

NORTH PACIFIC RESEARCH BOARD ARCTIC PROGRAM – REQUEST FOR PRE-PROPOSALS

This notice constitutes a call for pre-proposals for an Arctic marine integrated ecosystem research program. The North Pacific Research Board (NPRB) has conducted interdisciplinary marine ecosystem research programs in the Bering Sea (<http://www.nprb.org/bering-sea-project>) and Gulf of Alaska (<http://www.nprb.org/gulf-of-alaska-project>). This program aims to build on the success of those programs to implement a similar program in the Arctic (<http://www.nprb.org/arctic-program>). Integration of data and analyses across disciplines will be central to this Arctic program. The Arctic program will be conducted in partnership with the Bureau of Ocean Energy Management (BOEM) and North Slope Borough/Shell Baseline Studies Program (BSP), and the North Pacific Marine Research Institute (NPMRI).

The U.S. Office of Naval Research (ONR) is interested in supporting some aspects of the research program directly if the work proposed addresses the mission of the agency. NPRB may share pre-proposals with ONR, particularly if they include physical science or marine mammal research. Some projects funded separately by organizations such as National Science Foundation (NSF), National Oceanic and Atmospheric Administration (NOAA), U.S. Geological Survey (USGS), Alaska Ocean Observing System (AOOS), and others will also be coordinated with this program. NPRB has also worked closely with the Interagency Arctic Research Policy Committee (IARPC) Chukchi and Beaufort Sea Ecosystem Collaboration Team and the U.S. Arctic Research Commission (USARC) to develop this highly-collaborative program.

The NPRB-coordinated Arctic program will focus on processes influencing the structure and function of the Arctic marine ecosystem. An Implementation Plan is available on the NPRB website on the Arctic Program page (<http://www.nprb.org/arctic-program/implementation-plan>) and should be carefully consulted during the development of pre-proposals.

Pre-Proposals responding to this RFP should be sent to ArcticProgram@nprb.org prior to 4:00 pm Alaska Daylight Time, Friday, July 31, 2015

PROGRAM OVERVIEW

This NPRB-led program will involve the integration of multiple streams of marine data, including physical forcing mechanisms, marine ecology, human dimensions, and consideration of ecosystem services. Success of the program will rely on careful coordination and effective collaboration. All participants will be expected to collaborate with colleagues outside of their specific discipline and innovate means of integrating data to achieve ecosystem-level understanding.

Research will be centered in the Chukchi Sea, but will also include the Bering Strait and northern Bering Sea, especially with respect to advective forcing and sea ice dynamics. NPRB is interested in also including teleconnections to the Beaufort Sea and Arctic Basin and encourages collaboration with programs such as the BOEM-funded Marine Arctic Ecosystem Study (MARES) and Russian-American Long-Term Census of the Arctic (RUSALCA). NPRB is also interested in integrating global-and regional-scale atmospheric and climate data. Opportunities to facilitate comparisons between the Chukchi Sea and other marginal or regional seas throughout the Arctic will also be encouraged.

Pre-proposals are solicited in several categories. We encourage both multidisciplinary proposals that address multiple elements of the Arctic marine environment as well as discrete projects that focus on a particular element of the ecosystem but integrate into larger initiatives. Each pre-proposal is expected to demonstrate how that proposal might integrate in a multi-disciplinary program that considers physical drivers and trophic linkages. A selection of pre-proposals in each category will be invited to submit full proposals that will compete for funding. Those invited to submit full proposals will be encouraged to illustrate linkages to the proposals competing in other categories to demonstrate how projects funded in each category would integrate to form a cohesive program. Towards that end, the titles of successful pre-proposals will be made public, as well as the identities and e-mail addresses of the lead Principal Investigators.

NPRB is cooperating with other funding organizations to formally include the existing projects listed in Appendix A in the Arctic ecosystem program. The projects that appear in the appendix will collaborate with projects funded through this call for proposals; the lead Principal Investigators will participate in annual PI meetings, share preliminary data with collaborators, and contribute intellectually to addressing the core hypotheses of the funded research program. Proposers are encouraged to describe how their research would utilize the data and expertise provided by existing projects. Existing projects are not intended to constrain the direction of the new research projects proposed. NPRB is committed to regularly communicating the research plans, intermediate progress, final results and management applications of the Arctic program to the broader scientific community, stakeholders, and the public. NPRB will dedicate resources to facilitating this communication.

The core hypotheses to be tested by the research program will be determined in meetings involving all PIs once funding decisions have been announced. Proposers are strongly encouraged to articulate testable hypotheses that could be addressed by the work proposed.

Following review of pre-proposals, invitations will be released for full proposals in fall 2015. Full proposals will be reviewed during winter 2015 and final funding decisions made in spring 2016. Some field sampling may proceed in fall 2016 if proposers leverage logistical resources in place. Most field observations are anticipated to occur 2017-2019. At least two years of integrated analysis and synthesis will follow. Additional funding for synthesis may be provided for 2019-2021.

