OCEAN CONSERVATION RESEARCH

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Ms. Kelly Hammerle,
Five-Year Program Manager,
BOEM (HM-3120),
381 Elden Street,
Herndon, Virginia 20170

Cc: Abigail Hopper, BOEM Director

Re: Draft Proposed OCS Oil and Gas Leasing Program for 2017-2022

Dear Ms. Hammerle,

We appreciate the opportunity to comment on the 2015-2022 Draft Proposed Program (5 Year DPP) on leasing areas of the Outer Continental Shelf (OCS) (ostensibly for the purpose of extraction and production of fossil fuel).

I am sure that we will not be the only commenters to refer to what is becoming the most threatening concern for all life on our planet – climate disruption, indisputably caused by the release of carbon dioxide into the atmosphere through the combustion of fossil fuel. In light of what is becoming the Holocene Extinction,[1] and the inevitable social, economic, and environmental catastrophes that are in the arc of our planetary environment and civilization, promoting the continuation of fossil fuel-based economy is unconscionable beyond the magnitude of being psychopathic. This is particularly true in light of the fact that renewable energy strategies such as wind power will provide greater, more reliable energy resources with more robust job growth, and a more proactive and positive impact on our domestic economy[2] while slowing climate disruption and improving the chances of survival for the most plant and animal species through the next century.

Although if the Outer Continental Shelf Lands Act[3] (OCSLA) calls for the preparation of a nationwide offshore oil and gas leasing program "setting forth a five-year schedule of

[1] Barnosky, Anthony D.; Matzke, Nicholas; Tomiya, Susumu; Wogan, Guinevere O. U.; Swartz, Brian; Quental, Tiago B.; Marshall, Charles; McGuire, Jenny L.; Lindsey, Emily L.; Maguire, Kaitlin C.; Mersey, Ben; Ferrer, Elizabeth A. (3 March 2011). "Has the Earth's sixth mass extinction already arrived?". Nature 471 (7336): 51–57

[2] Oceana "Offshore Energy by the Numbers: An Economic Analysis of Offshore Drilling and Wind Energy in the Atlantic." Research paper 2015

[3] OCS Lands Act (43 U.S. Code [U.S.C.] 1331 et seq.) Section 18

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lease sales designed to best meet the Nation's energy needs" then the phrase "best meet" taken literally could mean that our energy needs are best met by not leasing OCS lands for fossil fuel development. If taken literally by BOEM in the OCS planning, the 2015-2122 DPP could become the chokepoint on what will otherwise become a short and disastrous hydrocarbon-driven future.[4]

The 2017-2022 DPP discusses the "Option Value"[5] of exploiting a resource in the context of uncertainties of hydrocarbon pricing, and of the uncertainties of environmental and social cost.[6] While the Offshore Environmental Cost Model (OECM) considers air emitted pollutants and oils spills up top 100,000 barrels, it completely overlooks the overarching environmental cost of catastrophic climate change. Understanding that these catastrophic changes are "uncertain" only in scale and frequency of occurrence, omitting the social and environmental costs of ocean acidification, extreme weather events, sea level rise, and dramatically shifting global weather patterns is a serious oversight. We know that if we continue depending on fossil fuel that full one third of Louisiana or half of Florida[7] will be subsumed by the ocean. The costs of needing to build seawalls around Manhattan, or "bunker" San Diego, Seattle, San Francisco, and Galveston, or ship water to California to prevent environmental mass migrations needs to be included in the OECM calculus.

Additionally the suggestion that the cost, or "Net Social Value" (NSV) calculus considers "fuel switching" in terms of "oil to natural gas, oil to coal, etc." [8] while not mentioning the positive NSV in fuel switching from oil to wind, oil to photovoltaic, or oil to tidal power is a significant oversight in the model.

We hope that some consideration of these facts and perspectives are weighed into whether and how many OCS lease areas are postponed for fossil fuel exploitation until we are certain of the true value of the deposits and true costs of exploiting them.

