Pacific Marine Arctic Regional Synthesis (PacMARS)

PI Meeting Report

Annapolis, Maryland, USA
September 24-25, 2012

SESYNC (National Socio-Environmental Synthesis Center)

Supported by the North Pacific Marine Research Institute

Attendees

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Collaborators, Advisors, Program Managers and Project Assistants:

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Abbreviation	Institution
UMCES-CBL	University of Maryland Center for Environmental Science, Chesapeake Biological Laboratory
WHOI	Woods Hole Oceanographic Institution
URI	University of Rhode Island
UAF	University of Alaska Fairbanks
NCAR/EOL	National Center for Atmospheric Research Earth Observing Laboratory
UT	University of Texas at Austin
FIT	Florida Institute of Technology
NOAA	National Oceanic and Atmospheric Administration
OSTP	White House Office of Science and Technology Policy
NPRB	North Pacific Research Board

Agenda

PacMARS PI meeting at SESYNC, Annapolis September 24-25, 2012

Sunday, Sept. 23

- Participants arrive Annapolis, MD.

Monday, Sept 24

0845 Welcome and logistics (Jackie Grebmeier and Eva Bailey)

0900 NPRB opening statements (Francis Wiese/Danielle Dickson)

0915 Overview of PacMARS Goals and Objectives (Grebmeier)

0930 Status Physical and chemical oceanography effort-Steve Okkonen, Lee Cooper, John Trefry

1015 Break

1045 Status Lower trophic studies (water column): Carin Ashjian, Bob Campbell

1115 Status Lower trophic studies (benthos): Bodil Bluhm. Jackie Grebmeier/Lee Cooper

1200 Lunch

1330 Food web studies: Ken Dunton and Continued overall PacMARS discussions

1400 Higher trophic study collaboration update: Jackie Grebmeier and Sue Moore

1430 Community social science interactions; Sveta Yamin-Pasternak, Gay Sheffield

1500 Break

1530 Data management and Questionnaire: Jim Moore

1600 Open discussions and 1st day action items

1900 Continued discussions during group dinner

Wed., Sept 25

0805 Continental breakfast at SESYNC

0830 Open discussion of data acquisition, other players

0930 Plans for PacMARS data meeting

1000 Break

1030 Data analyses: example of templates for GIS (Alynne Bayard)

1100 Open discussion: data input and products, format data meeting

1130 Direction for Open Science workshop: PacMARS (Jackie Grebmeier) and SOAR (Sue Moore)

1200 Lunch at SESYNC

1330 Input from Eddy Carmack and Bob Ulanowicz

1400 Discussion

1430 Break

1500 Summary of Action Items

1600 End of meeting

Introduction

The Pacific Marine Arctic Regional Synthesis (PacMARS) is a research synthesis effort underwritten by the North Pacific Marine Research Institute to assemble by mid-year 2013 up-to-date written documentation that contributes to understanding the Pacific-influenced continental shelf ecosystem of the Arctic Ocean. Our study area extends from Saint Lawrence Island in the Bering Sea through Bering Strait into the Chukchi and Beaufort Seas and our objective is to compile the best available knowledge from local communities, peer-reviewed social and natural sciences, as well as less readily available knowledge sources

As seasonal sea ice continues to decline in the Arctic, having reached a record minima in 2012, oil and gas exploration is increasing, and additional ship traffic through Bering Strait, is a portend of changes to come if the Northern Sea Route along the north coast of Russia becomes a practical ice-free route between Asia and Europe, reducing shipping costs significantly. The Northwest Passage through the Canadian Arctic has also become ice-free several times in recent summers, a significant change. All of the Arctic countries, including Russia, the United States, Canada, and Denmark (Greenland) are exploring the limits of their arctic continental shelves in order to advance claims under the Law of the Sea Treaty.

Within this context of environmental and likely socio-economic changes, wildlife populations and human communities are adjusting to these shifts in seasonal sea ice coverage and climatic warming that has been much more obvious than at lower latitudes. Subsistence hunting patterns in the Arctic are changing, and it is also clear that many organisms, from plankton to top predators may be changing their migration and foraging patterns. Productivity is also forecast to change as sea ice declines and penetration of sunlight into open water increases.

The overall goal of PacMARS is to provide guidance for scientific research needs in the region, as well as to serve stakeholder needs for understanding this important ecosystem and its vulnerabilities. This synthesis is expected to lead within the next two years to new research initiatives by US federal agencies, as well as to bring attention to the findings of several sustained research efforts that have been undertaken in the Pacific Arctic region over the past several decades. We are also actively working with other knowledge synthesis efforts, such as Synthesis of Arctic Research (SOAR) that is underwritten by the Bureau of Ocean Energy Management (BOEM) and the National Oceanic and Atmospheric Administration (NOAA). SOAR has somewhat more expertise than our synthesis effort on higher trophic levels, but the major difference is that it is chartered to synthesis knowledge for the North American Arctic over a longer time frame. As a result the joint results of the efforts may include an overview that can be used in the near future to design appropriate research initiatives for the knowledge uncertainties (PacMARS) as well as a more nuanced view of environmental changes that take into account trends over multi-annual physical and biological cycles (SOAR). We are actively sharing information and participants between the two synthesis efforts.