RESEARCH PRIORITIES

The NPRB Arctic Program will focus on the Chukchi Sea and will include Bering Strait and the northern Bering Sea. Research should explore system processes and species dynamics relevant to ecosystem structure and function in Arctic marine systems, resource management, subsistence use, and human impacts. Research questions should be posed in the context of developing a mechanistic understanding of how physical processes (e.g., sea ice dynamics, advection patterns, seasonal patterns, winter conditions and seasonal reset) influence ecosystem structure and function, define temporal or spatial hotspots, influence relative shifts in benthic and pelagic systems, and influence the persistence, abundance, distribution, and life history of apex predators, species important to subsistence, and species or species guilds that are essential to ecosystem function. Research should inform a baseline understanding of current processes as well as an understanding of how systems might shift in the context of a changing climate. In developing an Arctic Program, funding partners aim to:

- (1) structure research to inform or facilitate comparisons of mechanisms and processes relevant to areas not directly encompassed in the program, potentially including the Beaufort Sea, Arctic basin, and Northern Bering Sea

- (2) encourage the development of analyses and models that can be scaled down to localized phenomena and up to regional/global scales (e.g., physical forcing and climate models)
- (3) create opportunities for collaboration across the Chukchi Sea shelf with scientists and initiatives in Russia through existing mechanisms (e.g., RUSALCA) and enhance those collaborations and/or explore new mechanisms for collaboration with research conducted across the US/Russia maritime boundary in the western Chukchi Sea
- (4) coordinate with and enable comparisons to other Arctic systems and research in Arctic regional seas (e.g., Barents Sea Nansen’s Legacy Project)

A total of 8 million dollars will be made available for this Arctic program. Research related to the program would initiate in spring 2016 and end in spring 2022. NPRB will reserve \$600,000 for program management, \$500,000 for data management, and \$150,000 for communication and outreach. Remaining funds may be disbursed in each of the funding categories below.

The overarching question that this program will address is the following:

How do physical, biological and ecological processes in the Chukchi Sea influence the distribution, life history, and interactions of species or species guilds critical to subsistence and ecosystem function? How might those processes change in the next fifty years?

Individual categories are described below. Proposal limits under each category will be maintained. It is anticipated that multiple proposals would be supported under each category. Please note that the questions listed under each category are intended to direct the proposal applicants towards relevant questions; these are not prescriptive nor should applicants feel obliged to address only one.

Categories	Target Funding
1. Patterns in subsistence use and potential shifts in response to ecosystem change (\$500,000 individual proposal limit)	\$500,000
What are local people’s perceptions of the natural physical and ecological drivers of changes in the availability of animals for subsistence harvest? Studies are sought that will a) achieve iterative exchange of information and relationship building between local people and scientists and b) develop processes and analytical methods that utilize local and traditional knowledge and western science in concert to achieve greater understanding of the system.	
What are the primary drivers (natural, social, cultural, economic) of shifts in subsistence use patterns? Have shifts in harvest patterns affected food security and, if so, how?	
How resilient are human communities to variability, anomalies, and shifts in the marine environment?	
2. Species distribution and interaction: Physical, biological and ecological drivers and important thresholds/tipping points relevant to the distribution and life history of apex predators, species importance to subsistence, and species and species guilds essential to ecosystem function (\$850,000 individual proposal limit)	\$2,500,000

How are the distribution and life history of upper trophic predators (including those that represent important subsistence resources for local communities) influenced by changes in the abundance, density, location, and timing of lower trophic prey resources (benthic and pelagic) and what are the mechanisms that determine the availability of lower trophic prey resources?	
What are the mechanisms that create and maintain biological hotspots? Are the primary drivers static (e.g., bathymetry, topography), and will these hotspots persist or shift? To what extent are hotspots associated with specific annual, seasonal, or finer-scale temporal fluctuations (e.g., hot-times)? Are benthic or pelagic hotspots related to areas where nutrient-rich winter water is retained on the shelf and, if so, what are the mechanisms that influence winter water retention?	
How important are hotspots in maintaining the ecological structure of the ecosystem and to what degree do species or species guilds critical to ecosystem function or subsistence species rely on them?	
Is the range of variability in key parameters observed at hotspots the same as the range of variability observed elsewhere? To what degree are patterns observed at hotspots representative of patterns in the broader ecosystem?	
Does the structure and function of the Chukchi Sea ecosystem (in its current form) rely on one or more species? Which species and age classes? What ecosystem-level effects might we expect if these species were substantially reduced at local or system-wide geographic scales?	
How sensitive and resilient are species to variability, anomalies, and shifts in the physical environment? Studies should focus on species of species guilds critical to ecosystem function or subsistence.	
Do tipping points exist that could cause major shifts in distribution, population-level survival, or the role of species in this environment? Consider tipping points that go beyond trophic interactions (e.g., habitat requirements, association with sea ice)? Studies should focus on species or species guilds critical to ecosystem function or subsistence.	
3. Oceanography and lower trophic level productivity: Influence of sea ice dynamics and advection on the phenology, magnitude and location of primary and secondary production, match-mismatch, benthic-pelagic coupling, and the influence of winter conditions (\$850,000 individual proposal limit)	\$2,750,000
How are the distribution and life history of upper trophic predators, (including those that provide important subsistence resources for local communities), influenced by changes in the abundance, density, location, and timing of lower trophic prey resources (benthic and pelagic) and what are the mechanisms that determine the availability of lower trophic prey resources?	
What are the rates of consumption, growth, reproduction, and mortality of secondary producers (benthic and pelagic) and to what extent are these rates limited by primary production, water properties, and other factors?	
How do variation in the timing and location of sea ice breakup/retreat, the strength of advection, and the properties of advected water influence primary production patterns? What factors limit primary production in this	

