USGS
science for a changing world

An Evaluation of the Science Needs to Inform Decisions on Outer Continental Shelf Energy Development in the Chukchi and Beaufort Seas, Alaska

Background

On March 31, 2010, Secretary of the Interior Ken Salazar announced a national strategy for Outer Continental Shelf (OCS) oil and gas development. In that announcement, the Administration outlined a three-pronged approach (U.S. Department of the Interior, 2010a):

> ***Development:*** "…expand development and production throughout the Gulf of Mexico, including resource-rich areas of the Eastern Gulf of Mexico…"
>
> ***Exploration:*** "…expand oil and gas exploration in frontier areas, such as the Arctic Ocean and areas in the Atlantic Ocean, to gather the information necessary to develop resources in the right places and the right ways."
>
> ***Conservation:*** "…calls for the protection of special areas like Bristol Bay in Alaska…national treasure[s] that we must protect for future generations."

In a companion announcement (U.S. Department of the Interior, 2010b), within the Administration's "Exploration" component, the Secretary asked the U.S. Geological Survey (USGS) to conduct an initial, independent evaluation of the science needs that would inform the Administration's consideration of the right places and the right ways in which to develop oil and gas resources in the Arctic OCS, particularly focused on the Beaufort and Chukchi Seas (fig. 1).

