



MARINE MAMMAL COMMISSION

18 September 2014

Mr. Michael S. Rolland
Chief, Leasing Section
Bureau of Ocean Energy Management
3801 Centerpoint Drive, Suite 500
Anchorage, AK 99503-5823

Dear Mr. Rolland:

The Marine Mammal Commission, in consultation with its Committee of Scientific Advisors on Marine Mammals, has reviewed the Bureau of Ocean Energy Management (BOEM) Call for Information notices regarding the Beaufort Sea Lease Sale 242, scheduled to be held in 2017 (79 Fed. Reg. 44060). The Commission provides the following recommendations regarding environmentally sensitive areas in the Beaufort Sea that BOEM should evaluate and consider eliminating from the lease sale.

Background

Several species of marine mammals spend all or part of the year in the Beaufort Sea planning area. All are protected under the Marine Mammal Protection Act (MMPA), and some, including bowhead whales, polar bears, and ringed seals, are also protected under the Endangered Species Act (ESA). Arctic marine mammals also represent important subsistence and cultural resources for Native communities of northern and western Alaska. The MMPA authorizes Alaska Natives to take marine mammals for subsistence purposes and for creating and selling authentic native articles of handicrafts and clothing. Expansion of oil and gas activities in the Beaufort Sea and the potential impacts of that expansion on marine mammals, their environment, and Alaska Natives therefore are of particular concern. BOEM, the National Oceanic and Atmospheric Administration (NOAA), Fish and Wildlife Service (FWS), U.S. Geological Survey (USGS), the state of Alaska, the North Slope Borough, the oil and gas industry, and other entities have made significant investments in research to characterize the physical and biological processes of the Beaufort Sea and to assess the impacts of oil and gas development on marine mammals, the marine environment, and subsistence communities. Nevertheless, considerable uncertainty remains regarding the long-term, sublethal, and cumulative environmental effects of oil and gas development and how to minimize and mitigate the impacts of such development on Arctic marine mammals and Alaska Native communities (Holland-Bartels and Pierce 2011, Clement et al. 2013).

In light of this uncertainty, and in recognition of federal laws protecting marine mammals and recognizing the importance of marine mammals to Alaska Native subsistence hunters, the Commission supports BOEM's approach of ensuring that the geographical scope of any Beaufort Sea lease sale is carefully delimited and specified, as opposed to the area-wide leasing approach that has been followed in previous lease sales. It is important to identify and evaluate environmentally sensitive areas where oil and gas development has the potential to significantly affect both marine mammals and the Alaska Native communities that depend on them for subsistence. This information can then be used to minimize and mitigate impacts on marine mammals and subsistence

activities by either excluding such areas from lease sales or imposing seasonal or other restrictions on oil and gas-associated activities.

The Beaufort Sea as important habitat for marine mammals

Several marine mammal species occur regularly throughout the Beaufort Sea planning area including bowhead whales, beluga whales, polar bears, ringed seals, and bearded seals. Gray whales, ribbon seals, and walrus occur seasonally in the western portion of the planning area, and spotted seals occur in coastal waters (Smith 2010, 2011). The distribution and movements of these species have been studied using aerial surveys, tagging, passive acoustic monitoring, and other methods. Most species tend to exhibit fairly consistent migratory and feeding patterns. Inter-annual variations in seasonal movements can be attributed in part to fluctuations in ice cover, upwelling, and prey availability.

Bowhead whales. Most of the population of the Bering-Chukchi-Beaufort stock of bowhead whales migrates through the Alaskan Beaufort Sea to and from its summer feeding grounds in the eastern Beaufort Sea with well-documented regularity. Bowhead whale seasonal movements were summarized in Moore and Reeves (1993) and further documented by more recent aerial surveys (Clarke et al. 2011a, b, c, 2012, 2013, 2014), tagging studies (ADF&G 2010), acoustic monitoring (Shelden et al. 2013), and traditional knowledge (Huntington and Quakenbush 2009, Huntington 2013). Bowheads typically enter the Beaufort Sea near Point Barrow in April and May of each year after wintering in the Bering Sea and migrating north through the Chukchi Sea in early spring. After passing Point Barrow, whales travel northeastward to as far north as 72° N latitude and then eastward (often passing under extensive sea ice) to primary summer feeding grounds in the eastern Beaufort Sea, with most reaching Amundsen Gulf in May to June. Some animals remain in the Chukchi and western Beaufort Sea throughout the summer. In late August and early September bowheads begin their migration westward across the shelf, leaving the Beaufort Sea by October or November and traveling west and south through the Chukchi Sea and back into the Bering Sea for the winter.

Bowhead whales appear to feed in the Beaufort Sea throughout the spring, summer, and fall. Some feeding occurs in the spring as whales pass through Barrow Canyon on their migration east (Lowry et al. 2004, Moore et al. 2010, Mocklin et al. 2012). Summer feeding occurs primarily in the eastern Beaufort Sea, however some whales may also feed in the Alaskan Beaufort Sea in the summer (Shelden et al. 2013). In the late summer and fall, when whales travel westward on their return trip to the Chukchi Sea, they feed along the way in shallow (<20m) waters near Kaktovik, Camden Bay, Cross Island, Smith Bay, and offshore of Elson Lagoon (Lowry et al. 2004, Huntington and Quakenbush 2009, Ashjian et al. 2010, Moore et al. 2010, Galginitis 2014, Huntington 2013). Late summer and fall feeding also occurs in the middle shelf (20–40m) and shelf break (40–200m) waters of the central Beaufort Sea (Koski and Miller 2009, Christman et al. 2013), in shelf waters off Barrow (Shelden et al. 2013), and in Barrow Canyon (Moore et al. 2010, Shelden et al. 2013). Bowheads feed at the surface, in the water column, and on the bottom (Würsig et al. 1989). Their primary prey includes copepods, euphausiids, and amphipods (Lowry et al. 2004, Moore et al. 2010).