The PacMARS Principal Investigators (PI) meeting facilitated a gathering of the PacMARS PI's, collaborators, advisors, program managers and project assistants. The goal of the meeting was to identify data sets, research questions and collaborative efforts needed to reach the PacMARS program goals. The meeting also helped identify short-term and longer range action items including planning the upcoming data meeting, hub meetings and data submission logistics.

Day 1 (September 24, 2012)

Jackie Grebmeier (UMCES-CBL) began the meeting by welcoming everyone and introducing **Amanda Grimes (Director of Administration and External Affairs-SESYNC)**. Amanda gave some background about SESYNC and how a program like PacMARS fits well in the mission of a national socio-environmental synthesis center. She described how programs at the center support the synthesis of natural and social science in addressing problems of the environment and how fostering fundamental, discovery-driven synthesis research that contributes to actionable science is central to the center's mission. **Margaret Palmer (Executive Director-SESYNC)** spoke about SESYNC and passed out literature about the center. Margaret explained how they use synthesis to bring together large data sets and how SESYNC goes beyond quantifying larger data sets with a focus on bringing natural and social scientists together. More information can be found by visiting their website (http://www.sesync.org/).

Presentation Summaries

Introduction

Jackie Grebmeier (UMCES-CBL) gave an introduction showing a summary of the PacMARS goals and objectives:

PacMARS Goal: to facilitate new synergies in understanding of the marine ecosystem in the greater Bering Strait region, including the northern Bering, Chukchi and Beaufort seas.

PacMARS research team and collaborators will:

1) identify and synthesize existing data sets that are critical for evaluating the current state of knowledge of this marine ecosystem, including human dimensions and

2) define the high-priority, overarching scientific themes and research needs for the next decade or more of marine ecosystem studies in the Pacific Arctic Region.

This synthesis effort will contribute to NPRB's overall mission to promote understanding of north Pacific ecosystems in order to help enable effective management and sustainable use of marine resources, from subsistence use to fisheries to industrial exploration and development.

Objective 1: bring together multiple data sets and/or providing internet-based linkages to data sets while developing practical synthesis mechanisms.

The data assembled and other synthesis products will be publicly available at the National Center for Atmospheric Research (NCAR)'s Earth Observing Laboratory (EOL; http://arctic.eol.ucar.edu). This data inventory and synthesis effort will enable our second objective:

Objective 2: the development of forward science planning and identification of science needs for an integrated, multi-agency research and modeling effort in the Chukchi/Beaufort region that could be initiated in 2014.

Our large-scale work products will include a mid-term (July 2013) interim report of the synthesis activities and products, along with a summary of future research activities.

The final report in 2014 will be the basis for a peer-reviewed book with individual chapters developed as an interdisciplinary effort.

Jackie showed a table listing the PacMARS Principal investigator team and some committed as well as potential collaborators. Next she showed table 2 from the PacMARS proposal/workstatement which is a summary of the PacMARS six research themes and the data syntheses and approaches that will be used to address them. She explained that during the meeting each PI will get into the details for each project. Finally, Jackie showed the PI Meeting agenda and gave some additional logistical information.

North Pacific Research Board

The program managers from the North Pacific Research Board (**Francis Wiese** and **Danielle Dickson**) summarized NPRB's intent to use PacMARS to help identify research needs for a large scale research program in the future. They mentioned that they were having monthly conference calls with the research leads and that there was great interest from the PacMARS advisory board and they have been directing people to the January 2013 meeting as a more public meeting.

Physical and Chemical Oceanography

Lee Cooper (UMCES-CBL) provided a presentation on aspects of the status of the physical and chemical oceanographic effort. Collaborators on this presentation included Steve Okkonen (UAF) and John Trefry (FIT). Lee described the potentially available data sets including the Sir Wilfrid Laurier cruises (July 1998-July 2012 and beyond to 2017) with data including CTD, nutrients,O-18, chlorophyll, benthic data, grain size, C/N, sediment

chlorophyll and biological community analysis. He explained how gaps in the data were being addressed and listed possible synthesis expectations. These cruises occur every July, with very similar timing, and some potential questions/activities include:

1) Have chlorophyll concentrations and total inventories changed?
2) Need to assess water mass position (via nutrients?).
3) Tie-in with current and future DBO (Distributed Biological Observatory).

Lee described sedimentation data using ^{137}Cs and ^{210}Pb and identified data sources (SBI (Western Arctic Shelf-Basin Interactions), COMIDA (Chukchi Sea Offshore Monitoring in Drilling Area) CAB (Chemical and Benthos), RUSALCA (Russian-American Long-term Census of the Arctic), and the Bering Sea program). Lee also described using stable oxygen isotope data as key to understanding water mass transport through the Bering Strait and new freshwater contributions through melting sea ice. Lee detailed comparative opportunities using data from the Chukchi Shelf (Polar Star 1993, SBI 2002, NASA ICESCAPES 2009-2010) and data that are currently being analyzed in his lab.

