

NPRB Progress Report 2

1. PROJECT INFORMATION

NPMRI Project Number:	A01/T2201–T2207
Title:	Pacific Marine Arctic Synthesis of the Northern Bering, Chukchi and Beaufort Seas
Subaward period	June 15, 2012 to June 14, 2014
Amount of funding	\$1,449,997
Report period	September 27, 2012 to December 21, 2012
Report submission date	December 21, 2012
Lead Author of Report*	Dr. Jacqueline Grebmeier

**Although there may be only one lead author of the report, all PIs and co-PIs of the project, as identified in the approved statement of work and listed below, are responsible for the content of the Semiannual Progress report in terms of completeness and accuracy.*

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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



2. PROJECT OVERVIEW

A. Briefly (4-5 sentences) describe both the research purpose and the underlying need for this research: The Pacific Marine Arctic Regional Synthesis (**PacMARS**) effort will facilitate new synergies in understanding of the marine ecosystem in the greater Bering Strait region, including the northern Bering, Chukchi and Beaufort seas. This synthesis effort will contribute to NPRB's overall mission by promoting 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.

The 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.
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.

B. List the objective(s) of the research project, exactly as described in your approved Statement of Work.

1. **Identify and link existing data sets**, tabulate data archive sites and provide value-added annotated metadata for existing data that promote understanding of the marine ecosystem extending from north of St. Lawrence Island in the Bering Sea to the Chukchi and Beaufort seas, including traditional ecological knowledge where it can be readily transferred (Data synthesis).
2. **Synthesize existing scientific and traditional knowledge of the marine ecosystem**, with a focus on territorial waters of the United States and its adjoining Exclusive Economic Zone, but to also include input from beyond this region through collaborations with both Russian [e.g. [Russian-American Long-term Census of the Arctic \(RUSALCA\)](#)] and Canadian [e.g. [Canada's Three Oceans program \(C3O\)](#)] scientists who will cooperate with our effort. Other internationally generated data within the [Pacific Arctic Group \(PAG\)](#) international framework will also be contributed, including from Japan (point of contact, Dr. Takashi Kikuchi), Korea (point of contact, Dr. Sung Ho Kang), and China (point of contact, Dr. Jianfeng He) (Data synthesis)
3. **Develop overarching scientific themes and research needs** to facilitate the design of the next iteration of integrated marine ecosystem studies in the Pacific-influenced Arctic, including the appropriate temporal and spatial scales of data needed for ecosystem-level assessment. (Research Needs).
4. **Emphasize system-wide, synoptic understanding**, in addition to discipline-specific syntheses of the northern Bering, Chukchi and Beaufort ecosystems. Given time and resource limitations, we will prioritize our efforts towards integrating across disciplines and we will use geographical and habitat-scaled approaches to achieve linkages among biophysical observations and human communities (Research Needs).
5. **Undertake a social-ecological science synthesis** of (1) major research initiatives, (2) emerging research approaches and methods, and (3) related documented research needs and concerns. Each of these approaches will be geared toward identifying current research directions and gaps in knowledge concerning the maritime societies living within the marine ecosystems of the Northern Bering,



Chukchi, and Beaufort Seas. Cumulatively, this contribution will result in an interdisciplinary socio-ecological synopsis of these marine ecosystems (Research Needs).

C. Provide a table showing the timeline and milestones for the entire project.

Table 1. Timeline and milestones for the PacMARS project.

Date	Milestones
2012	
2012	Notification of support
July	Funds allocated; PI coordination conference call; initiated preparation of templates and data submission protocols, identify new data sets, envision synthesis products
Sept 24-26	PacMARS PI meeting, Annapolis, MD; Sue Moore participated to provide linkage to SOAR program
Oct 22	<i>Quarterly Report to NPRB #1: revised status report</i>
Dec 10-11	Data workshop at Boulder, CO; invitees and PIs utilized computer-aided networking of data sets already preloaded via the EOL-ACADIS website; initiated development of synthesis products, maps, and discussed progress on making data available as well as future products that will meet synthesis needs.
Dec 21	<i>Quarterly Report to NPRB #2</i>
2013	
Jan 20	1-day open community workshop on Sun. Jan 20, 2013 in collaboration with SOAR (Synthesis of Arctic Research) prior to the AMSS in Anchorage; purpose to give update on preliminary synthesis results, solicit community input, and open discussion of developing themes for science direction
Jan - Mar	Alaska community “Town Hall” input meetings at 3 “hub” communities to entrain local comments from 17 local villages from St. Lawrence Island to Kaktovik; attended by designated members of the PacMARS team. The three meetings will be held in Nome, Kotzebue and Barrow. Two separate pilot-scope meetings will be held in the individual villages of Savoonga and Gambell to explore village-based input on an even more local scale.
Mar 15	<i>Quarterly Report to NPRB #3</i>
Apr-June	Draft chapters for interim report
June 15	<i>Quarterly Report #4-submission of PacMARS interim report</i>
June-Sept	Finalize draft interim report for NPRB; continue drafting synthesis publications and provide feedback to local Alaska communities via no-cost by PIs during field season community outreach
Sept 15	<i>Quarterly Report #5-report on community interactions; status publications</i>
Sept-Dec	Continuation of synthesis analyses and draft manuscript preparations
Dec 15	<i>Quarterly Report #6-update on synthesis products, book preparation</i>
2014	
Jan	PacMARS presentations at the AMSS 2014; recommendation for another PacMARS-SOAR open community meeting, with focus on social community feedback
Mar 15	<i>Quarterly Report #7-report from 2nd open community PacMARS-SOAR workshop, finalize all synthesis publications and submission for polar PacMARS book</i>
June 15	Final report to NPRB; PacMARS book/special issue in ready to publish stage



3. PROGRESS SUMMARY

A. Describe report period progress.

1. **General Project Progress:** During this reporting period, the PacMARS co-PI team has been accumulating data sets and preparing data spreadsheets and in some cases shape files for submission to the PacMARS EOL data sites (<http://pacmars.eol.ucar.edu/>). Jim Moore's team prepared the PacMARS EOL data website that is linked to the PacMARS home project portal at CBL (<http://pacmars.cbl.umces.edu/>). Google Analytics tracking (Figure 1) shows that the website is being accessed regularly.