Beluga whales. Two genetically distinct stocks of beluga whales move through the Beaufort Sea planning area during the summer and fall—the Eastern Beaufort Sea stock and the Eastern Chukchi

Sea stock (O’Corry-Crowe et al. 1997, Allen and Angliss 2014). Each has distinct distribution and movement patterns and home ranges (Hauser et al. 2014). Aerial surveys and tagging studies have shown that the Eastern Chukchi Sea stock travels north from the eastern Chukchi Sea to Barrow starting in May (Clarke et al. 1993, Moore et al. 1993, Suydam et al. 2005, Clarke et al. 2014). Barrow Canyon has been identified as core habitat for this stock during the early summer (Hauser et al. 2014). Animals from this stock then travel north and east into continental slope and basin waters of the Beaufort Sea, to as far north as 80° N latitude in moderate to heavy ice conditions (Moore et al. 2000, Suydam et al. 2005, Asselin et al. 2011). The Eastern Beaufort Sea stock also winters in the Bering Sea and travels north in the spring through the Chukchi Sea and east across the Beaufort Sea to the relatively shallow (<80m), immensely productive waters of the Mackenzie River delta, and to western Amundsen Gulf in the eastern Beaufort Sea (Harwood et al. 1996, Harwood et al. 2014, Hauser et al. 2014).

Tagging studies have shown that in the late summer and fall, the two beluga stocks in the Beaufort Sea appear to switch positions longitudinally, with the Eastern Chukchi Sea stock traveling east to the eastern Beaufort Sea and the Eastern Beaufort Sea stock traveling west toward Barrow (Hauser et al. 2014). Both stocks are generally located along the outer edge of the continental shelf and in slope waters during this time (Moore et al. 2000; Clarke et al. 2014, Hauser et al. 2014). Such migratory “switching” results in considerable geographical overlap of the two stocks starting in September and extending through November as they both leave the Beaufort Sea and head south through the Chukchi Sea and back into the Bering Sea for the winter (Suydam et al. 2005, Hauser et al. 2014).

Feeding by beluga whales in the Beaufort Sea has not been well documented but they are thought to feed opportunistically on Arctic cod while in shallow waters of the eastern Beaufort (Welch et al. 1993) and on benthic species in deeper, ice-covered slope and basin waters (Loseto et al. 2008). Also, Alaska Native hunters have identified Camden Bay as a feeding area for belugas and seals (Huntington 2013).

Gray whales. Aerial survey data indicate that gray whales are now more prevalent in Arctic waters than they were in the 1970s and 1980s, probably to take advantage of the increased opportunities for foraging there in what are now seasonally ice-free waters (Perryman et al. 2002, Stafford et al. 2007, Moore et al. 2014). Gray whales are present in the Beaufort Sea from August to October and are seen primarily in the western Beaufort Sea in the Barrow Canyon area and nearshore areas east of Barrow (Clarke et al. 2011a, b, c, 2012, 2013, 2014). Most gray whales observed in these areas were either feeding or traveling. Sightings are reported much less frequently in the central Beaufort Sea. Gray whale calls have been detected in the western Beaufort Sea throughout the winter, from October to May (Stafford et al. 2007).

Ice seals. Four species of pinnipeds occur in or adjacent to the Beaufort Sea planning area—ringed seals, bearded seals, spotted seals, and ribbon seals. Ringed seals are present in the Alaskan Beaufort Sea year round, usually in association with fast ice (Moulton et al. 2002, Frost et al. 2004). They are concentrated close to shore in the late winter and spring, and move offshore with the ice edge as it recedes in the summer (Moulton et al. 2002, Frost et al. 2004). Ringed seals play an important role in Arctic food webs, preying on Arctic cod and a variety of invertebrates and being preyed upon by polar bears (Kelly et al. 2010). Bearded seals generally prefer loose, mobile pack ice with 70 to 90 percent coverage, cracks in large floes, and shorefast ice (Ray et al. 2010). They are

present year-round on the Beaufort Sea continental shelf, typically in waters <200m. They prey mainly on benthic invertebrates and demersal fishes (Kovacs 2002, Cameron et al. 2010, MacIntyre et al. 2010, Quakenbush et al. 2011). Spotted and ribbon seals are typically associated with pack ice in open waters of the continental shelf (Laidre et al. 2008). Spotted seals are found throughout the Alaskan Beaufort Sea in the summer and occur close to shore particularly near coastal haul-out sites (<20m water depth; Rugh et al. 1997, Smith 2010, 2011). Ribbon seal occurrence is limited to the summer and fall in shelf and slope waters of the western Beaufort Sea (Boveng et al. 2008). Both spotted and ribbon seals feed on mid-water and benthic fishes (Laidre et al. 2008).

Walrus. Pacific walrus range across the Russian and U.S. Chukchi Sea, with occasional occurrence in the western Beaufort Sea (Jay et al. 2010, Garlich-Miller et al. 2011). Walrus haul out on sea ice and feed primarily on benthic invertebrates in waters less than 80m deep (Fay and Burns 1988). The nutrient-rich waters of the U.S. Chukchi Sea, and particularly Hanna Shoal (Dunton 2012), provide important summer and fall feeding areas for walrus (Jay et al. 2012). Benthic productivity is generally lower in the Beaufort Sea than the Chukchi Sea (Codispoti et al. 2013), which presumably limits foraging opportunities for walrus in the Beaufort Sea.

Polar bears. The southern Beaufort Sea population of polar bears is distributed throughout the Beaufort Sea planning area (Schliebe et al. 2006). The Chukchi Sea population of polar bears also occurs regularly in the western portion of the Beaufort Sea to 153° W longitude, and has been tracked as far east as Camden Bay (Amstrup et al. 2002, Amstrup et al. 2005). Annual movement patterns vary within the home ranges of individual bears, and are correlated with ice type and the availability of ringed seals, their major prey item (Amstrup 2000). FWS is revisiting the designation of critical habitat for polar bears, which the Commission expects will include consideration of barrier island, terrestrial denning, and sea ice habitats.

Sensitivity of Arctic marine mammals to climate change

The effects of climate change on physical, chemical, biological, and human components of Arctic ecosystems are many, far-reaching, and accelerating. The rapid decline of multi-year sea ice¹ in the Beaufort Sea will result, or has already resulted, in habitat loss and changes in foraging patterns for ice-obligate species such as ringed seals, bearded seals, walrus, and polar bears (Schliebe et al. 2006, Gleason and Rode 2009, Kelly et al. 2010, Jay et al. 2012, Pagano et al. 2012, MacIntyre et al. 2013), with continued declines in sea ice projected to have detrimental effects on reproduction and survival (Cameron et al. 2010, Hunter et al. 2010, Kelly et al. 2010, MacCracken 2012). Ice-associated species, such as bowhead whales, beluga whales, ribbon seals, and spotted seals, and their prey species, are expected to experience shifts in distribution which may affect foraging success (Moore 2008, Huntington 2009, Kovacs et al. 2010, Grebmeier 2012, Clarke et al. 2014, Moore et al. 2014: Fig 11.10).

