Pacific Marine Arctic Regional Synthesis (PacMARS) – Synthesis of Arctic Research (SOAR)

Open Science Workshop

Meeting Report

Anchorage, Alaska, USA
January 20, 2013

PacMARS-SOAR OPEN SCIENCE MEETING
20 January 2013
AFT Deck, Captain Cook Hotel, Anchorage AK
FINAL AGENDA

8:30-8:45 INTRODUCTION PacMARS & SOAR (Grebmeier & Moore)

8:45-10:15 PacMARS Theme Overview (20 min presentations)
- Physics, Hydrography & Contaminants (Themes 1, 2 & 6; Cooper, Okkonen, Trefry)
- Lower Trophics, Biodiversity & Phenology of Biological Production (Themes 2, 3 & 4; Bluhm, Ashjian, Campbell, Dunton, Grebmeier)
- Subsistence (Theme 5; Yamin- Pasternak and Sheffield)
- Questions and Discussion

10:15-10:30 BREAK

10:30-12:00 SOAR Project 'Case Studies' (15 min presentations)
- Physics/Hotspots (Grebmeier/Pickart)
- Lower Trophics/Upper Trophic Prey (Ashjian)
- Upper Trophics/Hotspots (Ferguson/Kuletz)
- Acoustic Ecology (Clark)
- Questions and Discussion

12:00-1:30 LUNCH BREAK

1:30-3:00 Breakout Sessions – 4 tables 'captained' by 1 person each from PacMARS & SOAR to focus on Future Directions for research; shift participants @ 30min intervals
- Physics, Hydrography & Contaminants (Cooper and Crowley)
- Lower Trophics, Biodiversity, and Phenology (Bluhm and Ashjian)
- Subsistence (Yamin-Pasternak and Guy)
- Upper Trophics and Acoustic Ecology (Sheffield and Ferguson/Clark)

3:00-3:15 BREAK

3:15-4:00 Summary of Breakout Sessions and Discussion (breakout leads PacMARS and SOAR)

4:00-5:00 Overview of Identified Future Directions and Open Discussion (Grebmeier & Moore)

5:00 Close workshop

Background

The Pacific Marine Arctic Regional Synthesis (PacMARS) is a project underwritten by the North Pacific Marine Research Institute with support from Shell and Conoco Phillips, 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. The objective is to compile the best available knowledge from peer-reviewed natural and social sciences, as well as less readily available knowledge sources. The overall goal is to provide guidance for scientific research needs in the region. The Synthesis of Arctic Research (SOAR) is a 5-year project supported by the Bureau of Ocean Energy Management (BOEM) and the National Oceanic and Atmospheric Administration (NOAA). SOAR is chartered to synthesize scientific information and local observations to improve understanding of the relationships among oceanographic conditions, benthic organisms, lower trophic prey species (forage fish and zooplankton), seabirds, and marine mammal distribution and behavior for the Pacific Arctic region. The SOAR effort builds on existing interdisciplinary work to develop detailed syntheses to inform management decision-makers and to guide future research studies. The PacMARS/SOAR schematic (Figure 1) indicates the interface of the initial products of both projects.