John Trefry (FIT) spoke about the synthesis of chemical contaminants in sediments, seawater and biota. Collaborators for his presentation included Ken Dunton, Lee Cooper, Gay Sheffield and Brenda Konar. Work so far has been focused on assembling data sets and references. John stated that PacMARS scientists have been involved in most programs that targeted contaminants in sediments, water and lower trophic level organisms in the Chukchi and Beaufort seas. Confirmation is needed, especially from social scientists, regarding key contaminants to include in the synthesis. Collaboration is needed with PacMARS PIs regarding contaminants in higher trophic level organisms, including marine mammals.

John showed example summary maps of total mercury in sediments and in snow crabs and gastropods in an area of the NE Chukchi Sea and stated that we will be clarifying where appropriate (e.g., THg and MeHg), and where we can, the degree to which the amount of chemical present is likely to be anthropogenic and with a regional versus global source. He also commented that as part of the synthesis we would also focus on biomagnification of contaminants within the food web.

Several attendees offered suggestions on possible available data sets and contaminants of interest:

1) STAMP (bird, egg and mammal data), NPRB has these data sets (Francis Weise)
2) USFWS (bird data), Gay Sheffield
3) John asked Sveta what contaminants might be of concern for local subsistence.
4) Sue Moore suggested PCBs, radioisotopes and ^{137}Cs (tuna foraging with Fukishima plume) as contaminants of interest.
5) Sue Moore mentioned Terry Wells (NOAA) as a contact for contaminant-related data.
6) Sue Moore suggested the ANWAP (Arctic Nuclear Waste Assessment Program), led by ONR (Office of Naval Research, 1990's study of Soviet radionuclide dumping) as another data source.
7) Gay Sheffield and Sue Moore suggested sea health and disease related to contaminants.
8) The Alaska Native Health Organization studies (Jim Burner as contact person)
9) Brendan Kelly suggested we contact the Indigenous People's Council for Marine Mammals (IPCoMM; http://www.ipcommalaska.org/).

Status of Lower Trophic Studies (Water Column)

Carin Ashjian (WHOI) provided a presentation about zooplankton and phytoplankton distributions.

Collaborators on this presentation were Robert Campbell (URI) and Susan Mills (WHOI). Carin stated that the overall objectives of their work are:

1) Develop data sets to start to address the following questions:
-Will warmer water temperatures and reduced ice cover result in an increase in primary production in Arctic seas, and if so, how will this affect the sequestration of carbon, ocean acidification and food web dynamics?
-How will a changing climate affect the timing, magnitude, and duration of production cycles?
-Will changes likely result in successful colonization and replacement of arctic endemics by subarctic populations/species?
-Will future climate conditions alter the strength of benthic-pelagic coupling and if so, in which direction?
-What is the connectivity to physical oceanography for the Chukchi and Beaufort Sea food web?

2) Identify critical research questions based on our present understanding or lack thereof to drive future research initiatives.

3) Identify knowledge gaps, and data synthesis gaps, to drive future research initiatives
E.g., The present synthesis can not include rate measurements.

The specific objectives for data synthesis include:
1) Compile all available data sets from the PACMARS region that meet our criteria into a single database that can be manipulated and plotted using software tools such as MATLAB or GIS.

2) Produce maps of total zooplankton abundance or biomass and of dominant/important species and life stages for selected periods (e.g., *Calanus glacialis*/*marshallae* in the 1950s, 1960s, 1970s, etc.) depending on:
-Data availability
-Data coverage
-Hydrographic information
-Climate/weather information
-Sea ice seasonal patterns and coverage
-Estimated error in contouring (e.g., kriging)

3) Produce similar maps, at the same grid density and temporal extent, of phytoplankton biomass (chlorophyll) and, if possible, primary production using data from Matrai et al. augmented by more recent data if available (collaborate with Bodil on this).

4) Compare zooplankton and phytoplankton maps with maps of hydrography, sea ice, currents when possible
Produce a comprehensive list of the data sets, noting specifics of collection and analysis methodologies as well as regions and dates, and availability of data.

Carin explained some of the challenges for this synthesis effort. These included:

1) Finding data sets
-Use archived data (ArcOD, AOOS, NODC, EOL)
-Contact colleagues
-Form new connections with other scientists (e.g., Japanese scientists)

-Advice from advisory committee re: industry related

2) Some data archives do not contain abundance data (e.g., OBIS).

3) Different methodologies have been used to collect/analyze samples so that not all data sets will be compatible due to variations in:

-Mesh size
-Net type
-Depths sampled
-Identification specificity varies (e.g., no life stages in OCSEAP on NODC)
-Wet weight vs. dry weight vs. carbon weight
-Method of estimating or determining weight
-Confusion or uncertainties in identification of species

4) Avoid duplicating ongoing graduate student efforts (e.g., Imme Rutzen and Jennifer Questel at UAF).

