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March 13, 2019

Bureau of Land Management
Alaska State Office,
Attention—Coastal Plain EIS
222 West 7th Avenue, #13
Anchorage, AK 99513–7599

Re: Comments on Draft Environmental Impact Statement for the Coastal Plain Oil and Gas Leasing Program

To Whom It May Concern:

On behalf of the Animal Welfare Institute ("AWI"), I submit the following comments on the Bureau of Land Management's ("BLM") Draft Environmental Impact Statement ("DEIS") for the Coastal Plain Oil and Gas Leasing Program in Alaska. *See* 83 Fed. Reg. 67337 (Dec. 28, 2018).

AWI is a nonprofit charitable organization founded in 1951 that is dedicated to reducing animal suffering caused by people. AWI engages policymakers, scientists, industry, and the public to achieve better treatment of animals everywhere—in the laboratory, on the farm, in commerce, at home, and in the wild.

These comments and the attached exhibits address legal concerns and provide technical information in the form of peer-reviewed studies that the agency should consider in its decisionmaking process.

I. The Alternatives Analysis is Legally Deficient.

The alternatives analysis contained in the DEIS is inadequate because BLM failed to adequately consider an appropriate range of reasonable alternatives. The "heart" of the NEPA process is an agency's duty to consider "alternatives to the proposed action" and to "study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources." 42 U.S.C. §§ 4332(2)(C)(iii), 4332(2)(E). The Council on Environmental Quality's NEPA regulations require the action agency to: (a) rigorously explore and objectively evaluate all reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated; (b) devote substantial treatment to each alternative considered in detail including the proposed action so that reviewers may evaluate their comparative merits; (c) include reasonable alternatives not within the jurisdiction of the lead agency; (d) include the alternative of no action; (e) identify the agency's preferred alternative or alternatives, if one or more exists, in the draft statement and identify such alternative in the final statement unless another law prohibits the expression of such a preference; and (f) include appropriate mitigation measures not already included in the proposed action or alternatives. *Id.*; *see also* 43 C.F.R. § 46.415(b).

That analysis must identify multiple viable alternatives, so that an agency can make "a real, informed choice" between the spectrum of reasonable options. *Friends of Yosemite Valley v. Kempthorne*, 520 F.3d 1024, 1039 (9th Cir. 2008). "A 'viable but unexamined alternative renders [the] environmental impact statement inadequate.'" *Muckleshoot Indian Tribe v. U.S. Forest Serv.*, 177 F.3d 800, 814 (9th Cir. 1999) (quoting *Citizens for a Better Henderson v. Hodel*, 768 F.2d 1051, 1057 (9th Cir. 1985)). "The purpose of NEPA's alternatives requirement is to ensure agencies do not undertake projects "without intense consideration of other more ecologically sound courses of action, including shelving the entire project, or of accomplishing the same result by entirely different means." *Envtl. Defense Fund, Inc. v. U.S. Army Corps of Engrs.*, 492 F.2d 1123, 1135 (5th Cir. 1974).

The courts, in the Ninth Circuit as well as elsewhere, have consistently held that an agency's failure to consider a reasonable alternative is fatal to an agency's NEPA analysis. *See, e.g., Idaho Conserv. League v. Mumma*, 956 F.2d 1508, 1519-20 (9th Cir. 1992) ("The existence of a viable, but unexamined alternative renders an environmental impact statement inadequate."). If the agencies reject an alternative from consideration, they must explain why a particular option is not feasible and was therefore eliminated from further consideration. 40 C.F.R. § 1502.14(a). The courts will scrutinize this explanation to ensure that the reasons given are adequately supported by the record. *See Muckleshoot Indian Tribe*, 177 F.3d at 813-15, *Idaho Conserv. League*, 956 F.2d at 1522 (while agencies can use criteria to determine which options to fully evaluate, those criteria are subject to judicial review), *Citizens for a Better Henderson*, 768 F.2d at 1057.

BLM considered four alternatives in the DEIS: (1) Alternative A, the no action alternative whereby no federal minerals in the Coastal Plain would be offered for future oil and gas lease sales; (2) Alternative B, which would offer approximately 1,563,500 acres for oil and gas lease sales, including 359,400 acres that would be subject to non-surface occupancy ("NSO"), 585,400 acres that would be subject to timing limitations ("TLs"), and approximately 618,700 acres that would be subject only to standard terms and conditions; (3) Alternative C, which would offer approximately 1,563,500 acres for oil and gas lease sales, including 932,500 acres that would be subject to NSO, 317,100 acres that would be subject to TLs, and approximately 313,900 acres that would be subject only to standard terms and conditions; and (4) Alternative D, which has two sub-alternatives. Under both sub-alternatives, approximately 1,037,200 acres would be offered for oil and gas lease sales, including 708,600 acres that would be subject to NSO, and 123,900 acres that would be subject to controlled surface use ("CSU"). Under Alternative D1, no areas would be subject to TLs, and approximately 204,700 acres would be subject to standard terms and conditions. Alternative D2 would lease approximately 204,700 acres subject to TLs, with no areas subject to standard terms and conditions.

There are other reasonable alternatives that BLM failed to consider that would serve the BLM's stated purpose and need for the oil and gas leasing program. PL 115-97 requires that at least two lease sales be held by December 22, 2024, and that each sale offer for lease at least 400,000 acres of the highest high carbon potential ("HCP") lands within the Coastal Plain.[1] This total of 800,000 acres constitutes approximately 51 percent of the Coastal Plain's total acreage of approximately 1,563,500 acres. Yet the alternatives analyzed in the DEIS would open a substantially higher amount of acreage for lease. The minimum acreage proposed to be offered for lease is 1,037,200 acres under Alternatives D1 and D2, or 66 percent of the Coastal Plain, while the maximum acreage proposed to be offered under Alternatives B and C is 1,563,500 acres, or 100 percent of the Coastal Plain.

The DEIS states that BLM "considered an alternative that would make only 800,000 acres available for lease sales, which is the minimum acreage necessary to comply with the requirement in Section 20001(c)(1) of PL 115-97[.]"[2] BLM provided one-quarter page of analysis of this alternative before rejecting it based upon the following rationale:

> The best available information regarding hydrocarbon discovery potential in the Coastal Plain provides a rough estimate of 427,900 acres of high HCP, 658,400 acres of medium HCP, and 477,200 acres of low HCP. Acreages within low and medium HCP areas must be made available, in addition to the high HCP areas, for the two lease sales to meet the 800,000-acre minimum under PL 115-97. In addition, the actual potential development area would be much less with the 2,000-acre limitation on surface disturbance. This alternative would also be similar in concept to Alternatives D1 and D2, which make only 1,037,200 acres available for lease sales. For all these reasons, an alternative that considered only 800,000 acres available for leasing was eliminated from detailed analysis.[3]