system? How does stratification influence primary production, and how variable are stratification patterns in time (seasonally and inter-annually) and space?	
Are changes in advective forcing over the Chukchi Sea shelf dominated by remote forcing (e.g., pressure fields in the Bering Sea that control flow through Bering Strait) or local conditions? What are the implications for our ability to predict flow patterns at various scales?	
To what extent do winter conditions "reset" the Chukchi Sea ecosystem each year? Do anomalous summer conditions in a given year influence spring phenology the following year? Are the impacts of seasonal warming cumulative across time? What are the rates of consumption, reproduction, survival of organisms during winter and how do they affect spring production?	
How will changes in sea ice dynamics, strength and patterns of advection, and phenology of biological production influence pelagic-benthic coupling in the Chukchi Sea? What are the mechanisms that determine the partitioning of energy between the pelagic and benthic realms and how are they affected by changes in sea ice dynamics and advection?	
Do thresholds exist that, if crossed, would cause significant shifts in the balance of energy between the pelagic and benthic components of the Chukchi Sea ecosystem? Is it possible to predict such shifts through monitoring key parameters and, if so, what are those parameters and on what scale (geographically and temporally) would observations be required?	
4. Modeling (\$500,000 individual proposal limit)	\$500,000
NPRB may fund a fully-coupled ice-atmosphere-oceanography model that examines the feedbacks and interactions of processes relevant to each of these physical systems and improves understanding of the processes driving the ecology of the Chukchi Sea. To the extent possible, models should utilize field data collected by moorings in the Bering Strait and northeast Chukchi Sea and remotely-sensed sea ice data.	
NPRB solicits proposals for modeling efforts that address questions related to interactions among the biological components of the system and interactions between biological components and physical drivers (e.g., nutrient-phytoplankton-zooplankton models that include sea ice algae; network modeling, multispecies models).	
5. Other areas of research that align with priorities 1-4 above (\$500,000 individual proposal limit)	\$500,000
Proposals to conduct work that does not fit clearly within categories A-E above may be considered if a compelling case is made and if these proposals articulate specifically how the proposed work would align with the areas of research detailed above.	
Total	\$6,750,000

PRE-PROPOSAL SUBMISSION INSTRUCTIONS

Pre-proposal research plans are limited to five pages (excluding tables, figures, and literature cited, all of which should follow the five pages of project description) and must include the following elements:

A. Category

Identify the specific category (1-5) identified in the Arctic Program RFP to which you are responding. Categories include:

1. Patterns in subsistence use and potential shifts in response to ecosystem change;
2. Species distribution and interaction: Physical, biological and ecological drivers and important thresholds/tipping points relevant to the distribution and life history of apex predators, species importance to subsistence, and species and species guilds essential to ecosystem function;
3. Oceanography and lower trophic level productivity: Influence of sea ice dynamics and advection on the phenology, magnitude and location of primary and secondary production, match-mismatch, benthic-pelagic coupling, and the influence of winter conditions;
4. Modeling; and
5. Other areas of research that align with priorities 1-4 above.

B. Rationale and justification

Describe the rationale and justification for the proposed work and how it addresses ecosystem information needs identified as important by federal or state agencies or the scientific community. Explain how the proposed work will address the focus of the funding category and how it will contribute to answering the overarching questions “How do physical, biological and ecological processes in the Chukchi Sea influence the distribution, life history and interactions of species or species guilds critical to subsistence and ecosystem function. How might those processes change in the next fifty years?”

C. Hypotheses

Articulate testable hypotheses that the proposed research will address. Hypotheses should explore mechanistic processes in detail.

D. Objectives

Provide a numbered, annotated list of your project objectives. Objectives are the fundamental and measurable goals of your proposed work and will be used to evaluate progress and completion of the project. Project objectives must be achievable and specific.