With the preceding argument as a background we will focus on other environmental consequences of leasing OCS tracts for fossil fuel exploration, extraction, and production. We understand that the bulk of public concern expressed falls under two main arguments:

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[4] e.g.: Cook, B.I., T.R. Ault, and J.E. Smerdon, 2015: "Unprecedented 21st-century drought risk in the American Southwest and Central Plains." Sci. Adv., 1, no. 1, e1400082, doi:10.1126/sciadv.1400082

[5] 2017-2022 DPP, Section 8.1.1.1

[6] *Ibid.* Section 8.1.1.5

[7] James P. M. Syvitski, Albert J. Kettner, Irina Overeem, Eric W. H. Hutton, Mark T. Hannon, G. Robert Brakenridge, John Day, Charles Vörösmarty, Yoshiki Saito, Liviu Giosan & Robert J. Nicholls "Sinking deltas due to human activities" Nature Geoscience 2, 681 - 686 (2009) doi:10.1038/ngeo629

[8] 2017-2022 DPP, Section B.1.3 NSV: Net Social Value

the impacts of involved with 3D exploratory seismic surveys[9] and ongoing 4D seismic surveys associated extracting hydrocarbons from the OCS, and the probability of another catastrophic oil spill occurring that will compromise the current economically robust and healthy uses of the OCS. (These uses include commercial and recreational fishing, subsistence harvesting, onshore quality of life resources for tourism and coastal lifestyles, and the preservation of coastal wetlands and marine protected areas as buffers for sea level rise and extreme weather events, and of course hydrokinetic and wind power projects.)

The probability and impacts of another oil spill will likely be well articulated by others so we will spare the review – suffice it to say that we share these concerns. The balance of our arguments herein will focus on the biological impacts of noise from fossil fuel enterprises that will result from the leases.

In the course of exploiting fossil fuel deposits geophysical and geological surveys are required – first to locate the deposits, and then to monitor them while the extraction takes place. Current technology involves seismic surveys to locate (3D) and monitor (4D) using towed arrays of seismic airguns. Despite the erroneous, and continued insistence of BOEM that "there has been no documented scientific evidence of noise from air guns used in geological and geophysical (G&G) seismic activities adversely affecting marine animal populations…"[10] there is in fact a lot of scientific evidence documenting and substantiating seismic survey impacts to marine life.[11]

For marine mammals there are many published accounts of migratory disruptions,[12,13,14] communication disruptions,[15,16] population displacement[17,18] feeding disruptions,[19]

[9] These exploratory surveys are largely, but not entirely addressed in the BOEM "Atlantic Geophysical and Geological PEIS of 2014"
[10] William Yancy Brown "The science behind the decision" in BOEM *Science Notes,* August 22, 2014.
[11] William Brown's use of the word "populations" is a disingenuous attempt to side-step the well documented impacts on individual and "non-population scale" groups. Because the impacts have not been studied in "population scales" does not substantiate the intention of Brown's prevarication.
[12] Manuel Castellote, Christopher W. Clark, Marc O. Lammers 2012 "Acoustic and behavioral changes by fin whales (*Balaenoptera physalus*) in response to shipping and airgun noise." Biological Conservation 147 (2012) 115–122
[13] Richardson, W.J., G.W. Miller, and C.R. Greene Jr., "Displacement of migrating bowhead whales by sounds from seismic surveys in shallow waters of the Beaufort Sea." Journal of the Acoustical Society of America 106:2281 (1999)
[14] Castellote, M. Clark, C.W., Lammers M.O. "Potential negative effects in the reproduction and survival on fin whales (*Balaenoptera physalus*) by shipping and airgun noise." International Whaling Commission report SC/62/E3 - 2010
[15] Di Iorio, L., and C. W.Clark, "Exposure to seismic survey alters blue whale acoustic communication." Biology Letters, doi:10.1098/rsbl.2009.0651 (2009)
[16] Blackwell, S.B., et al., "Effects of airgun sounds on bowhead whale calling rates in the Alaskan Beaufort Sea" Marine Mammal Science, DOI: 10.1111/mms.12001 (2013)

system compromise,[20,21] and even seismic survey associated strandings.[22] Additionally there is evidence of increased metabolic stress in marine mammals due to anthropogenic (shipping) noise that would compromise health and breeding success.[23] There is no reason to believe that seismic survey noise would be any less stressful to marine mammals than shipping noise.