At the same time declines in the extent and thickness of summer sea ice in the Arctic are creating expanded economic opportunities. In much of the Arctic, the earlier disappearance of sea ice from coastlines coupled with the ice's retreat farther from shore during the summer and tendency to remain offshore longer in the fall means there is now a large and growing seasonal window of open water that creates additional opportunities for oil and gas exploration and

¹ <http://nsidc.org>

development, shipping, tourism, commercial fishing, and military operations (Huntington 2009). These activities increase potential threats to Arctic marine mammals, including ship strikes, pollution, entanglement in fishing nets or lines, exposure to pathogens and anthropogenic sound, and other forms of disturbance.

Our challenge in the short term is to understand the effects of climate change, anticipate the impacts on Arctic species, and provide protective measures that support the adaptation of those species and the human communities dependent upon them to the fullest extent possible. Understanding the impacts of climate change will also be important for separating out and mitigating the impacts of climate change from increased human activity in the Arctic. It is partly with these goals in mind that the Commission offers the following recommendations.

Seasonal restrictions on oil and gas activities to protect marine mammals and Alaska Native subsistence opportunities

The protection of vulnerable marine mammal species is critical in the Arctic planning areas. The Beaufort Sea planning area is home to approximately 9,500 residents, most of whom are Alaska Natives (North Slope Borough, Brower 1998). Alaska Native communities are highly dependent on many of those species for subsistence (Braund and Associates 2010) and access to food in some communities by means other than hunting is limited and expensive.

In recognition of the importance of marine mammals as a subsistence resource for Alaska Natives, section 101(a)(5)(A)(i)(I) of the MMPA requires that authorized incidental takes not have an unmitigable adverse impact on the availability of marine mammals for subsistence. Accordingly, NMFS and FWS include seasonal restrictions on oil and gas exploration activities in MMPA incidental harassment authorizations and take regulations to reduce the potential for oil and gas-related activities to disturb marine mammals and disrupt marine mammal subsistence hunting activities. In the past, those restrictions have been based largely on measures developed and agreed upon between oil and gas companies and affected subsistence communities and outlined in Conflict Avoidance Agreements² or Plans of Cooperation³. For example, NMFS-imposed seasonal restrictions on oil and gas-related exploration activities in the Beaufort Sea have been directed primarily at minimizing disruption of the spring and fall bowhead whale hunts near Barrow and the fall bowhead whale hunts near Kaktovik and Cross Island. Some of those restrictions have been proposed by NMFS as standard mitigation measures for all oil and gas activities in the Beaufort Sea (NMFS 2013).

² Conflict Avoidance Agreements are annually-negotiated agreements between oil and gas companies and a coalition of Alaska Native hunters represented by the Alaska Eskimo Whaling Commission (AEWC) and the Whaling Captains' Associations of 11 AEWC communities which include provisions to reduce disturbance of bowhead whale hunts in the Beaufort and Chukchi Seas. However, they do not currently include provisions for reducing disturbance of other marine mammal species taken for subsistence.

³ NMFS general regulations governing small takes of marine mammals incidental to specific activities require that incidental take applicants submit either a Plan of Cooperation or information identifying what measures are being taken to minimize any adverse effects on the availability of marine mammals for subsistence uses (50 C.F.R. § 216.104(a)(12)). FWS regulations authorizing the incidental take of small numbers of polar bears and Pacific walrus during oil and gas activities in the Beaufort Sea require Letter of Authorization holders to develop and submit an FWS-approved Plan of Cooperation (50 C.F.R. § 18.128(a)(6)(ii)).

The Commission supports the adoption of seasonal restrictions that have been developed and agreed upon by industry and Alaska Native hunters, as these reflect best available science, current traditional knowledge regarding the expected arrival time and behavior of marine mammals in important hunting areas, and best practices deemed feasible by industry to mitigate disturbance of marine mammal subsistence hunts. As such, the Commission recommends that BOEM and the Bureau of Safety and Environmental Enforcement adopt seasonal restrictions on seismic and drilling activities in the Beaufort Sea as outlined in Conflict Avoidance Agreements, Plans of Cooperation, and other documents negotiated between industry and Alaska Native communities to prevent or minimize disturbance of marine mammal subsistence hunts. Beyond minimizing disturbance of subsistence hunts, BOEM may also need to consider additional measures for protecting particularly vulnerable segments of marine mammal populations (e.g., mothers and young) and important areas used by marine mammals (such as feeding, calving, or resting habitats or restrictive migration corridors).

In addition, given recent restrictions on exploration activities designed to reduce interactions with migrating marine mammals, subsistence hunters, or encroaching sea ice, the Commission does not anticipate that BOEM would give approval for a significant level of oil and gas exploration activity to occur from November through June. Nevertheless, the Commission recommends that BOEM and BSEE allow exploration activities only during the open-water season (1 July to 31 October). If permits for seismic activities are requested for November and December (or later), the Commission recommends that BOEM, NMFS, and FWS require (1) adequate baseline data for assessing and mitigating potential impacts and (2) implementation of appropriate monitoring approaches that take into account the difficult viewing conditions caused by darkness and inclement weather in the Beaufort Sea during that time period. Similarly, the Commission recommends that BOEM and BSEE require additional spatial/temporal restrictions as appropriate to avoid disturbance of ice-obligate and ice-associated marine mammals should development and production activities be considered outside of the open-water season.

Exclusion of key marine mammal habitat and subsistence hunt areas

BOEM has excluded from scoping for Lease Sale 242 areas off Point Barrow extending east toward Admiralty Bay and areas north and east of Kaktovik. However, the excluded areas are considerably smaller in size than areas identified by Braund and Associates (2010) as medium- to high-use subsistence hunting areas for marine mammals and other species. Waters around Camden Bay and Cross Island are also fall bowhead whale hunting areas (Huntington 2013, Galginaitis 2014), but were not included in the Braund and Associates (2010) subsistence study and were not excluded from scoping by BOEM.