E. Expected outcomes and deliverables

Describe the expected products of the proposed research and how they would contribute to improving ecosystem understanding or addressing resource management needs.

F. Project design and conceptual approach

Describe and justify the proposed a) geographic location and timing of data collection, b) types of information that will be collected (e.g., focal species, parameters measured), c) sampling methodology and platform, and d) analytical techniques. Describe the conceptual or statistical model underlying your experimental work. Describe and justify the experimental design, methodologies and the analytical approach, including assumptions, sample size required (and

power analysis where appropriate), model validation, and other relevant information needed to determine the utility and technical feasibility of accomplishing your research, analyzing the data, and achieving the expected outcomes.

The information described above (A–F) should be contained within the five-page research plan. In addition, the following information is required, and will not be counted in your five-page limit:

Integration with existing projects and reliance on other sources of data

Describe how the proposed work would integrate with collaborating projects listed in the RFP appendix to address the hypotheses posed. Describe the extent to which the proposed research relies on data that will not be collected directly through the proposal (e.g., existing public data or data that might be collected by projects funded in other categories of this RFP). If you are aware of pre-proposals submitted in other funding categories and you have communicated with the lead PIs about how your respective work might be integrated, please describe that here.

Project Management

Describe the organization and management of the project as well as the experience and qualifications of the principal and co-investigator(s). Individuals with full-time equivalent (FTE) positions must indicate standing time availability as authorized by their supervisor. Applicants must seek to avoid duplication of other research efforts; demonstrate how PIs/Co-PIs will coordinate and collaborate with other projects and leverage their proposals with support from other sources. If more than one investigator is involved, the applicant must clearly identify which one will be responsible for the overall work (the designated lead principal investigator), as well as the specific responsibilities of each PI/Co-PI involved in the project.

If applicable, **permits** that may be required to conduct the project must be documented in this Program Management section. If available, permit applications or granted permit numbers should be provided. Permitting requirements are the responsibility of the applicants; NPRB will not financially support the permit application process.

Budget

Budgets must be organized according to federal fiscal years (Oct. 1-Sep. 30) and the budget for each institution should be described separately. Subawards will be issued to each participating institution directly. Each institution will receive incremental subawards, i.e., the total amount of funding will not be awarded at the beginning of the project, but rather, funds will be awarded in two or three increments throughout the project. NPRB will expect that funds issued through initial subawards will be spent on schedule. Please note that all funds are disbursed on a reimbursable basis.

Templates for budget summary (MS Excel format) and budget narrative (MS Word format) are available on the following website ([link](#)).

Budgets must include:

- Funds for all PIs to travel to a kickoff meeting in Anchorage, AK in June 2016 for three days during which the core hypotheses of the program will be decided.
- Funds for lead PIs to travel to logistics planning meetings in Anchorage, AK for two days in October 2016 and 2017.
- Funds for all PIs, Co-PIs, and graduate students to travel to annual PI meetings in Alaska for four days in March 2017-2021.

- Funds for the lead PIs to travel to the Alaska Marine Science Symposium in Anchorage for four days annually in January 2017-2021.
- Detailed budgets for field data collection if applicable to the project. Coordinated field data collection is expected to occur in 2017 and 2018. Field work will only be possible in 2016 if logistics are supported by in-kind contributions from existing projects (i.e., funds awarded through this call for pre-proposals may not be available in time for field work in 2016). Detail the following in your budget: charter costs for vessels or other platforms, number of days at sea, timing (month and year), and source of any in-kind support or leveraged funds. Please indicate in your budget narrative if you anticipate any berth space will be available to collaborators.
- Anticipated other support and cost leveraging per year and organization.
- Support for synthesis activities for at least two years following completion of field data collection.

PI descriptions

Provide a one-page curriculum vitae (that includes current activities and publications relevant to the work proposed) for all Principal Investigators (PIs) and Co-Investigators (Co-PIs) associated with the proposal. PIs and Co-PIs are those who will receive funds. Collaborators are those who will participate in the project but will not request funds; a curriculum vitae is not required for collaborators.

INFORMATIONAL TELECONFERENCE

NPRB will hold a teleconference on Thursday, June 4 at 10 am Alaska Time to provide an overview of the prospective program and information contained in this RFP and to answer questions from participants. A list of interested individuals will be posted on the NPRB Arctic program website following the call. If you are unable to join the call and would like your name added to the list of interested individuals or groups, contact Senior Program Manager Danielle Dickson [Danielle.Dickson@nprb.org]. To join the call, please dial 1-866-694-1319 and enter the PIN 8351 when prompted.