BOEM has also missed the literature on the impacts of seismic surveys on fisheries and catch rates[24,25] and at least at close range, physiological impacts on fish.[26] The evidence that decreased fisheries catch rates return after some period[27] may speak to the apparent evidence of no short-term or catastrophic impacts on some commercial fish species, but without more comprehensive longitudinal studies on the same populations any assumptions about long-term impacts are purely speculative. This is particularly in light of the repeated fish population exposures that will occur throughout the 4D seismic survey regimes in ongoing deepwater fossil fuel Extractions and Production (E&P) operations.[28]

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[17] Parente, C.L., J.P. Araújo, and M.E. Araújo, "Diversity of cetaceans as a tool in monitoring environmental impacts of seismic surveys," Biota Neotropical, 7 (1): 49-55 (2007)

[18] Weller, D.W., et al., "Influence of seismic surveys on western gray whales off Sakhalin Island, Russia in 2001." Paper No. SC/54/BRG14 presented to the International Whaling Commission Scientific Committee (2002)

[19] Frances C. Robertson, William R. Koski, Tannis A. Thomas, W. John Richardson, Bernd Würsig, Andrew W. Trites "Seismic operations have variable effects on dive-cycle behavior of bowhead whales in the Beaufort Sea" Endangered Species Res. Vol. 21: 143–160, 2013

[20] Gray, H. and K. Van Waerebeek, "Postural instability and akinesia in a pantropical spotted dolphin, *Stenella attenuata*, in proximity to operating airguns of a geophysical seismic vessel." Journal for Nature Conservation; 19:363-367.(2011)

[21] Mann, D., et al., "Hearing loss in stranded odontocete dolphins and whales." PLos ONE, 5(11): (2010).

[22] Hildebrand, J.A., "Impacts of anthropogenic sound" in *Marine mammal research: conservation beyond crisis.* The Johns Hopkins University Press, Baltimore, Maryland, pp. 101-124 (2005)

[23] Rosalind M. Rolland, Susan E. Parks, Kathleen E. Hunt, Manuel Castellote, Peter J. Corkeron, Douglas P. Nowacek, Samuel K. Wasser and Scott D. Kraus. 2012 "Evidence that ship noise increases stress in right whales" Proc. R. Soc. B

[24] Engås, A. S. Løkkeborg, E. Ona, and A.V. Soldal. 1996." Effects of seismic shooting on local abundance and catch rates of cod (*Gadus morhua*) and haddock (*Melanogrammus aeglefinus*)". Can. J. Fish. Aquat. Sci. 53:2238-2249.

[25] Løkkeborg, S. and A.V. Soldal. 1993. The influence of seismic exploration with airguns on cod (*Gadus morhua*) behaviour and catch rates. ICES mar. Sci. Symp., 196:62-67.

[26] McCauley, R. D., Fewtrell, J. & Popper, A. N. (2003). "High intensity anthropogenic sound damages fish ears." Journal of the Acoustical Society of America 113, 638–642

[27] Skalski, J. R., W. H. Pearson, and C. I. Malme. 1992. Effects of sounds from a geophysical survey device on catch-per-unit-effort in a hook-and-line fishery for rockfish (*Sebastes spp*.). Canadian Journal of Fisheries and Aquatic Science 49:1357-1365.

[28] Active Fossil Fuel E&P operations typically require three to four 4D surveys per year in the areas above and adjacent to producing deposits.