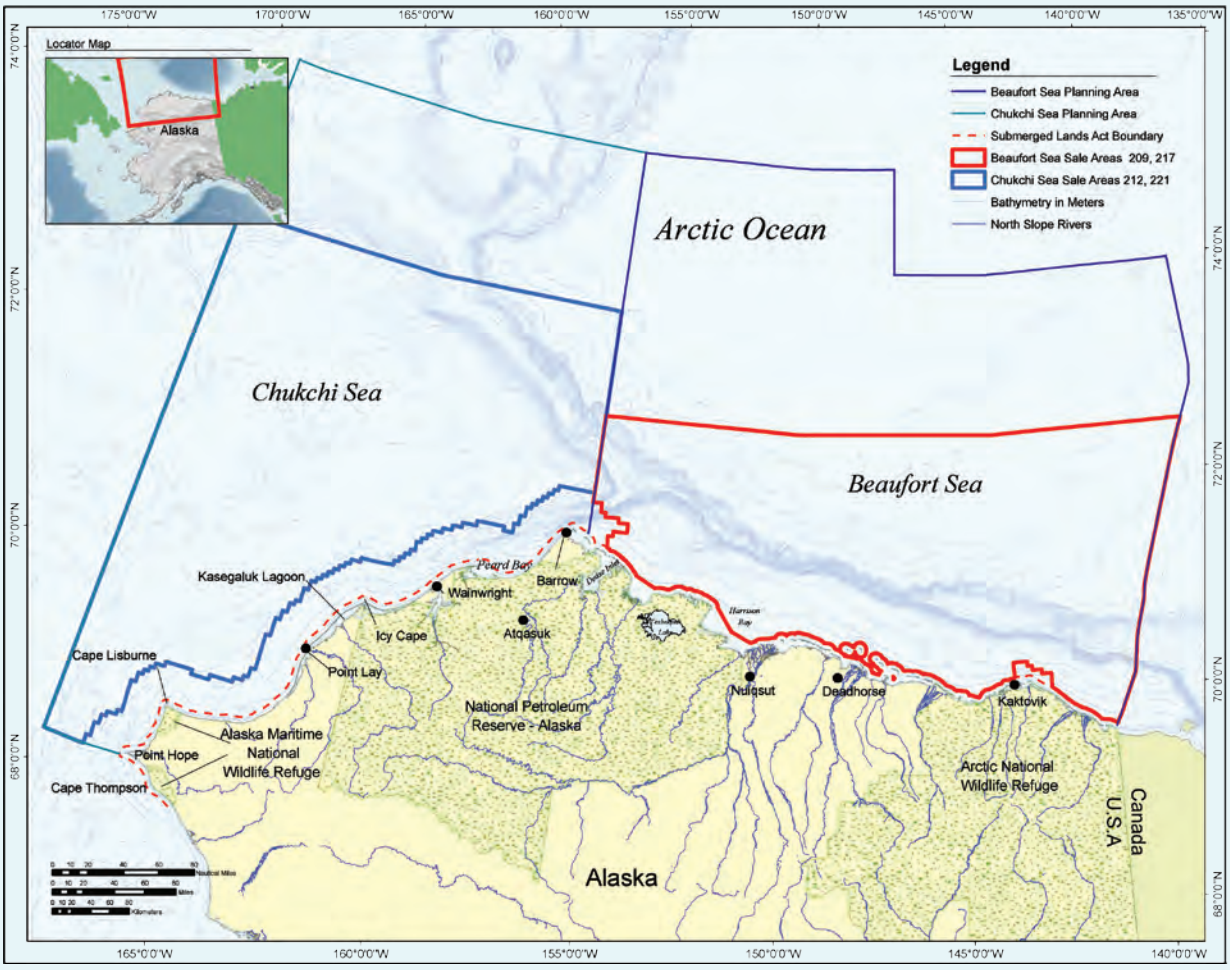

Figure 1. North Slope of Alaska from Point Hope to the United States–Canada border showing principal coastal communities, Outer Continental Shelf oil and gas leasing areas, and major Federal land holdings. From the Bureau of Ocean Energy Management, Regulation and Enforcement, formerly the Minerals Management Service (2008).

Oil and gas potential is significant in Arctic Alaska (fig. 2). On Alaska's North Slope, the Nation's largest oil field, Prudhoe Bay, has been in production for several decades. Oil has been produced from the Beaufort Sea OCS since the early 2000s, and the Arctic OCS potential for production of additional oil and gas resources is significant. Beyond petroleum potential, this region supports unique fish and wildlife resources and ecosystems, and indigenous people who rely on these resources for subsistence. While the potential for, and interest in, energy resources is clear, there is significant public discourse over the ability to develop oil and gas resources safely, to understand environmental and social consequences of any development, and to implement effective impact prevention and mitigation strategies. Such discourse often revolves around different views on the sufficiency of the scientific information available to evaluate energy development options and to understand environmental sensitivity in this frontier area.

The USGS was asked to summarize key existing scientific information, develop a rapid process to identify where knowledge gaps exist, and provide initial guidance of what new and (or) continued research could improve decision making. Determining what is a "science gap" or what is "sufficient science" is difficult. These concepts vary with the values and beliefs of every concerned individual when faced with complex issues and uncertainty. Decisions to develop resources in the Arctic are inherently difficult because they must consider factors such as the economic stakes, Native traditions, environmental risks, and multiple objectives.