OTHER RESOURCES

The NPRB Arctic Program website includes a list of resources for investigators that proposers may find helpful, including reports of recent synthesis efforts and documents that outline federal research priorities. Please visit: <http://www.nprb.org/arctic-program/resources-for-investigators/>. Also please feel free to contact Science Director Matthew Baker [Matthew.Baker@nprb.org] or Senior Program Manager Danielle Dickson [Danielle.Dickson@nprb.org] with any questions.

PRE-PROPOSAL REVIEW PROCESS

Pre-proposals will be evaluated by the NPRB science and advisory panels, which will make recommendations to the board. The board will decide which pre-proposals to invite to submit full proposals on September 25, 2015 and staff will notify proposers shortly thereafter. Representatives of the other institutions contributing money to the program (BOEM, BSP) will be represented at panel and board meetings and will participate in discussion but will not vote during pre-proposal selection.

Invitations for full proposals

Based on the board's decision, invitations for full proposals will be issued by October 9, 2015. The titles of successful pre-proposals will be made public, as well as the identities and e-mail addresses of the lead Principal Investigators. Full proposals will be expected to discuss how they envision integrating with other potential aspects of the program. Full proposals will likely be due by January 15, 2016. Full proposals will be sent out for peer review, reviewed by the NPRB science and advisory panels in spring 2016 and the board will make funding decisions in May 2016.

Program Integration

Full integration of the funded elements of the program will occur after funding decisions have been announced. NPRB will organize a kick-off meeting in June 2016 for all funded PIs and collaborators, during which the core hypotheses for the program will be decided and the expected contributions of participants identified. A leadership group will be established that includes a representative from each of the main components of the funded program. This leadership group will work closely with the NPRB program manager and will be responsible for overall project management and integration.

TIMELINE

Call for pre-proposals released	May 20, 2015
Pre-proposal submission deadline	July 31, 2015
Invitations for full proposals issued	October 9, 2015
Full proposal submission deadline	January 15, 2016
Proposers notified of funding decisions	May 15, 2016
Initial meeting of Principal Investigators	June 2016
Initial sampling and data synthesis	June 2016
First coordinated field season	June 2017

NPRB anticipates announcing funding decisions in May 2016. Field data collection will only occur in 2016 if logistics are provided through separately-funded projects. Field data collection supported through this program will occur beginning in 2017. NPRB anticipates announcing the availability of additional funds to support synthesis in 2020, however, projects proposed in response to this call should include in their budgets support for synthesis activities for two years following the completion of data collection.



Request for Pre-proposals – Appendix A

May 2015

North Pacific Research Board is cooperating with other funding organizations to formally include the existing projects listed here in the Arctic ecosystem program. These projects will collaborate with projects funded through this call for proposals; the lead Principal Investigators will participate in annual PI meetings, share preliminary data with collaborators, and contribute intellectually to addressing the core hypotheses of the funded research program. Proposers are encouraged to describe how their research would utilize the data and expertise provided by existing projects. Existing projects are not intended to constrain the direction of the new research projects proposed.

Bering Strait mooring program

Funding provided by National Science Foundation

A physical oceanographic year-round mooring program has been maintained in the Bering Strait since 1990, with measurements for other disciplines being incorporated in recent years. For an overview of this prior mooring and accompanying section work, please see Woodgate, Stafford and Pahl (submitted) <http://psc.apl.washington.edu/HLD/Bstrait/BStraitMooringSynthesis2015.html>. Under National Science Foundation Arctic Observing Network (NSF-AON) funding, a set of 3 Bering Strait moorings will be maintained in the strait from summer 2014 to recovery in summer 2018, with annual mooring turn-around cruises, which (as time and weather allow) run accompanying CTD sections (no water samples) in the strait.

Lying all in US waters, the three mooring sites are:

- A2 (center of US channel);
- A4 (east side of US channel, measuring the Alaskan Coastal Current); and
- A3 (central to the strait about ~ 35km north of the Diomed Islands, at a site found to give a useful average of the flow through the Russian and US channels of the strait).

The data from the 3 moorings sites (combined with some satellite data) allow hourly quantification of the volume, heat and freshwater fluxes through the strait and an estimate of the physical water properties of the mean flow, of the waters in the US and Russian channels, and of the Alaskan Coastal Current. These data are being combined with modeling results (Heimbach and Nguyen, MIT) and traditional knowledge (Raymond-Yakoubian, Kawerak, Inc) to yield a fuller understanding of the properties of the throughflow.

Each mooring carries lower level (~45m) and upper level (~17m) temperature and salinity sensors and an upward looking ADCP measuring water velocity in 2m bins to the surface, and some measure of ice thickness and ice velocity. (All instruments are internally recording, thus data are only available after recovery, and data calibration.) All calibrated data and data products are available via our website

(psc.apl.washington.edu/BeringStrait.html), ACADIS and NODC. See e.g., the 2014 cruise report for full details, including mooring locations, cruise maps, and preliminary results (Woodgate et al., 2014, Bering Strait Norseman II 2014 Mooring Cruise Report, 73 pp, available at <http://psc.apl.washington.edu/BeringStrait.html>).