Seismic surveys are known to cause migratory disruptions of important fisheries species.[29] With the likely scenario of multiple and concurrent 4D seismic surveys - particularly in the Arctic and Atlantic areas, the impact of offshore fossil fuel disruptions to commercial and recreational fisheries would be inevitable. That these disruptions have not been recognized in the Western and Central Gulf of Mexico (GOM) is likely due to a lack of any baseline studies than to a paucity of evidence. This absence of clear correlations between seismic impacts and fisheries compromise is exacerbated by the complex synergy between other environmental stressors to fisheries such as seasonal marine hypoxia, questionably regulated fishing practices, receding coastal wetlands, coastal subsidence, and other environmental, social, and economic effects of a predominantly fossil fuel-driven economy in the GOM.

BOEM's "Science behind the decision" article does not mention concern for seismic impacts on invertebrates, but because they are part of the food chain, any compromise to vitality of squid[30,31] (for example) will certainly impact commercial fisheries as well as compromise the major food stock for many odontocetes. There is also recent evidence of impacts of seismic airgun noise on the larval development of scallops[32] and evidence that anthropogenic (shipping) noise disturbs mollusks that are not otherwise disturbed by natural noises at the same exposure levels.[33] So with all of the evidence that seismic airgun surveys do impact marine biota at all trophic levels, BOEM's maintaining that "there is no scientific evidence of impacts" is irresponsible and inexcusable.

These impacts mentioned above of both 3D and 4D seismic surveys required for OCS fossil fuel development should be sufficient evidence that offshore fossil fuel operations will significantly disrupt marine life and commercial and recreational fisheries, and should thus be limited to areas currently in production and where existing fossil fuel infrastructure can play out its remaining investment life.

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[29] Slotte, A., K. Hansen, J. Dalen, E. Ona. 2004. Acoustic mapping of pelagic fish distribution and abundance in relation to a seismic shooting area off the Norwegian west coast. Fisheries Research 67:143-150.

[30] Michel André, Marta Solé, Marc Lenoir, Mercè Durfort, Carme Quero, Alex Mas, Antoni Lombarte, Mike van der Schaar, Manel López-Bejar, Maria Morell, Serge Zaugg, and Ludwig Houégnigan (2011) "Low-frequency sounds induce acoustic trauma in cephalopods" Front Ecol. Environ. 2011; doi:10.1890/100124

[31] A. Guerra, A.F. González and F. Rocha (2004) "A review of the records of giant squid in the north-eastern Atlantic and severe injuries in *Architeuthis dux* stranded after acoustic explorations" International Council for the Exploration of the Sea CC:29

[32] de Soto, Natacha Aguilar; Delorme, Natali; Atkins, John; Howard, Sunkita; Williams, James; Johnson, Mark "Anthropogenic noise causes body malformations and delays development in marine larvae." Scientific reports 2013 v3

[33] Hansjoerg P. Kunc, Gillian N. Lyons, Julia D. Sigwart, Kirsty E. McLaughlin, and Jonathan D. R. Houghton "Anthropogenic Noise Affects Behavior across Sensory Modalities."The American Naturalist Vol. 184, No. 4 (October 2014), pp. E93-E100

Seismic surveys notwithstanding, it is clear that once the airguns go into the water the soundscapes of the proposed areas will be transformed forever. This will be due to a number of noise producing equipment and technologies required for new offshore and deepwater technologies:

Ongoing and expanding acoustical impacts from offshore fossil fuel E&P

In deepwater OCS off the Atlantic and in the Beaufort Sea Fossil Fuel E&P operations will most likely be managed from dynamically positioned, thruster stabilized operating platforms, or Floating Production, Storage, and Offloading (FPSO) vessels. These are stabilized by six to eight motor-driven propellers in the 5000-6000hp power range. So these drilling and operations platforms are stabilized by the equivalent of six to eight mid-weight cargo ships concentrated in the area of a single drilling and operations rig. In calmer sea states these may not be kicking up that much broad-band noise, but there is a reason that these platforms have all their horsepower – because they need it in high-swell conditions.

