktuk to the Beaufort Sea and Canada Basin (Aug 2-Sept 4, 2013). Sampling will include CTD/rosette profiling, vertical net casts, turbulence probe casts, XCTD and UCTD casts, recovery of moorings (WHOI, NIPR), deployment of moorings (WHOI), underway measurements and both ship and helicopter based ice observations.

Leg 1 on the CCGS Sir Wilfrid Laurier will undertake underway sampling from Victoria, BC to the northern Bering Sea as part of the Canadian-US C30 and DBO (Distributed Biological Observatory) program. Leg 3 SWL will occur in late Sept-mid Oct 2013 to undertake physical oceanographic sampling and mooring studies. The suggestion was made that PAG needs to look

at heat transfer Bering Strait to slope and basin; Topics: heat flux, shelf-basin exchange, Northwind Ridge, western Canada Basin, eddies.

Figure 1. The planned 2013 cruise track for the CCGS Louis S. St. Laurent (LSSL).

Figure 2. The planned 2013 SWL cruise track from Victoria to Barrow.

b. China (ppt3)

Jianfeng He of the Polar Research Institute of China (PRIC) provided a presentation for the Chinese delegation. The Xuelong will be renovated during the summer of 2013. The main engine, propeller and relative instruments will be replaced along with some scientific equipment. Chinese scientists plan to participate in a cooperative cruise with Russia on board the Akademik M.A. Lavrentyev in August - September 2013 (Figure 3). Sampling will include surface sediments, sediment cores, CTD observation, chemical and biological analysis (nutrients, chlorophyll-a and plankton).

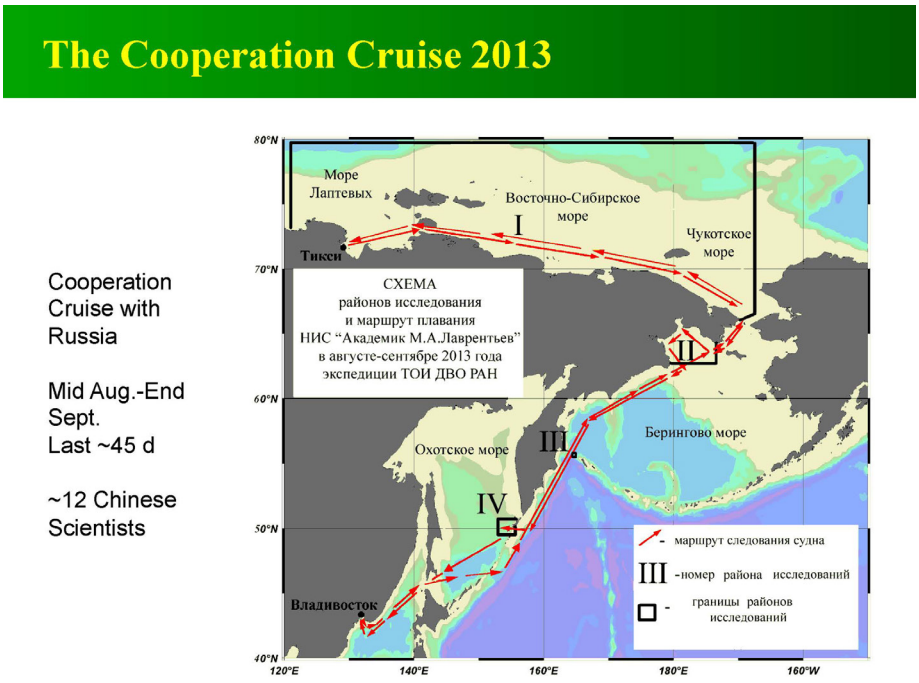


Figure 3. Akademic M.A. Lavrentyev cooperative cruise track.

In 2012 there was a Xuelong cruise from the end of July-August 2012. Both DBO 2 and 3 were occupied during this cruise

c. Japan (ppt4)

Takashi Kikchu (Japan Agency for Marine-Earth Science and Technology-JAMSTEC) provided a presentation for the Japanese delegation. He presented updates of the 2012 field results and plans for the 2013 field season. In 2013 Japanese arctic research cruises are planned on the T/S Oshoro-maru (Figure 4 and 5) and the R/V Mirai (September-October 2013). Japanese scientists will also participate on the July 2013 CCGS SWL cruise, the CCGS LSSL cruise and the IBRV Aaron arctic cruise.

The RV Mirai cruise took place in the Arctic September 13 – October 14, 2012. Data was collected included CTD, water column, sediment, moorings, sea ice observations, and paleoceanography. Moorings were placed at DB03, DB05 and NW Ridge and upper and lower

Barrow Canyon. In September, there were strong wind events that limited sampling in the DB03 region. Patterns of decreasing dissolved oxygen over time at depth were also observed. Zooplankton and smaller fish data were collected using an AZFP, a multi-frequency acoustic fish profiler. Additionally sea ice thickness and production were mapped (Tamura and Ohshima 2011 JGR) by SSM/I at moorings B1 and B3.

Leg 1, on the Oshoro-Maru, is planned for June 14-27, 2013 in the SE Bering Sea (Figure 4). The plan is to occupy DBO1, 2, 3 and 5 and fixed point observations are to be collected over two weeks. Collections off Barrow on September 5-6 will be good since closure by the Alaska Eskimo Whaling Commission (AEWC) during the last week off September and early October was planned. Data on atmospheric impacts on ocean stratification and ecosystem on sea ice reduction in the region was also collected. Wave height was also measured. Dr. Inoue (NIPR/JAMSTEC) collected meteorological observations, including Arctic atmospheric circulation. On April 18 at 2 pm, Radiosone observations were also collected for assimilation into Arctic study, however there was no geological sampling. Cruise participants included Japanese, Chinese, and British researchers.