BLM's summary rejection of alternatives that would lease between 800,000 acres to approximately 1,000,000 acres is arbitrary and capricious. BLM has not adequately explained how leasing massive areas with low carbon potential meets the purpose and need articulated in the DEIS. PL 115-97 specifically mandates that each of the two leases encompass "the areas having the highest potential for discovery of hydrocarbons."[4] BLM has stated that "acreages within low and medium HCP areas must be made available, in addition to the high HCP areas, for the two lease sales to meet the 800,000-acre minimum under PL 115-97." This is not supported by data provided in the DEIS. Within the Coastal Plain, there are 427,900 acres of high HCP, 658,400 acres of medium HCP, and 477,200 acres of low HCP.[5] Adding the acres identified to be high HCP and medium HCP produces a total of 1,086,300 acres. This is 286,300

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[1] Bureau of Land Mgmt., Coastal Plain Oil and Gas Leasing Program Draft Environmental Impact Statement 23 (2018) (hereinafter "DEIS").
[2] *Id.* at 69.
[3] *Id.*
[4] *Id.*
[5] *Id.* at 69, 171.

acres greater than the minimum 800,000 acres that must be leased under the law. Therefore, BLM's assertion that areas of low HCP must also be leased does not pass muster.

Leasing in low HCP areas gives preference to oil and gas development at the expense of other uses because the presence of leases can limit BLM's ability to manage for other resources, in violation of FLPMA's multiple use mandate. As a result, it is more consistent with both PL 115-97 and BLM's statutory obligations to provide that low potential lands are categorically determined to be unsuitable for leasing unless and until they can be shown to contain resources that have the potential to be developed.

In light of this, BLM is legally required to adequately consider alternatives that would offer a lower amount of acreage for lease.

II. BLM Failed to Adequately Consider the Impacts of the Leasing Program on Climate Change.

BLM failed to take a hard look at the climate change impacts from oil and gas leasing and development in the Coastal Plain. The DEIS partially discloses the amount of carbon dioxide pollution that may result from oil and gas leasing and development.[6] However, BLM must take a hard look at the climate change impacts from emissions that would result from allowing extraction of oil and gas resources in the Coastal Plain. Production, transportation, refinement, and eventual combustion of this oil and gas would emit large quantities of greenhouse gases. BLM must therefore consider the climate impacts of this additional oil and gas production in its NEPA analysis. Courts have held that where agency actions make additional resources available to consumers, the effects of consumption of that resource must be considered. *Mid States Coalition for Progress v. Surface Transportation Board*, 345 F.3d 520 (8th Cir. 2003). Yet BLM has avoided performing an analysis of the greenhouse gas emissions that would result from oil and gas development that is reasonably foreseeable. *See New Mexico ex rel. Richardson v. Bureau of Land Mgmt.*, 565 F.3d 683, 718 (10th Cir. 2009) (assessment of all "reasonably foreseeable" impacts must occur at the earliest practicable point).

These emissions' contribution to climate change are precisely the type of "[cumulative] impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions" that must be considered by the agency. 40 C.F.R. § 1508.7; *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin*., 538 F.3d 1172, 1217 (9th Cir. 2008). Failure to do so would "impermissibly subject[s] the decisionmaking process contemplated by NEPA to 'the tyranny of small decisions.' " *Kern*, 284 F.3d at 1078 (citation omitted). A cumulative effects analysis requires more than "general statements about possible effects and some risk" or simply conclusory statements regarding the impacts of a project. *Klamath Siskiyou Wildlands Center v. BLM*, 387 F.3d 989, 995 (9th Cir. 2004) (citation omitted); *Oregon Natural Resources Council v. BLM*, 470 F.3d 818, 822-23 (9th Cir. 2006).

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[6] DEIS at 77-78, Tables 3-3, 3-4.

It is well settled that where an agency action causes greenhouse gas pollution, NEPA mandates that agencies analyze and disclose the impacts of that pollution. As the Ninth Circuit has held: "the fact that climate change is largely a global phenomenon that includes actions that are outside of [the agency's] control . . . does not release the agency from the duty of assessing the effects of its actions on global warming within the context of other actions that also affect global warming." *Ctr. for Biological Diversity*, 538 F.3d at 1217 (quotations and citations omitted); *see also Border Power Plant Working Grp. v. U.S. Dep't of Energy*, 260 F. Supp. 2d 997, 1028-29 (S.D. Cal. 2003) (finding agency failure to disclose project's indirect carbon dioxide emissions violates NEPA). The need to evaluate such impacts is bolstered by the fact that "[t]he harms associated with climate change are serious and well recognized," and environmental changes caused by climate change "have already inflicted significant harms" to many resources around the globe. *Massachusetts v. EPA*, 549 U.S. 497, 521 (2007); *see also id.* at 525 (recognizing "the enormity of the potential consequences associated with manmade climate change."). "Conclusory remarks" "do not equip a decisionmaker to make an informed decision about alternative courses of action." *Natural Resources Defense Council v. Hodel*, 865 F.2d 288, 298 (D.C. Cir. 1988). Similarly, "[p]erfunctory references do not constitute analysis useful to a decisionmaker in deciding whether, or how, to alter the program to lessen cumulative environmental impacts." *Id.* BLM's conclusory treatment of the cumulative impacts of greenhouse gas emissions fails to meet the hard look requirement under NEPA. *See Morris v. U.S. Nuclear Reg. Comm'n*, 598 F.3d 677, 681 (10th Cir. 2010).

Additionally, the DEIS fails to take a hard look at the impact of methane pollution specifically from oil and gas development in the Coastal Plain. Oil and natural gas systems are the biggest contributor to methane emissions in the United States, accounting for over one quarter of all methane emissions, or 129.9 million metric tons of carbon dioxide equivalent each year.[7] This does not include methane that has been flared, captured, or otherwise controlled.[8] However, methane emission rates can differ quite dramatically from one oil and gas field to the next, and, depending on the type of mitigation and emission controls employed, emissions can range anywhere from 1 percent to 12 percent of production.[9] In order to sufficiently understand the scope of methane emission impacts, BLM should quantify estimated emission rates and analyze alternatives that would mitigate these impacts.

By producing a DEIS that partially discloses the amount of carbon dioxide pollution from foreseeable oil and gas leasing and development, but fails to take the essential next step of disclosing the impacts that such pollution, including methane pollution, would have on climate change, BLM has failed to meet NEPA's standards.

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[7] *See* U.S. EPA, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2012*, at 3-63 (2014).

[8] *Id.*

[9] *See, e.g.,* David T. Allen, et. al., *Measurements of methane emissions at natural gas production sites in the United States*, PNAS (2013) (finding emissions as low as 1.5% of production at select cites); Anna Karion, et. al., *Methane emissions estimate from airborn measurements over a western United States gas field*, Geophysical Research Letters (2013) (finding emissions of 6 to 12 percent, on average, in the Uintah Basin).