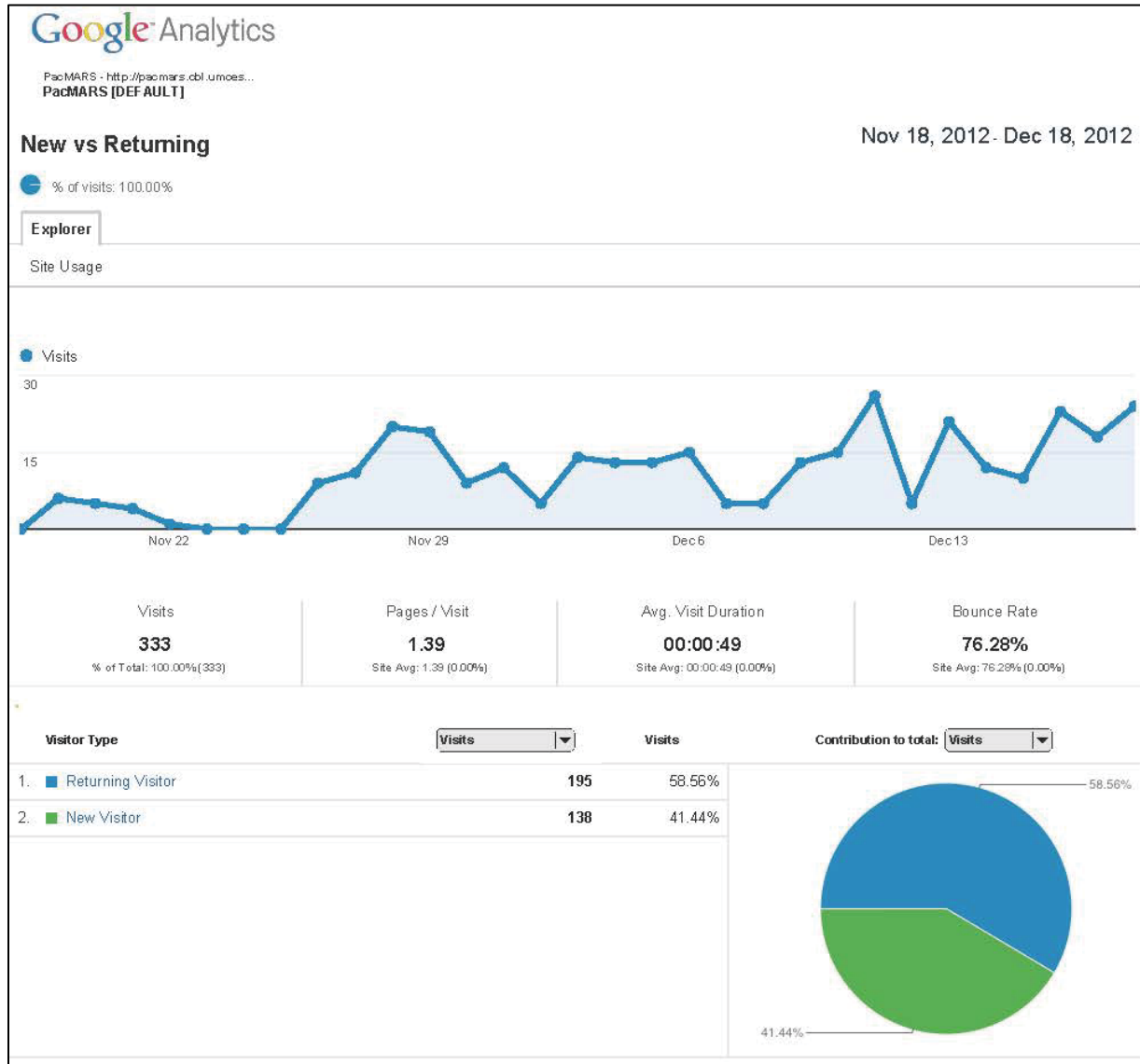


Figure 1. Google Analytics data for <http://pacmars.cbl.umces.edu/> from November 18 to December 18, 2012.

The PacMARS data meeting was hosted by EOL in Boulder, Colorado Dec. 10-11, 2012. The two day meeting began with talks on the EOL data website, archive, and updated data entries. We then proceeded with short data and synthesis product talks by each of the PacMARS PIs. Subsequently, the invited collaborators provided talks on data availability, both via public archives and those that will become



available soon after publications. On the second day we discussed the results of the data questionnaire, results from the PacMARS GIS “tiger team” teleconference, development and utilization of the EOL GIS website, and the AOOS/AXIOM (Alaska Ocean Observing System/Axiom Consulting and Design effort to serve the recently released Chukchi Sea Environmental Studies Program (CESP) (<http://www.chukchiscience.com/>) industry data within the AXIOM ocean space. After lunch we split into three breakout groups: one for the social science/hub meeting discussion, a second including the GIS “tiger team” for further discussions of GIS data and development, and the final one that covered more general science synthesis efforts. The meeting presentations and draft minutes are posted at <http://pacmars.cbl.umces.edu/PacMARSDataMeetingMaterials.html>.

Grebmeier presented an update on planning for the January 20, 2013 workshop at both the data meeting in Boulder (Dec. 10-11, 2012) as well as for the subsequent PacMARS advisory meeting on Dec. 12, 2012 in Boulder, CO. The PacMARS-SOAR Open Science Meeting will be held immediately prior to the Alaska Marine Science Symposium in 2013. An announcement of the workshop is posted on the NPRB AMSS website and was announced on the Arctic listserver Dec. 13, 2012. This announcement and the agenda for the meeting are posted on the PacMARS home page, including a request for free registration for the workshop (<http://pacmars.cbl.umces.edu/PacMARSSOAROpenScienceMeeting.html>). The format for the workshop is to have PacMARS investigators give three 20 min talks covering the 6 themes of the PacMARS synthesis activity, followed by 4-15 minute talks highlighting SOAR research papers.

An initial number of action items have been completed and others identified that affect all themes of the project and are outlined below:

In progress:

- Continued monthly PacMARS-NPRB conference calls
- Coordinating travel plans to the Joint SOAR Open Science Meeting and community meetings
- Continued submission of point source and composite synthesis data sets to the EOL archive
- Continued input and development of the DBO data table, Appendix A
- Development of a table highlighting key multidisciplinary projects in the Chukchi and Beaufort seas with listing of process studies and citations
- Development of a draft data policy, and templates for data submission and template metafile descriptions are available on the EOL data website
- Develop PacMARS PI biographic single pagers for community meetings; also develop generic one page PacMARS description for Alaskan communities

Completed:

- EOL developed the PacMARS data portal (<http://pacmars.eol.ucar.edu/>)
- Coordinated travel plans for the PacMARS Data Meeting
- Grebmeier and Yamin-Pasternak developed a formal letter of explanation for inviting traditional knowledge collaborators (Lead Responsibility: Sheffield and Yamin-Pasternak).
- The EOL data archive investigators generated a data questionnaire used by the PI's and collaborators to identify what data will be submitted and in what format it will be provided. This questionnaire was also used by other collaborators who attending the data meeting in Boulder. (Lead Responsibility: Jim Moore and Jackie Grebmeier)
- Geographic Information System (GIS) coordination: Developed agreement on shapefiles, projections, fonts and a road map for uploading files to NCAR; Generated 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 formed the PacMARS GIS “tiger team”.



2. *Specific Objective Progress*

a) **Identify and link existing data sets:** During this reporting period, each funded group relayed information on relevant activities, including data set and additional collaborators identification. Most of the effort has been put into compiling information on what data sets each research group can contribute, links to other already available databases and identifying gaps needed for projected analysis and synthesis.