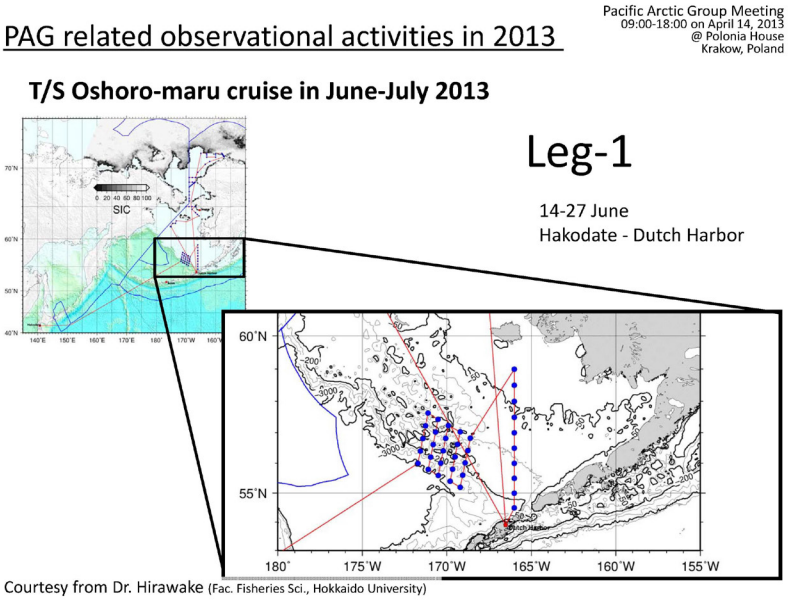


Figure 4. T/S Oshoro-maru cruise in June-July 2013 (Leg-1).

The T/S Oshoro-Maru cruise goals include investigating relationships between biology at higher trophic levels and oceanographic conditions and to construct a habitat model of biology under current conditions.

The R/V Mirai cruise objectives include understanding the impact of atmospheric events on ocean stratification and ecosystem in the sea ice reduction region of the Arctic Ocean and gaining an understanding the uncertainty of Arctic atmospheric circulation. The R/V Mirai cruise will include fixed point observations for two weeks. Estimates will be made of the changes in biological production caused by enhanced ocean circulation due to sea ice loss.

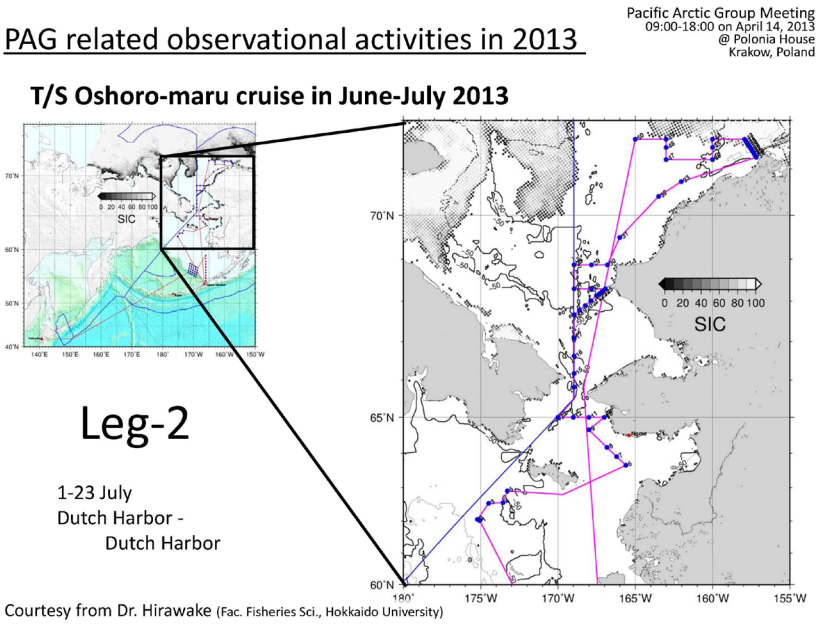


Figure 5. T/S Oshoro-maru cruise in June-July 2013 (Leg-2).

The fall 2013 Mirai cruise will be led by Dr. Nishino (JAMSTEC) (Figure 6). The ship will be off Barrow 9/5-6. This date is good since closure by AEWC last week Sept-early Oct). Studies

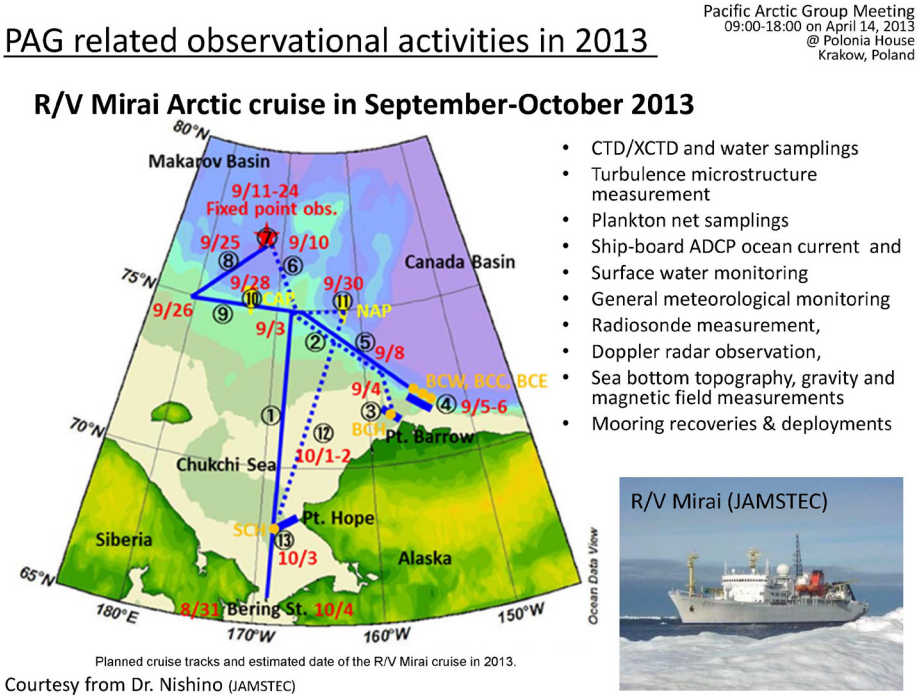


Figure 6. Station track for the R/V Mirai cruise to the Arctic in fall 2013.

will include the impact of atmospheric forcing on ocean stratification and ecosystem in sea ice reduction region. The influence of the deepening nitricline will be evaluated. Meteorological observations and Arctic atmospheric circulation will be studied by Dr. Inoue (NIPR/JAMSTEC).

d. Korea (ppt5)

Sung-Ho Kang (Korea Polar Research Institute-KOPRI) provided a presentation for the Korean delegation on the 2012 cruise and the planned 2013 cruise (Figure 7).