For further details (e.g., re data collaborations or possible additions to the moorings), contact Rebecca Woodgate.

Rebecca Woodgate, University of Washington, (206) 221-3268, woodgate@apl.washington.edu, psc.apl.washington.edu/BeringStrait.html

Arctic Marine Biodiversity Observing Network (AMBON)

Funding provided by Bureau of Ocean Energy Management, National Oceanic and Atmospheric Administration, and Shell

This study will build on emerging distributed biological observatories (DBOs) by developing a prototype ecosystem-based marine biodiversity network over offshore oil and gas lease areas in the Chukchi Sea, monitoring multiple trophic levels and species, and informed by historical data and past modeling efforts. Such a network will: expand upon planned and recently-launched observing sites, systems, and programs; employ innovative techniques for data discovery and methods that dynamically interrelate data sets and add value to existing monitoring data; collaborate with the U. S. Integrated Ocean Observing System (U.S. IOOS) participants and funding agencies to optimize data management and modeling capabilities.

Katrin Iken, University of Alaska Fairbanks, (907) 474-5192, kbiken@alaska.edu, <https://www.sfos.uaf.edu/>

Aerial Survey Arctic Marine Mammals (ASAMM)

Funding provided by Bureau of Ocean Energy Management

Bowhead whales, gray whales, beluga whales, Pacific walrus, polar bears, bearded seals, and other species of ice seals are known to seasonally occupy the Chukchi Sea. All of these species are subject to changes in environmental variables such as oceanographic currents, sea temperature, sea ice cover, prey availability, and anthropogenic impacts. Having a good understanding of the seasonal distribution, relative abundance, and habitat use of marine mammals in the Chukchi Sea is fundamentally important to evaluating the potential environmental impacts associated with oil and gas exploration and development and other anthropogenic activities. Aerial surveys of marine mammals are an efficient tool because they offer quick coverage of large marine areas. Past surveys are available for comparison with new data to assess whether changes in distribution or abundance have occurred since the earlier surveys were completed.

Megan Ferguson, National Oceanic and Atmospheric Administration, (206) 526-6274, Megan.Ferguson@noaa.gov, <http://www.nmfs.noaa.gov/>

Chukchi Acoustic, Oceanography and Zooplankton Study (CHAOZ)

Funding provided by Bureau of Ocean Energy Management

Baleen whales are subject to changes in environmental variables such as oceanographic currents, sea temperature, sea ice cover, prey availability, and anthropogenic impacts. Extreme ice-retreat and climate warming in the western Arctic over the last decade is anticipated to lead to changes in species composition and distribution, evidenced already through local knowledge and opportunistic observations. Hanna Shoal in the northeast Chukchi Sea is an area of special biological concern bordering the boundary between Chukchi and Arctic Ocean waters and its importance bowhead, gray and other whales, as well as walruses and ice seals, is not well known. The shallower waters of the shoal have long been known as traps for grounding of sea ice, and the creation of reoccurring polynyas. In most recent years, floating pack ice in summer persists in this area longer than elsewhere in the Chukchi, often surrounded by open water even to the north. Biological “hot spots” in the Chukchi Sea are thought to be related to coupled pelagic and benthic productivity.

Catherine Berchok, National Oceanic and Atmospheric Administration, (206) 526-6331,
Catherine.Berchok@noaa.gov, <http://www.nmfs.noaa.gov/>

Characterization of the Circulation on the Continental Shelf Areas of the Northeast Chukchi and Western Beaufort Seas

Funding provided by Bureau of Ocean Energy Management

This study is a continuation and expansion of the existing surface circulation study within the northeast Chukchi Sea. Prior to 2009, surface current observations on the Chukchi shelf were extremely limited. Through a joint Industry/BOEM supported study, the University of Alaska Fairbanks (UAF), Coastal Marine Institute began measuring surface currents during the open water period on the Chukchi shelf beginning in September 2009 with the deployment of long range, High Frequency (HF) radar systems located at the villages of Barrow and Wainwright. In 2010, coverage was expanded to the southwest to include additional offshore lease areas. The surface current data was supplemented by water column profile data collected by Slocum Gliders. Acoustic Doppler current profilers (ADCPs) were also deployed across the Alaska Coastal Current at the head of Barrow Canyon to assess the annual flow regime, the connectivity between surface and subsurface currents during the open water season, and the changes in subsurface currents beneath the mobile pack ice and lead system during the winter months. This study will expand present efforts to improve understanding of the flow regime and shelf dynamics between the inner and outer Chukchi shelf, the exchange of waters between the Chukchi Sea and western Beaufort shelf through Barrow Canyon, and the upwelling of Atlantic Waters.