During the PacMARS data meeting in Boulder, CO each research group presented updated results of data mining activities and organization efforts. Data sets already available in the NCAR database (SBI, BEST, etc.) were identified as well as other relevant databases (OBIS, OCSEAP, NODC, etc.) that are being identified in the living Appendix A-Table 1 Data summary table. Each research group listed and explained what types of data they would be able to contribute as well as how they could provide detail for metadata. In addition, our invited collaborators made presentations on data availability to the PacMARS project, either data sets or links to publically available data.

The action item(s) related to data sets included:

- Data uploading consistency was discussed and examples of data format for uploading to the NCAR database were presented.
- Submission of point source and combined data sets
- Submission of metadata files for both point source and combined data sets; these will go public in June 2013. GIS maps will be available for the community, but synthesis data sets that form the basis for them will be password protected until June 2014 to allow publication of the combined synthetic data products by PacMARS PIs and collaborators.

Standard Fields for all GIS files include initial columns for:

1. Cruise Name; 2. Station Number; 3. Station Name; 4. Latitude (decimal degrees); 5. Longitude (decimal degrees); 4. Year and/or Date; 5. Time (UTC).

Preferred Standard Fields for Pie Chart-type displays include:

1. Cruise Name; 2. Station Number; 3. Station Name; 4. Latitude (decimal degrees); 5. Longitude (decimal degrees); 4. Year and/or Date; 5. Time (UTC); 6. Totals by each Fauna Class (or, by discretion for mapping of other taxa/quantitative data); 7. Total count (e.g. Total Abundance or other quantitative data)

The EOL team developed and deployed the PacMARS Data Archive web site. The homepage is an interactive Mapserver display of the PacMARS region, presenting plots of data by dataset and types of data. The view can be zoomed and panned, while GIS plotted data that have been submitted to the archive can be added in layers for visualization and review. For those with password access, the data at the stations can be displayed by utilizing the query button. A link to order and download the full dataset is also displayed upon querying.

An alternative method of ordering data from the archive is the Data Access page that is linked from the initial PacMARS Data Archive page. This Data Access page is similar to that in place for the Bering Sea Project data archive. A table lists datasets meeting criteria chosen from menus of PIs' names and data types.

EOL has acquired a Windows workstation for use with ESRI ArcGIS, and USGS software packages. EOL hosted a conference call among the GIS specialists who will be preparing and submitting datasets to the PacMARS data archive to reach consensus on formats and types of files for the data archive.



Interested PIs were also invited to join. Alynne Bayard of the Grebmeier/Cooper GIS team, along with PIs Ashjian, Cooper, and Moore participated in a GIS “tiger team” conference call 11/14/12. Team introductions and main duties were discussed, as were data and metadata formats necessary to support the PacMARS map server and project. Bayard prepared and submitted shapefiles to EOL for Grebmeier/Cooper, along with other PacMARS team members, in support of generating products and examples for the Data Meeting held in Boulder, CO, December, 10-11, 2012, along with attending that meeting. It was discovered during the call that all but one of the data providers uses ArcGIS for preparing the data. Consensus was reached by the GIS “Tiger Team” members who were on the conference call that GIS data should be submitted as shapefiles. The non-ArcGIS user(s) may submit data with georeferencing information embedded within a TIFF file, in the GeoTIFF format.

To codify the metadata that accompanies the data submissions, an XML template will be developed by members of the GIS team. The template will be used within ArcGIS, and the outputted metadata file will be compliant with the ISO 19115 and FGDC standards. The GIS “Tiger Team”, along with Rob Bochenek of AXIOM, gathered during a breakout session at the PacMARS data workshop in Boulder to prioritize and discuss metadata issues. Discussion during the workshop and suggestions from participants focused the breakout discussion on the display of metadata and data in the Mapserver. It was agreed among the members to work towards standardized metadata for the SOAR-PacMARS meeting that precedes the AMSS.

The EOL data management team has developed an online tool for submission of data and metadata to the PacMARS archive, accessible from a “Submit Data” link on the main page. An easy to fill out form gathers the metadata necessary to archive the data, saving it directly to the database, and a file upload page enables securely transferring the data files to the archive. The metadata and file upload tool were demonstrated at the PacMARS data workshop on December 10-11, 2012 in Boulder. The EOL team was on hand at the workshop sessions to make note of the data that may be expected to be submitted to the archive, and to answer questions on the Mapserver and data submission tool.

EOL hosted the planned Data Meeting in Boulder on 10-11 December 2012. It was attended by ~40 people representing the PI team, collaborators, program managers and additional EOL staff working on PacMARS. The discussions were wide-ranging and addressed all aspects of project data issues including the provision of datasets, formatting, PI highlights, results from the PacMARS data questionnaire, demonstrations of EOL and Axiom tools, roll out of the industry data from Alaska, and details about the community workshops planned for early in 2013. Plans for the special PacMARS/SOARS workshop at the AMSS were also discussed. EOL also hosted the PacMARS Advisory Committee on December 12, 2012 in Boulder to review progress and discuss other data that might be included in the PacMARS inventory.

b) Synthesize existing scientific and traditional knowledge of the marine ecosystem:

During the reporting period individual PacMARS PIs have been contacting individuals, project leads, archives, agencies and associations in Alaska and elsewhere to help identify available environmental data sets as well as traditional knowledge data publically available that could be integrated with existing scientific knowledge. These activities are outlined below in the themes section of this progress report.

c) Develop overarching scientific themes and research needs: During the reporting period the PIs collected data that will be evaluated in the context of the overarching scientific themes and research needs discussed in our original proposal, at the PI meeting in Annapolis, and reiterated at the Boulder data meeting December 10-11, 2012.

The completed and new action item(s) related to **overarching themes** considered during the Sept-Dec period included

**Completed:**

- Generated a PacMARS/SOAR theme table that helps illustrate the differences in scope and approach of the two separate programs, available on PacMARS and SOAR websites (<http://pacmars.cbl.umces.edu/PacMARSSOAROpenScienceMeeting.html>)
- Drafted a PacMARS-SOAR schematic, available on PacMARS website (<http://pacmars.cbl.umces.edu/PacMARSSOAROpenScienceMeeting.html>)
- Provided written guidance to Brendan Kelly on the usability of the National Ocean Data Center archive to assist with a reporting requirement at the Office of Science and Technology Policy.
- Jointly developed the announcement for the January 20, 2013 PacMARS-SOAR open science workshop just prior to the AMSS with Sue Moore; also developed agenda for the workshop, and requesting posting of it through the Arctic listserver as well as sent out the announcement to the Pacific Arctic Group listserver

Ongoing:

- Updates to the PacMARS data table (Appendix A); near-future plans are to convert the table into a narrative document with additional descriptions of data sets that were considered in the PacMARS analysis.
- Input of point source and composite data sets to the EOL PacMARS data portal; upload of metafiles for both types of data

d) Emphasize system-wide, synoptic understanding: We are prioritizing our efforts towards integrating across disciplines and we are using geographical and habitat-scaled approaches to achieve linkages among biophysical observations and human communities. Our data collections will be tracked back to the proposal themes and questions via schematics as drafted during the Boulder data meeting.

e) Undertake a synthesis of social-ecological interactions: The understanding of our study region as a social-ecological system, an approach that regards humans as integrated component of the natural environment, is the principal framework for the PacMARS assessment of studies relating the course of subsistence livelihoods in the time of change.