The KOREA Araon 2012 cruise took place for 40 days and covered 10 countries. Water column, meteorological measurements, CTD, sediment, moorings, observations of sea ice, and paleoceanography data were collected. An intensive study of sea ice was conducted including productivity experiments and (species) of algae. More ocean acidification was noted in the Pacific Winter water in 2012 compared to 1997. This increase acidification impacts pteropods and (possibly) benthic organisms, especial with potential increased upwelling onto shelves at the slope region. Plans for 2013 include Phase I in the Chukchi Sea, then II and III in the Beaufort seas. Only geophysical data collection is planned working with Canadian colleagues during Leg 2 (September) that will include geohazard research (gas hydrate) in the Canadian Beaufort Sea.

Leg 1 is planned for August 25 to September 3 for Nome to Barrow. Leg 1 (August) will focus on ocean and paleoceanography in the Chukchi Sea and northern Alaska margin. Four countries will participate in a joint survey (Korea, Germany, USA and Japan). Samples will include SBP and multibeam and long sediment cores (jumbo piston long core). Leg 2 is planned for

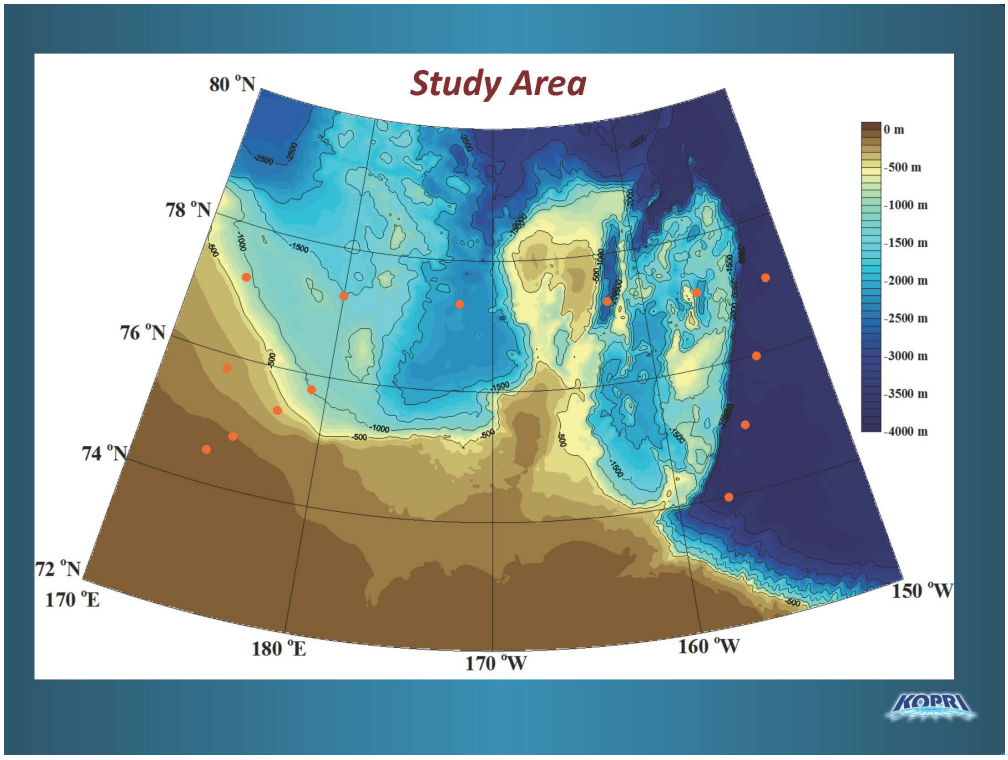


Figure 7. Study area for R/V Aaron in 2012 and 2013 (September 12-28 from Barrow to the Beaufort Sea (Geohazard research)).

Gas hydrate data collection is planned for the Canadian Beaufort sea region. Long term cruise plans include a sea ice camp in August for two months. An ice camp is also planned for 2015. In 2014, the Araon plans to visit the Bering and Chukchi seas, including some of the DBO region. CTD data collection is also planned from September 12-28 in the Beaufort Sea.

e. Russia / United States (ppt6)

Kathy Crane (National Oceanic and Atmospheric Administration) provided a presentation for the Russian and United States delegation. In 2013 the Russian American Long-term Census of the Arctic (RUSALCA) program is undergoing a 10 year review. Data analysis and synthesis will take place for two years with potential restructuring of the program science plan.

Figure 8. Station locations for the 2012 RUSALCA project.

RUSALCA-1 is now a decade old. Sampling and observations are needed where there is maximum sea ice loss. Monitoring of freshwater, heat flux, nutrients, and transport pathways as well as ecosystem indicators of climate change is needed. Modeling and forecasting of change analysis must be conducted. It is also necessary to improve Russian-Arctic science relations. Unknown Arctic areas also need to be explored. RUSCALCA co-founders include NOAA (National Oceanic and Atmospheric Administration), NSF (National Science Foundation), RAS, (Russian Academy of Sciences), and FWS (US Fish and Wildlife Service). There has been a 50% increase of heat through the Bering Strait over the last decade (Woodgate et.al, 2012).

Mooring issues during Leg 2 process cruise contributed to a few days data collection time loss. Data analysis and synthesis activities from the 10 years of the RUSALCA program are needed. There are opportunities for tracking changes in RUSALCA data under the umbrella of the GEOTRACERS (NSF-funded) program. Coming to an understanding of new patterns in the RUSLCA region and consideration of moving further north (yet maintaining monitoring sites) is needed. This year funds from NOAA RUSALCA NOAA assisted with retrieval of the Bering

Strait moorings, with the US Office of Naval Research (ONR) funding the redeployment on the US side only. The future status of Bering Strait mooring array is pending.

Wieslaw Maslowski of the US Naval Postgraduate School is modeling data for assimilation of RUSALCA into physical models. Jia Wang (lead, NOAA, GLERL) is in the process of taking CTD and ecosystem data. Opportunities for modeling and prediction activities exist. Access to processed mooring data is needed for modeling the Bering Strait mooring data since only the raw data is publically available. There are also data conversion issues of raw data between Russian and USA data.