Thomas Weingartner, University of Alaska Fairbanks, (907) 474-7993, tjweingartner@alaska.edu,
<https://www.sfos.uaf.edu/>

Distribution of Fish, Crab and Lower Trophic Communities in the Chukchi Sea Lease Area

Funding provided by Bureau of Ocean Energy Management

This study proposes to develop a broader understanding of abundance and distribution of demersal and pelagic fish, crab, and lower trophic communities needed to evaluate and mitigate the effects of offshore oil and gas development. Formerly, several BOEM funded studies have identified temporal, seasonal, and spatial gaps in data on fish in the Chukchi Sea near the lease areas. This study is designed specifically to fill these information needs. It will build upon recent information on invertebrate communities in the Chukchi offshore lease area obtained by the 2009 study “Chukchi Sea Offshore Monitoring in Drilling Area (COMIDA): Chemistry and Benthos (CAB).” It will create a similar survey design such that data sets are compatible, comparable, and extend the time series and contribute to further knowledge of pelagic fishes in the northeast Chukchi Sea.

Franz Mueter, University of Alaska Fairbanks, (907) 796-5448, fmueter@alaska.edu,
<https://www.sfos.uaf.edu/>

Marine Arctic Ecosystem Study (MARES)

Funding provided by Bureau of Ocean Energy Management

This project intends to collect additional comprehensive and integrated information in the Arctic on the spatio-temporal distribution of fundamental physical, biological and chemical variables, their associated interactions and regulating mechanisms, as well as the distribution of cultural and subsistence resources which sustain local communities. This information will be used to better understand and assess arctic ecosystem sensitivities and vulnerabilities as a function of space and time to aid decision-makers in minimizing the impact of the oil and gas industry on the Outer Continental Shelf. The resulting information will support NEPA analyses, environmental impact assessments, in validating models, as well as in Oil-Spill Risk Analysis. Additionally, these observations and improved description and understanding of biogeochemical and physical interactions will aid to improve the accuracy of model simulations and forecasts. Coordinated observational and modeling efforts will produce information that will be analyzed from different perspectives: a) ecosystem understanding and environmental protection, b) climate change and monitoring, and c) Oil-Spill Risk Analysis.

Francis Weise, Stantec Consulting, (907) 343-5276, francis.wiese@stantec.com, <http://www.stantec.com/>

Lori Quakenbush, Alaska Department of Fish & Game, (907) 459-7214, lori.quakenbush@alaska.gov,
<http://www.adfg.alaska.gov/index.cfm?adfg=divisions.wcoverview>

NE Chukchi Sea Moored Ecosystem Observatory

Funding provided by Alaska Ocean Observing System, North Pacific Research Board, Olgoonik-Fairweather, University of Alaska Fairbanks, Université Laval, and University of Washington

A multi-institutional, multi-investigator partnership operates and maintains a subsurface moored observatory on the NE Chukchi shelf near 71.6N, 161.5W. The first deployment occurred in September 2014 and the mooring will be re-deployed annually through at least 2018.

The instruments record with high temporal resolution throughout the year, including the under-sampled and poorly understood seasons when sea ice typically inhibits ship-based sampling. Measurements include ice, ocean physics, nutrient and carbonate chemistry, particulate matter, phytoplankton, zooplankton, fisheries, and marine mammal datasets, thereby providing multifaceted views into the inter-trophic co-variability of the Chukchi shelf ecosystem. The scientific objectives of this monitoring effort are to:

1. Quantify hourly, daily, seasonal, annual, and inter-annual variations in selected physical, chemical, and biological measurement parameters on the shallow Chukchi Sea continental shelf.
2. Relate the timing and magnitude of fluctuations in nutrient and carbonate chemistry, particulate, and fish/zooplankton parameters to the current field and the physical hydrography, wind, light, and ice environment.
3. Provide researchers and resource managers with a broad-spectrum and multi-year set of reference observations that can be applied to evaluating and improving regional and global-scale biogeochemical, ice-ocean circulation, ecosystem, and stock-assessment models.

The observatory consortium welcomes new partners, new applications of the data already being collected, and new instrumentation that can further enhance the value of the existing efforts.

In accordance with the NPRB data policy, all data collected on this mooring are publicly available. There will be two data releases associated with each dataset. The first will come immediately after the recovery cruise and will include raw, unprocessed, data for users with time-sensitive applications. The second release includes fully processed data following requisite calibrations, application of calibration coefficients, and editing, typically within ~6 months of mooring recovery. Additional details about the mooring configuration, data policy, and the observatory consortium are available online at: <http://mather.sfos.uaf.edu/~seth/CEO>.