Carin gave two examples illustrating some of the challenges in synthesizing the zooplankton and phytoplankton data sets. She ended the talk with a table of possible data sets.

Status of Lower Trophic Studies (Benthos)

Bodil Bluhm (UAF) spoke about biodiversity-productivity relationships in the US Chukchi and Beaufort Seas. Collaborators for this presentation were Jackie Grebmeier (UMCES-CBL), Lee Cooper (UMCES-CBL), Ken Dunton (UT) and Carin Ashjian (WHOI). Bodil stated that the objectives for this synthesis were to map measure(s) of biodiversity in selected areas of the Pacific Arctic and to identify relationship between productivity and diversity. Challenges and caveats included:

-Different sampling gears / mesh sizes
-Variable taxonomic resolution
-Various time periods
-Measure of productivity
-Spatial gaps
-Spatial / temporal mismatch of diversity and productivity data

Bodil described why biodiversity is important and examples of international efforts to promote and measure biodiversity in standardized ways. She specifically mentioned the Convention on Biological Diversity (international treaty to promote conservation and sustainable use of biodiversity and human well-being), Circumpolar Biodiversity Monitoring Program under CAFF/Arctic Council (Monitoring plan: Gill et al. 2011) and the Arctic Biodiversity Assessment – Trends 2010.

She presented summaries of biodiversity data including arctic inventory, species richness, pan-arctic diversity, new species since 2000 and infauna and epifauna in the Chukchi Sea. She also discussed small and regional scale species distributions, changes in biodiversity on global scale as well as distribution changes in the Arctic. Data sources for diversity data included:

-Arctic Ocean Diversity project
-Ocean Biogeographic Information System
-Chukchi Sea infauna: Dunton, Feder, Grebmeier, Schonberg, possibly Blanchard
-Chukchi Sea epifauna: Bluhm, Feder, Iken, possibly Konar/Ravelo, Blanchard

-Beaufort Sea Boulder Patch(es): Dunton & Schonberg, possibly Iken & Konar
-Beaufort Sea infauna: Dunton & Schonberg, Carey, Broad
-Beaufort Sea epifauna: Carey, Frost & Llowry, possibly Ravelo/Konar

Bodil then described why productivity, changes in productivity and relationships between diversity and productivity are important. Data sources for productivity included:
-Chl a: Matrai and Codispoti, Grebmeier, others
-*In situ* productivity data (Lee, Whitledge, Sambrotto, Hill, Cota, others)

Bodil also noted some issues with satelite versus *in situ* chlorophyll a measurements. Specifically she noted that satelite derived numbers tend to underestimate (missing deep chl maximums) or overestimate (dense CDOM) seasonally. There was discussion about industry data (Shell) and Molly McCammon's data plans for industry data (Axiom).

Jackie Grebmeier (UMCES-CBL) presented on benthic processes (intital efforts). Lee Cooper (UMCES-CBL) was the collaborator for this presentation. Jackie stated that the goal of the benthic processes synthesis is to compile data sets into a common format and then identify target species of importance to higher trophic level organisms. GIS and krigging techniques will be used to derive gridded products of abundance and standing stock for benthic infauna and to compare maps of gridded data of benthic parameters to physical parameters (sea ice, seawater temperature and salinity, primary production) as well as both zooplankton population measures and higher trophic feeding spatial areas to address the core themes. Her objectives were:
-Identify and collate available benthic infaunal and epifaunal data, including abundance, standing stock, biodiversity and rate process (collaborate with Bluhm and Dunton).
-Prepare regional and spatial distribution maps.
-Benthic data will be overlain with temporal and spatial measures of environmental parameters, such as seawater temperatures, salinity, nutrients, winds, and currents, when available identify data sets and work with other project leads to find the location or input the data into the EOL data archive.

Jackie showed a table with a data matrix of key projects and associated PI's for data submission to the PacMARS EOL data portal. Jackie presented data on dominant benthic macroinfauna & biomass in the Pacific Arctic region, sediment community oxygen consumption 1984-2010, % silt and clay content as an indicator of deposition zones and total organic carbon content in surface sediments as an indicator of current speed and material deposition zones. She also showed results about threatened spectacled eiders (keyed to sea ice and specific bivalves), spatial gradient in benthic biomass (gC/m^2) in the northern Bering Sea, biomass (gC/m^2) of infaunal types in the northern region south of St. Lawrence Island and benthic infaunal abundance and biomass.

Action items included:
1) Standardize data entry of benthic infauna, epifauna and environmental data for EOL archive.

2) Plot abundance and biomass GIS krigged data with environmental data

3) Evaluate coincident lower and higher trophic level data.

4) Identify further data from national and international data archives, collaborating scientists.

5) Develop synthesis products for scientific and local community discussions about future scientific direction in the PacMARS region.