The human communities within the study area live in close proximity and everyday contact with the sea and land. They derive their livelihood from the local ecological resources, either through direct harvesting practices or through local exchange networks. The environment within which they operate, albeit one that has not been transformed as visibly as vast urban or agricultural zones, is an anthropogenic environment. Such features as trails, waterways, sea ice pathways, year-round homes, familial campsite structures, temporary shelters used while traveling and/or gathering food, ice cellars, and various landmarks are part of the toolset that facilitates the knowledge and use of that environment. The so-called permanent infrastructure, such village post offices and schools, brought in through the workings of various colonial and legal processes, now also functions as part of that toolset. The latter helps foster the idea of permanent residence and, alongside ancestral ties to a more geographically dispersed area, adds a dimension of a legal and cognitive attachment to a locale, with a strong fidelity to the local geography.

Numerous subsistence and land use studies are being reviewed within the scope of the PacMARS study of subsistence livelihoods. To date, Sveta Yamin-Pasternak's review has included land use studies, and in some cases multi-year subsistence data reports for the villages of Kaktovik, Nuiqsut, Barrow, Wainwright, Kotzebue, Kivalina, Shishmareff, Diomede, Savoonga, and Gambell. This review has shown that the residents of the coastal communities in the northern Bering, Chukchi, and Beaufort regions derive at least 50% and sometimes up to 90% of the products they consume from the local ecological resources. The cultural knowledge and social values enabling this level of local food procurement is an inherent part of the regional social-ecological systems.



Securing access to subsistence resources, while being tied to a residence and a school, necessitates transportation and mobility (i.e. a reliable mode of transportation and a reliable pathway along which to travel), knowledge of landscape, and ability to accommodate seasonal subsistence work with the everyday institutional and family obligations. This infrastructure helps deliver vital services (e.g. mail, health clinic, school and air landing strip) and but is not adapted for easy translocation. It is nevertheless one of the driving factors providing a sense of place for people in this landscape, and it impacts the schedules and routes along which they engage in the food harvesting and preparation practices. Vulnerability of this constructed environment to changing climate and physical environment (such as coastal erosion and flooding homes, thermokarst and flooding of land travel routes) affects the scope of participation in the social-ecological system. While terrestrially situated, the homes of residents of the coastal Arctic villages are oriented in great part toward marine resources, are part of the marine ecosystem, as their elimination (such as by threat of coastal erosion) also eliminates prominent actors within that ecosystem (such as by threat of village closure, relocation, outmigration). Hence, while the observations in the more direct confines of the seascape, such as the apparent relationship between changing sea ice and marine mammal behavior will be among the crucial parameters to explore in studying subsistence and climate change, the human component of the maritime environment extends the overall parameters of this social ecological system beyond the reach of the sea.

3. Progress on PacMARS Research Themes

As mentioned above, we organized our PacMARS proposal around **6 research themes**, which we identified as foci for specific synthetic questions that would improve our understanding of the Pacific Arctic region. We provide a brief summary below of these themes and actions that have been undertaken that would contribute to that effort initially. Data sources that we have identified to help address these specific questions and themes (many are appropriate for multiple themes) are tabulated in Appendix A and online at <http://pacmars.cbl.umces.edu/>.

a) Ice Cover (primary production relationships, currents, winds, bathymetry):

We have and continue to compile data sets to common format, develop GIS mapping protocols, upload appropriate data to ACADIS website, interact with AOOS, and will use the PacMARS synthesis and community input to feed into development of a multi-agency 5-year field program, including the following elements consistent with this theme:

- Bathymetry+Seasonal and interannual changes in T, S (river discharge), winds, currents
- Regional and spatial distributions (GIS or krigged gridded data) of pelagic standing stocks (phytoplankton, zooplankton), and where possible, phenology of biological production cycles
- Phytoplankton: We used the Matrai et al. data set (through 2004) to generate integrated (0-100 m or total water depth if < 100 m) water column chlorophyll, primary production, and phaeopigment estimates at all locations where the vertical resolution of the data permitted. The data set (ascii format) were provided to Alynne Bayard and Janet Scannell as a test case for incorporation into the MapServer. Once the data were in MapServer, these data were plotted as integrated chlorophyll abundance coded points on the map for the whole data set and for just July-August data collected before and after 2000. This initial analysis revealed that, for the period of July-August, there was a strong spatial bias in the locations of the sampling with most data pre-2000 collected in the northern Bering and Southern Chukchi Seas and most data post-2000 collected in the northern Chukchi Sea. This strongly suggests that comparing these data between those periods to detect climate change will be quite difficult given the spatial disparity in sampling locations. We also produced a preliminary gridded map of integrated chlorophyll for the study region that demonstrated considerably more detail and spatial variability in integrated chlorophyll than was discernable using the maps on the MapServer. We are continuing to identify and request data sets from colleagues working in this region for the post-2004 years. Once we have compiled more data sets, we will work to produce gridded maps of the chlorophyll distribution for particular seasons and years using either a linear interpolation gridding routine or krigging. These maps then can be compared to the



distributions of physical attributes (Okkonen CTD data set) and of other biological variables (e.g., benthic biomass, copepod biomass).

- **Zooplankton:** During this quarter, we have worked to identify and provide a preliminary description of the available data sets on zooplankton abundances. We have compiled a preliminary table with information on ~75 data sets. We have also reformatted the Smith and Lane SBI data (2002 and 2004) so that it can be used. In our review, we have found that some of the data sets do not contain sufficient specificity regarding life stages to be useful. In particular, most of the OCSEAP data sets identify copepods only to type (e.g., calanoid) and are not useful for synthetic comparisons. Similarly, the recently released industry data set (CSESP - Chukchi Sea Environmental Studies Program) also does not identify copepod species to life stage and therefore are of limited utility. The mesh size also varies among studies, with earlier studies tending to utilize larger mesh (e.g., 505 μm) that does not quantitatively sample the smaller copepod species or the smaller life stages of the older copepod species.