In its determination of which areas to exclude from Lease Sale 242, BOEM should consider not only potential disturbance from exploration activities but also the potential for more significant disturbance caused by development and production of oil and gas resources over the long term. Bowhead whale avoidance of ship noise and seismic and drilling activity has been well documented (see review by Reeves et al. 2014), and marine mammal avoidance of development areas over time could alter the timing and distribution of their migrations and their feeding patterns. Changes in migration patterns could result in whales traveling at greater distances from shore, with serious implications for subsistence whaling success and hunter safety.

Based on current seasonal restrictions on exploration activities, the best available information on important feeding areas, and traditional knowledge regarding marine mammal subsistence hunting areas, the Commission recommends that BOEM exclude from leasing the following areas:

- an expanded area north and east of the current Barrow exclusion area, to include all of Barrow Canyon to the shelf break and coastal waters out to the 20m isobath extending to the western edge of Smith Bay (concentration area for feeding bowhead whales, fall bowhead whale hunting area, and bearded and ringed seal harvest area; Clarke et al. 2014, Braund and Associates 2010);
- Cross Island, including waters east to Tigvariak Island and seaward out to the 50 m isobath (fall bowhead whale hunting area; Galginaitis 2014);
- waters seaward of Camden Bay to the 20m isobath (fall bowhead whale hunting area and beluga and seal feeding area; Huntington 2013); and
- an expanded area east of the current Kaktovik exclusion area and out to the 40m isobath (fall bowhead whale hunting area; Braund and Associates 2010).

The Commission recommends that BOEM consult with Alaska Native communities, marine mammal co-management organizations, and scientists with experience and knowledge regarding marine mammal use of these areas and the importance of these areas for Alaska Native subsistence to more accurately determine the appropriate size of the areas to be excluded from leasing.

Exclusion of continental slope and basin waters

The Beaufort Sea planning area extends north to 75° N latitude at its western end and 74° N latitude to the east and includes the steep continental slope and Arctic basin waters up to 4,000 m in depth. Marine mammal aerial survey data are limited to areas south of 72° N latitude (Clarke et al. 2014). When those data are combined with recent tagging and acoustic studies it becomes clear that the continental slope area (extending to at least 73° N latitude in the west and to 70° N latitude in the east) and deeper areas farther north are used by bearded and ringed seals, polar bears, and beluga and bowhead whales (Smith 2010 and 2011). Due to their distance from shore, these areas are not visited regularly by subsistence hunters, but all five of those species are important components of the Beaufort Sea ecosystem and important subsistence and cultural resources for Alaska Natives. Given the paucity of information on marine mammal use and movements to and from these high Arctic areas, a precautionary approach to oil and gas leasing is warranted.

Relatively little information exists regarding oil and gas reserves in offshore areas of the Beaufort Sea. Few seismic surveys have been conducted there and the information that is available indicates low petroleum potential compared to nearshore and onshore areas (BOEM 2012). In addition, higher-latitude slope and basin waters have a higher probability of persistent sea ice throughout the open-water season, even in years of minimal ice cover (Smith 2010 and 2011), which would make exploration activities in such areas all the more challenging and dangerous (if even feasible). For these reasons, the Commission recommends that BOEM prohibit future lease sales in the continental slope and basin waters (>200m depth) of the Beaufort Sea planning area.

Research to support management of oil and gas activities

Arguably the greatest industry-related risk of acute harm to marine mammals comes from exposure to oil from a spill or other large discharge event. The nature and severity of injury to marine mammals depends on a variety of factors, including the chemical composition of the oil (or other toxin), the amount and duration of exposure, the exposure pathway (e.g., inhalation, ingestion), and the physical characteristics of the animals exposed (i.e., whether they have fur, baleen, etc.). Research on the effects of oil on marine mammals is limited but provides ample evidence that exposure can cause significant harm (MMC 2011, Schwacke et al. 2013).

There is considerable uncertainty regarding industry's ability to respond to oil spills in the Arctic environment. As evidenced by the low recovery of oil during the Deepwater Horizon oil spill (NOAA 2010), current oil spill response technologies are less than adequate for recovery of spilled oil even under more ideal conditions. Oil spill response efforts in the Arctic would be additionally hampered by ice and inadequate in-ice response technologies, the remoteness of the spill, extended periods of darkness and severe weather, lack of trained personnel, and lack of equipment and infrastructure (Ebinger et al. 2014). Although considerable research has been carried out on oil spill response and recovery in ice-filled waters, industry and regulators have had only limited opportunities to test promising technologies and methods in Arctic environmental conditions on operational scales (NRC 2014). The wide occurrence of marine mammals throughout the planning area means that significant effort will be required on the part of industry, BOEM, the Bureau of Safety and Environmental Enforcement, and local communities to ensure that oil spill response preparation, training, contingency planning, and implementation will be as effective as possible given current technologies and practices (Samuels et al. 2011).

Routine oil and gas exploration, development, and production activities—which generate sound from seismic surveys, drilling, and support activities, and discharge drilling muds, cuttings, and contaminated water into the marine environment—also can have harmful effects on marine mammals (Richardson et al. 1995, Clark and Gagnon 2006, Robertson et al. 2013, Blanchard et al. 2014). The severity of effects associated with sound-producing activities is highly variable and context-specific (e.g., responses may depend on the activity in which the animal is engaged, such as feeding or migrating, the presence of other animals in the vicinity, ocean and ice conditions, water depth, etc.; Robertson et al. 2013). More research is needed to understand and mitigate such effects. The cumulative effects of multiple sound sources on individual animals and populations are not well understood and hence inadequate to guide management (Moore et al. 2012). Uncertainties regarding the effects of oil and gas activities must be addressed transparently, with an emphasis on participatory decision-making in the development of precautionary mitigation measures (Blanchard et al. 2014).

For these reasons, the Commission recommends that BOEM and the Bureau of Safety and Environmental Enforcement continue to provide leadership and expand research on (1) improved technologies and capabilities to prevent and minimize harm to marine mammals from oil spills, cleanup activities and approaches (i.e., use of dispersants), and from routine oil and gas support activities such as increased ship traffic and associated collision and pollution exposure risk in the severe weather and ice conditions of Arctic waters, and (2) site-specific and cumulative effects of oil and gas development on marine mammals and on access to marine mammals by Alaskan Native hunters.