International collaboration was discussed and scientists in Russia, Canada and China were suggested as possible collaborators. Translation issues were brought up and it was noted that maps, scale (regional and big picture) and wording should be simplified so that local people can understand and be interested in synthesis results. Francis asked for species specific analyses to appeal to subsistence users. It was also discussed that results be connected to SOAR's efforts.

Food Web Studies

Ken Dunton (UT) provided a presentation about food web studies of the Western Arctic. He suggested three possible synthesis questions:

1) Are there cross-shelf differences in the assimilation of various carbon end-members?

2) How/why does trophic structure vary across the western arctic (gateway vs. marginal arctic seas)?

3) Is the character of the benthos linked to marine mammal distribution and feeding behavior?

Ken discussed trophic structure and carbon assimilation (using ^{13}C data). He contrasted shelf ecosystems with water masses and explained how ice cover influences ecosystem structure. He explained the importance of understanding marine versus land-based food webs. Findings from current data sources included:

1)Evidence for differential importance of various carbon sources related to predominant water mass type (Iken, Bluhm et al).

2) Highest benthic-feeding seabird and marine mammal populations correlate well with the areas of high abundance of food items (Grebmeier, Schonberg, Moore, et al.).

3) Isotopic analyses reveal four trophic levels with gastropod molluscs at the top ; evidence that both phytoplankton and benthic microalgae (or ice algae) are important carbon sources (McTigue, Trefry, Harvey, Dunton).

Ken listed these data sources for synthesis:

-Western Arctic Zooplankton (Schell and Saupe)
-Nearshore coast and lagoons (OCSEAP; USFWS; LGL studies)
-Bering Sea (McConnaughey and McRoy; Iken)
-Chukchi (RUSALCA, Bluhm; Grebmeier, Cooper, McTigue, Dunton)
-Beaufort (Schell, Dunton, Saupe, UAF PIs, Canadians??)
-Fisheries (Norcross, Vanessa von Biela)
-Birds (Churchwell and Powell)
-Mammals (NMML); Cape Thompson Project Chariot (Wolfe and Wilminovsky)

Danielle mentioned that the LGL studies were being consolidated. Brendan suggested the Project Chariot report (1960's) would have ice, seals and bird data.

Ken concluded by showing a conceptual food web for the Northeast Chukchi Sea and explained how to use

isotopic signatures for developing and understanding these interactions.

Higher Trophic Study Collaboration

Sue Moore (NOAA) gave an overview of the Synthesis of Arctic Research (SOAR) program. Collaborators were Phyllis Stabeno (NOAA) and Lisa Guy (NOAA). The website for more information is: http://www.arctic.noaa.gov/soar/. Sue started with basic details about SOAR:

WHAT: inter-disciplinary synthesis of marine science data and observations for the Pacific Arctic Region (PAR)

WHERE: focus is US waters of the PAR, but integration of information from Canadian and Russian studies is encouraged

WHY: lots of marine research in PAR, but little integration and synthesis

WHEN: 5-year project (2011-2016), in 2 Phases (Phase 1 = 2011-13)

WHO: -guidance - 11 member Science Steering Committee + PIs
-BOEM-funded Project – Heather Crowley (COR)
-Project Coordinator - Lisa Guy
-Project Management - NOAA/PMEL; NOAA/Fisheries S&T
-Integration and Synthesis - multiple laboratories

Sue listed the science steering committee and project PI's and explained how SOAR is looking at the Pacific Arctic Region (PAR) including the Northern Bering, Chukchi and Beaufort Seas. She presented the SOAR project timeline and listed the three science themes:
1) Hotspot Mechanisms & Trophic Dynamics
2) Year in the Life of selected Seabirds and Marine Mammals
3) Responses to step-change in Physical Drivers of the Marine Ecosystem

Sue presented the key SOAR milestones for 2012-2013. These included a science workshop (synthesis themes and project teams), integration & analysis (PT Proposals = $$, Quarterly Updates) and science products (peer-reviewed papers, science presentations, education outreach).

Jackie Grebmeier (UMCES-CBL) provided a presentation about observed changes in higher trophic levels in the Pacific Arctic region. She gave examples including:

-Pacific zooplankton in Beaufort Sea
-Benthic species in Chukchi Sea
-Commercially fished "Bering Sea" species and snow crab in the western Beaufort Sea
-Seabird declines with drop in clam biomass and access to ice-associated cod
-Gray whale feeding-focus shift from northern Bering to Chukchi
-Walrus hauling out on land in unprecedented numbers
-Polar bears reported drowned at sea and scavenging and denning on land

Jackie described how the Distributed Biological Observatory (DBO) helps link physics to biology. She listed the sites, sampling design and available datasets.

Jackie gave several higher trophic level change examples including how threatened spectacled eiders populations are keyed to sea ice and specific bivalves and benthic foragers like gray whales and walrus responding to changes in sea ice and amphipod availability.