III. Additional Studies on Wildlife Impacts that BLM Should Incorporate into EIS.

This section provides additional information and peer-reviewed studies on the following five issues: (1) caribou; (2) polar bears; (3) whales; (4) seals; and (5) the impact of marine noise on wildlife. BLM did not consider the studies listed below in the DEIS, which are attached to these comments for your convenience.

a. Caribou.

The Porcupine Caribou Herd ("PCH") and the Central Arctic Herd ("CAH") both rely on habitat located in the Coastal Plain for vital parts of their lifecycle. The PCH migrates 700 miles, twice a year, to the Coastal Plain during calving season.[10] The PCH has calved in the Coastal Plain for thousands of years. Females return there year after year to give birth. Approximately 40,000 calves are born on the Coastal Plain each year.[11] The PCH mainly uses the Coastal Plain as a staging ground with the south central portion representing a core caribou calving ground. The PCH uses the western portion of the Coastal Plain as a post-calving ground.[12] The CAH also uses a portion of the Coastal Plain for calving.

The impacts on the PCH and CAH from oil and gas exploration and development may be severely detrimental to the health of the herd. Caribou are known to be skittish and wary of human activity preferring to seek out alternate high-quality forage areas in order to avoid industrial sites.[13] Various studies support the conclusion that industrial activity disturbs caribou and alters their behavioral patterns. A summary of such studies was reported by Science:

> In Canada's Northwest Territories . . . researchers found that caribou spent less time than expected in areas as far as 14 kilometers away from diamond mines. To the west of the Arctic refuge, in the heart of the North Slope oil fields, researchers with the U.S. Geological Survey (USGS) found that, in the 1980s and 1990s, the Central Arctic caribou herd shifted calving areas away from well concentrations. And in long term studies of the Porcupine herd (named after the Porcupine River in the Yukon and Alaska), Johnson found that even decades after

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[10] U.S. Fish and Wildlife Service, Caribou. 2016. Available at: https://www.fws.gov/refuge/arctic/caribou.html; Mission 2007: Devising and Analyzing the Most Environmental Correct Method for Drilling in the 1002 Region of the Arctic National Wildlife Refuge, Massachusetts Institute of Technology. Available at: http://web.mit.edu/12.000/www/m2007/teams/editing/report.html.

[11] Bourne, Joel, Arctic Refuge Has Lots of Wildlife – Oil, Maybe Not So Much, National Geographic. Dec. 17, 2017. Available at: https://news.nationalgeographic.com/2017/12/arctic-wildlife-refuge-tax-bill-oil-drilling-environment/.

[12] Mission 2007: Devising and Analyzing the Most Environmental Correct Method for Drilling in the 1002 Region of the Arctic National Wildlife Refuge, Massachusetts Institute of Technology. Available at: http://web.mit.edu/12.000/www/m2007/teams/editing/report.html.

[13] Cornwall, Warren, Drilling in Arctic Refuge could put North America's Largest Caribou Herd at Risk, Science. Nov. 21, 2017. Available at: http://www.sciencemag.org/news/2017/11/drilling-arctic-refuge-could-put-north-america-s-largest-caribou-herd-risk.

> oil development in the Canadian portion of its range, caribou were still avoiding areas within 6 kilometers of roads and wells.[14]

Despite the tendency of caribou to avoid industrial sites, the caribou in the PCH often calve on a slice of the Arctic refuge's coastal plain that can be as narrow as 14 kilometers in places, located between the Brooks Range mountains and the Arctic Ocean. These animals do not have many options for expanding or altering their calving location.[15]

In light of this, there are a number of highly concerning aspects of the proposed alternatives. The DEIS states:

> Alternative B would suspend major construction activities and place limits on vehicle traffic and vehicle speeds in the PCH primary calving habitat area (Lease Stipulation 7 and ROP 23) during the calving period (May 20 to June 20).[16] The PCH calving habitat area would not be subject to specific lease stipulations after June 20, although the area is used extensively by the PCH during the post-calving period (PCTC 1993); it would still be subject to the limitations in ROP 23 and ROP 34. As a result, some potential impacts on caribou distribution and movements may occur in this area during the post-calving period."[17]

These limitations are not protective enough. The inherent antipredator response of new caribou mothers during the first three weeks of calving makes them wary of roads, pipelines, vehicles, and human activity.[18] Mothers with calves try to stay at least 4 km from roads, and researchers have documented displacement of calving grounds away from oil field structures.[19] Disturbed mothers may run, which greatly increases the likelihood of them losing their calves. Additionally, one study indicated, based on satellite photos that distinguish between high and low-quality vegetation, that the vegetation in alternative calving grounds that the caribou used as a result of displacement was deficient in nutrients compared with the preferred and traditional grounds. This nutritional deficiency was identified as the cause for a decline in caribou fertility rates from 83 percent on the traditional calving grounds to 65 percent of cows calving on the alternative grounds.[20]

Additionally, noise pollution from oil fields in the 1002 area historically caused the PCH to cease migration to areas of the Coastal Plain for calving season. Many animals cannot tolerate drilling noises in excess of 75 decibels, causing them to avoid those areas.[21] Furthermore, main

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[14] *Id.*
[15] *Id.*
[16] DEIS at 187.
[17] Id. at 188.
[18] Pelley, Janet, Will Drilling for Oil Disrupt the Arctic National Wildlife Refuge? Environmental Science and Technology at 246. June 2001. Available at: https://pubs.acs.org/doi/pdfplus/10.1021/es0123756.
[19] *Id.*
[20] *Id.* at 246-47.
[21] Drolet, Amelie, Côté, Steeve, and Dussault, Christian, Simulated drilling noise affects the space use of a large terrestrial mammal, Wildlife Biology 22(6), p. 284-293. 2016. Available at: http://www.bioone.org/doi/full/10.2981/wlb.00225; Mergener, Adam, et al., The Arctic National

pipelines can adversely alter caribou movement after calving, as they seek relief from harassment by insects. Oil development in the 1002 area could reduce the access to these important relief habitats. If caribou cannot freely move to a lower density insect habitat, there could be severe consequences, including disease or death, particularly for calves.[22]

These impacts can strongly affect calf survival and the long-term stability of the PCH and CAH. An article published in Science reported that a "2002 USGS modeling study estimated that if drilling on the coastal plain were as extensive as on the North Slope, the survival rate of caribou calves would drop by as much as 8%, depending on where most calving occurred, in part because of greater exposure to predators and lower-quality forage."[23] Other researchers report even higher mortality rates, with models suggesting that displacement from the calving grounds will lead to an 18–20 percent increase in calf mortality, causing dramatic herd declines.[24] Additionally, in 1992, the Alaska Department of Fish and Game found that calf survival was very high on the Coastal Plain, and very low when the caribou were displaced further south or east[25]—as would result from oil and gas development in the 1002 area. Such mortality could ultimately cause herd numbers to fluctuate more dramatically, and make it harder for caribou to recover from declines.[26] Furthermore, one concerning impact of climate change on the survival rates of caribou is the likelihood of an increased incidence of rain-on-snow events. Such events can be devastating to caribou because they create an impenetrable layer of ice that covers the plants caribou rely on.[27]

Wildlife Reserve: Save the Caribou, University of Massachusetts. Dec. 4, 2017. Available at: https://blogs.umass.edu/natsci397a-eross/the-arctic-national-wildlife-reserve-save-the-caribou/.