During the discussion period it was mentioned that there is no paper yet that explicitly shows that heat through the Bering Strait is melting ice. Is this really heat flux causing the sea ice melt? If heat in the Bering Strait and temperatures in Chukchi Sea are the same, it is not due to heat flux. Or is all the sea ice melt due to influences of the atmosphere? There are no significant heat differences in Barrow Canyon and the Canada Basin

Another topic was evaluating the conduits for marine flow through submarine canyons and the critical importance of tracking variability of shelf-basin exchange at the Chukchi/basin region. Is shelf water heated locally or advected in? We also discussed the potential for RUSALCA supporting mooring in Herald Canyon. What would be best configuration? Opinions are coming forward that now is the time to establish a mooring network comprised of Bering Strait, Barrow Canyon and Herald Canyon,

f. United States (ppt7)

Jackie Grebmeier (UMCES) provided a presentation for the United States delegation on ship operations in 2012 and planned operations in 2013. Upcoming projects include continuation of US-lead with international collaborations of Arctic Observing Network (AON) projects in the northern Bering, Chukchi and Beaufort seas. These projects include: cruises on the Fairweather for bathymetric mapping (NOAA), Outer Continental Shelf mapping, Distributed Biological Observatory (DBO) sampling on the CCGS Sir Wilfrid Laurier and joint US-Canadian studies on the Chukchi Plateau (CCGS Sir Wilfrid Laurier)), and the NOAA-sponsored CHAOZ (Chukchi Acoustic, Oceanographic, and Zooplankton) study.

3. DBO (Distributed Biological Observatory) Status Report (ppt8)

Jackie Grebmeier, PAG chair (University of Maryland Center for Environmental Sciences) provided a presentation reporting on the DBO meeting in Seattle, Washington, USA (February 27 – March 1, 2013). Figure 10 provides and outline of the DBO goals and location of latitudinal transect line for select measurements. The power point presentation describes additional 2012 and planned 2013 DBO activities in the Pacific Arctic.

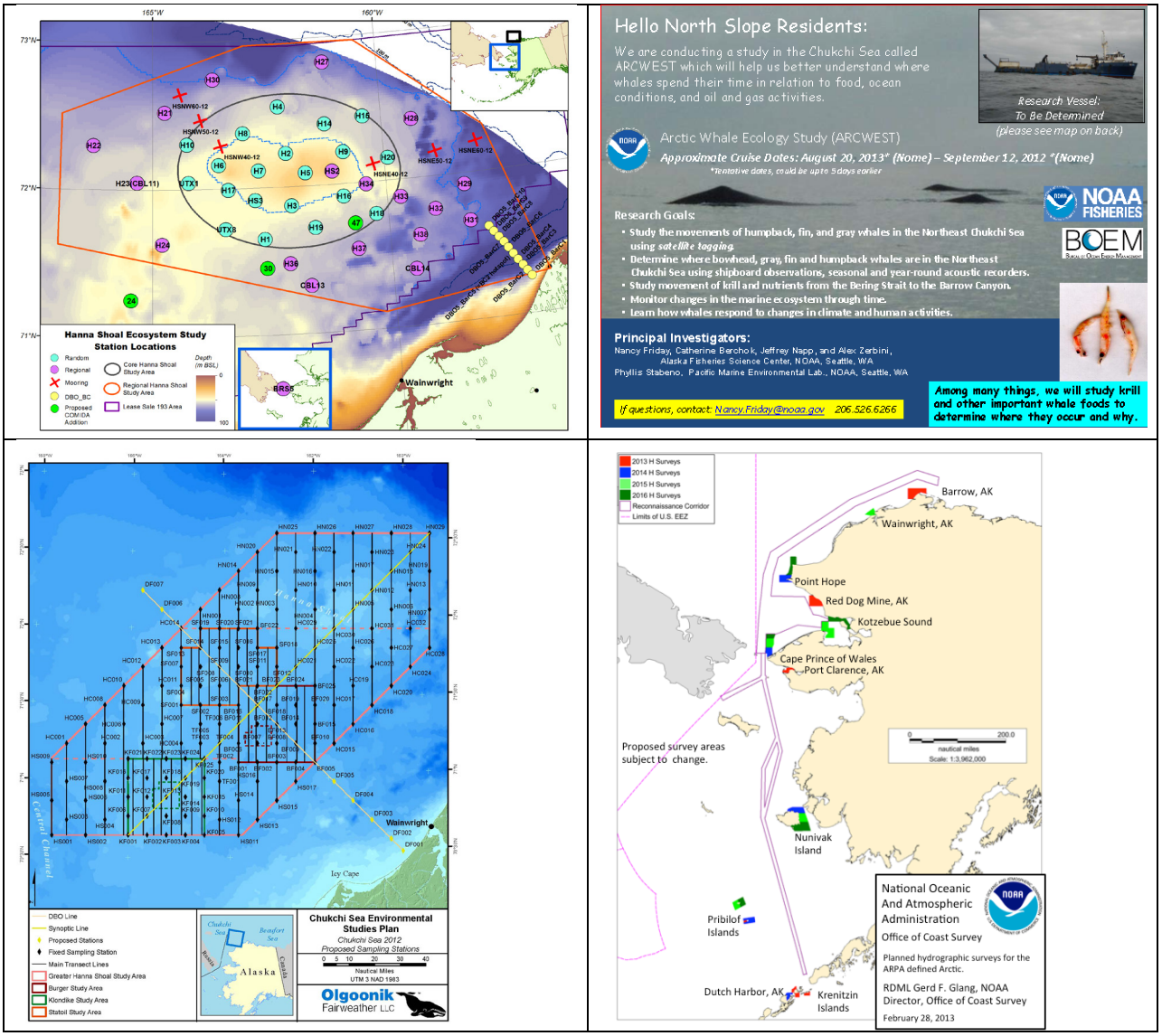


Figure 9. Examples of additional US field programs during 2012 (Upper left panel: COMIDA study, upper right-ArcWEST, lower left: industry studies via CSESP (Chukchi Sea Environmental Studies Program), and right NOAA Coast Survey program on the RV Fairweather.