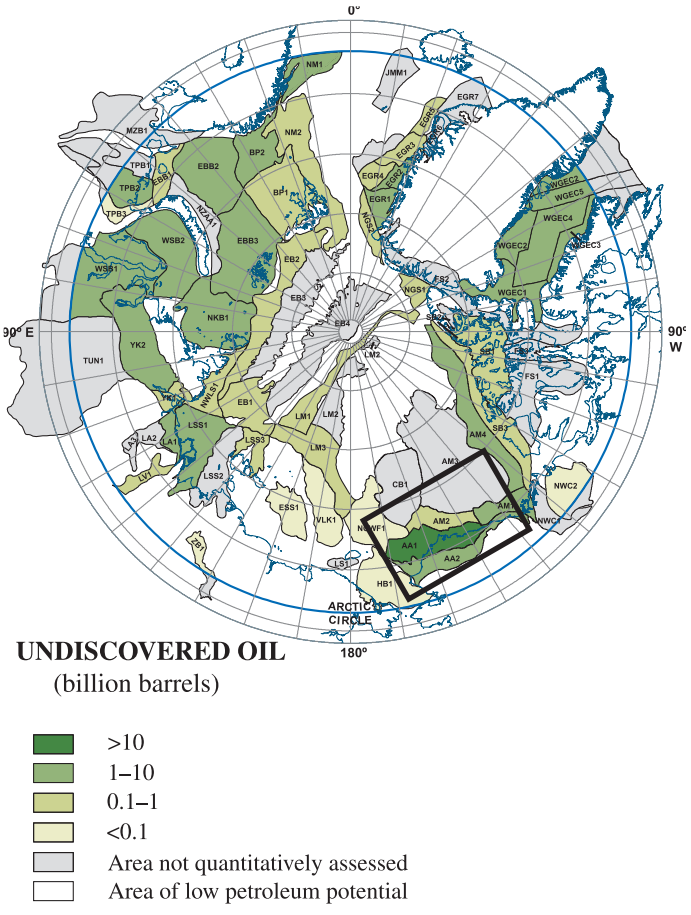

Figure 2. Assessment units of the Circum-Arctic Oil and Gas Assessment, color-coded according to the mean estimated undiscovered, technically recoverable oil resources. The open rectangle denotes the approximate location of the Alaska North Slope and Beaufort and Chukchi Seas OCS areas. Modified from Gautier and others (2009).

High levels of project uncertainty are inherent in working in a frontier environment. Decisions are complicated because multiple choices need to be made and multiple organizations must make those choices.

Thus, the USGS OCS Team took an inclusive approach to its "science gap and sufficiency" evaluation by not only examining available literature, but also gathering input from many entities that influence decisions about what science is "needed" for oil and gas development in the Arctic OCS.

The USGS OCS Team examined more than 400 scientific publications, workshop findings, science policy documents, and web sites. The team met with more than 40 individuals and organizations that have research or science assessments on these issues. Our group conducted a series of structured discussion sessions with key vested parties, including Alaska North Slope and Native interests, the oil industry, State of Alaska, Federal regulatory agencies, and non-regulatory organizations. Finally, we held a special session at the Alaska Marine Science Symposium (in Anchorage, January 2011) to gain focused input from the science community on key topics.

Results

The USGS developed more than 50 findings and an equal number of recommendations in the course of our examination of these topics. Specific and detailed scientific information, key knowledge gaps, and recommendations are presented in Holland-Bartels and Pierce (2011). Those recommendations are important for understanding what the USGS discovered in the course of this study and to help inform and improve decision making. In this Fact Sheet, we provide a high-level summary and synthesis of our findings to help inform the Secretary of the Interior's considerations to develop oil and gas resources in the Arctic OCS.

Climate change is impacting physical, biological, and social conditions in the Arctic and affecting all resource-management strategies. Climate conditions in the Arctic have been undergoing remarkable changes, particularly during the last 20 years. Climate model projections show pronounced warming that will continue to change the physical environment and ecological conditions (for example, ocean acidification, sea-ice ecosystems, species response). While international development of global climate models is progressing rapidly, forecasting techniques currently lack sufficient regional grain, particularly in the Arctic. Thus, a more refined regional understanding of climate change is required to help clarify development scenarios. Uncertainties exist on topics for which more science focus is required, including: (1) physical parameters, such as storm frequency and intensity, and circulation patterns, and (2) species' response to environmental changes, for which periodic population and distributional surveys could provide key data.

A key aspect critical to any development planning scenario is sufficient information for effective ***oil-spill risk assessment, preparedness, and response***. There have been significant advances in spill-risk evaluation and response knowledge, but concern remains that key inputs to spill models (oceanographic, weather, ecological) are insufficient and that the manner in which ecological data are included is not always clear, nor quantitative. Further, the applicability of laboratory and mesoscale studies to full field conditions remains largely untested, although international efforts are improving this foundation. Both the *Exxon Valdez* and the *Deepwater Horizon* oil spills demonstrate that spill contingency planning and a suite of spill response tools must be available

and effective. Significant questions exist about the scientific and technical information needed for contingency planning and prompt emergency response (response gap) in the Arctic, which are potentially complicated by a changing climate.