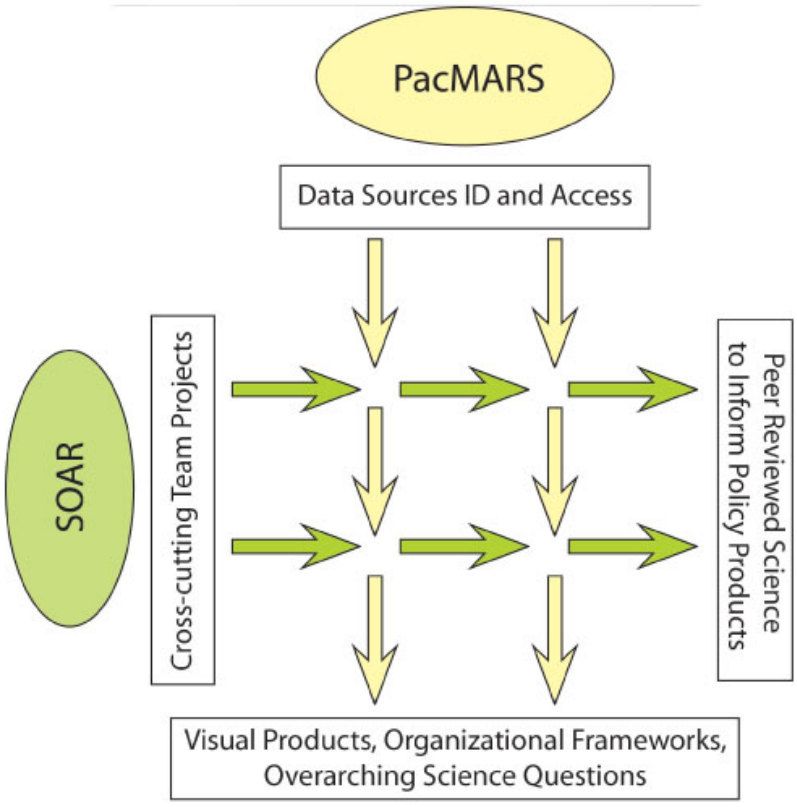

Figure 1. PacMARS/SOAR schematic showing initial products of both projects.

Based on the synergistic objectives, PacMARS and SOAR have developed a comparative table outlining the PacMARS themes and SOAR journal articles and the associated planned synthesis products for each project (see Appendix A). Both projects jointly sponsored the open community workshop on 20 January 2013, just prior to the 2013 Alaska Marine Science Symposium in Anchorage, Alaska, to provide an update of their activities and to solicit input on themes for future research initiatives in the region. The agenda for the PacMARS-SOAR workshop included highlight presentations of activities from both synthesis projects, followed by breakout sessions with the workshop participants. The goal of these breakout sessions was to identify additional data synthesis activities being undertaken, and to articulate a composite of scientific themes for future interdisciplinary and interagency efforts in the Chukchi and Beaufort seas.

Introduction

Jackie Grebmeier (UMCES-CBL) (ppt1) began the meeting by welcoming everyone (see Appendix B for a list of workshop attendees) and giving an overview of the PacMARS goals and activities. She introduced the PacMARS team, PI's and advisors. Jackie explained that the PacMARS-SOAR Open Science Workshop would help facilitate determining the themes and needs for research for the next 5-10 years in the northern Bering, Chukchi and Beaufort seas. PacMARS has a rapid time frame with a detailed interim report targeted for June 2013. There are 6 themes within the PacMARS project:

1. Ice cover- primary production relationships, currents, winds, bathymetry
2. Phenology of biological production cycles in relation to physical environment
3. Benthic-pelagic coupling in relation to physical-chemical environment
4. Current state of lower trophic prey-base and higher trophic feeding hot spots
5. Subsistence lifestyles in time of climate change
6. Chemical contaminants in sediment and biota

The PacMARS talks will provide an update on the results to date for these objectives.

Sue Moore (NOAA/Fisheries, Office of Science & Technology) (ppt2) introduced the SOAR program and indicated that draft manuscripts for the first SOAR Special Issue will be completed by the end of summer 2013 related to SOAR objectives.

She noted the comparative PacMARS SOAR table (see Appendix B and available online: http://pacmars.cbl.umces.edu/PacMARS%20and%20SOAR_SynergiesTable_FINAL_18_Dec%20v2.pdf) that shows the linkages between PacMARS and SOAR. A special issue of Phase I SOAR papers in Progress in Oceanography has been confirmed.

PacMARS Theme Overviews

Lee Cooper (UMCES-CBL) (ppt3) provided a presentation on physics, hydrography and contaminants (themes 1, 2 & 6). Co-PI's for this presentation included **Steve Okkonen (UAF)** and **John Trefry (FIT)**.

Bodil Bluhm (UAF) (ppt4) provided a presentation on lower trophics, biodiversity and phenology of biological production (themes 2, 3 &4). Co-PI's for this presentation **included Carin Ashjian (WHOI)**, **Robert Campbell (URI)**, **Kenneth Dunton (UT) and Jackie Grebmeier (UMCES-CBL)**.