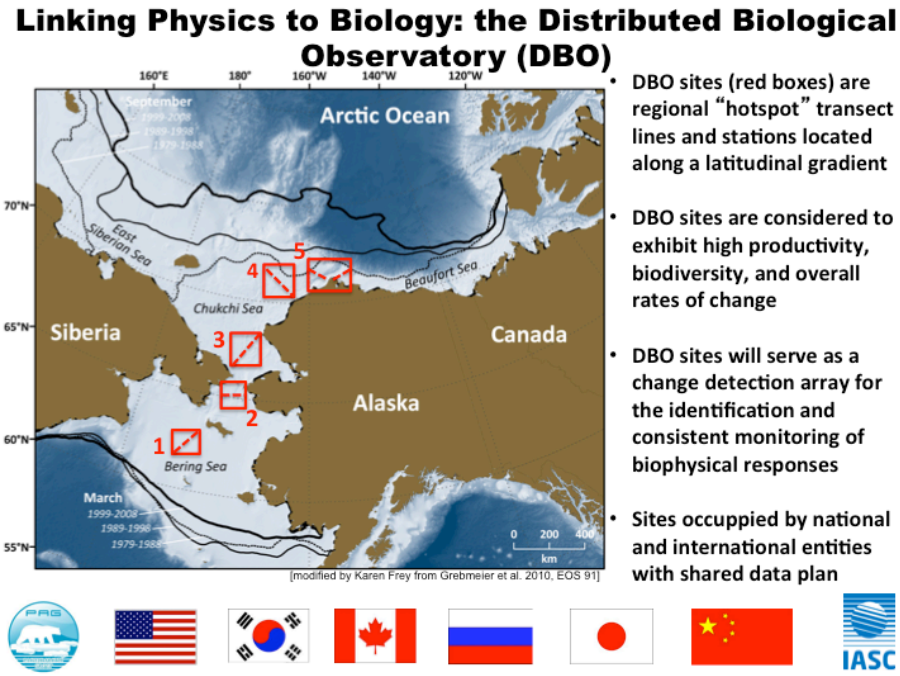


Figure 10. Schematic of the DBO sampling locations and summary of objectives.

4. UPDATE ON NEW PAG ACTIVITIES AND SYNTHESIS ACTIVITIES

a. Kathy Crane: RUSALCA Program (see ppt6)
Kathy Crane (National Oceanic and Atmospheric Administration) gave a presentation on RUSALCA activities).

A Long term study of the Pacific Arctic Climate-Sea Ice is expected to begin in 2014. Observations where sea ice is reducing the greatest will be collected and include regional physics and response to change. The Circumpolar Biodiversity Monitoring Program *(*CBMP*)* is a program under the Arctic Council and will monitor environmental and biodiversity aspects by countries in the Arctic. US CBMP Arctic Portal data is also being submitted to a CBMP data portal in Iceland. The Arctic Council has endorsed observing networks. RUSALCA, as an observing program, is planning to move some sampling north of Herald Canyon.

A discussion of important topics in the Pacific Arctic region and programs the PAG members need to evaluate include to:

- the structure, variability and heat transport of Atlantic Water in the Arctic ocean and interaction with Pacific waters related to sea ice response
- methane flux monitoring from sea floor and atmosphere
- collect further information from the NABOS cruise (Igor Polayov)
- discuss the MOSAIC plan for a drift station (IASC Atmospheric Working Group)
- gas hydrate studies in Copenhagen, Denmark
- The Roshydromet proposed drift station with NOAA, how interact with MOSAIC?

- Concern with Arctic observations: drift station only one point, one year; e.g., SHEBA, MOSAIC, but not be able say anything to predict, need daily observations, buoys, weather stations
- need for sustained observations; not possible with floating platforms; need set stations, too
- MOSAIC drifting stations, measuring processes, not easily instrumented buoy
- ITP only data available for thermodynamics data online, important for prediction, adaptive observational network
- Be aware
    - Arctic Report Card NOAA contributions
    - Request give data preprocessed or type parameters to put into composite data base
    - Need for maps freshwater content, heat content, max T Atlantic water
    - Some biological parameters

b. Sea Ice and Atmosphere (ppt9)

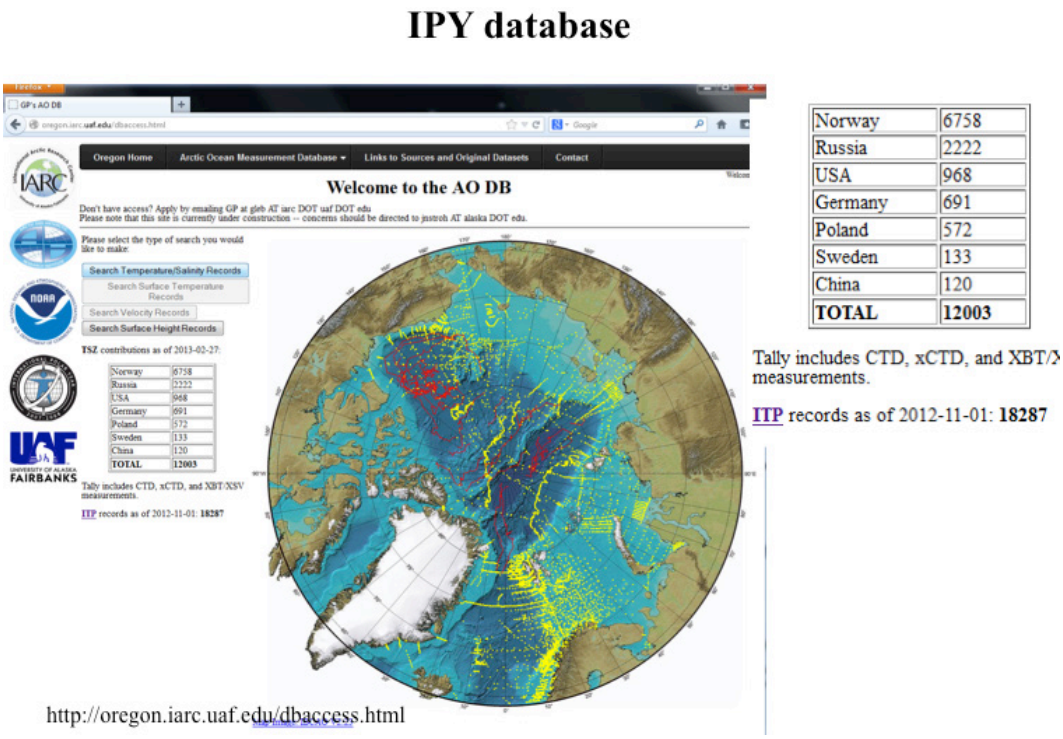
Baek-Min Kim (Korea Polar Research Institute) provided a presentation on a comprehensive observational study in the seasonal ice zone.