Inherent in understanding the full suite of impacts—both beneficial and detrimental—is the need to understand the cumulative effects of all changes (human and natural) in the Arctic. The development of a comprehensive, quantitative, cumulative effects analysis for the Arctic OCS remains a challenge. Numerous efforts have been unsuccessful at developing a transparent, quantitative, and comprehensive method to assess cumulative impacts. This methodology challenge, combined with the lack of available foundational geospatial data for the Arctic OCS, makes the process and findings of cumulative impact analyses inadequate to a broad suite of stakeholders. Climate change exacerbates this challenge by influencing the baseline such that it becomes a "moving" target. Thus, development of new, more analytical approaches to cumulative analyses would likely benefit the overall decision making on oil and gas development options.

Resonating throughout every topic we studied were several overarching themes, which include the need for: (1) ***large-scale synthesis of data and information,*** (2) ***enhanced dialog and collaborative science planning,*** and (3) ***a more transparent and inclusive planning and decision-making process.***

Information and data in the Arctic are emerging rapidly, but most studies focus on subjects with small spatial and temporal extent and are independently conducted with limited synthesis. Access to information, especially in Arctic frontier areas, is critical to move forward strategically. Thus, large-scale synoptic efforts are needed to synthesize the many studies, on a full range of topics and on individual topics, by many researchers and organizations examining the Arctic. One example, from onshore Alaska (fig. 3), shows the type of data synthesis that is needed to inform decision making.

Enhanced dialog and collaborative science planning are essential, both domestically and internationally. There are many entities in the "decision arena" of *Federal* oil and gas development, all of which bring critical information to the decision process and have responsibility along the spectrum of potential