[22] Clough, N.K., Patton, P.C., and Christiansen, A.C., eds., 1987, Arctic National Wildlife Refuge, Alaska, coastal plain resource assessment, Report and Recommendation to the Congress of the United States and final legislative environmental impact statement: Washington, D.C., U.S. Fish and Wildlife Service, U.S. Geological Survey and Bureau of Land Management, v. 1 at 122. Available at: https://pubs.usgs.gov/fedgov/70039559/report.pdf.

[23] Cornwall, Warren, Drilling in Arctic Refuge could put North America's Largest Caribou Herd at Risk, Science. Nov. 21, 2017. Available at: http://www.sciencemag.org/news/2017/11/drilling-arctic-refuge-could-put-north-america-s-largest-caribou-herd-risk.

[24] Pelley, Janet, Will Drilling for Oil Disrupt the Arctic National Wildlife Refuge? Environmental Science and Technology at 247. June 2001. Available at: https://pubs.acs.org/doi/pdfplus/10.1021/es0123756.

[25] Kenneth Whitten, Movement Patterns of the Porcupine Caribou Herd in Relation to Oil Development, Alaska Department of Fish and Game, Division of Wildlife Conservation. November 1992. Available at: http://www.adfg.alaska.gov/static/home/library/pdfs/wildlife/research_pdfs/92_ca_porc_whitten.pdf.

[26] Cornwall, Warren, Drilling in Arctic Refuge could put North America's Largest Caribou Herd at Risk, Science. Nov. 21, 2017. Available at: http://www.sciencemag.org/news/2017/11/drilling-arctic-refuge-could-put-north-america-s-largest-caribou-herd-risk.

[27] Berger, J., et al., Climate Degradation and Extreme Icing Events Constrain Life in Cold-Adapted Mammals, Nature (2018); Bintanja, R. and O. Andry, Towards a Rain-Dominated Arctic, 7 Nature Climate Change 263 (2017); Bieniek, P., et al., Assessment of Alaska Rain-on-

To help inform BLM's decisionmaking, below is a list of additional studies that BLM should consider.

Impact of oil development on caribou:

- Bradshaw, C. et al., Effects of Petroleum Exploration on Woodland Caribou in Northeastern Alberta, 61 J. Wildlife Mgmt. 1127 (1997).
- Bradshaw C. et al., Energetic Implications of Disturbance Caused by Petroleum Exploration to Woodland Caribou, 76 Canadian J. Zoology 1319 (1998).
- Cameron, R.D. et al., Caribou Distribution and Group Composition Associated with Construction of the Trans-Alaska Pipeline, 93 Canadian Field Naturalist 155 (1979).
- Cameron, R.D., Issue: Caribou and Petroleum Development in Arctic Alaska, 36 Arctic 227 (1983).
- Cronin, M.A., et al., Northern Alaska Oil Fields and Caribou, 28 Wildlife Society Bulletin 919 (2000).
- Dyer, S.J., et al., Quantifying Barrier Effects of Roads and Seismic Lines on Movements of Female Woodland Caribou in Northeastern Alberta, 80 Canadian J. Zoology 839 (2002).

Threats to caribou:

- Apps, C.D. and B.N. McLellan, Factors Influencing the Dispersion and Fragmentation of Endangered Mountain Caribou Populations, 130 Biological Conservation 84 (2006).
- Festa-Bianchet, M., et al., Conservation of caribou (Rangifer tarandus) in Canada: an uncertain future, 89 Canadian J. Zoology 419 (2011).
- Gunn, A., et al., Insights into Integrating Cumulative Effects and Collabroative Co-management for Migratory Tundra Caribou Herds in the Northwest Territories, Canada 19 Ecology and Society 4 (2014).
- Gustine, D.D., et al., Climate-Driven Effects of Fire on Winter Habitat for Caribou in the Alaskan-Yukon Arctic, 9 PLOS One 1 (2014).
- Johnson, C.J., et al., Cumulative Effects of Human Developments on Arctic Wildlife, 160 Wildlife Monographs 1 (2005).

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snow Events Using Dynamical Downscaling, 57 J. Applied Meteorology and Climatology 1847 (2018); Forbes, B.C., et al., Sea Ice, Rain-on-snow and Tundra Reindeer Nomadism in Arctic Russia, 12 Biology Letters 1 (2016); Rennert, K.J., et al., Soil Thermal and Ecological Impacts of Rain on Snow Events in the Circumpolar Arctic, 22 J. of Climate 2302 (2009); Wendler, G., et al., On the Precipitation and Precipitation Change in Alaska, 8 Atmosphere 253 (2017); Russell, D.E., et al., Migratory Tundra Caribou and Wild Reindeer, NOAA Arctic Report Card 2018 (2018); Dolant, C., et al., Meteorological Inventory of Rain-on-snow Events in the Canadian Arctic Archipelago and Satellite Detection Assessment Using Passive Microwave Data, Physical Geography (2017).

- Johnson, C.J. and Martin-Hugues St-Laurant, Unifying Framework for Understanding Impacts of Human Developments on Wildlife, Energy Development and Wildlife Conservation in Western North America 27 (D.E. Naugle ed., 2011).
- Latham, M.C., et al., Why Are Caribou Declining in the Oil Sands?, Ecological Society of America 65 (2012).
- Lesmerises, F., et al., Spatiotemporal Response of Mountain Caribou to the Intensity of Backcountry Skiing, 217 Biological Conservation 149 (2018).
- Simpson, K. and E. Terry, Impacts of Backcountry Recreation Activities on Mountain Caribou, Ministry of Environment, Lands and Parks, Wildlife Working Report No. WR-99 (2000).
- Vistnes, I. and C. Nellemann, The Matter of Spatial and Temporal Scales: a review of reindeer and caribou response to human activity, Polar Biology 1 (2007).
- Vistnes, I. and C. Nellemann, Impacts of Human Activity on Reindeer and Caribou: the matter of spatical and temporal scales, 12 Rangifer 47 (2007).
- Wasser, S.K., et al., The Influences of Wolf Predation, Habitat Loss, and Human Activity on Caribou and Moose in the Alberta Oil Sands, 9 Front Ecol Envt. 546 (2011).
- Webster, L., The Effects of Human Related Harassment on Caribou (Rangifer tarandus), Ministry of Environment, Williams Lake, BC (1997).
- Wolfe, S.A., et al., Response of Reindeer and Caribou to Human Activities, 19 Polar Research 63 (2000).