The mesh sizes of the zooplankton nets determine which species and life stages of those species can be effectively collected. The larger meshes (e.g., 500 μm) do not quantitatively collect many of the smaller species (e.g., *Oithona*) or the smaller life stages of even the larger species (e.g., Copepodid 1 of *Calanus glacialis/marshallae*, copepodite stages of *Pseudocalanus* spp.). Therefore, when trying to synthesize data from many different cruises, it is important to either only consider data collected using similar mesh sizes (e.g., 150 or 200 μm) or to only consider life stages/species that are quantitatively sampled across the mesh sizes used in the studies. So for example, one could consider adult *Calanus glacialis/marshallae* from across a range of mesh sizes (150-500 μm) but one would not want to consider smaller copepods such as *Pseudocalanus* spp. from across that same range; one would also not include the data from the larger mesh nets if looking at *Pseudocalanus* spp. Because many of the earlier studies employed large mesh sizes, those data cannot be considered for small species/life stage comparisons.

A second reason why life stage is important, aside from questions regarding population dynamics, is that one can estimate total biomass of that species by using "standard" values for the biomass of individual life stages in combination with the abundance of each life stage. Although there is variation within stage in size, that is usually much less than the variation among life stages and considerable value can be obtained by deriving such an estimate of total species biomass. Since the PacMARS synthesis activities plan to focus on abundance or biomass of the adult life stages of a few key species, and since the life stage is not identified for the majority of the OCSEAP data, those data are really not useful to us. Other approaches may be used. For example, Imme Rutzen, a graduate student of Dr. Russ Hopcroft's at the University of Alaska Fairbanks (UAF), has been working on presence/absence of copepod species (in addition to abundance) and the OCSEAP data should be appropriate for her consideration.

Finally, we anticipate that we can make recommendations for current and future collections based on our review of what has been collected to date (or not collected, e.g., rate studies) and our understanding, and the limitations to understanding, of the ecology of these seas both at present and under future climate change.

We are continuing to add information on the more recent data sets, most specifically the RUSALCA project, industry funded work, and work by non-US scientists. We are also working to produce a map showing the locations by sampling year/decade of the zooplankton samples in the data sets that we have retrieved to accompany the compilation table. Aside from the sheer enormity of the task of compiling the data, our biggest obstacle continues to be how to successfully integrate and coordinate with Dr. Russ Hopcroft (University of Alaska Fairbanks) and his students to avoid compromising the students' independent theses and dissertations that have some of the same objectives for zooplankton synthetic analyses. This topic is discussed in additional detail on the next page.



Other composite data sets are being prepared by PacMARS PIs for:

- Sediment grain size, carbon content, and potential chemical and radioactive contaminants
- 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

b) Phenology of Biological Production Cycles in Relation to Physical Environment:

We are preparing regionally specific temporal and spatial distributions (GIS or krigged gridded data) of benthic standing stocks (infauna and epifauna); temporal/spatial variations in stratification (T, S), nutrients, winds, currents; we are using direct links with SOAR to achieve synthesis of data sets specific to higher trophic organism parameters and link to people; we will request input from SOAR into mid-term report. The zooplankton team has identified zooplankton data sets and has developed an annotated list (including details of the sampling methodology) of those sets. We have also downloaded several data sets to explore synthesis strategies to make composite files for the EOL PacMARS data site

As mentioned previously, we have working with Dr. Hopcroft at UAF regarding the best way to accomplish our goals without compromising the dissertation of his graduate student, Imme Ruizen, funded through the National Science Foundation. The goals of her research are almost identical to some of the goals of the PacMARS zooplankton effort and include developing GIS maps of both total zooplankton and specific species abundances. Discussions at the data meeting in Boulder centered on some approaches that will protect the student's rights to protect her intellectual contributions. For example, the public metadata files associated with this effort will include links to the individual data files that are publically available. Additional data sharing is anticipated and there are plans to use some of these data products in preliminary plots that can be used for demonstration and not formally published without the student's participation. We are compiling meta-data on the data sets that will be included in our table showing the information on zooplankton data sets from this region. There are also plans to produce maps of station locations with the assumption that there should not pose any problems.

We will continue these discussions at the January 2013 AMSS as well as through email. In the meantime, we have started preparing data sets from the 2000s to be used in a synthetic map. Please see Theme a) for progress in the zooplankton and chlorophyll data syntheses.

c) Benthic-Pelagic Coupling in Relation to Physical-Chemical Environment:

Several important data sets are being examined for completeness so that they can be transferred to public archives. These include data collected during annual cruises of the Sir Wilfrid Laurier through the Bering and Chukchi Seas from 1998-2012 that are jointly supported by US and Canadian collaborators under different data archiving protocols and locations. These cruises have sampled water column, sediments and biological systems, but limited funding has not permitted the collected data to be delivered to accessible archives or made otherwise publicly available. The Canadian sourced data (1998-2012 annual cruises) was transferred to the EOL archive during the Boulder meeting. Similar organizational efforts are being accomplished with data collected other individual researchers that have not been migrated into publicly accessible archives.

d) Current State of Lower Trophic Prey-Base and Higher Trophic Feeding Hot Spots:

During the reporting period, key coordinating activities were undertaken with higher trophic level researchers who are involved in the SOAR project. Sue Moore (NOAA, whales, SOAR lead), Chad Jay (USCS, walrus), Brenda Norcross (UAF, fish), Kathy Kuletz (US Fish and Wildlife Service, seabirds) participated in the December 2012 PacMARS data meeting in Boulder, CO and provide updates to data links and data sets for the PacMARS project.



Dunton has provided over 1500 data entries representing nearly 3000 isotopic values of nitrogen and carbon for the western Arctic. These data have been entered on the PacMARS secure database web server. The data entries reflect contributions from the Chukchi Sea under RUSALCA (Bluhm, Iken, and Dunton), BERPAC and ISHTAR (Cooper and Grebmeier), OCSEAP (Naidu) and SBI (Dunton and Schonberg). In addition, isotopic data are available from studies funded in the Beaufort Sea under projects led by Dunton and others over the past three decades (sponsors include NSF, Shell Alaska, OCSEAP, USF&WS, and BOEM). Additional stable isotopic data is being sought from the work conducted by Don Schell and his students at UAF since the 1970s through the help of Susan Saupe and Norma Haubenstock. We hope to have over 95% of the available isotopic data collected in the western Arctic on the PacMARS website by February. We will initiate the search for other trophic information (non-isotopic) in January. Dunton sincerely appreciates the assistance from Bodil Bluhm and Katrin Iken in tracking down the RUSALCA data. We are also determining if any useable trophic information is available from various stomach content records for marine mammals. Our synthesis efforts will include close collaboration with GIS experts at UT-Austin to produce spatial maps of isotopic distributions among the key trophic groups. Other spatial distribution analysis will be undertaken of feeding locations of marine mammals, seabirds, and fish; coordinate and link data collections through PacMARS collaborators (Jay, Kuletz, Moore)