The presentation discussed the importance of the seasonal ice zone, particularly the role of air-sea interactions in Arctic amplification. This topic is important to evaluate the connection of the Arctic ocean and global atmospheric circulation. Further information of this topic were outlined in a white paper for the May 2013 Arctic Observing Submit (AOS) in Vancouver, Canada. Multiple meso-scale measurements can be made in the ocean and atmosphere from sea ice and land-based research camps (Figure 11.) In 2015 an Arctic drifting study is being proposed (Igor Polyakov and David Barber, AOS13 white paper), including both ice- and ship-based studies to investigate air-sea interaction and KOPRI plans to include their ship operations during to this collaborative effort. Land-based meteorological observations are also proposed. Project measurements would include vertical radiosonds, shipborn CTD, ADCP, LIDAR, water collections for phytoplankton and other biological measurements.

c. Modeling (ppt10)

Gleb Panteleev (International Arctic Research Center) provided a presentation on preliminary modeling results of physical oceanography from the Bering Sea and Pacific sector of the Arctic Ocean. His presentation covered his efforts in developing an IPY database of physical parameters that are being used in sensitivity analyses for both water column and mooring data. There is a need to formulate currents in larger sea areas and to model Bering Strait transport and well as other parameters in the Pacific Arctic region. Data can be provided via his website listed in his presentation and he will also provide data access to collaborators. All are welcome.

Figure 11. Proposed observing strategy in the Pacific sector of the Arctic Ocean.



Norway	6758
Russia	2222
USA	968
Germany	691
Poland	572
Sweden	133
China	120
TOTAL	**12003**

Tally includes CTD, xCTD, and XBT/X measurements.

ITP records as of 2012-11-01: **18287**

Figure 12. Distribution of physical oceanographic data sets forming an IPY database for the modeling effort.

d. Chukchi Borderland and Arctic Basins 2007 and 2008 special sea ice event (ppt10)

Koji Shimada (Japan-lead) does not believe that the estimates of loss of sea ice by 2020 are correct. Latitude 74.5 degrees north seems like a critical area. There is potential for a time series of temperature at 50 m depth from 2000-2012 in the Northwind Ridge area. This analysis might show "hotspots" of Arctic Ocean warming starting in the late 1990s to the present. The ocean is getting warmer and the warm layer is getting thicker. There is an increase of pumping warm surface water downward. From 2007-2008 there was an anomalous heat release in subsurface warming. The IASC Marine Working Group will have a workshop on mixing heat. There are also issues with sea ice motion. In 2012 there was a pile up of loose sea ice, but in 2013 there was almost no pile up of sea ice. There have also been changes in heat content in the western part of Canada Basin. Northwind Ridge is a key area to understand heat flux and the fate of sea ice. Heat content has increased over the last few years has been enough to melt 80 cm of ice. Sea ice salinity is high, thus also influencing ice melt. A small committee is needed to (develop) the PAG plan.

e. Conclusion of Springer Book and Ongoing Synthesis Activities (ppt11)

Jackie Grebmeier, CBL/UMCES provided a presentation on PAG synthesis activities as outlined in the following list:

Summary of PAR Synthesis Activities

- **Fall 2007:** PAG created PAR synthesis group
- **Jan. 2008**: PAR Modeling Workshop #1, Sanya, China; resulted in special issue of **Chinese Journal of Polar Science, Vol. 9, 2008**; 13 papers
- **May 2009:** PAR Biology Workshop #2, Seattle, WA, USA; **Feature article in EOS (May 2010)**; producing chapters for book in progress
- **June 2009:** PAR Marine Carbon Cycling Workshop #3, Xiamen, China; Special issue Deep Sea-Research in progress, Lead editor: Wei-Jun Cai et al.-**special issue DSR Sept 2012**
- **Feb. 2010**: AGU/ALSO/TOS Ocean Sciences Meeting, Portland, Oregon, USA: PAG session; also June OSLO IPY Conference, Oslo, Norway AG session)
- **June 2010:** PAR Synthesis Lead author meeting, OSLO IPY Conference, Oslo, Norway
- **Fall 2011-Spring 2013**: submission, review, revisions of chapter manuscripts; final book to Springer May 2013, **publication date end 2013**
- **Sept 2012:** PAG presentation and poster at PICES meeting, Hiroshima, Japan and ISAR3 Tokyo, Japan
- **Dec 2012**: DBO Arctic Report Card article-**Grebmeier et al. 2012**
- **2013-2014: Special issue Deep Sea-Research II, in progress, RV Aaron cruise results,** Lead editors: Sang Lee, Sung-Ho Kang, Jacqueline Grebmeier

Further details of ongoing and future synthesis activities can be found in the presentation.

f. Data Issues

PAG will continue to discuss data collection, sharing and archiving through it collaborative activities. For example, the DBO has a draft data policy and working groups to address data collection standards, data sharing, data archiving, and joint publications.