Impact of noise on caribou:

- Harrington, F.H., Caribou, Military Jets and Noise: the interplay of behavioral ecology and evolutionary psychology, 14 Rangifer 73 (2003).
- Horejsi, B.L., Behavioral Response of Barren Ground Caribou to a Moving Vehicle, 34 Arctic 180 (1981).
- Flydal, K., et al., Reindeer (Rangifer tarandus tarandus) Perception of Noise from Power Lines, 23 Rangifer 21 (2003).
- Luick, B.R., et al., Modeling Energy and Reproductive Costs in Caribou Exposed to Low Flying Military Jet Aircraft 9 Rangifer 209 (1996).
- Mahoney, S.P., et al., Caribou Reactions to Provocation by Snowmachines in Newfoundland, 21 Rangifer 35 (2001).
- Pepper, C.B., et al., A Review of the Effects of Aircraft Noise on Wildlife and Humans, Current Control Mechanisms, and the Need for Further Study, 32 Envtl. Mgmt. 418 (2003).
- Seip, D., et al., Displacement of Mountain Caribou from Winter Habitat by Snowmobiles, Draft Manuscript (July 2006).
- White, R.G., et al., Energy Expenditures of Caribou Responding to Low-Altitude Jet Aircraft, Armstrong Laboratory (1993).

Impact of oil development on caribou:

- Noel, L.E., et al., Caribou Distribution Near an Oilfield Road on Alaska's North Slope, 1978-2001, 32 Wildlife Society Bulletin 757 (2004).
- Russell, D.E., et al., Oil and the Porcupine Caribou Herd – Can We Quantify the Impacts?, 9 Rangifer 255 (1996).
- Wilson, R.R., et al., Accounting for Uncertainty in Oil and Gas Development Impacts to Wildlife in Alaska, 6 Conservation Letters 350 (2013).

Population status of caribou:

- Cameron, R.D., et al., Section 4: the Central Arctic Caribou Herd, 38 Biological Science Report USGS/BRD (2002).

General information on caribou:

- Dalziel, B.D., et al., Detecting Collective Behavior in Animal Relocations Data, with Application to Migrating Caribou, 7 Methods in Ecology and Evolution 30 (2016).
- Le Corre, M., et al., Weather Conditions and Variation in Timing of Spring and Fall Migrations of Migratory Caribou, 98 J. of Mammalogy 260 (2017).
- Wilson, K.S., et al., The Biogeography of Home Range Size of Woodland Caribou Rangifer tarandus caribou, 25 Diversity and Distributions 205 (2019).

b. Polar Bears.

Oil and gas development in the Coastal Plain is likely to negatively impact polar bears. One important impact that polar bears face from oil and gas development in the Coastal Plain is disturbance of their denning sites. Only approximately 25,000 polar bears exist today,[28] and roughly 50 bears come into the Arctic Refuge each year in September, with denning beginning in the late fall. These bears are part of the Southern Beaufort Sea population, which numbers about 900 animals.[29] According to the Fish and Wildlife Service, which tracks collared polar bears, "collared bears are a subset of the total number of bears that use this area. Tracking of the collared bears identified 53 dens along the mainland coast, 26 (50%) of which were within the bounds of the Arctic National Wildlife Refuge. Twenty-two of the 53 dens (42%) were within the bounds of the 1002 area."[30] Polar bears give birth during mid-winter in deep dens of ice and snow. The Coastal Plain hosts the highest density of polar bear dens in Alaska, and is a

[28] IUCN/SSC Polar Bear Specialist Group, global polar bear population estimates. 2014. Available at: http://pbsg.npolar.no/en/status/pb-global-estimate.html; IUCN/SSC Polar Bear Specialist Group, Summary of polar bear population status per 2017. 2017. Available at: http://pbsg.npolar.no/en/status/status-table.html.

[29] National Wildlife Refuge Association, Protecting the Arctic National Wildlife Refuge, Available at: https://www.refugeassociation.org/advocacy/refuge-issues/arctic/.

[30] U.S. Fish and Wildlife Service, Polar Bear Denning. 2014. Available at: https://www.fws.gov/refuge/arctic/pbdenning.html.

critical site for polar bears to make their dens and give birth.[31] As climate change shrinks sea ice, biologists anticipate that even more bears will be forced to build their snow dens onshore, making the Coastal Plain even more vital in the future.[32] Denning polar bears subjected to human disturbances may abandon dens before their young can survive an Arctic winter.[33] This, in turn, can adversely affect their winter survival and could increase risks to humans due to a potential increase in polar bear/human conflicts by polar bears who abandon their dens.

The DEIS states: "[p]olar bears have been shown to den in the program area with greater frequency than expected, based on available habitat . . . . thus, the program area has been shown to be an important area for maternal denning and would likely increase in importance as the percentage of bears denning on land increases with continuing sea-ice loss.[34] BLM concedes that: "expansion of oil and gas development along the arctic coast on both land and sea may reach a level at which such effects become problematic for polar bears in the future."[35]

To help inform BLM's decisionmaking, below is a list of additional studies on polar bears that BLM should consider.

Polar bear population in Beaufort Sea and Chukchi Sea:

- Amstrup, S.C., Movements, Distribution, and Population Dynamics of Polar Bears in the Beaufort Sea, Thesis, University of Alaska (1995).
- Amstrup, S.C., et al., Movements and Distribution of Polar Bears in the Beaufort Sea, Can. J. Zoology 948 (2000).
- Amstrup, S.C. et al., Polar Bears in the Beaufort Sea: a 30-year mark-recapture case history, 6 J. Agric. Biological Envtl. Statistics 221 (2001).
- Pongracz J. and A.E. Derocher, Summer Refugia of Polar Bears (Ursus maritimus) in the Southern Beaufort Sea, 40 Polar Biology 753 (2017).
- Regehr, E.V. et al., Integrated Population Modeling Provides the First Empirical Estimates of Vital Rates and Abundance for Polar Bears in the Chukchi Sea, 8:16780 Scientific Reports 1 (2018).
- Rode, K.D. et al., Variation in the Response of an Arctic Top Predator Experiencing Habitat Loss: feeding and reproductive ecology of two polar bear populations, Global Change Biology 1 (2013).

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[31] Bourne, Joel, Arctic Refuge Has Lots of Wildlife – Oil, Maybe Not So Much, National Geographic. Dec. 17, 2017. Available at: https://news.nationalgeographic.com/2017/12/arctic-wildlife-refuge-tax-bill-oil-drilling-environment/.
[32] *Id.*
[33] Durner, George, Amstrup, Steven, and Ambrosius, Ken, *Polar Bear Maternal Den Habitat in the Arctic National Wildlife Refuge, Alaska*, 59 Artic Institute of North America 1. 2006. Available at https://arctic.journalhosting.ucalgary.ca/arctic/index.php/arctic/article/view/361.
[34] DEIS at 198.
[35] *Id.* at 218.