Bluhm continued to identify and load benthic epifaunal invertebrate data for the lower trophic prey base and biodiversity-productivity objectives of PacMARS with data sets outlined in Progress Report #1 in Kotzebue Sound from 1978 and the Russian and US Chukchi Sea from 2004, 2007, 2008. Norton Sound trawl data has also been collected by NMFS/ADF&G every three years since 1976. Additional epifauna data that just became available to PacMARS are from the NE Chukchi Sea that were collected during CSESP studies in 2008-2010 was just released through AOOS and will be added to the PacMARS data archive. Eventually data will also become available from the Herald Valley and the S. Chukchi Sea that were collected during RUSALCA 2012, the US Beaufort Sea collected during OCSEAP, and the US Beaufort Sea collected during WEBSEC. Data from the NE Chukchi (COMIDA-CAB, 2009 and 2010) are now available at NODC. A UAF graduate student (under co-PI Konar) has submitted and revised an article based on these data and Konar has indicated that there should not be a problem including the data in the PacMARS synthesis. Data from the US Beaufort Sea (BeauFish, BOEM, 2011) are part of the same Konar UAF graduate student thesis and might not be available for the PacMARS synthesis because the student's second manuscript (based on the 2011 BeauFish epifauna data) is currently in preparation. Bluhm will have a conversation with the project officer of the funding agency about the data archiving plan and the potential availability of the data before the project end. Trawl data from the N Bering Sea that are part of a thesis at Southern Illinois University (Jim Lovvorn, advisor), for species richness has also been added to the data archive. Dr. Lovvorn kindly provided data on species richness, but not total abundance and biomass because his graduate student is currently analyzing those data. The synthesis map will include the station locations and a web link or other pointer to the status of this data set.

Most, but not all, surveys mentioned here primarily resolve taxa to the species level with the exception of difficult groups. Different trawls, trawl duration and mesh size can also bias comparability for standing stock estimates as well as species richness/biodiversity indices.

Bluhm has started identifying macrofaunal invertebrate data from the Pacific Arctic that are identified mostly to species level. These include (in no particular order) (1) a data set from 1976 by Feder (UAF, retired) collected in Kotzebue Sound, (2) the CSESP data (2008-2012) from the Northeastern Chukchi Sea collected by Blanchard (UAF), (3) COMIDA CAB data collected by Dunton and Schonberg in 2009/2010, (4) data from the 1970s from the US Beaufort Sea shelf collected during OCSEAP by Carey (formerly Oregon State University); Bluhm, Schonberg and Dunton are collaborating on this effort, (5) two data sets from the Canada Basin Ocean Exploration expeditions in 2002 and 2005 (Bluhm collected those data), and (6) Canadian data primarily from the 1970s and 1980s compiled by Cusson et al. 2007



Mar. Ecol. Prog. Ser. 331:281-290 (held by P. Archambault at U. Quebec). It yet remains to be clarified which data can be uploaded to the EOL site and which we can link to.

Grebmeier has extensive macroinfauna data from the PacMARS region, resolved to the family level, with dominant fauna to species level in many cases, some that are already at EOL from past projects as well as other data archives. For PacMARS she is migrating other data sets into synthetic “all station” files from other published data to be loaded at the PacMARS EOL data site through collaboration with Army Blanchard (UAF) and Russian and Chinese scientists. These synthetic data files contain benthic station abundance and biomass data, including dominant macroinfauna, for cruises collected from the 1970s-2010. The associated metadata file for these data will list links to individual cruise data submission locations, when available, including an updated version of the table of source data published in Grebmeier et al. 2006. In addition, associated environmental data are also being combined into “all station” files, including sediment grain size, total organic carbon content, sediment chlorophyll and sediment oxygen uptake rates. The metadata files for these composite datasets will also included links to individual cruise data archive sites as well as associated publication lists.

e) Subsistence Livelihoods in Times of Climate Change:

Sveta Yamin-Pasternak has been involved in a continuing review of subsistence literature for the region. She has reviewed a number of land use studies, and in some cases multi-year subsistence data reports for the villages of Kaktovik, Nuiqsut, Barrow, Wainwright, Kotzebue, Kivalina, Shishmareff, Diomede, Savoonga, and Gambell). She has also reviewed several integrated studies that examine the interaction of specific parameters within the context of climate change (e.g. receding sea ice, walrus and ice seal migration and haulout behavior, modification of hunting practices in coastal settlements). In annotating the specific studies, Yamin-Pasternak has made efforts to learn about the specifics of data management; she will include this information in the synthesis product. The Arctic Observing Network Design and Implementation Plan, which has been publicized during the current reporting period, has also been studied. In synthesizing the PacMARS literature and data resources, Yamin-Pasternak will adhere to the AON’s recommendations to note the key species important to Arctic peoples and environmental variables such as sea ice that most influence resource availability. In connection with that recommendation, Yamin-Pasternak has been studying the Siberian Yupik and Inupiaq sea ice dictionaries, and also studies that integrate these indigenous vocabularies, which show the precision-oriented capabilities of the indigenous languages to communicate environmental observation and change. Finally, Yamin-Pasternak will continue to stress the importance of maintaining an integrated view of the social-ecological system in trying to grasp the adaptation strategies and needs of the subsistence livelihoods in the time of change.

Yamin-Pasternak completed a full-day training workshop, undertaken by the staff of the Arctic Field Office of the Bureau of Land Management, including the BLM coordinator of the NPRA Subsistence Advisory Panel. This workshop was specifically designed for the benefit of the PacMARS project to address concerns related to community outreach and consultations. She gained insight into best practices in organizing information packets for this type of meeting. As a result Yamin-Pasternak and Sheffield are coordinating the development of a PacMARS information project binder, containing project overview and summaries of each PI expertise, to be distributed among the local communities in the PacMARS study region. The community hub meeting planning has proceeded with a decision to have two types: smaller community meetings in later January and hub meetings in Feb-April. PIs Yamin-Pasternak and Sheffield will be working with PIs Cooper and Grebmeier on a standard format. PI Yamin-Pasternak was in Nome during this reporting periods and had discussions with Gay Sheffield. The following schedule has been set so far:

- Jan 28: Savoonga community meeting (Pasternak, Sheffield, Cooper, and Grebmeier)
- Jan 29: Gambell community meeting (Pasternak, Sheffield, Cooper, and Grebmeier)
- Feb. 11: Barrow hub meeting (Pasternak, Sheffield, Ashjian and Okkonen)



Yamin-Pasternak and Sheffield received many helpful suggestions from the social science breakout group at the PacMARS meeting in Boulder. She is following up on those suggestions at the time of writing. Sheffield and Yamin-Pasternak had two work sessions in Nome, exchanging insights on the maritime subsistence harvest strategies they observed in the course of their work in the Bering Strait. They have regular phone meetings to discuss the synthesis process and meetings with community representatives. Yamin-Pasternak is engaged in active correspondence with the PIs of several ongoing products, agencies addressing management issues and carrying out research programs in the study area, and other experts in the field.

The correspondence with Dr. Philippe Amstislavski, which unfolded following a session on health and climate change in remote, resource-dependent populations, has grown into a collaboration along one of the PacMARS directions – mobility and subsistence resource access. Amstislavski, currently working with colleagues at the Columbia University Earth Institute to develop web-based monitoring toolkits of landscape-level change, is helping diversify the social science approaches in the PacMARS project. He joined the PacMARS data meeting in Boulder in an invited collaborative capacity.