Mr. Michael S. Rolland
18 September 2014
Page 9

BOEM's Environmental Studies Program has been a major supporter of research in the Arctic to better understand the distribution and ecology of marine mammals protected under the MMPA and the ESA, and the subsistence use of marine mammals by Alaska Native communities. This research has also built a better understanding of the potential effects of offshore energy activities on marine mammals. Recently BOEM initiated a multi-year Marine Arctic Ecosystem Study (MARES) focused on the Beaufort Sea planning area, in collaboration with several public and private partners including the Marine Mammal Commission. The objective of MARES is "to advance the overall knowledge of the Arctic marine environment and its role as a driver of marine ecosystem functioning and change" (MARES Solicitation M14PS00023). Coupled with previous and ongoing BOEM-supported research on Arctic marine mammals, MARES promises to contribute significantly to knowledge regarding seasonal and inter-annual variability in physical and chemical processes and patterns and related effects on biological and human communities.

The NMFS Office of Protected Resources has recently announced its intent to develop a long-term Comprehensive Monitoring Plan to address the monitoring of oil and gas activities in the Arctic and to help better understand the aggregate impacts of energy development activities. This effort will need to be closely coordinated with ongoing research on marine mammals being conducted by BOEM, NMFS's National Marine Mammal Laboratory, FWS, USGS, the state of Alaska, the North Slope Borough, Alaska Native organizations, academia, non-governmental organizations, and industry. The Commission recommends that BOEM work closely with NMFS, FWS, and other entities to ensure the Comprehensive Monitoring Plan being developed by NMFS considers information available from BOEM's Environmental Studies Program to support (1) a comprehensive approach to assessment of environmental impacts on marine mammals and subsistence communities from oil and gas activities, (2) an adaptive management approach to eliminating, reducing, or mitigating the impacts of oil and gas activities, and (3) application of metrics to evaluate the effectiveness of those measures.

The Commission hopes that you find these recommendations and comments helpful. Please contact me at (301) 504-0087 if you have questions or if the Commission can assist you further as you consider these matters.

Sincerely,

A handwritten signature in blue ink that reads "Rebecca J. Lent".

Rebecca J. Lent, Ph.D.
Executive Director

cc: Jon Kurland, NMFS Alaska Regional Office, Juneau, AK
Donna Wieting, NMFS Office of Protected Resources, Silver Spring, MD
Deborah Pierce Williams, FWS Marine Mammals Management Office, Anchorage, AK
Rodney Cluck, BOEM Environmental Studies Program, Herndon, VA
Mark Fesmire, BSEE Alaska Region Director, Anchorage, AK

References

- Alaska Department of Fish and Game (ADF&G). 2010. Satellite Tracking of Western Arctic Bowhead Whales, Final Report. Bureau of Ocean Energy Management, Regulation, and Enforcement, OCS Study BOEMRE 2010-033, 118 pages.
- Allen, B.M., and R.P. Angliss. 2014. Alaska marine mammal stock assessments, 2013. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-AFSC-277, 294 pages.
- Amstrup, S.C., G.M. Durner, I. Stirling, N.J. Lunn, and F. Messler. 2000. Movements and distribution of polar bears in the Beaufort Sea. *Canadian Journal of Zoology* 78(6):948-966.
- Amstrup, S.C., G.M. Durner, A.S. Fischbach, K. Simac, and G. Weston-Yok. 2002. Polar bear research in the Beaufort Sea. Pages 109-125 *in*: Lunn, N.J., S. Schliebe, and E.W. Born (editors), *Polar bears: Proceedings of the 13th Working Meeting of the IUCN/SSC Polar Bear Specialist Group, 23-28 June 2001, Nuuk, Greenland*. IUCN, Gland, Switzerland and Cambridge, United Kingdom.
- Amstrup, S.C., G.M. Durner, I. Stirling, and T.L. McDonald. 2005. Allocating harvests among polar bear stocks in the Beaufort Sea. *Arctic* 58(3):247-259.
- Ashjian, C.J., S.R. Braund, R.G. Campbell, J.C. George, J. Kruse, W. Maslowski, S.E. Moore, C.R. Nicolson, S.R. Okkonen, B.F. Sherr, E.B. Sherr, and Y.H. Spitz. 2010. Climate variability, oceanography, bowhead whale distribution, and Inupiat subsistence whaling near Barrow, Alaska. *Arctic* 63(2):179-194.
- Asselin, N.C., D.G. Barber, I. Stirling, S.H. Ferguson, and P.R. Richard. 2011. Beluga (*Delphinapterus leucas*) habitat selection in the eastern Beaufort Sea in spring, 1975-1979. *Polar Biology* 34:1973-1988.
- Blackwell, S.B., J.W. Lawson, M.T. Williams. Tolerance by ringed seals (*Phoca hispida*) to impact pipe-driving and construction sounds at an oil production island. *Journal of the Acoustical Society of America* 115(5):2346-2357.
- Blanchard, A., K.H. Hauge, G. Andersen, J.H. Fossa, B.E. Grøsvik, N.O. Handegard, M. Kaiser, S. Meier, E. Olsen. and F. Vikebø. 2014. Harmful routines? Uncertainty in science and conflicting views on routine petroleum operations in Norway. *Marine Policy* 43:313-320.
- BOEM (Bureau of Ocean Energy Management). 2012. Beaufort Sea Analytical Considerations (map) <http://www.boem.gov/5-year/2012-2017/Map-Beaufort/>
- Boveng, P.L., J.L. Bengtson, T.W. Buckley, M.F. Cameron, S.P. Dahle, B.A. Megrey, J.E. Overland, and N.J. Williamson. 2008. Status review of the ribbon seal (*Histiophoca fasciata*). NOAA Technical Memorandum NMFS-AFSC-191, 115 pages.
- Braund, S.R. and Associates. 2010. Subsistence mapping of Nuiqsut, Kaktovik, and Barrow. MMS OCS Study Number 2009-003, 430 pages.
- Brower, Jr., H., and H. Taqulik. 1998. Subsistence hunting activities and the Inupiat Eskimo. *Cultural Survival Quarterly* 22.3 - Crisis on the Last Frontier. <https://www.culturalsurvival.org/publications/cultural-survival-quarterly/united-states/subsistence-hunting-activities-and-inupiat-es>
- Cameron, M.F., J.L. Bengtson, P.L. Boveng, J.K. Jansen, B.P. Kelly, S.P. Dahle, E.A. Logerwell, J.E. Overland, C.L. Sabine, G.T. Waring, and J. M. Wilder. 2010. Status review of the bearded seal (*Erignathus barbatus*). NOAA Technical Memorandum NMFS-AFSC-211, 246 pages.
- Christman, C.L., J.J. Citta, L.T. Quakenbush, J.T. Clarke, B.K. Rone, R.A. Shea, M.C. Ferguson, and M.P. Heide-Jørgensen. 2013. Presence and behavior of bowhead whales (*Balaena mysticetus*) in the Alaskan Beaufort Sea in July 2011. *Polar Biology* 36:1851-1856.