- Stirling, I., Polar Bears and Seals in the Eastern Beaufort Sea and Amundsen Gulf: a synthesis of population trends and ecological relationships over three decades, 55 Arctic 59 (2002).

<u>Impact of climate change on polar bears</u>:

- Anderson, M. and J. Aars, Barents Sea Polar Bears (Ursus maritimus): population biology and anthropogenic threats, Norwegian Polar Institute (2016);
- Atwood, T.C., et al., Evaluating and Ranking Threats to the Long-Term Persistence of Polar Bears, U.S. Geological Survey and U.S. Dept. of Interior (2014).
- Atwood, T.C. et al., Forecasting the Relative Influence of Environmental and Anthropogenic Stressors on Polar Bears, 7 Ecosphere 1 (2016).
- Derocher, A.E. et al., Rapid Ecosystem Change and Polar Bear Conservation, Conservation Letters 368 (2013).
- Durner, G.M. et al., Increased Arctic Sea Ice Drift Alters Adult Female Polar Bear Movements and Energetics, Global Change Biology 1 (2017).
- Hamilton, C.D., et al., An Arctic Predator-Prey System in Flux: climate change impacts on coastal space use by polar bears and ringed seals, J. Animal Ecology 1 (2017).
- Laidre, K.L., Range Contraction and Increasing Isolation of a Polar Bear Subpopulation in an Era of Sea-Ice Loss, 8 Ecology and Evolution 2062 (2018).
- Pilford, N.W. et al., Migratory Response of Polar Bears to Sea Ice Loss: to swim or not to swim, 39 Ecography 001 (2016).
- Whiteman, J.P., Out of Balance in the Arctic, 359 Science 514 (2018).

<u>Threats to polar bears</u>:

- Stirling, I. and W. Calvert, Environmental Threats to Marine Mammals in the Canadian Arctic, 21 Polar Record 433 (1983).
- Vongraven, D. and E. Peacock, Development of a Pan-Arctic Monitoring Plan for Polar Bears, Conservation of Arctic Flora and Fauna Monitoring Series Report No. 1 (2011).

<u>Impact of motorized vehicles and ships on polar bears</u>:

- Dyck, M.G., Effects of Tundra Vehicle Activity on Polar Bears (Ursus maritimus) at Churchill, Manitoba, Thesis, University of Manitoba (2001).
- Smultea, M.A. et al., Polar Bear (Ursus maritimus) Behavior near Icebreaker Operations in the Chukchi Sea, 1991, 69 Arctic 177 (2016).
- Aars, J. et al., Polar Bear Management and Research in Norway 2001-2005, Proceedings of the 14th Working Meeting of the IUCN/SSC Polar Bear Specialist Group 145 (2006).
- Anderson, M. and J. Aars, Barents Sea Polar Bears (Ursus maritimus): population biology and anthropogenic threats, Norwegian Polar Institute (2016).

<u>Ecotoxicological effects on polar bears</u>:

- Aars, J. et al., Polar Bear Management and Research in Norway 2001-2005, Proceedings of the 14th Working Meeting of the IUCN/SSC Polar Bear Specialist Group 145 (2006).

- Anderson, M. and J. Aars, Barents Sea Polar Bears (Ursus maritimus): population biology and anthropogenic threats, Norwegian Polar Institute (2016).
- Derocher, A.E. and I. Stirling, Oil Contamination of Polar Bears, 27 Polar Record 56 (1991).

Polar bear denning:

- Derocher, A.E. et al., Sea Ice and Polar Bear Den Ecology at Hopen Island, Svalbard, Marine Ecology Progress Series (2011).

Impact of industrial activity on polar bears:

- Wilson, R.R., et al., Identifying Polar Bear Resource Selection Patterns to Inform Offshore Development in a Dynamic and Changing Arctic, 5(10) Ecosphere 136 (2014)

Population status of polar bears:

- Hamilton, S.G. and A.E. Derocher, Assessment of Global Polar Bear Abundance and Vulnerability, 22 Animal Conservation 83 (2019).
- Peacock, E., et al., Population Ecology of Polar Bears in Davis Strait, Canada and Greenland, 77 J. Wildlife Mgmt. 463 (2013).
- Yurkowski, D.J., et al., Abundance and Species Diversity Hotspots of Tracked Marine Predators Across the North American Arctic, 25 Diversity and Distributions 328 (2019).

General information on polar bears:

- U.S. Fish and Wildlife. 2015. Polar Bear (*Ursus maritimus*) Conservation Management Plan, Draft. U.S. Fish and Wildlife, Region 7, Anchorage, Alaska. 59 pp.

c. Whales.

Oil and gas development in the Coastal Plain is likely to negatively impact whales in the form of increased risk of vessel strikes and increased ocean noise from vessel traffic and exploration and development activities. Oil and gas exploration requires the use of seismic surveys, which use a controlled sound source, such as an airgun, to transmit sound waves to the ocean floor.[36] Oil and gas development based on these surveys involves exploratory drilling and the construction of platforms and transport systems, which all emit noise, increase vessel and air traffic, and heighten the risk of oil spills.[37] The Marine Mammal Commission, an independent agency of the U.S. Government, has described the impact of oil and gas exploration and development on marine mammals as follows:

> Seismic airguns emit high energy, low-frequency impulsive sound that travels long distances. Marine mammal response to seismic surveys can cause disruption of important marine mammal behaviors, and—at close range—physiological

[36] Marine Mammal Comm'n, Oil and Gas Development and Marine Mammals. Available at: https://www.mmc.gov/priority-topics/offshore-energy-development-and-marine-mammals/offshore-oil-and-gas-development-and-marine-mammals/.

[37] *Id.*

> injury. Sound from airguns can also mask biologically important sounds, including communication calls between individuals of the same species . . . . Once seismic surveys are completed, exploratory drilling is used to confirm the presence of hydrocarbon reserves and to make decisions regarding the economic feasibility of developing an oil and gas field . . . . Exploratory drilling may impact marine mammals based on disturbance by sound emitted during drilling, during seismic profiling of the well, and from support vessels or aircraft. Drilling can also result in oil spills, which can affect marine mammals directly by contact, inhalation, or ingestion, or indirectly by affecting marine mammal prey or habitat . . . . If suitable oil and gas reserves are found, the next stage of development involves construction and installation of drilling platforms or structures and transport systems (e.g., pipelines). Construction begins with site surveys and planning, which can involve high-resolution geophysical surveys and result in sound-related effects. Impact pile driving during construction of shallow-water platforms also can be a significant source of low-frequency sound. Both shallow- and deep-water construction can require aircraft and vessel activity, which can cause marine mammals to avoid or move away from preferred habitat and increase the risk of ship strikes. The construction and anchoring of infrastructure and equipment can alter or degrade bottom habitat, which can affect the distribution of marine mammal prey. If oil or gas is to be transported by pipeline, either buried or on the seafloor, more construction activity is required and therefore more sound would be emitted and seabed disturbance can result. Finally, all of these activities may increase the amount of debris in surrounding waters and thus increase ingestion hazards for marine mammals . . . . Seismic surveys may be conducted on a regular basis to guide drilling activities and monitor changes within the reservoir and the pipeline. Both drilling and seismic activities generate sound that may be harmful to marine mammals. Vessel and aircraft activity is a source of chronic disturbance and vessel activity can increase the potential for ship strikes and fuel spills.[38]

To help inform BLM's decisionmaking, below is a list of additional studies that BLM should consider.