Yamin-Pasternak has also solicited the participation of Dr. Phil Loring, a human ecologist with the University of Alaska Center for Climate Assessment and Policy, specializing in Alaska coastal and marine resources. Loring joined the PacMARS meeting in Boulder and will continue to advise the PacMARS team on data resources and approaches to carrying out the synthesis.

f) Chemical Contaminants in Sediment and Biota:

Scientists at NCAR have been given contacts and access to the following large data sets for metal and organic contaminants: (1) ANIMIDA and cANIMIDA in the Beaufort Sea (1999-2006) through Battelle, Duxbury, MA and (2) COMIDA in the northeastern Chukchi Sea (2009-2012) through the University of Texas at Austin. One additional large data set for contaminants from the oil industry (Shell, ConocoPhillips, Statoil) for Camden Bay in the Beaufort Sea and for the northeastern Chukchi Sea also has been accessed. Data in these data sets include contaminants in water, sediment and biota (benthic fauna and fish). John Trefry worked with Sathy Naidu and others to synthesize data from UAF and other scientists in a manuscript in *Marine Pollution Bulletin* (Naidu, A.S., Blanchard, A.L., Misra, D., Trefry, J.H., Dasher, D.H., Kelley, J.J., Venkatesan, M.I., 2012. Historical changes in trace metals and hydrocarbons in nearshore sediments, Alaskan Beaufort Sea, prior and subsequent to petroleum-related industrial development: Part I. Trace metals. *Marine Pollution Bulletin* 64, 2177-2189). These data are now accessible for the PacMARS effort.

We also have prepared a draft list of contaminants to include in the PacMARS synthesis. This "focus" list is drawn from ~20 metals and many more organic substances for which data are available in varying degrees. This list includes potential contaminants for which adequate data exist and for which environmental concern is greatest. At present, the list is as follows: Mercury (Hg), Lead (Pb), Cadmium (Cd), Arsenic (As), Polychlorinated Biphenyls (PCBs), Petroleum Hydrocarbons, Polycyclic Aromatic Hydrocarbons (PAH), and selected pesticides (final choice of specific pesticide compounds still evolving). Sue Moore has also facilitated efforts by Trefry to identify specific contaminant scientists working in marine mammals.

4. Describe preliminary results:

Grebmeier has submitted preliminary "all station" synthetic files for GIS plotting in spatial mode. The data and shape files include dates and spatial location for time series and regional analyses. Files submitted or in progress to submit include station summary values for:

- 1) benthic macroinfaunal abundance g wet weight biomass, and gC biomass
- 2) sediment grain size composition (% phi)



- 3) sediment total organic carbon content (%TOC)
- 4) sediment surface sediment chlorophyll content (mg/m²)
- 5) sediment community oxygen consumption (mmol O₂/m²/d)

Okkonen has downloaded and synthesized CTD data from NODC and other archives into data tables and composite maps, such as time-averaged (1970-2009) fields within 0.2 degree longitude x 0.1 degree latitude (~8 km x 11 km) grid cells from ~10500 CTD casts. The data summarized in this figure are likely most applicable to research theme b, although these data also apply to themes a and c. More recent data are still being collected for post-2000 CTD data. Sea ice and current meter mooring data are still being collected, although data locations from collaborators Tom Weingartner and Bob Pickart were provided at the Boulder data meeting.

Both Bering Strait and Kotzebue areas are currently engaged in the community-driven projects directed at a better understanding of subsistence. The Kawerak Social Science Research Program in Nome is focusing on the knowledge and use of walrus and four types of ice seals. The Northwest Arctic Borough is undertaking a more broad mapping project of the subsistence use areas in the NWAB region. Yamin-Pasternak has been aware of these efforts for some time, and has attended several presentations on the Kawerak walrus and sea ice project coordinator led by Dr. Lily Ray (at the Beringia Days Conference in Nome, at the International Congress for Circumpolar Health in Fairbanks, and a Resilience and Adaptation seminar in Fairbanks). She has also volunteered to provide a review of the research methods for the Northwest Arctic Borough mapping project at the request of the NWAB's former Social Anthropologist Dr. Brendan Chapman. During the North Pacific Research Board Advisory committee meeting, which followed the PacMARS meeting, the NWAB subsistence mapping coordinator Mr. Zach Stevenson made a presentation about the project, the power point (ppt) summary of which was then passed along to Yamin-Pasternak. It is possible that certain data products of the Kawerak project will become available within the PacMARS timeline. In any case, familiarity with these projects is helping Yamin-Pasternak assess the priorities of local initiatives in documenting local knowledge of animal behavior in connection with subsistence practices and in the context of climate change. Similar studies are available for the North Slope area. Together with the subsistence reports and integrated studies of human animal interaction, these resources are helping Yamin-Pasternak make progress in identifying the direction of the synthesis. These may include:

- extended community subsistence profiles, discussing seasonal harvest patterns within a broader treatment of each community as an integrated component of the social-ecological system grappling with consequences environmental change

- social implications and LEK-based interpretation of the sea-ice driven changes in animal behavior, such as walrus travel from land haulouts to distant feeding waters (described by Dr. Chad Jay, USGS Alaska Science Center at the Boulder PacMARS, by Dr. Lily Ray, Kawerak, as well as a number of publications reviewed by Yamin-Pasternak)

- access to resources, reported to be a concern in several recent reports for the study area (for example Dr. Todd Brinkman reports for Wainwright and Kaktovik shared with Yamin-Pasternak). The issue of resource access (and not so much distribution or overall presence of key species) is being recognized as one of the key directions in the PacMARS resource question "How is climate change affecting indigenous subsistence livelihoods?" The social-ecological system approach described in the section 2e is integral to the understanding of parameters facilitating resource access. As an example, the EOL Nelson Island place names mapserver (<http://mapserver.eol.ucar.edu/best/>), developed by EOL during the Bering Sea Project can serve as a case study for PacMARS. While Nelson Island is located to the south of our study area and the EOL server does not focus on marine resources, this output is being used by the PacMARS team to exemplify a data product. As another example at the Boulder meeting, Sveta Yamin-Pasternak and Philippe Amstislavski presented a case study of interrelationships between reindeer herder mobility and hydrological landscape change in west Siberian Arctic. Yamin-Pasternak



and Amstislavsky will continue to collaborate in exploring how a similar methodology can be applied to understand mobility and resource access in the settings of the maritime societies in the Alaskan Arctic.