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Northern Bering Sea bottom trawl survey

Funding provided by National Oceanic and Atmospheric Administration

Biennial northern Bering Sea (NBS) shelf surveys will start in 2017. This survey will provide long-term monitoring of bottom fishes, crabs, and other demersal macrofauna to help provide a better understanding of how biota and the ecosystem are responding to climate change and loss of sea ice. The ultimate goal is a long time-series of standardized data collections that will provide quantitative indices of abundance for determining how climate change is affecting population trends and community structure. The expanded survey data collections from the NBS will also augment those from the eastern Bering Sea (EBS) shelf and provide new insight into the spatial and temporal response of bottom fish and crab populations to

highly variable interannual ice cover and summer bottom temperatures across the entire eastern Bering Sea shelf. Digital data are available online (http://www.afsc.noaa.gov/RACE/groundfish/survey_data/data.htm).

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Northern Bering Sea BASIS (Bering-Arctic Subarctic Integrated Survey)

Funding provided by National Oceanic and Atmospheric Administration

The northern Bering Sea BASIS survey will continue in 2016 and 2018. These surveys will assess the relative abundance, size, and energetic status of late summer/early fall fish species such as western Alaska juvenile Chinook and chum salmon, capelin, herring, juvenile pollock, and saffron cod. Bio/physical oceanographic data will also be collected to assess the impact of climate change and variability on the ecosystem. When combined with the southeastern Bering Sea BASIS survey, the resulting survey effort will cover much of the eastern Bering Sea shelf. Digital data are available from the program leader Ed Farley.

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Chukchi Ecology and Seal Survey (CHESS)

Funding provided by National Oceanic and Atmospheric Administration

A comprehensive survey for the abundance and distribution of bearded and ringed seals in the Chukchi Sea will be conducted in 2016. In collaboration with the U.S. Fish and Wildlife Service, the objectives may be expanded to include polar bears. The survey will be based on coupled infrared and color imagers. Animals will be detected by infrared video and the species will be identified from high-resolution color photographs, a method demonstrated to be highly effective in recent surveys of the Bering Sea pack ice zone. Because large portions of the bearded and ringed seal populations use the Russian waters of the western Chukchi Sea, the survey will require collaboration with the Russian Federation. The Chukchi survey will complement the results of the Bering Sea survey, leaving only the Beaufort Sea as a gap in complete estimates of the breeding populations of ice seals in the seas surrounding Alaska.

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Influence of sea ice on ecosystem shifts in Arctic seas

Funding provided by U.S. Geological Survey Changing Arctic Ecosystems Initiative

The decline of Arctic sea ice is predicted to promote an ecosystem shift from benthic-dominated to pelagic-dominated communities on Arctic shelves, raising concern for species like walrus and eiders that feed on benthic organisms. Sea ice dynamics are thought to support a rich benthic ecosystem by promoting the export of surface primary production to the ocean floor. As sea ice extent diminishes, more prolonged open-water phytoplankton blooms and increased zooplankton grazing may increasingly route surface primary production to pelagic consumers. The pace of declining benthic production has been difficult to quantify, leaving resource managers with much uncertainty. We propose to relate annually resolved growth increments in benthic bivalves with satellite derived sea ice records to develop a predictive relationship between sea ice and benthic production. Bivalves are a key prey item for both walrus and eiders. The relative contributions of sea ice algae and phytoplankton, the two major sources of surface primary production, will also be described for bivalves using stable isotope analysis. Changes in bivalve size will be converted to differences in caloric content available to predators. Combining these products with model projections of future sea ice cover will allow us to predict the pace of shifts in benthic production, clarify the underlying mechanism, and enhance forecasts of the population response of Department of Interior managed species to a changing Arctic environment. (Funded FY2014-FY2019)

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Regional Arctic System Model (RASM)

Funding provided by U.S. Office of Naval Research

The Regional Arctic System Model (RASM) has been developed to advance capability in simulating critical physical processes, feedbacks and their impact on the Arctic climate system and to reduce uncertainty in its prediction. RASM is a limited-area, fully coupled ice-ocean-atmosphere-land model that uses the Community Earth System Model (CESM) framework. It includes the Weather Research and Forecasting (WRF) model, the LANL Parallel Ocean Program (POP) and Community Ice Model (CICE) and the Variable Infiltration Capacity (VIC) land hydrology model. In addition, a streamflow routing (RVIC) model was recently implemented in RASM to transport the freshwater flux from the land surface to the Arctic Ocean. Finally, marine biogeochemistry components are currently being implemented in the ocean and sea ice components to expand RASM capability into Arctic ecosystem studies. The model domain is configured at horizontal resolution of $1/12^\circ$ (or ~9km) for the ice-ocean and 50 km for the atmosphere-land model components. It covers the entire Northern Hemisphere marine cryosphere, terrestrial drainage to the Arctic Ocean and its major inflow and outflow pathways, with optimal extension into the North Pacific / Atlantic to model the passage of cyclones into the Arctic. All RASM components are coupled at high frequency to realistically represent interactions among model components at inertial and longer time scales.

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<http://www.oc.nps.edu/NAME/RASM.htm>