Sveta Yamin-Pasternak (UAF) (ppt5) contributed a presentation entitled "Who Eats Whom and by How Much' Is Important but Not Enough: Why It Is Critical for the Arctic Research Synthesis Efforts to Consider the Social Impacts of Climate Change."

Discussion Session (PacMARS)

Jackie Grebmeier opened up the floor for questions and general discussion of the topics from the PacMARS theme overview presentations. Participants discussed why increased water column production does not materialize as more fish biomass (pelagic and demersal). Most of the area included in PacMARS is to the north of the SE Bering Sea fisheries region. For informational purposes, AOOS is funded to compile fisheries data and it is separated into nearshore and offshore areas. To date, there has not been much interest by commercial fisherman to look at northern offshore regions as the current data does not indicate high fishing potential in the region. Instead the area is utilized by large populations of benthic- and pelagic-feeding upper trophic levels of marine mammals and seabirds.

SOAR Project "Case Studies"

Jackie Grebmeier (ppt6) provided a presentation for **Robert Pickart (WHOI)** on physics and relations to biological hotspots. Jackie discussed why there is enhanced productivity in Barrow Canyon. She explained how circulation patterns, sea ice and physical dynamics in the Chukchi Sea influence nutrient transport into Barrow Canyon that results in increased chlorophyll seasonally and high benthic biomass. She presented examples of water column and sediment data that correspond to current patterns and how the variability in these parameters across the canyon in both pelagic and benthic measurements are important prey for upper trophic animals, such as seabirds and marine mammals, in the region.

Carin Ashjian (WHOI) (ppt7) provided a presentation on results available from lower and upper trophic levels, from phytoplankton to marine mammals. The co-PI on this presentation was **Steve Okkonen (UAF)**.

Megan Ferguson (NOAA/NMML) (ppt8) provided a presentation on upper trophic level megafauna and associated faunal hotspots. The co-PI on this presentation was **Kathy Kuletz (USFWS).**

Chris Clark (Cornell) (ppt9) provided a presentation on acoustic ecology in the Arctic. He presented concepts, data, data products and information on acoustic resources. During the presentation he explained how acoustics can be used to map space utilization and anthropogenic activities based on the acoustic behavior of animals. He showed data going back to the 1970's including a graphic of acoustic 3D space occupancy. He also showed how the acoustic environment can be mapped to show spatial and temporal variability. He is a co-author on a publication based upon this presentation that will be submitted in June 2013.

Discussion (SOAR)

Jackie Grebmeier opened up the floor for questions and general discussion of the topics from the SOAR project presentations. Discussion topics included clarification of the term 'hotspot' as identified in both time and space. Regional sites were identified using high concentrations of prey and feeding predators, along with statistical analyses. Another statement was made that both ship-based and marine mammal tagging data are being used in the SOAR-associated papers. SOAR will utilize data from both bowhead whale and walrus tagging that is also being archived as part of the PacMARS effort. Bowhead whale tagging is primarily movement data whereas the walrus tagging and associated modeling effort allows evaluation of both movement and feeding effort.

Breakout Session Summaries and Presentations

Jackie Grebmeier explained how the breakout sessions would work. There were four tables "captained" by one person each from PacMARS and SOAR to focus discussions on future research. Participants could stay at one table the entire time or switch tables every 30 minutes. Participants were tasked to identify any additional synthesis activities underway, and to develop a composite of scientific themes for future interdisciplinary and interagency efforts in the region. At the end of the breakout sessions each group gave a presentation summarizing the topics of discussion, data and data issues and the topics each group felt were the most important for future research.

The tables were divided into these groups and a brief summary of the results of the breakout session are given below and notes provided as ppt or word documents in a folder associated with the workshop.

1. **Physics, hydrography and contaminants:** led by **Lee Cooper (UMCES-CBL)** for PacMARS and **Heather Crowley (BOEM)** for SOAR.