These platforms also do not have anchors – which means that as soon as the rig is put in service it is driving the propellers continuously. The propellers are typically steep pitch, high torque configurations that are not designed for reduced cavitation, so in the world of propellers they are among the noisiest. These platforms need to be evaluated under all likely drive conditions to make sure that the National Marine Fisheries Service (NMFS) "Level B take" 120dB re:1uPa continuous noise threshold is not exceeded.[34]

Additionally subsea operations employ various acoustical navigation and orienting beacons to locate equipment (Acoustic Positioning and Control Systems – APCS)[35], Acoustic Doppler Current Profilers (ADCP) to monitor currents and depth,[36] and sighting beacons to locate operation areas.[37] These noise sources are similar in function to airport radio beacons, except they are acoustical – and often operate on the 10kHz – 100kHz range – overlapping the communication and bio-sonar ranges of odontocetes, and the detection frequencies of clupeiforme fishes (shad, herring, menhaden, and sardines)[38]

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[34] NOAA Fisheries Interim Sound Threshold Guidance: http://www.westcoast.fisheries.noaa.gov/protected_species/marine_mammals/threshold_guidance.html

[35] J-E. Rygh, Arnijot Skogvang "Challenging the Hydro-Acoustics" Offshore Technologies Conference 1992 DOI http://dx.doi.org/10.4043/7047-MS

[36] Martin Visbeck, "Deep Velocity Profiling Using Lowered Acoustic Doppler Current Profilers: Bottom Track and Inverse Solutions." 2002: J. Atmos. Oceanic Technol., 19, 794–807

[37] Adam Weintrit "Marine and Offshore Telematics Systems" 2012 in "Marine and Offshore Telematics Systems" Springer Berlin Heidelberg

[38] David A. Mann, Zhongmin Lu, Mardi C. Hastings and Arthur N. Popper" Detection of ultrasonic tones and simulated dolphin echolocation clicks by a teleost fish, the American shad (*Alosa sapidissima*)" J. Acoust. Soc. Am. 104 , 562 (1998)

which are important commercial species as well as feeding stock for marine mammals and larger commercial species.

These noises are usually continuous so they must be below the NMFS "Level B take" 120dB re:1uPa continuous noise criteria. And as these noises are coded digital noise and alien to fish and marine mammals, they also need to be assessed in terms of migratory disruptions and elevated stress levels in stand-alone applications as well as in installed and operating environments.

Additionally deepwater operations (Beaufort and Atlantic) are introducing equipment and practices that involve seafloor mounted ("subsea") equipment used to "pre-refine" (separate wanted product from unwanted brine, gas, mud, and solids), re-inject unwanted materials and substances back into a deposit, and pump or pressure-drive wanted product to the surface. In many locations this multi-phase materials handling is being done across high differential pressures, and likely some consequent noise.

The various noises from these subsea processes need to be evaluated and accounted for prior to opening up new lease areas, because unless this information is brought into the impacts discussion prior to deployment it could become an environmental liability that will be "too expensive to mitigate" once in place. This is particularly the case in areas where high overpressure exists at the wellhead with multiphase materials (sand, brine, gas, oil).

Increasingly offshore enterprises are managed by Autonomous Underwater Vessels (AUV) or Remotely Operated Vessels (ROV). ROVs are typically controlled through communication cables in their umbilical tether. AUV's on the other hand are controlled by way of acoustical communication networks.[39] These also often operate in the 25kHz – 100kHz range and as they are continuous noise need to comply with the NMFS continuous noise criteria of 120dB re:1uPa.

