

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
<p><u>Theme 1: Ice cover – primary production relationships, currents, winds, bathymetry</u></p> <p>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?</p> <p>1b. What is the connectivity to local/regional biogeochemistry and physical oceanography for the Chukchi and Beaufort Sea food web?</p>	<p>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:</p> <ul style="list-style-type: none"> • 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 	<p>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)</p>	<ul style="list-style-type: none"> • 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]

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?

Theme 3. Benthic-pelagic coupling in relation to physical-chemical environment

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 benthic standing stocks (infauna and epifauna)
- Temporal/spatial variations in stratification (T,S), nutrients, winds, currents,

- 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

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]

Theme 4: Current state of lower trophic prey-base and higher trophic feeding hot spots

4a. How will migration routes and important feeding hotspots of marine mammals and seabirds change in response to changing climate conditions and increased industrial and commercial activity?

4b. What are the current relationships between biodiversity and productivity?

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 [broad scale]
- George, Druckenmiller, and Laidre – Arctic sea ice retreat effects on bowhead whale body condition [broad scale]
- 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]
- Jay, Grebmeier et al. – Effects of walrus shift to central place foragers in the Chukchi [regional scale]

Theme 5: Subsistence lifestyles in times of climate change

5a. How will the subsistence food gathering of Native Alaskans in coastal villages change from the northern Bering Sea to the Beaufort Sea

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

<p>as environmental changes occur?</p> <p>5b. What information is needed by communities to effectively adapt to the changes in the regional ecosystem?</p> <p><u>Theme 6: Chemical Contaminants in Sediment and Biota</u></p> <p>6a. What are the levels of chemical contaminants in sediments and seawater and how do they move through the food chain?</p> <p>6b. Are there any potential impacts of varying contaminant burdens in sediment and prey on high trophic organisms, including humans?</p>	<p>assessment, hub meetings planning, continue Alaska Arctic Slope region review</p> <ul style="list-style-type: none"> • 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 • Regional and spatial distributions (GIS or kriged gridded data) of chemical contaminants in sediment and biota 	
<p><u>Data archiving and GIS mapping efforts</u></p>	<ul style="list-style-type: none"> • 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 	