The physics, hydrography and contaminants group discussed coastal sea level, contaminants, ice cover, primary production, sea ice conditions and sediment transport. Important topics included documenting change, monitoring (historic, real-time, and future) and key variables needed for developing a biophysical model. There was consensus that the above conditions/data be monitored and modeled (if possible in a predictive way). It was determined that more use of industry data was needed and that the PacMARS and SOAR programs are critically important for identifying available data sets.

2. **Lower Trophics, Biodiversity and Phenology:** led by **Bodil Bluhm (UAF)** for PacMARS and **Carin Ashjian (WHOI)** for SOAR.

The lower trophics, biodiversity and phenology group discussed the quality of available data and data access issues. Important topics included:

a) Critical to characterize data sets even if full content is not available

b) Data sets to which we link should be in permanent archives

c) Link with other syntheses like RUSALCA (Russian-American Longterm Census of the Arctic) and CSESP (Chukchi Sea Environmental Studied Program)

d) Access to international data is unclear

The group developed three focus questions:

1) How will organisms adapt to changing environmental conditions? (e.g., rates, survivability, temperature changes)

2) How will the input of organisms/carbon into the Chukchi, and ultimately Beaufort Sea, change in the future through changes in transport, changes in the timing of peak transport relative to organism/carbon concentration, or total abundance/concentration of organisms/carbon?

3) Related to 2), will expatriate organisms have the ability to adapt, survive, and persist in the Chukchi/Beaufort as environmental conditions (e.g., temperature, timing) change?

Data is needed for rate measurements (growth rates, respiration, feeding, reproduction), physiology (adaptability of organisms to new environmental conditions), seasonality and transferability of rates to modeling efforts. The group also discussed the logistic requirements to adequately gather data to resolve seasonality and to measure rates in this low temperature environment.

3. **Subsistence:** led by **Sveta Yamin-Pasternak (UAF)** for PacMARS and **Lisa Guy (UW/JISAO)** for SOAR.

The subsistence theme group discussed prospective social science research needs for the next 5 years of research in the region. During the discussion, the group considered how to change focus from products and outcomes to processes and relationships. An interactive computer graphic knowledge map was suggested. It was recognized that models of this type may not be within the scope and timeframe possible with PacMARS, but could serve as a longer-term goal. Specific attention was given to the socioeconomic effects of climate change on local people. Issues discussed included:

- Coastal erosion
- Changes in hunting and harvest
- Social impacts (adaptive, destructive or multidirectional)

The PacMARS community hub meetings were discussed and there was concern expressed that the timeframe for planning the meetings was too short, due to the rapid timeframe of the PacMARS project. Ideas were brought forth about the appropriate timing of the meetings, the issue of meeting fatigue, and how well the meetings would work for receiving community feedback. There was a general consensus that PacMARS could be a first step in a long-term relationship with local communities. The group suggested that program managers take on the role of maintaining relationships between the local communities and project scientists. Many research teams are going out to villages and asking the same questions and the breakout group thought that this could be confusing and make getting feedback difficult. The recommendation was made to listen more and talk less, and to return to villages in-person to communicate project results and outcomes.

4. **Upper Trophics and Acoustic Ecology:** led by **Gay Sheffield (UAF)** for PacMARS and **Megan Ferguson (BOEM)** and **Chris Clark (Cornell)** for SOAR.

The upper trophics and acoustic ecology group discussed key upper trophic topics, fundamental themes for research, and what resources are available to get an integrated, more predictive, responsive model. Conductivity is important (flows between regions / organisms) and data suggest progression of organisms and ecosystems north. There was discussion of bottom up versus top down systems and how we should measure changes in function. Key locations included Bering Strait (chokepoint), Point Hope, Barrow Canyon, Peard Bay, Hanna Shoal, the village of Kaktovik, and the Mackenzie River. Temporal scales were discussed and integration of wind and current models with biological data. Acoustic data acquisition is applied with an eye towards bowhead whales and other marine mammals. Data could be mined for other species occurrence, synthesis and integration. Passive acoustic data is used to for species identification, reproduction, migration and foraging. Active acoustic data can be used for estimating abundance and density of fishes/invertebrates.