<u>Impact of oil development on whales</u>:

- Awbrey, F.T. and B.S. Stewart, Behavioral Responses of Wild Beluga Whales (Delphinapterus leucas) to Noise from Oil Drilling, 74 J. Acoustical Society of America S54 (1983).
- Helm, R.C., et al., Overview of Effects of Oil Spills on Marine Mammals, Handbook of Oil Spill Science and Technology (1st ed. 2015).
- Kishigami, Nobuhiro, Climate Change, Oil and Gas Development, and Inupiat Whaling in Northwest Alaska, 34 Etudes/Inuit/Studies 91 (2010).
- Ljungblad, D.K., Observations on the Behavioral Responses of Bowhead Whales (Balaena mysticetus) to Active Geophysical Vessels in the Alaskan Beaufort Sea, 41 Arctic 183 (1988).

[38] *Id.*

- Madsen, P.T., et al., Male Sperm Whale Behavior During Exposures to Distant Seismic Survey Pulses, 28.3 Aquatic Mammals 231 (2002).
- Miles, P.R. and W.J. Richardson, Predication of Drilling Site-Specific Interaction of Industrial Acoustic Stimuli and Endangered Whales in the Alaskan Beaufort Sea, OCS Study, MMS 87-0084, Report No. 6509 (1987).
- Reeves, R.R., Bowhead Whales and Acoustic Seismic Surveys in the Beaufort Sea, 22 Polar Record 271 (1984).
- Richardson, W.J. and M.A. Fraker, Behaviour of Bowhead Whales Balaena mysticetus Summering in the Beaufort Sea: reactions to industrial activities, 32 Biological Conservation 195 (1985).
- Richardson, W.J., et al., Reactions of Bowhead Whales, Balaena mysticetus, to Seismic Exploration in the Canadian Beaufort Sea, 79 J. Acoustic Society of America 1117 (1986).
- Robertson, F.C., et al., Seismic Operations Have Variable Effects on Dive-Cycle Behavior of Bowhead Whales in the Beaufort Sea, 21 Endangered Species Research 143 (2013).
- Thomas, J.A., et al., Behavior and Blood Catecholamines of Captive Belugas During Playbacks of Noise from an Oil Drilling Platform, 9 Zoo Biology 393 (1990).
- Weller, D.W., et al., Influence of Seismic Surveys on Western Gray Whales off Sakhalin Island, Russia in 2001, International Whaling Commission Scientific Committee SC/54/BRG14 (2002).

Impact of noise on whales:

- Blackwell, S.B., et al., Effects of Airgun Sounds on Bowhead Whale Calling Rates: evidence for two behavioral thresholds, PLOS One 1 (2015).
- Castellote, M., et al., Potential Negative Effects in the Reproduction and Survival on Fin Whales (Balaenoptera physalus) by Shipping and Airgun Noise (2010).
- Croll, D.A., et al., Effect of Anthropogenic Low-Frequency Noise on the Foraging Ecology of Balaenoptera Whales, 4 Animal Conservation 13 (2001).
- Ellison, W.T., et al., A New Context-Based Approach to Assess Marine Mammal Behavioral Responses to Anthropogenic Sounds, 26 Conservation Biology 21 (2011).
- Ellison, W.T., et al., Modeling the Aggregated Exposure and Responses of Bowhead Whales Balaena mysticetus to Multiple Sources of Anthropogenic Underwater Sound, 30 Endangered Species Research 95 (2016).
- Gervaise, C., et al., Shipping Noise in Whale Habitat: Characteristics, Sources, Budget, and Impact on Belugas in Saguenay-St. Lawrence Marine Park Hub, 132 J. Acoustical Society of America 76 (2012).
- Klinck, H., et al., Seasonal Presence of Cetaceans and Ambient Noise Levels in Polar Waters in the North Atlantic, 132 J. Acoustical Society of America (2012).
- Moore, S.E. and J.T. Clarke, Potential Impact of Offshore Human Activities on Gray Whales (Eschrichtius robustus), 4 J. Cetacean Resource Mgmt. 19 (2002).
- Nowacek, D.P., et al., Response of Cetaceans to Anthropogenic Noise, 37 Mammal Review 81 (2007).

- Patenaude, N.J., et al., Aircraft Sound and Disturbance to Bowhead and Beluga Whales During Spring Migration in the Alaskan Beaufort Sea, 18 Marine Mammal Science 309 (2002).
- Perry, C., A Review of the Impact of Anthropogenic Noise on Cetaceans, Environmental Investigation Agency SC/50/E9 (1998).
- Weilgart, L.S., The Impacts of Anthropogenic Ocean Noise on Cetaceans and Implications for Management, 85 Canadian J. Zoology 1091 (2007).

Impact of vessels on whales:

- Van der Hoop, J.M., et al., Assessment of Management to Mitigate Anthropogenic Effects on Large Whales, Conservation Biology 1 (2012).

d. Seals.

The DEIS discussed the impact of oil and gas development on seals in both marine and terrestrial environments. The health of seal populations is of great importance to the health of polar bear populations, as seals are the primary prey source of polar bears.[39] As marine mammals, oil and gas exploration and development influence seals in ways that are similar to the impact on whales, which is described above. Seals also experience additional impacts from terrestrial oil and gas activities. These terrestrial activities can negatively impact breeding, pupping, molting, and basking.

To help inform BLM's decisionmaking, below is a list of additional studies that BLM should consider.

Impact of oil development on seals:

- Moulton, V.D., et al., Effects of an Offshore Oil Development on Local Abundance and Distribution of Ringed Seals (Phoca hispida) of the Alaskan Beaufort Sea, 21 Marine Mammal Science 217 (2005).
- Born, E.W. et al., Escape Responses of Hauled Out Ringed Seals (Phoca hispida) to Aircraft Disturbance, 21 Polar Biology 171 (1999).
- Burns, J.J., and B.P. Kelly, Studies of Ringed Seals in the Alaskan Beaufort Sea during Winter: impacts of seismic exploration, Alaska Dept. Fish and Game Annual Report (1982).
- Harris, R.E., et al., Seal Responses to Airgun Sounds During Summer Seismic Surveys in the Alaskan Beaufort Sea, 17 Marine Mammal Science 795 (2001).
- Holliday, D.V., et al., Sound and Vibration Levels in a Ringed Seal Lair from Seismic Profiling on the Ice in the Beaufort Sea, 74 J. Acoustical Society of America 54 (1983).
- Moulton, V.D., et al., Ringed Seal Densities and Noise Near an Icebound Artificial Island with Construction and Drilling, 4 Acoustics Research Letters Online 112 (2003).