- Clark, C.W., and G.C. Gagnon. 2006. Considering the temporal and spatial scales of noise exposures from seismic surveys on baleen whales. International Whaling Commission SC/58/E9.
- Clarke, J.T., C.L. Christman, M.C. Ferguson, and S.L. Grassia. 2011a. Aerial surveys of endangered whales in the Beaufort Sea, Fall 2006-2008: Final Report. OCS Study BOEMRE 2010-042. National Marine Mammal Laboratory, Alaska Fisheries Science Center, NMFS, NOAA, 7600 Sand Point Way NE, F/AKC3, Seattle, Washington 98115-6349, 230 pages.
- Clarke, J.T., C.L. Christman, S.L. Grassia, A.A. Brower, and M.C. Ferguson. 2011b. Aerial surveys of endangered whales in the Beaufort Sea, Fall 2009: Final Report. OCS Study BOEMRE 2010-040. National Marine Mammal Laboratory, Alaska Fisheries Science Center, NMFS, NOAA, 7600 Sand Point Way NE, F/AKC3, Seattle, Washington 98115-6349, 92 pages.
- Clarke, J.T., C.L. Christman, A.A. Brower, M.C. Ferguson, and S.L. Grassia. 2011c. Aerial surveys of endangered whales in the Beaufort Sea, Fall 2010: Annual Report. OCS Study BOEMRE 2011-035. National Marine Mammal Laboratory, Alaska Fisheries Science Center, NMFS, NOAA, 7600 Sand Point Way NE, F/AKC3, Seattle, Washington 98115-6349, 119 pages.
- Clarke, J.T., C.L. Christman, A.A. Brower, and M.C. Ferguson. 2012. Distribution and relative abundance of marine mammals in the Alaskan Chukchi and Beaufort Seas, 2011: Annual Report. OCS Study BOEMRE 2012-009. National Marine Mammal Laboratory, Alaska Fisheries Science Center, NMFS, NOAA, 7600 Sand Point Way NE, F/AKC3, Seattle, Washington 98115-6349, 344 pages.
- Clarke, J.T., C.L. Christman, A.A. Brower, and M.C. Ferguson. 2013. Distribution and relative abundance of marine mammals in the northeastern Chukchi and western Beaufort Seas, 2012: Annual Report. Bureau of Ocean Energy Management OCS Study BOEM 2013-00117, 349 pages.
- Clarke, J.T., C.L. Christman, A.A. Brower, and M.C. Ferguson. 2014. Distribution and relative abundance of marine mammals in the northeastern Chukchi and western Beaufort Seas, 2013: Annual Report. Bureau of Ocean Energy Management OCS Study BOEM 2014-018, 330 pages.
- Clement, J.P., J.L. Bengtson, and B.P. Kelly. 2013. Managing for the future in a rapidly changing Arctic. A report to the President. Interagency Working Group on Coordination of Domestic Energy Development and Permitting in Alaska (D.J. Hayes, Chair), Washington, D.C., 59 pages.
- Codispoti, L.A., V. Kelly, A. Thessen, P. Matrai, S. Shuttles, V. Hill, M. Steele, and B. Light. 2013. Synthesis of primary production in the Arctic Ocean: III. Nitrate and phosphate based estimates of net community production. *Progress in Oceanography* 110:126-150.
- Dunton, K.H. 2012. Chukchi Sea Offshore Monitoring in Drilling Area (COMIDA): Chemical and benthos (CAB). Prepared for BOEM, Contract number M08PC20056. OCS Study BOEM 2012-012, 311 pages.
- Ebinger, C., J.P. Banks, and A. Schackmann. 2014. Offshore oil and gas governance in the Arctic: A leadership role for the U.S. Brookings Institute, Energy Security Initiative, Policy Brief 14-01.
- Fay, F.H., and J.J. Burns. 1988. Maximal feeding depth of walruses. *Arctic* 41(3):239-240.
- Frost, K.J., L.F. Lowry, G. Pendleton, and H.R. Nute. 2004. Factors affecting the observed densities of ringed seals, *Phoca hispida*, in the Alaskan Beaufort Sea, 1996-99. *Arctic* 57(2):115-128.
- Galginaitis, M. 2014. Monitoring Cross Island whaling activities, Beaufort Sea, Alaska: 2008-2012 Final Report, Incorporating ANIMIDA and cANIMIDA (2001-2007). U.S. Department of the Interior, Bureau of Ocean Energy Management, Alaska Region, Anchorage, AK. OCS Study BOEM 2013-212, 208 pages.