These acoustic technologies and noise sources above are only an overview of what will be deployed and utilized in offshore fossil fuel E&P operations. To date none of these equipment and technologies have been tested for impacts on marine mammals and fish. It must also be noted that *in situ* all of these noise sources will be operating concurrently and that together they create a very non-biological soundscape which may have

[39] An, E. ; Beaujean, P.-P. ; Baud, B. ; Carlson, T. ; Folleco, Andres ; Tzyh Jong Tarn "Multiple communicating autonomous underwater vehicles." IEEE International Conference on Robotics and Automation, 2004. Proceedings. ICRA 2004 Vol.5 4461 - 4464

cumulative stress impacts greater than the arithmetic sum of the impacts of the individual sources.[40]

This is particularly important as multiple human enterprises expand into the OCS which all have some measurable impacts but are not considered cumulatively or synergistically in individually NEPA mandated Environmental Impact Statements.[41] These enterprises include ongoing seismic surveys, benthic profile surveys, fisheries management surveys, military training range exercises, commercial and industrial shipping, commercial fishing operations, recreational boating and fishing, offshore wind energy development, offshore wave, current, and tidal energy development, seafloor mining, dredging, and dumping.

The long-used, and often erroneous assumption that disturbed animals will avoid areas of disturbance[42] is obviated by the increasing ubiquity of anthropogenic disturbances. Under continued stress animals will succumb to physiological compromise effecting the breeding success of every animal in the compromised environment – fish stocks will slowly erode, whales will not replenish at the death rates, corals will become subject to viral and fungal infection, there will be a slowly decreasing supply of food at all trophic levels – even while all individual disturbances or "takes" are all within "managed guidelines" that supposedly do not cause population-level impacts. The "straw the breaks the camel's back" analogy comes to mind here.

The above assaults all adding to the habitat stress of climate disruption and ocean acidification makes it all the more critical to not support or encourage fossil fuel development and expansion into the US OCS - because burning hydrocarbon is at the very core of the climate disaster.

Summary of concerns:

1) Preparatory 3D and ongoing 4D seismic surveys will harm marine mammals, compromise commercials and recreational fisheries, and harm various marine invertebrates that are critical to the entire marine food chain.
2) Dynamically positioned offshore deepwater operations platforms and FPSOs will generate continuous mechanical noise and needs to be regulated under the NMFS "Level B take" from continuous noise exposure guidelines of 120dB re: 1uPa.

[40] Andrew J. Wright and Line A. Kyhn "Practical management of cumulative anthropogenic impacts with working marine examples" 2014 Conservation Biology, Volume 00, No. 0, 1–8
[41] Currently the Mid and South Atlantic is operating under the PEIS for the US Navy Atlantic Fleet Testing and Training Range. See 77 Fed. Reg. 27771 (May 11, 2012); 77 Fed. Reg. 29636 (May 18, 2012) and may soon be operating under the PEIS for the Atlantic OCS Geological and Geophysical survey plan.
[42] Beale CM. "The behavioral ecology of disturbance responses." International Journal of Comparative Psychology 2007, 20:111–120

3) Acoustic Positioning and Control Systems, Acoustic Doppler Current Profilers and other navigation and sighting beacons need to be evaluated for impacts to marine mammals and clupeiforme fish and due to their continuous operation need to be regulated under the NMFS "Level B take" from continuous noise exposure guidelines of 120dB re: 1uPa.
4) Subsea processing equipment such as separators, re-injectors, multi-phase pumps, and power distribution systems used in deepwater E&P operations need to be evaluated for impacts to marine mammals, and due to their continuous operation need to be regulated under the NMFS "Level B take" from continuous noise exposure guidelines of 120dB re: 1uPa
5) Acoustical control of ocean equipment through direct modems or multi-nodal acoustical communications networks that operate below 250 kHz need to be evaluated for impacts to marine mammals and clupeiforme fish and due to their continuous operation need to be regulated under the NMFS "Level B take" from continuous noise exposure guidelines of 120dB re: 1uPa.
6) Acoustical impacts of all noise sources used in OCS Oil and Gas E&P need to be evaluated as a complete soundscape, and not just as an assembly of individual noise sources. The industrial soundscape resulting from all of the contributing noises need to be considered as a whole, in terms of cumulative impacts and life-term effects.

In consideration of the above arguments, leasing areas on the US Outer Continental Shelf for fossil fuel development is unwise, economically and environmentally costly, and portends larger global disasters due to climate disruption which no amount of short-term economic benefits can justify.

Sincerely,

Michael Stocker
Director
Ocean Conservation Research