5. Describe any concerns you may have about your project's progress.

- 1) The principal investigators continue to be concerned that the scope of work and performance period is ambitious, but have recognized this constraint since beginning to prepare the proposal. We are trying to work within the funded requirements of the project and time frame, including the amount of effort that is actually budgeted, while continuing to make progress on other independently funded projects. At the data meeting we developed a time line that has the end of February 2013 as the date for submission of individual natural science cruise data or links in order to allow the PIs to prepare, analyze and describe results for the June interim report, although additions to already prepared products can be undertaken through early spring. We will continue to accept data into the EOL data archive later than this date, but they may not make a significant contribution to the interim report. In addition, we recognize that the social science/hub meeting results will come into the EOL site through April. We will utilize those data in the interim report (see summary of December 2012 data meeting for further information).
- 2) Notably some data are currently in ongoing student theses, although the core data sets may already be released for the public (e.g., OCEAP industry data). Since the synthetic composite files may contain some of these data, we will password protect the underlying data associated with the produced figures until the end of the PacMARS project (June 2014). However, the publically-available metafile on the PacMARS data site for these synthesis products will list the available location of the individual data sets. This compromise was agreed to at the data meeting in order to let the students and other recently collected data sets by national and international collaborators be included in the composite maps for the PacMARS project, yet allow the authors of these synthetic products to publish the composite data in year 2 of the PacMARS project.
- 3) Our social science subprogram does not include any human subject research. Only publically available data and/or comments from the community meetings, without attribution, will be available for this synthesis efforts. We are concerned that differences in the protocols guiding the use of human subjects data vs. most other data, create differences in social and natural science perspectives on intellectual property rights. These differences in the awareness of the community perspectives surrounding the sharing and use of human subjects data, are sensitive issues that require continuous attention of all PIs as we assemble the synthesis resources.

6. Describe integration activity.

The PacMARS data meeting in Boulder, Colorado, encompassing both PacMARS PIs, collaborators, and invited participants, provided an illustration of the rich data sets coming into the PacMARS effort as well as others. The PI meeting in Annapolis was helpful for encouraging integration activities that are likely to accelerate over the subsequent reporting periods. Each PI presented examples of data sets that they have begun to work with and much of the ensuing discussion concerned ways that individual PIs could collaborate with each other to produce a synergistic result.

7. List poster and oral presentations at scientific conferences or seminars.

Grebmeier and Cooper submitted a PacMARS poster abstract for the January 2013 AMSS 2013 meeting on behalf of the full PacMARS PI group (to be presented by them and Wakefield Symposium in March 2013 (to be presented by co-PI Bodil Bluhm).

8. Communication and coordination

We are coordinating with the SOAR project that is NOAA-BOEM supported. PIs Jacqueline Grebmeier and Carin Ashjian serve on the SOAR steering committee, and Sue Moore, a SOAR PI, is the lead liaison in our cooperative efforts and attended the Annapolis PI meeting. The Google Analytics analysis (Figure 1) indicates our web site (<http://pasmars.cbl.umces.edu>) is being actively accessed. Yamin-Pasternak has addressed questions from Kawerak on how the ethnographic data will be used and how the region



communities will benefit from the PacMARS effort. Yamin-Pasternak and Sheffield have outlined a format for scientist-community collaborations to be provided to community meeting participants.

4. PROGRESS STATUS

We think the project is proceeding according to our expectations. Again, as expressed elsewhere, the pace and ambition of the work effort may require some adjustment of practical goals and approaches as we continue our work.

5. EXPECTED WORKPLAN FOR NEXT REPORTING PERIOD

- General: A finalized meeting report will be generated from the Boulder data meeting summarizing the individual presentations, including goals and approaches to be used over the coming months (Lead Responsibility: Grebmeier, Cooper and E.Bailey). Currently we have uploaded all the presentations to the PacMARS website, along with the minutes from the workshop (<http://pacmars.cbl.umces.edu/PacMARSDataMeetingMaterials.html>). The final report will just be a clean-up of those minutes.
- All PIS are preparing one-page biographical sheets for the community meetings, following a template provide by PI Yamin-Pasternak.
- Individual data sets will continue to be transferred to the EOL data archive through the end of February to meet the next stage for developing synthesis products tracked to the original themes and questions of the proposal. Data submitted past this date will be accepted, but may not make the June interim report (Responsibility: All PIs, as stipulated by theme; see below).
- Members of the PacMARS PI team will participate in Alaskan community and hub meetings in Jan and Feb 2013. Further meeting times will be arranged for winter/early spring. (Lead Responsibility: Sheffield and Yamin-Pasternak)
- Members of the PacMARS team will prepare three 20 min presentations of PacMARS efforts associated with our themes for a joint PacMARS-SOAR open community workshop to be held January 20, 2013 prior to the AMSS in Anchorage, Alaska.
- We have been asked by the NPRB to provide an outline of the final report, with a plan to incrementally flesh out details. The first version of this outline is to be provided to the NPRB by January 9, 2013, so that it can be discussed by the advisory committee in their next regularly scheduled teleconference on January 14, 2014.

Other Action Items by Theme:

Ice Cover (primary production relationships, currents, winds, bathymetry):

Action Item: Continue identifying appropriate data sets (e.g. Appendix A) and needs through winter and spring 2013 for the interim report (Key responsibilities: Okkonen, Ashjian, Cooper, Dunton, (Collaborators from data workshop)

Phenology of Biological Production Cycles in Relation to Physical Environment

Action Item: Continue to identify appropriate data sets and data needs through February 2013: Ashjian, Campbell, Okkonen; collaborators from data meeting)

Benthic-Pelagic Coupling in Relation to Physical-Chemical Environment

Action Item: Identifying appropriate data sets (e.g. Appendix A) and needs; 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: Continuing to identify and update appropriate data sets (e.g. Appendix A) and needs; Wilfrid Laurier annual trips 1998-2012 with Canadian partners)

Key responsibilities: Ashjian, Bluhm Campbell, Cooper, Dunton, Grebmeier, Okkonen,

Collaborators:

- a. via PacMARS letters in proposal: Chad Jay (walrus), Kathy Kuletz (seabirds), Sue Moore (whales and SOAR leadership), Robert Pickart (physical oceanography), Karen Frey
- b. subaward: Molly McCammon (AOSS), with subaward to Rob Bochenek (AXIOM)
- c. small personal support contracts*.: John Nelson* (zooplankton), Brenda Norcross (fish),

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, wanting to know about “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 in Anchorage are being developed (Lead Responsibility: Sheffield, Yamin-Pasternak, Grebmeier, Cooper, Ashjian, Campbell).

Chemical Contaminants in Sediment and Biota

Action Items: Identifying appropriate data sets (e.g. Appendix A) and needs; Key responsibilities: Trefry, Sheffield, Cooper

Higher Level Synthesis by Carmack and Ulanowicz

Both senior advisors Carmack and Ulanowicz will be attending the AMSS meeting and the joint SOAR-PacMARS workshop. They are both enthusiastic about being involved in the project and hope to collaborate on a creative synthetic book chapter or manuscript involving network and ecosystem understanding that will be derived from some of the other data to be synthesized during the project.

6. OTHER RELEVANT INFORMATION

We just received access to industry-funded data last week during the Boulder, Colorado data meeting December 1-11, 2012. The PacMARS PIs will work to include those data into the EOL data archive and associated synthesis products.