- Garlich-Miller, J.G. MacCracken, J. Snyder, R. Meehan, M. Myers, J.M. Wilder, E. Lance, and A. Matz. 2011. Status review of the Pacific walrus (*Odobenus rosmarus divergens*). 155 pages.
- Gleason, J.S., and K.D. Rode. 2009. Polar bear distribution and habitat association reflect long-term changes in fall sea ice conditions in the Alaskan Beaufort Sea. *Arctic* 62(4):405-417.
- Grebmeier, J.M. 2012. Shifting patterns of life in the Pacific Arctic and sub-Arctic seas. *Annual Review of Marine Science* 4:63-78.
- Harwood, L.A., S. Innes, P. Norton, and M.C.S. Kingsley. 1996. Distribution and abundance of beluga whales in the Mackenzie estuary, southeast Beaufort Sea, and west Amundsen Gulf during late July 1992. *Canadian Journal of Fisheries and Aquatic Sciences* 53(10):2262-2273.
- Harwood, L.A., J. Iacozza, J.C. Auld, P. Norton, and L. Loseto. 2014. Belugas in the Mackenzie River estuary, NT: Habitat use and hot spots in the Tarium Niryutait Marine Protected Area. *Ocean and Coastal Management* 100:128-138.
- Hauser, D.D.W., K.L. Laidre, R.S. Suydam, and P.R. Richard. 2014. Population-specific home ranges and migration timing of Pacific Arctic beluga whales (*Delphinapterus leucas*). *Polar Biology* doi:10.1007/s00300-014-1510-1.
- Holland-Bartels, L., and B. Pierce (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 pages.
- Hunter, C.M., H. Caswell, M.C. Runge, E.V. Regeher, S.C. Amstrup, and I. Stirling. 2010. Climate change threatens polar bear populations: a stochastic demographic analysis. *Ecology* 91(10):2883-2897.
- Huntington, H.P., and L.T. Quakenbush. 2009. Traditional knowledge of bowhead whale migratory patterns near Kaktovik and Barrow, Alaska. Report to the Barrow and Kaktovik Captains Associations and the Alaska Eskimo Whaling Commission, 13 pages.
- Huntington, H.P. 2009. A preliminary assessment of threats to Arctic marine mammals and their conservation in the coming decades. *Marine Policy* 33:77-82.
- Huntington, H.P. 2013. Traditional knowledge regarding bowhead whales and Camden Bay, Beaufort, Alaska, 15 pages.
- Jay, C.V., B.G. Marcot, and D.C. Douglas. 2010. Projected status of the Pacific walrus (*Odobenus rosmarus divergens*) in the 21st century. U.S. Geological Survey Administrative Report submitted to the U.S. Fish and Wildlife Service, 90 pages.
- Jay, C.V., A.S. Fischbach, and A.A. Kochnev. 2012. Walrus areas of use in the Chukchi Sea during sparse sea ice cover. *Marine Ecology Progress Series* 468:1-13.
- Kelly, B.P., J.L. Bengtson, P.L. Boveng, M.F. Cameron, S.P. Dahle, J.K. Jansen, E.A. Logerwell, J.E. Overland, C.L. Sabine, G.T. Waring, and J.M. Wilder. 2010. Status review of the ringed seal (*Phoca hispida*). U.S. Department of Commerce, NOAA Technical Memorandum NMFS-AFSC-212, 250 pages.
- Koski, W.R., and G.W. Miller. 2009. Habitat use by different size classes of bowhead whales in the central Beaufort Sea during late summer and autumn. *Arctic* 62: 137-150.
- Kovacs, K. M. 2002. Bearded seal *Erignathus barbatus*. Pages 84-87 in W.F. Perrin, B. Würsig, and J.G. M. Thewissen (editors). *Encyclopedia of Marine Mammals*. Academic Press, San Diego, California.
- Kovacs, K.M., C.Lydersen, J.E. Overland, and S.E. Moore. 2010. Impacts of changing sea-ice conditions on Arctic marine mammals. *Marine Biodiversity* doi:10.1007/s12526-010-0061-0.

- Laidre, K.L., I. Stirling, L.F. Lowry, Ø. Wiig, M.P. Heide-Jørgensen, and S.H. Ferguson. 2008. Quantifying the sensitivity of Arctic marine mammals to climate-induced habitat change. *Ecological Applications* 18(2):S97-S125.
- Loseto, L.L., G.A. Stern, D. Deibel, T.L. Connelly, A. Prokopowicz, D.R.S. Lean, L. Fortier, and S.H. Ferguson. 2008. Linking mercury exposure to habitat and feeding behaviour in Beaufort Sea beluga whales. *Journal of Marine Systems* 74:1012–1024.
- Lowry, L.F., G. Sheffield, and J.C. George. 2004. Bowhead whale feeding in the Alaskan Beaufort Sea, based on stomach contents analyses. *Journal of Cetacean Research Management* 6(3):215–223.
- MacCracken, J.G. 2012. Pacific walrus and climate change: observations and predictions. *Ecology and Evolution* 2(8): 2072–2090.
- MacIntyre, K.Q., K.M. Stafford, C.L. Berchok, and P.L. Boveng. 2013. Year-round acoustic detection of bearded seals (*Erignathus barbatus*) in the Beaufort Sea relative to changing environmental conditions, 2008–2010. *Polar Biology* doi:10.1007/s00300-013-1337-1.
- Mocklin, J.A., D.J. Rugh, S.E. Moore, and R.P. Angliss. 2012. Using aerial photography to investigate evidence of feeding by bowhead whales. *Marine Mammal Science* 28(3):602–19.
- Moore, S.E., and R.R. Reeves. 1993. Distribution and movements. Pages 313–386 in J.J. Burns, J.J. Montague, and C.J. Cowles (editors). *The Bowhead Whale*. Special Publication Number 2 of The Society for Marine Mammalogy, Lawrence, Kansas.
- Moore, S.E. 2008. Marine mammals as ecosystem sentinels. *Journal of Mammalogy* 89(3):534-540.
- Moore, S.E., and H.P. Huntington. 2008. Arctic marine mammals and climate change: impacts and resilience. *Ecological Applications* 18(2):S157–S165.
- Moore, S.E., J.C. George, G. Sheffield, J. Bacon, and C.J. Ashjian. 2010. Bowhead whale distribution and feeding near Barrow, Alaska, in late summer 2005-06. *Arctic* 63(2):195–205.
- Moore, S.E., R.R. Reeves, B.L. Southall, T.J. Ragen, R.S. Suydam, and C.W. Clark. 2012. A new framework for assessing the effects of anthropogenic sound on marine mammals in a rapidly changing Arctic. *BioScience* 62(3): 289-295.
- Moore, S.E., E. Logerwell, L. Eisner, E.V. RFarley, Jr. L.A. Harwood, K. Kuletz, J. Lovvorn, J.R. Murphy, and L.T. Quakenbush. 2014. Chapter 11: Marine fishes, birds and mammals as sentinels of ecosystem variability and reorganization in the Pacific Arctic region. Pages 337–392 in: J.M. Grebmeier and W. Maslowski (editors), *The Pacific Arctic Region: Ecosystem Status and Trends in a Rapidly Changing Environment*, Springer Science+Business Media Dordrecht (doi:10.1007/978-94-017-8863-2_11).
- Moulton, V.D., W.J. Richardson, T.L. MacDonald, R.E. Elliott, and M.T. Williams. 2002. Factors influencing local abundance and haulout behaviour of ringed seals (*Phoca hispida*) on landfast ice of the Alaskan Beaufort Sea. *Canadian Journal of Zoology* 80:1900–1917.
- NMFS (National Marine Fisheries Service). 2013. Effects of oil and gas activities in the Arctic Ocean: supplemental draft environmental impact statement, 1408 pages.
- NOAA. 2010. BP Deepwater Horizon oil budget: What happened to the oil?, August 4, 2010, 5 pages.
- North Slope Borough. People of the Arctic. Official Website of the North Slope Borough. <http://www.north-slope.org/information/visitors-information>
- NRC (National Research Council). 2014. Responding to oil spills in the U.S. Arctic marine environment. National Academies Press, Washington, D.C., 195 pages.
- O'Corry-Crowe, G.M., R.S. Suydam, A. Rosenberg, K.J. Frost, and A.E. Dizon. 1997. Phylogeography, population structure and dispersal patterns of the beluga whale