5. INTERACTIONS WITH OTHER ORGANIZATIONS – IASC, SAON, PICES, APECS, OTHERS

a. ICARPIII (3rd International Conference on Arctic Research Planning) (ppt12)

David Hik (University of Alberta, President of IASC) provided a presentation on the 3rd International Conference on Arctic Research Planning process. ICARPII will solicit partners, such as PAG, to contribute activities in support of ICARPII. Questions for discussion with the PAG group related to what activities can PAG highlight within ICARPIII? For example, an Arctic Freshwater Synthesis and Network was put forward by the IASC terrestrial WG.

b. International Polar Initiative (IPI) (ppt13)

David Hik (University of Alberta) provided a presentation on the International Polar Initiative

Focus on optimizing better coordination of existing resources, as well as on the services science can provide to society, is needed. Emerging challenges need to be identified. IPI should be included as a polar component of "Future Earth" reforming. An earth system approach (linking global sciences?) should be considered that includes bipolar and the third pole (alpine and high altitude) as well as natural and human systems. In order to address "What do we really need to know by 2030?" new IPI framework of activities for 2017-2018 is needed. How will IASC inform national funders? This can be done by connecting with the Belmont Forum meeting (AOS) where funders can participate in early discussions and facilitate planning (trends?). There are concerns that the third pole approach seems too broad. There are also concerns about losing sustaining observations. Web resources include: www.icsu.org/future-earth

c. SAON (Sustaining Arctic Observing Networks) (ppt14)

David Hik (University of Alberta) provided a presentation on the Sustaining Arctic Observing Networks (SAON) program. Note that the PAG DBO program is a SAON task. The SAON Secretariat is co-sponsored by AMAP (Arctic Monitoring and Assessment Program) and IASC (International Arctic Science Committee). Some of the objectives of the SAON program is to enhance geospatial tools**,** maintain national inventories of Arctic countries and associates develop community based monitoring, and promote standards for data and interoperability of data archives.

Dr. Hik also briefly outlined the goals of the upcoming Arctic Observing Summit (AOS;

www.arcticobservingsummit.org), including 30-40 white papers on observing topics. The 2nd AOS will be associated with the 2014 ASSW in Helsinki, Finland. Subsequently, the AOS will be held every 2 years.

d. PICES-MONITOR

Jackie Grebmeier and Takashi Kikuchi made oral and poster presentations on behalf of PAG at the Technical Committee on Monitoring (MONITOR) during the 2012 PICES meeting in Hiroshima, Japan. Both MONITOR and PAG have expresses an interest to provide updates of activities to each organization as well as look for opportunities for collaboration.

i.

Figure 13. PAG poster presented at the 2012 PICES meeting in Hiroshima, Japan.

e. Plans for ART (Arctic Rapid Transition) (ppt15)

Monika Kedra (Institute of Oceanology, Polish Academy of Sciences) provided a presentation on the ART activities for 2012-2013 (Fig. 14). A proposal is pending (recently support) for a TRANSSIZ cruise on the Polarstern (support by Germany). ART is an early career initiative and

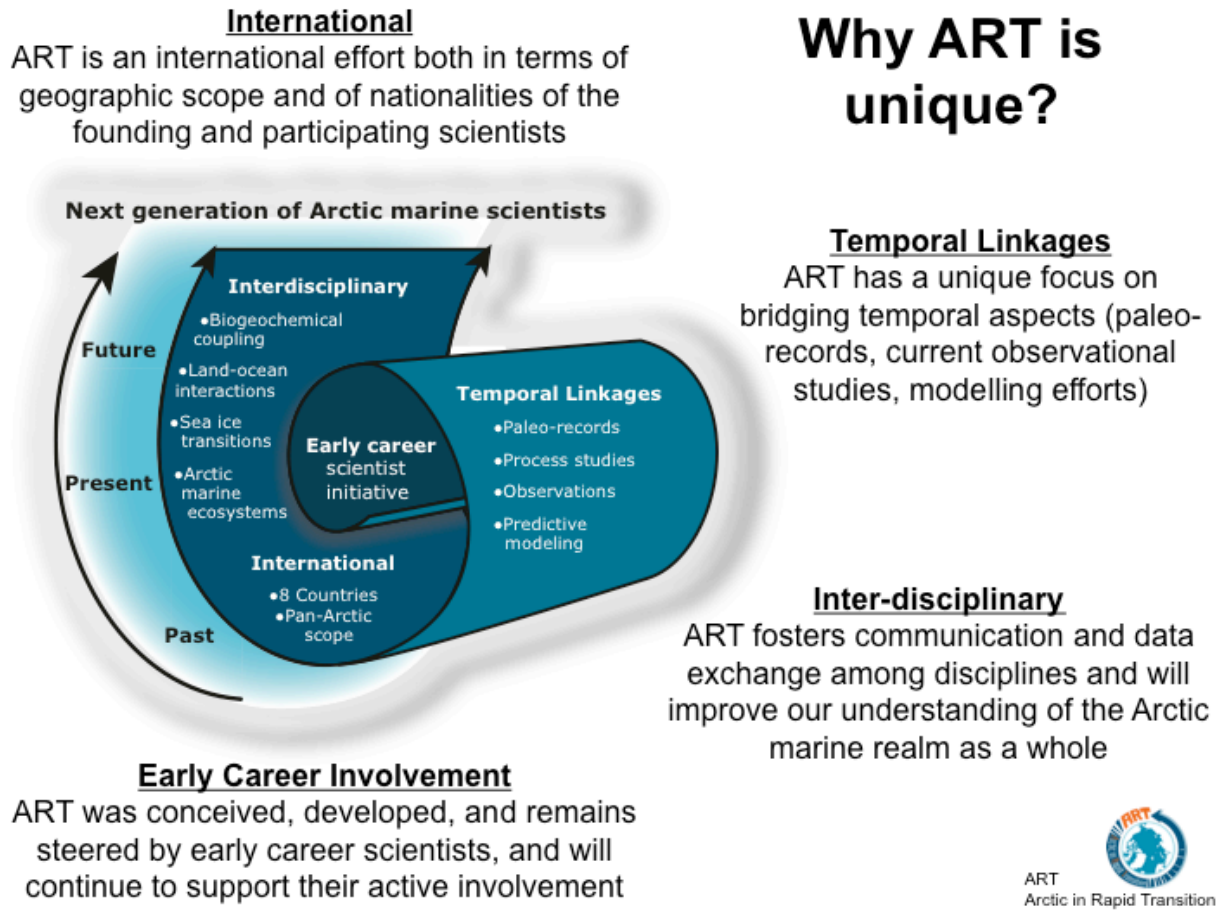


Figure 14. Outline of the ART initiative and activities.

the funded cruise also fits within the GEOTRACERS program. Finally it would be good to get APECS involved within PAG for the 2014 ASSW.