Community Social Science Interactions

Sveta Yamin-Pasternak (UAF) and **Gay Sheffield (UAF)** provided a presentation on human-environmental interactions, local knowledge, and community-based observations. They stated that we are living in a changed and changing climate with local people observing these changes on a daily basis. They identified the fields of study used for this synthesis:

1) Ethnobiology Ethnobotany Ethnozoology Ethnoecology Ethnooceanography
   -"ethno" direction of an established natural science field

2)Traditional Ecological Knowledge
   -knowledge gained through first-hand experiences, local interpretive and explanatory models, reinforced by intergenerational continuity and core cultural beliefs

3)Indigenous Resource Management, Adaptive Co-Management
   -Oriented toward policy with an understanding that policy interventions are interactive factors in an evolving system

They listed examples of resources to consult for the PacMARS human-environment interaction studies among the coastal Alaska Inupiaq and Siberian Yupik communities:

1) Examples of IPY Projects with Community Based Observation:
   -SIKU-Sea Ice Knowledge and Use
   -ELOKA-Exchange for Local Observation and Knowledge of the Arctic
   -BSSN-Bering Sea Subnetwork
2) IPY Criteria for Community-Based Monitoring:
   -Innovative local observations and monitoring strategies implemented in each project
   -New and improved knowledge
   -What scientist from other IPY disciplines may learn from observation records produced by each project
3) Regional-focus University Programs, Research Programs of Regional Indigenous Organizations, State and Federal Agency Programs, Archival Collections:
   -BLM Arctic Field Office, sociocultural research program, Subsistence Advisory Panel
   -Kawerak Social Science Program, Eskimo Heritage Program Archives
   -Northwest Arctic Borough Subsistence Mapping Project
   -Native Village of Kotzebue Seal Projects
   -University of Alaska Fairbanks Resilience and Adaptation Program Alumni Dissertations
   -Alaska and Polar Regions Collection, UAF Rasmuson Library (historical subsistence reports, ethnographic monographs)

They presented a summary of the directions of this synthesis:
1) Data Sets
   -which they will annotate (content, availability and conditions of use, location and/or link)
   -which they will synthesize within the scope of social science research

-which they will attempt to integrate interdisciplinary

2) Critical Questions to Reflect Upon:
-Which communities, cohorts are being engaged, under-involved in major Community Based Monitoring initiatives?
-Whose perspectives are represented, under-represented?
-What are the conditions/restrictions/stipulations on the archiving, sharing, and use of data?

They gave detail about the three regional (hub) meetings that will be held in mid-winter 2013 as part of the PacMARS project:
1) NW Arctic (Kotzebue): Kotzebue, Point Hope, Kivalina, Buckland
2) North Slope (Barrow): Barrow, Wainwright, Point Lay, Nuiqsut,Kaktovik
3) Bering Strait (Nome): Diomede Island, King Island, Gambell, Savoonga, Brevig, Mission, Teller, Shishmaref

Meetings :
- Will not involve human subjects data collection
- Will not be considered a social science research component

Opportunity to:
- Enhance awareness of current regional research
- Solicit recommendations re. local data resources
- Solicit methodology for summarizing / conveying data
- Document potential needs for outreach / education

Expected outcomes:
- Future research needs - integrated perspective
- Mechanisms for meaningful outreach and education

Data Management and Questionnaire

Jim Moore (NCAR/EOL) spoke about NCAR Earth Observing Laboratory support to PacMARS. Collaborators for this presentation were Don Stott (NCAR/EOL) and Steve Williams (NCAR/EOL). Jim listed the major support tasks:
-Develop PacMARS Data Management Website
-Implement Data Questionnaire & Evaluate Results
-Provide GIS capabilities for project use
-Build inventory/archive for all project datasets (alternative to 'Lee's computer' and 'Ken's magnetic tape/ paper output')
-Organize and host Data Workshop (Dec 10-11)
-Assistance as needed for Alaska community workshops

He spoke about the PacMARS data management website. Specific information included:

1)The Data Management web site at EOL (pacmars.eol.ucar.edu) will coordinate with the University of Maryland PacMARS project site (pacmars.cbl.umces.edu).

2)As data sets are submitted to the Data Management portal, GIS information will be mapped onto the

PacMARS area to identify each dataset by location.

3)Each of the data set sites on the map can be expanded to give further information, along with a link directly to the data.

Jim explained and there was discussion about the data questionnaire. He also gave detailed information about the GIS functionality of PacMARS data portal and how archive queries through the master list using metadata would be obtained for each dataset. He showed many examples of how the mapserver would work and an example of the online form for metadata submission and file upload.

He listed the near term challenges (action items):

-Complete, distribute and summarize questionnaire
-Identification of priorities based on science needs (consider data formats, quality, access, etc.)
-Determine realistic goals for data acquisition
-Begin development of PacMARS data inventory (metadata is key)
-Requirements for processing of different formats (gridded, GIS layers, point data, seasonal, annual, etc.)
-Data accessibility (international, archive sites)
-Preparations for Data Meeting, community meeting

Day 2 (September 25, 2012)

Data Acquisition Discussion

Jackie Grebmeier welcomed everyone back to the meeting.