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[39] Polar Bears International, Polar Bear Status. Available at: https://polarbearsinternational.org/climate-change/status.

- Moulton, V.D., et al., Effects of an Offshore Oil Development on Local Abundance and Distribution of Ringed Seals (Phoca hispida) of the Alaskan Beaufort Sea, 21 Marine Mammal Science 217 (2005).
- Ringed Seal (Phoca hispida) Use of Subnivean Structures in the Alaskan Beaufort Sea During Development of an Oil Production Facility, 32 Aquatic Mammals 311 (2006).

Impact of noise on seals:

- Bohne, B.A. et al., Examination of Potential Hearing Damage in Weddell Seals (Leptonychotes weddelli) in McMurdo Sound, Antarctica, Antarctic Journal 174 (1985).
- Costa, D.P., et al., The Effect of a Low-Frequency Sound Source (Acoustic Thermometry of the Ocean Climate) on the Diving Behavior of Juvenile Northern Elephant Seals, Migounga angustirostris, 113 J. Acoustic Society of America 1155 (2003).
- Cummings, W.C., et al., Potential Impacts of Man-Made Noise on Ringed Seals: vocalizations and reactions, Outer Continental Shelf Environmental Assessment Program Research Unit 636 (1984).
- Gales, R.S., Effects of Noise of Offshore Oil and Gas Operations on Marine Mammals – an introductory assessment, Naval Oceans Systems Center, U.S. Bureau of Land Mgmt. (1982).
- Gotz, T. and V.M. Janik, Aversiveness of Sounds in Phocid Seals: psycho-physiological factors, learning processes and motivation, 213 J. Experimental Biology 1536 (2010).
- Hastie, G.D., et al., Sound Exposure in Harbour Seals During the Installation of an Offshore Wind Farm: predictions of auditory damage, 52 J. Applied Ecology 631 (2015).
- Hastie, G.D., et al., Harbour Seals Avoid Tidal Turbine Noise: Implications for Collision Risk, 55 J. Applied Ecology 684 (2018).
- Kastak, D. and R.J. Schusterman, Low-Frequency Amphibious Hearing in Pinnipeds: methods, measurements, noise, and ecology, 103 J. Acoustical Society of America 2216 (1998).
- Kastelein, R.A., et al., The Influence of Underwater Data Transmission Sounds on the Displacement Behaviour of Captive Harbour Seals (Phoca vitulina), 61 Marine Envtl. Research 19 (2006).
- Kastelein, R.A., et al., Hearing Threshold Shifts and Recovery in Harbour Seals (Phoca vitulina) after Octave-Band Noise Exposure at 4 kHz, 132 J. Acoustical Society of America, 2745 (2012).
- Kelly, B.P., et al., Ringed Seal Winter Ecology and Effects of Noise Disturbance (1986).
- Kelly, B.P., et al., Responses of Ringed Seals (Phoca hispida) to Noise Disturbance (1987).
- Ketten, D.R., Marine Mammal Auditory Systems: a summary of audiometric and anatomical data and implications for underwater acoustic impacts, 72 Polarforschung 79 (2004).
- Wright, A.J., et al., Do Marine Mammals Experience Stress Related to Anthropogenic Noise?, 20 Intl. J. Comparative Psychology 274 (2017).

Impact of vessels on seals:

- Johnson, A. and A. Acevedo-Gutierrez, Regulation Compliance by Vessels and Disturbance of Harbour Seals (Phoca vitulina), 85 Canadian J. Zoology 290 (2007).
- Petel, T.D.P., et al., An Assessment of the Audibility of Sound from Human Transport by breeding Weddell Seals (Leptonychotes weddellii) (2006).
- Thompson, P., et al., Framework for Assessing Impacts of Pile-Driving Noise from Offshore Wind Farm Construction on a Harbour Seal Population, 43 Envtl., Impact Assessment Review 73 (2013).
- Tougaard, J., et al., Underwater Noise from Three Types of Offshore Wind Turbines: estimation of impact zones for harbor porpoises and harbor seals, 125 J. Acoustic Society America 3766 (2009).

Seals in the Beaufort and Chukchi Seas:

- Harwood, L.A., et al., Fall Migration of Ringed Seals (Phoca hispida) through the Beaufort and Chukchi Seas, 2001-02, 65 Arctic 35 (2012).
- Moulton, V.D., et al., Factors Influencing Local Abundance and Haulout Behavior of Ringed Seals (Phoca hispida) on Landfast Ice of the Alaskan Beaufort Sea, 80 Canadian J. Zoology 1900 (2002).
- Stirling, I., Polar Bears and Seals in the Eastern Beaufort Sea and Amundsen Gulf: a synthesis of population trends and ecological relationships over three decades, 55 Arctic 59 (2002).

e. Noise in the Aquatic Environment.

Ocean noise caused by human activities can have serious adverse effects on marine species, as described above. To help inform BLM's decisionmaking, below is a list of additional studies that BLM should consider on this subject.

- Erbe, C., Effects of Underwater Noise on Marine Mammals, 730 Advances in Experimental Medicine and Biology 17 (2012).
- Halliday, W.D., et al., Potential Impacts of Shipping Noise on Marine Mammals in the Western Canadian Arctic, 123 Marine Pollution Bulletin 73 (2017).
- Hildebrand, J.A., Anthropogenic and Natural Sources of Ambient Noise in the Ocean, 395 Marine Ecology Progress Series 5 (2009).
- Hildebrand, J.A., Impacts of Anthropogenic Sound, Marine Mammal Research: Conservation Beyond Crisis 102 (Reynolds, J.E. et al., eds., 2005).
- Ketten, D.R., Marine Mammal Auditory Systems: a summary of audiometric and anatomical data and implications for underwater acoustic impacts, 72 Polarforschung 79 (2004).
- Kyhn, L.A., et al., Underwater Noise Emissions from a Drillship in the Arctic, Marine Pollution Bulletin (2014).

- Radle, A.L., The Effect of Noise on Wildlife: a literature review (2007).
- Slabbekoorn, H., et al., Effects of Anthropogenic Noise on Animals (2018).
- Southall, B., et al., Addressing the Effects of Human-Generated Sound on Marine Life: an integrated research plan for U.S. federal agencies. Interagency Task Force on Anthropogenic Sound and the Marine Environment of the Joint Subcommittee on Ocean Science and Technology. Washington, D.C.
- Weilgart, L.S., A Brief Review of Known Effects of Noise on Marine Mammals, 20 Intl. J. Comparative Psychology 159 (2007).

IV. Conclusion.

Thank you for your consideration of these comments. If you have any questions or there is any additional information we can provide, please do not hesitate to contact me.

Sincerely,

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