6. PAG Structure

a. **Executive committee** composed of **PAG Chair, Vice-Chairs** and **Leads** (from each of PAG activities).

b. **Current Rotation Plan: Chair and Secretariat**
2012-2014 – USA (Jackie Grebmeier, UMCES/CBL)
2014-2016 – Korea (Sung-Ho Kang, KOPRI)
2016-2018 – Japan (TBD
2018-2020 – Russia, China, Canada (TBD)

- Chair rotates 2 years, renewable for 2nd term
- Vice-chairs 2 years, renewable for 2nd term

7. OPEN DISCUSSION

The need for multi ship, international operations was discussed that could be facilitated by PAG. An important role for PAG could be continued coordination of ship time and logistics, especially to compare the same measurements collected in similar ways at the same time, but different locations in the Pacific sector. Note that WOCE has some similar observations as the DBO, specifically physical oceanographic measurements.

The question came up as to whether we really understand the communication between the Pacific shelf and basin, especially related to eddies, and in the context of freshening and warming Pacific waters.

Other issues brought forward related offshore shelf flow, such as the Mackenzie flow, as well as other parameters, such as wind, rivers, temperature anomalies, higher than expected solar input, all which provide complexity to understanding the system. Mackenzie River water can be tracked far off shore with anomalous surface temperature to 6 m depth.

8. ACTION ITEMS

The following action items were identified for future PAG planning activities and discussion, specifically requesting a white paper on each topic:

1. Create a subgroup for developing a plan on the topic of the role of air-sea interactions in the Arctic amplification as facilitated by PAG, including discussion about ice camps, buoys, and a coordinated effort (lead: Korea)

2. A focal group on physical oceanography to develop a white paper to move this topic forward (co-leads: Bill Williams-Canada and Koji Shimada-Japan). Topics might include:

- Northwind Ridge hotspot/Basin white paper-need develop coordinated effort white paper: climate "hotspot" (Koji Shimada)
- Shelf-basin exchange: Chukchi/Beaufort to Canada Basin (Bill Williams/Canada and Mary-Louise Timmermans/USA)
- Heat transport and freshwater flux
- Flux through Bering Strait (Rebecca Woodgate) and Barrow Canyon (Mitoyo Itoh) What about other shelf areas? East Siberian Sea?

3. Continued development of the DBO (lead Jackie Grebmeier)

9. REVIEW OF PAG OPERATING PROCEDURES, WEBSITE AND SECRETARIAT

a. Discussion PAG Format

- Business-science meeting during ASWW and a science focus meeting in the fall?

- Can science subgroups hold meetings outside schedule or should these be co-incident with PAG meetings?
- Location of secretariat same as location of Chair?

b. Recent and Future PAG Meetings

- Fall 2012 - Suzhou, P.R. China
- ASSW 2013 - Krakow, Poland
- Fall 2013 – KOPRI, Incheon, Korea, October 16-18, 2013 (ppt16)
- ASSW 2014 – Helsinki, Finland, April 2014
- Fall 2014 – USA (change Chair and Secretariat location to KOPRI)
- ASSW 2015 – Tokyo, Japan

APPENDIX A

PACIFIC ARCTIC GROUP MEETING FINAL AGENDA
April 14, 2013
Krakow, Poland

Time: 0900-1230 and 1430-1800
Location: Polonia House (*Dom Polonii*), no. 14 Market Square

April 13-PAG Executive Committee to review agenda

April 14-PAG Meeting 0900

Introduction and Welcome (Jackie Grebmeier)

Agenda items

1. Update (highlights) of 2012 field results and plans for 2013 field season
    a. Canada
    b. China
    c. Japan
    d. Korea
    e. Russia
    f. United States (Kathy Crane/Jackie Grebmeier)

2. Status report from DBO (Jackie Grebmeier)
    a. Report on DBO data meeting in Seattle, Washington, USA: 27 Feb-1 Mar 2013
    b. Establishing new DBO lines in Beaufort Sea, Chukchi Borderland, others?
    c. DBO data management
    d. Plans for DBO publications and 2013 field activities

3. Update on new PAG activities and synthesis activities, including brief proposals:
    a. RUSALCA program (Kathy Crane)
    b. Chukchi Borderland/Arctic Basin (Korea, Japan, others?)
    c. Chukchi Sea/Canada Basin physical oceanographic research (Bill Williams)
    d. Sea ice and atmosphere topic (TBD)
    e. Updates August 2012 big storm, CH4 survey, modeling
    f. Other proposals for new activities?

4. Conclusion of Springer book (Grebmeier)

5. Data issues
    a. PAG, possibly start with standard metadata file on common PAG portal
    b. Possible data format (Jinping Zhao)

6. PAG structure

a. Executive committee composed of PAG Chair, Vice-Chairs, and leads from each of PAG activities (need confirm those leads)
b. Current rotation plan: Chair and Secretariat
    i. 2012-2014 – US (J. Grebmeier, UMCES)
    ii. 2014-2016 – Korea
    iii. 2016-2018 – Japan
    iv. 2018-2020 – Russia, China, Canada?

7. Review of PAG operating procedures, website and Secretariat
    a. Discussion PAG format
        i. Business-science meeting during ASSW and a science focus meeting in the fall?
        ii. Can science subgroups hold meetings outside schedule or should these be co-incident with PAG meetings?
        iii. Location of Secretariat same as location of Chair?

8. Interactions with other organizations – IASC, SAON, PICES, APECS, others
    a. updates IASC, ISAR3, SAON, others
    b. plans for ART (Arctic in Rapid Transition)-Monika Kedra

9. Future PAG meetings
    - ASSW 2011-
    - Fall 2011-Sidney, BC Canada
    - ASSW 2012-
    - Fall 2012-Suzhou, P.R. China
    - ASSW 2013-Krakow, Poland
    - Fall 2013 – U.S.A (exact location TBD, likely Seattle)
    - ASSW 2014 – Finland
    - Fall 2014-TBD (change Chair and Secretariat location)-Korea, Canada, Russia, ?IARC-Alaska
    - ASSW 2015 – Tokyo, Japan

APPENDIX B-PAG MEETING PARTICIPANTS, APRIL 14, 2013 KRAKOW, POLAND

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