The group came up with the following challenge questions (given 5 years and unlimited funding):

- How do we think the Chukchi-Beaufort seas (US) are operating as a system?
- What are the key questions, key data, and data collection needs?
- Are there any model examples to use as a template for this process?

Overview and Open Discussion

Jackie Grebmeier (ppt10) provided a concluding presentation summarizing the workshop and giving an overview of identified future directions. PacMARS will continue to develop an annotated data source document and inventory of data files, data visualization products, synthesis products for the interim report and 2nd year publications, and hold community hub meetings. The EOL PacMARS data archive will serve as the central data portal. Input to data sets and activity are welcomed. Please contact PacMARS PIs for more information: http://pacmars.cbl.umces.edu

Sue Moore provided concluding comments for SOAR. There will be workshops and online discussions for development of synthesis papers for SOAR Phase 1. Submission for the special issue in Progress in Oceanography will be in June-August 2013. The second phase of SOAR will explore follow-on topics from Phase 1. Please contact SOAR PIs for more information: http://www.arctic.noaa.gov/soar/ .

Appendix A

Table 1. Comparison of synergistic activities between the NPRB-supported Pacific Marine Arctic Regional Synthesis (PacMARS) project and the BOEM-supported Synthesis of Arctic Research (SOAR) Physics to marine mammals in the Pacific Arctic project.

PacMARS Theme	Synthesis Products	SOAR Journal Outline	Synthesis Products
<u>Theme 1: Ice cover – primary production relationships, currents, winds, bathymetry</u> 1a. 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? 1b. What is the connectivity to local/regional biogeochemistry and physical oceanography for the Chukchi and Beaufort Sea food web?	Compile data sets to common format, GIS mapping, upload ACADIS website, connect to AOOS, use synthesis and community input for multi-agency 5 year field program, and publish a special issue PacMARS Springer book, including topics of: • Bathymetry + Seasonal and interannual changes in T, S (river discharge), winds, currents • Regional and spatial distributions (GIS or kriged gridded data) of pelagic standing stocks (phytoplankton, zooplankton), and where possible, phenology of biological production cycles • Sediment grain size, carbon content, and potential chemical and radioactive contaminants • Conceptual food web models • GIS maps of stable isotopic signatures for end-member sources of C and N over the western Arctic • Geostatistical GIS overlays among stable isotopic signatures and water	1. Response to questions regarding 'faster-than modeled' loss of sea ice, effects on primary productivity and anthropogenic impacts, i.e. 'New State' of the Arctic (**6 papers**)	• Overland et al. – Causes of drastic climate change for the Pacific Arctic [broad scale] • Frey et al. – Variability in annual persistence, breakup, and formation of sea ice cover in the Pacific Arctic region [broadscale] • Arrigo et al. – Primary production in the Pacific sector of the Arctic Ocean • Pickart et al. – Mechanisms for enhanced trophic productivity in Barrow Canyon, Chukchi Sea [regional scale] • Mathis et al. – An ocean acidification sensitivity index for the Pacific Arctic region [broadscale] • Clark et al. – A year in the acoustic world of western Arctic bowhead whales [broadscale]

PacMARS Theme	Synthesis Products	SOAR Journal Outline	Synthesis Products
Theme 2: Phenology of biological production cycles in relation to physical environment 2a. How will a changing climate affect the timing, magnitude, and duration of production cycles? 2b. Will changes likely result in successful colonization and replacement of arctic endemics by subarctic populations/species?	• Regional and spatial distributions (GIS or kriged gridded data) of benthic standing stocks (infauna and epifauna) • Temporal/spatial variations in stratification (T,S), nutrients, winds, currents,	2. Response to questions regarding affects of 'New State' on marine mammal and seabird prey (**5 papers**)	• Ashjian et al. – Influence of sea ice, oceanographic conditions and prey availability on the timing of fall bowhead whale migration from the Canadian Arctic along the Beaufort Shelf to Barrow, and subsequent whaling success in Beaufort Sea Coastal Communities [broadscale] • Grebmeier, Bluhm et al. – Benthic system analysis at predator-prey "hotspot" sites along a latitudinal gradient in the northern Bering and Chukchi Seas [regional- but, across a latitudinal range] • Lovvorn et al. – Effects of prey dispersion, sea ice, and walrus foraging on viability of an essential migration corridor for threatened sea ducks [regional scale] • Napp, Logerwell et al. – Fish of the Beaufort and Chukchi Seas: community structure, human use, and mechanisms determining similarities and differences (aka: A Tale of Two Shelves) [broadscale] • Divoky et al. – Consequences of the loss of summer ice to seabirds and marine mammals in the Chukchi and Beaufort seas [regional scale]