- Delphinapterus leucas* in the western Nearctic revealed by mitochondrial DNA. *Molecular Ecology* 6:955–970.
- Pagano, A.M., G.M. Durner, S.C. Amstrup, K.S. Simac, and G.S. York. 2012. Long-distance swimmer by polar bears (*Ursus maritimus*) of the southern Beaufort Sea during years of extensive open water. *Canadian Journal of Zoology* 90:663-676.
- Perryman, W.L., M.A. Donahue, P.C. Perkins, and S.B. Reilly. 2002. Gray whale calf production 1994–2000: Are observed fluctuations related to changes in sea ice cover? *Marine Mammal Science* 18(1):121–144.
- Quakenbush, L.T., J. Citta, and J. Crawford. 2011. Biology of the bearded seal (*Erignathus barbatus*) in Alaska, 1961–2009. Final report to National Marine Fisheries Service, 71 pages.
- Ray, G.C., J.E. Overland, and G.L. Hufford. 2010. Seascape as an organizing principle for evaluating walrus and seal sea-ice habitat in Beringia. *Geophysical Research Letters* 37:L20504 doi: 10.1029/2010GL044452.
- Reeves, R.R., P.J. Ewins, S. Agbayani, M.P. Heide-Jørgensen, K.M. Kovacs, C. Lydersen, R. Suydam, W. Elliott, G. Polet, Y. van Dijk, and R. Blijleven. 2014. Distribution of endemic cetaceans in relation to hydrocarbon development and commercial shipping in a warming Arctic. *Marine Policy* 44:375-389.
- Richardson, W.J., C.R. Greene Jr., J.S. Hanna, W.R. Koski, G.W. Miller, N.J. Patenaude, and M.A. Smultea. 1995. Acoustic effects of oil production activities on bowhead and white whales visible during spring migration near Point Barrow, Alaska—1991 and 1994 phases: sound propagation and whale responses to playbacks of icebreaker noise. Minerals Management Service OCS Study MMS 95-0051, 539 pages.
- Richardson, W.J. and B. Würsig. 1997. Influences of man-made noise and other human actions on cetacean behaviour. *Marine and Freshwater Behaviour and Physiology* 29:183–209.
- Robertson, F.C., W.R. Koski, T.A. Thomas, W.J. Richardson, B. Würsig, and A.W. Trites. 2013. Seismic operations have variable effects on dive-cycle behavior of bowhead whales in the Beaufort Sea. *Endangered Species Research* 21:143-160.
- Rugh, D.J. K.E.W. Shelden, and D.E. Withrow. 1997. Spotted seals, *Phoca largha*, in Alaska. *Marine Fisheries Review* 59(1):1–18.
- Samuels, W.B., D.E. Amstutz, and H.A. Crowley. 2011. Arctic climate change and oil spill risk analysis. *Frontiers of Earth Science* 5(4):350-362.
- Schliebe, S., T. Evans, K. Johnson, M. Roy, S. Miller, C. Hamilton, R. Meehan, and S. Jahrsdoerfer. 2006. Range-wide status review of the polar bear (*Ursinus maritimus*). U.S. Fish and Wildlife Service, 262 pages.
- Schwacke, L.H., C.R. Smith, F.I. Townsend, R.S. Wells, L.B. Hart, B.C. Balmer, T.K. Collier, S. De Guise, M.M. Fry, L.J. Guillette, Jr., S.V. Lamb, S.M. Lane, W.E. McFee, N.J. Place, M.C. Tumlin, G.M. Ylitalo, E.S. Zolman, and T.K. Rowles. 2013. Health of common bottlenose dolphins (*Tursiops truncatus*) in Barataria Bay, Louisiana, following the *Deepwater Horizon* oil spill. *Environmental Science & Technology*, dx.doi.org/10.1021/es403610f.
- Shelden, K.E.W., and J.A. Mocklin (editors). 2013. Bowhead Whale Feeding Ecology Study (BOWFEST) in the western Beaufort Sea. Final Report, OCS Study BOEM 2013-0114. National Marine Mammal Laboratory, Alaska Fisheries Science Center, NMFS, NOAA, 7600 Sand Point Way NE, Seattle, Washington 98115–6349, 350 pages.
- Smith, M.A. 2010. Arctic Marine Synthesis: Atlas of the Chukchi and Beaufort Seas. Audubon Alaska and Oceana: Anchorage.
- Smith, M.A. 2011. Place-based summary of the Arctic Marine Synthesis. Audubon Alaska.

- Stafford, K.M., S.E. Moore, M. Spillane, and S. Wiggins. 2007. Gray whale calls recorded near Barrow, Alaska, throughout the winter of 2003–04. *Arctic* 60(2):167-172.
- Suydam, R.S., L.F. Lowry, and K.J. Frost. 2005. Distribution and movements of beluga whales from the Eastern Chukchi Sea stock during summer and early autumn. Final Report to the Minerals Management Service, OCS Study MMS 2005–035, 39 pages.
- Welch, H.E., R.E. Crawford, and H. Hop. 1993. Occurrence of Arctic cod (*Boreogadus saida*) schools and their vulnerability to predation in the Canadian High Arctic. *Arctic* 46(4):331-339.
- Würsig, B., E.M. Dorsey, W.J. Richardson, and R.S. Wells. 1989. Feeding, aerial and play behavior of the bowhead whale, *Balaena mysticetus*, summering in the Beaufort Sea. *Aquatic Mammals* 15:27–37.