Jim Moore suggested setting up a data management wiki on the NCAR website.

Brendan Kelly asked for input in problems with the NOAA Arctic database (NODC).

The upcoming data meeting (December 10-11, 2012) was discussed. A list of invited collaborators was generated and Carin Ashjian detailed travel procedures. It was planned that the results from the data meeting would be summarized and presented to the PacMARS Advisory Board meeting on Decemeber 12, 2012. Data meeting objectives were discussed and included getting results from the data questionnaire, generating overlay maps and case studies to be presented at the January 20, 2013 PacMARS-SOAR workshop just prior to the Alaska Marine Science Symposium.

There was a general discussion about the geographic extent to be used for the overlay maps. There is need for a standard base map including bathymetry.

Data Analysis and Templates for GIS

Alynne Bayard (UMCES-CBL) presented about data analysis and examples of templates for GIS. She showed an example of preferred standard fields for all files. These included:

-Cruise Name
-Station Number

-Station Name
-Year and/or Date
-Time
-Latitude (decimal degrees)
-Longitude (decimal degrees)

She also showed an example of what would be included in the standard fields for generating something like pie charts:

-Cruise Name
-Station Number
-Station Name
-Year and/or Date
-Time
-Latitude (decimal degrees)
-Longitude (decimal degrees)
-Totals by each Fauna Class (or, by discretion for mapping of other taxa)
-Total count (e.g. Total Abundance)

There was a general discussion about the formats for data sets and what the standard station location radius would be. There was also some concern about password protecting some recent data, adding a disclaimer about recently collected data and noting pending data sets. There was general agreement that a PacMARS data policy should be developed.

Open Discussion: Data Input and Products

Jackie Grebmeier opened the floor to a general discussion about data input, products and formats for the data and hub meetings.

Sveta Yamin-Pasternak and Gay Sheffield described three types of social science data:

-Annotated data
-Synthesis data (broad theme)
-Core overlapping areas for integrative analysis

They suggested that some examples of data and/or case studies be available for presentation at the hub meetings. They also requested high resolution maps for the hub meetings. Sveta and Gay were asked to bring information on other data and when it will be available for the data meeting.

It was agreed that the specific focus of the PacMARS synthesis is on marine ecosystems in the Beaufort and Chuckchi Seas and that it must be communicated that this project is more focused than the entire Arctic.

Bob Ulanowicz suggested that we put data in a framework that is neutral to the divide between science and social science. It was discussed that we need articulation of what the local community representatives will bring to the hub meetings.

Direction for Open Science Workshop: PacMARS and SOAR

Sue Moore (NOAA) presented about how SOAR is the other synthesis project. SOAR focuses on the same region

(Pacific Arctic Region) as PacMARS, but with emphasis on US waters. Details are all on the webpage (http://www.arctic.noaa.gov/soar/index.shtml). Sue noted that there is no data product as a deliverable for SOAR. There will be a joint Open Science meeting with PacMARS on Sunday, January 20 just prior to the 2013 Alaska Marine Science Symposium.

Input from Senior Advisors

Eddy Carmack (DFO) spoke about how the area we are working in is a great arena for climate change, biogeochemical transformations and migration pathways. Economic development and exploitation make this area poised on a tipping point. He mentioned doing co-science and using a scale of understanding so that communities observe, participate and understand. He suggested that there should be more discussions on who are the users for the PacMARS products and that results should be related to how changes are affecting people and ecosystems connected to the coast.

Bob Ulanowicz (UMCES-CBL) presented about ecological network analysis. He gave an example of how ecological network analysis was used for philanthropy. He explained how in each analysis we need to examine the consequences, synergies and critical resources for the system of interest. Building the network can help show how things will change when inputs are changed, how feedbacks work within the network and how resources circulate and cycle within the network. He explained how network analysis mines data to determine foci points not initially obvious. He asked whether we should make a network and then make qualitative assessments or do we need models? Bob suggested doing a network analysis for the Beaufort and Chukchi Seas as a product for NPRB.

Brendan Kelly suggested that the audience wants a "what if" analysis. He used the example of sea ice declining.

Gay Sheffield suggested that a good question to ask is what do we know to be ready for 20 years from now?

Eddy Carmack asked if we could determine where the tipping point would be when ice no longer forms in winter in the Bering Sea.

Francis Weise mentioned that there was not enough time for a network analysis by June 2013, but Jackie suggested that a conceptual diagram of what is needed for a network analysis (identify data gaps) could be done.

Concluding Discussion

Action items were discussed and a list was created to be included in the progress report to NPRB:

•General: A meeting report will be generated from the Annapolis PI meeting summarizing the individual presentations, including goals and approaches to be used over the coming months (Lead Responsibility: Cooper and Grebmeier).