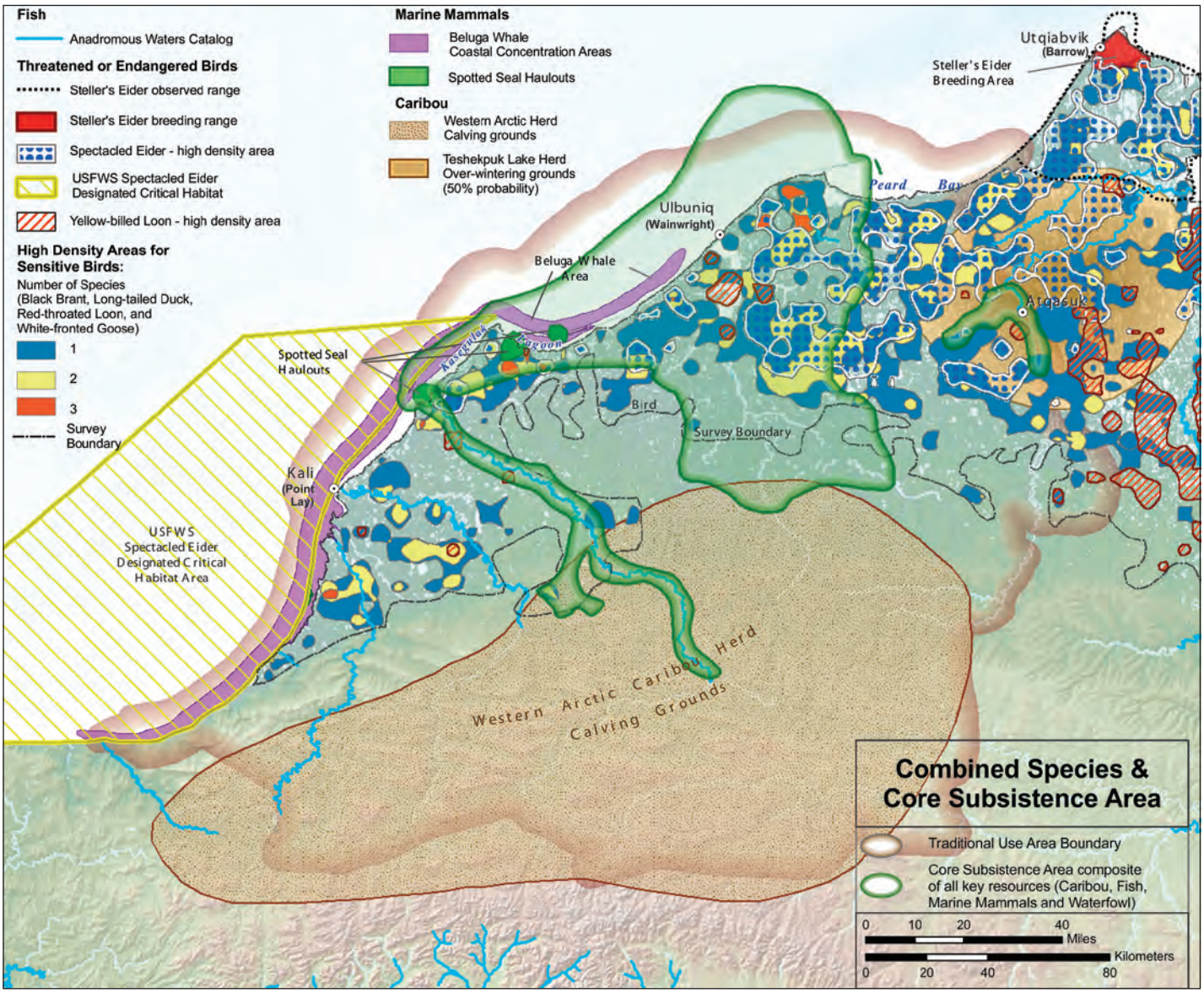

Figure 3. Combined sensitive species habitat areas and core subsistence areas for onshore Arctic Alaska. Modified from The Nature Conservancy and Wainwright Traditional Council (2008).

development. The many planning processes and consultations do not necessarily develop a consensus view on science gaps. There is a need for additional science dialogue with *Native communities* to more comprehensively incorporate local traditional knowledge into decisions. Significant research also is being conducted *internationally*, and emerging opportunities exist with other Arctic Nations. Enhanced science dialog and joint efforts would benefit all countries.

All these efforts will lead to a more transparent and inclusive science planning and decision-making process. Tools like Structured Decision Making (SDM) help the decision maker develop the fullest possible understanding of the complexities of the decision, including decision objectives, tradeoffs, uncertainties, and risks (fig. 4). In our discussions with individuals and groups, it became clear that evaluating science needs and filling identified science gaps will not be sufficient to address the many issues surrounding energy development in the Arctic. People have strong feelings about oil and gas development, which span the spectrum—some think there is already enough science and some think there will never be enough science. There are clearly areas of significant scientific research that form a sound basis upon which to make decisions; there are clearly areas where additional science is needed; but there also is an area in which more than science is needed. For that reason, we suggest the use of tools like Structured Decision Making to promote broad, transparent, and structured participation to inform decisions about energy development in the Arctic.