PacMARS Theme	Synthesis Products	SOAR Journal Outline	Synthesis Products
<u>Theme 3. Benthic-pelagic coupling in relation to physical-chemical environment</u> 3a. Will future climate conditions alter the strength of benthic-pelagic coupling and if so, in which direction? 3b. How will keystone species be affected?	• Regional and spatial distributions (GIS or kriged gridded data) of feeding locations of marine mammals, seabirds, and fish; **NOTE:** Coordinate and link data collections through PacMARS collaborators (Jay, Kuletz, Moore); **use direct link with SOAR** that is driven by synthesis of data sets specific to higher trophic organism parameters and link to people; request input from **SOAR** into mid-term report	3. Responses to questions regarding seabird and marine mammal adaptation to the 'New State' (**6 papers**)	• Kuletz, Ferguson et al. – Seasonal and spatial patterns in marine bird and mammal abundance and distribution in the Pacific Arctic: A comparison of biologically important pelagic areas [broadscale] • George, Druckenmiller, and Laidre – Arctic sea ice retreat effects on bowhead whale body condition [broadscale] • Suydam et al. – Relationship between beluga whales, Arctic cod and oceanographic conditions in Barrow Canyon and at the shelf break of the western Beaufort Sea [regional scale] • Quakenbush et al. – Oceanographic and other factors associated with western Arctic bowhead whale "hotspots" [regional scale] • Citta et al. – Oceanographic and other factors associated with bowhead whale movements across the Chukchi Sea in fall [broad scale]
<u>Theme 4: Current state of lower trophic prey-base and higher trophic feeding hot spots</u> 4a. How will migration routes and important feeding hotspots of marine mammals and seabirds change in		4. See SOAR #3 above.	• See SOAR #3 above.

response to changing climate conditions and increased industrial and commercial activity? 4b. What are the current relationships between biodiversity and productivity?			
<u>Theme 5: Subsistence lifestyles in times of climate change</u> 5a. How will the subsistence food gathering of Native Alaskans in coastal villages change from the northern Bering Sea to the Beaufort Sea as environmental changes occur? 5b. What information is needed by communities to effectively adapt to the changes in the regional ecosystem?	Community one-pagers with science and local input summaries, using Hub community meeting and: • Develop a working bibliography of library and web-based sources, begin Alaska Arctic Slope region review • Initiate exchanges with communities, preliminary recommendations assessment, hub meetings planning, continue Alaska Arctic Slope region review • Participate in Hub Meetings and draw summaries, begin Northwest Alaska region review • Northern Bering Strait region review, extrapolation of innovative and effective approaches, community one-pagers; identify future research needs based on syntheses		• SOAR papers planned.
PacMARS Theme	**Synthesis Products**	**SOAR Journal Outline**	**Synthesis Products**
<u>Theme 6: Chemical Contaminants in Sediment and Biota</u> 6a. What are the levels of chemical	• Regional and spatial distributions (GIS or kriged gridded data) of chemical contaminants in sediment and biota		

contaminants in sediments and seawater and how do they move through the food chain? 6b. Are there any potential impacts of varying contaminant burdens in sediment and prey on high trophic organisms, including humans?		
<u>Data archiving and GIS mapping efforts</u>	• Data moved onto public data portal GIS layer capability for all scientists to use • Develop PacMARS data table • Access to all PacMARS compiled and supporting datasets and synthesis products	

Appendix B

List of Attendees

Last	First	Affiliation	Location	Email address
Andrews	Russ	University of Alaska Fairbanks, Institute of Marine Science, Alaska SeaLife Center	Seward, AK, USA	russa@alaskasealife.org
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