•Examples of data are to be submitted to NCAR so that appropriate formats and templates can be created (Responsibility: all PIs, as stipulated by theme below).

•Individual data sets will be evaluated and prepared for transfer to the EOL data archive to help meet needs for the December Colorado data meeting (Responsibility: All PIs, as stipulated by theme; see below).

•We will firm up participation and invitations for the hub meetings in early 2013 in Barrow, Nome and

Kotzebue (Lead Responsibility: Sheffield and Yamin-Pasternak).

•Develop a formal letter of explanation for inviting traditional knowledge collaborators (Lead Responsibility: Sheffield and Yamin-Pasternak).

•The EOL data archive investigators will generate a data questionnaire to be used by the PI's and collaborators to identify what data will be submitted and in what format it will be provided. This questionnaire will also be used by the PI's to identify other collaborators and will be requested of all PacMARS data meeting participants. (Lead Responsibility: Jim Moore and Jackie Grebmeier).

•Geographic Information System (GIS) coordination. Develop agreement on shapefiles, projections, fonts and a road map for uploading files to NCAR; Generate examples of data analysis for each theme using the same GIS standards (e.g. projections, boundaries, font usage, symbols, mapping standards, shared shape files where appropriate) including those to be used at the Open Science Meeting with SOAR project. (Leads: Jim Moore, GIS personnel for Grebmeier/Cooper, Dunton and Trefry groups).

•Jim Moore will send out data submission protocols, discuss connection with COMIDA CAB data portal effort (e.g., with David Maidment, GIS ESRI lead for COMIDA, UTX Austin).

Other Action Items by Theme:

Ice Cover (primary production relationships, currents, winds, bathymetry)
Action Item: Identifying appropriate data sets (e.g. Appendix A) and needs prior to data workshop.
Key responsibilities: Cooper, Dunton, Frey, K (Collaborative participation in data workshop; also SOAR project); SOAR (Arrigo, Frey).

Phenology of Biological Production Cycles in Relation to Physical Environment
Action Item: Identifying appropriate data sets (e.g. Appendix A) and needs prior to data workshop.
Key responsibilities: Ashjian, Campbell, Okkonen; Frey, K (Collaborative participation in data workshop confirmed; also SOAR project)' Pickart (collaboration physical oceanography).

Benthic-Pelagic Coupling in Relation to Physical-Chemical Environment
Action Item: Identifying appropriate data sets (e.g. Appendix A) and needs prior to data workshop; e.g. Updating and incorporating data for Sir Wilfrid Laurier annual trips 1998-2012 with Canadian partners.Key responsibilities: Grebmeier, Cooper, Dunton, Trefry, Okkonen, Ashjian, Campbell, Bluhm.

Current State of Lower Trophic Prey-Base and Higher Trophic Feeding Hot Spots
Action Item: Identifying appropriate data sets (e.g. Appendix A) and needs prior to data workshop, e.g. Updating and incorporating data for Sir Wilfrid Laurier annual trips 1998-2012 with Canadian partners.
Key responsibilities: Bluhm, Cooper, Dunton, Grebmeier, Ashjian, Campbell, Okkonen, Grebmeier/Bluhm (per SOAR project), Jay, C. (collaborative PacMARS letter; also SOAR project participant), Kuletz (per collaboration with PacMARS and lead on SOAR project), Moore, S (collaboration between PacMARS and SOAR) Nelson, J (collaboration with PacMARS for zooplankton at hotspots), Norcross, B (collaboration with PacMARS for fish populations, Pickart (collaboration with PacMARS and SOAR focus project on Barrow Canyon with Grebmeier/Cooper)

Subsistence Livelihoods in Times of Climate Change

Action Items: Continue to Identify appropriate data sets using the Alaska and Polar Research Collection at UAF Rasmuson Library, Data Resources of the Alaska Center for Climate Assessment and Policy, IPY recommendations, the Subsistence and Climate Change Sections of the North Slope Borough Division of Wildlife Management, the BLM Arctic Field Office subsistence bibliography, among others; Continue to note the stipulations on the sharing and use of data in connection with each dataset considered for the Synthesis, Continue to address individual questions of the indigenous organizations and agencies about PacMARS, that want to know about it.

-What kind of engagement will PacMARS have, if any, with indigenous communities?
-How will the project results benefit region communities?
-What will be the products of the PacMARS project?
-How will ethnographic data be presented?

Lead Responsibility: Yamin-Pasternak.
Agendas for each of these hub meetings and the cooperative SOAR meeting in Anchorage will be developed and the meeting publicized appropriately (Lead Responsibility: Grebmeier, Cooper, Sheffield, Yamin-Pasternak, Ashjian, Campbell).

Chemical Contaminants in Sediment and Biota
Action Items: Identifying appropriate data sets (e.g. Appendix A) and needs prior to data workshop, e.g. Updating and incorporating data for Sir Wilfrid Laurier annual trips 1998-2012 with Canadian partners. Key responsibilities: Trefry, Sheffield, Cooper.