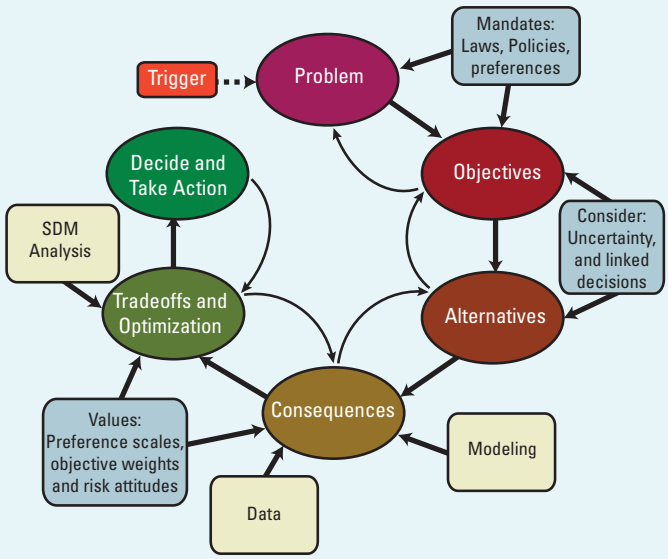

Figure 4. Schematic representing various steps included in a Structured Decision Making process. Modified from U.S. Fish and Wildlife Service (2008).

Thus, while there is a growing base of scientific and technical information for the Arctic, which is synopsized in Holland-Bartels and Pierce (2011), as are science gaps that should be addressed, many of the challenges emerging in Arctic oil and gas development decision making are beyond the ability of science alone to resolve. A collaborative and comprehensive Arctic science planning process would bring great value to the decisions required to proceed with development of oil and gas and other strategic assets in the Arctic in a changing climate environment. Such a science plan and its implementation must be informed by an SDM-like process and the syntheses of information we discussed above. This process needs to include appropriate measures of accountability for all responsible parties or entities. In our many discussions, we heard that managers, responders, scientists, and community members are willing to engage in discussing information needs, but they have a growing expectation that those needs will be considered and, if appropriate, addressed in a visible, documented manner.

References Cited

Gautier, D.L., Bird, K.J., Charpentier, R.R. , Grantz, A., Houseknecht, D.W., Klett, T.R., Moore, T.E., Pitman, J.K., Schenk, C.J., Schuenemeyer, J.H., Sorensen, K., Tennyson, M.E., Valin, Z.C., and Wandrey, C.J., 2009, Assessment of undiscovered oil and gas in the Arctic: Science, v. 324, no. 5931, p. 1175-1179, doi:10.1126/science.1169467, accessed April 27, 2011, at http://www.sciencemag.org/content/324/5931/1175.short.

Holland-Bartels, Leslie, and Pierce, Brenda, eds., 2011, An evaluation of the science needs to inform decisions on Outer Continental Shelf energy development in the Chukchi and Beaufort Seas, Alaska: U.S. Geological Survey Circular 1370, 278 p. (Also available at http://pubs.usgs.gov/circ/1370/.)

Minerals Management Service, 2008, Beaufort Sea and Chukchi Sea Planning Areas: Oil and Gas Lease Sales 209, 212, 217, and 221: Draft Environmental Impact Statement, OCS EIS/EA MMS 2008-0055.

The Nature Conservancy and Wainwright Traditional Council, 2008, Wainwright Traditional Use Area Conservation Plan Map Book: Anchorage, Alaska, 40 p.

U.S. Department of the Interior, 2010a, Secretary Salazar Announces Comprehensive Strategy for Offshore Oil and Gas Development and Exploration: Press Release, March 31, 2010, available at http://www.doi.gov/news/pressreleases/2010_03_31_release.cfm.

U.S. Department of the Interior, 2010b, Secretary Salazar Unveils Arctic Studies Initiative that will Inform Oil and Gas Decisions for Beaufort and Chukchi Seas: Press Release April 13, 2010, available at http://www.doi.gov/news/pressreleases/2010_04_13_releaseA.cfm.

U.S. Fish and Wildlife Service, 2008, Structured Decision Making: Fact Sheet—October 2008: accessed April 25, 2011, at http://www.fws.gov/science/doc/structured_decision_making_factsheet.pdf.

Authors: Leslie Holland-Bartels and Brenda Pierce

For more information, contact:

Energy Resources Program Coordinator
U.S. Geological Survey, MS 915A
Reston, VA 20192

Regional Executive, Alaska
U.S. Geological Survey
4210 University Drive
Anchorage, AK 99508