March 9, 2018
Kelly Hammerle,
Chief, National Oil & Gas Leasing Program Development & Coordination Branch
BOEM (VAM-LD)
45600 Woodland Road
Sterling, VA 20166-9216

Submitted online at http:www.regulations.gov, Docket ID: BOEM–2017–0074

Re: NRDC Comments for the 2019-2024 Outer Continental Shelf Oil and Gas Leasing Draft Proposed Program

Dear Ms. Hammerle:

On behalf of the Natural Resources Defense Council (NRDC) and our more than 3 million members and online activists, we submit these comments to the Bureau of Ocean Energy Management (BOEM) regarding the 2019-2024 Outer Continental Shelf (OCS) Oil and Gas Leasing Draft Proposed Program (DPP or Draft Proposal). For more than four decades, NRDC has monitored and engaged in policy processes related to leasing, exploring and producing oil and gas from our nation's oceans and we appreciate the opportunity to comment on this important issue.

The DPP is unprecedented in its scope: it opens 25 out of 26 planning areas for leasing and schedules 47 lease sales, the most of any Five-Year Leasing Program in history. At the same time, demand for offshore oil is decreasing. The United States is poised to become a net oil exporter by 2029 without additional offshore oil leasing that puts coastal communities and marine ecosystems at risk. Global oil demand is projected by many to peak by 2030 and then begin to decline, and oil prices are expected to remain low for the next several decades.[1]

New offshore oil and gas exploration is also fundamentally inconsistent with efforts to address climate change. We cannot meet our international obligations and avoid the worst impacts of climate change while at the same time exploiting new reserves.[2] Renewable energy, energy efficiency, and electric vehicles are viable alternatives to fossil fuels, and we should intensify our efforts to expand the use of them. The use of clean energy and transportation technologies has increased significantly in the past decade, providing clean sources of power and transportation while at the same time growing local economies, reducing climate change-causing emissions, and reducing our dependency on oil. We should focus on continuing to expand the use of renewable energy and transportation, and using energy more efficiently, rather than attempt to exploit new oil reserves.

[1] U.S Energy Information Administration. *Annual Energy Outlook 2018*. [hereinafter "AEO 2018"]. Available at https://www.eia.gov/outlooks/aeo/
[2] McGlade, C. and P. Elkins, 2015, The geographical distribution of fossil fuels unused when limiting global warming to 2 degrees C, Nature 517: 187-190 (Jan. 8, 2015).

Not only do we not need this oil, but exploiting this public resource would harm – not benefit – coastal communities, the marine environment, and the public.[3] The leasing process for areas in the OCS is already uncompetitive, resulting in low lease bids and minimal returns to the public. Opening a much vaster area of the OCS to leasing in such a short amount of time will further depress lease prices – essentially selling off our public resources at a steep discount. At the same time, the administration is attempting to roll back crucial safety measures that were adopted to prevent another catastrophic oil spill like the *Deepwater Horizon* from occurring. Exploiting offshore oil at a steep discount when we do not need this oil and cannot afford its climate and environmental impacts is not in our national interest.

NRDC does not believe that the DPP meets the requirements of the Outer Continental Shelf Lands Act (OCSLA). For example:

- **The Draft Proposed Program does not comply with Section 18(a) of OCSLA because it fails to consider relevant climate and energy policy information in developing a leasing program that will best meet national energy needs.** The DPP is rooted in the false premise that our nation will need to be developing new sources of offshore oil and gas for the next several decades. It ignores vitally relevant information, including the oil supply glut rendering offshore oil surplus to our energy needs, the climate change implications of its assumptions about future fossil fuel production and consumption, the viability of alternatives like electric vehicles and renewable energy, and our country's international obligations.
- **The Proposed Program fails to consider important information about the different OCS regions and the impacts of leasing on the environment, as required by Section 18(a).** The DPP does not comply with the OCSLA Section 18 requirements to consider ecological and other information about the different regions, the economic, social, and environmental values of the OCS, and the impacts of fossil fuel development on the marine, coastal, and human environments.[4]
- The Department of the Interior is unable to demonstrate that the DPP will "obtain a proper balance between the potential for environmental damage, the potential for the discovery of oil and gas, and the potential for adverse impact on the coastal zone."[5]

I. The Draft Proposed Program does not comply with Section 18(a) of OCSLA or the Administrative Procedure Act because it fails to consider relevant climate and energy policy information in developing a leasing program that will best meet national energy needs.

One of the underlying rationales for the BOEM's Draft Proposal is that the potential oil and gas resources from these offshore leases will be "fundamental to America's energy security in the

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[3] Hilzenrath, D. and Pacifico, N., Drilling Down: Big Oil's Bidding, The Project on Government Oversight (Feb. 22, 2018) http://www.pogo.org/our-work/articles/2018/drilling-down-big-oils-bidding.html.; Congressional Budget Office, Options for Increasing Federal Income From Crude Oil and Natural Gas on Federal Lands, (April 2016) https://www.cbo.gov/sites/default/files/114th-congress-2015-2016/reports/51421-oil_and_gas_options-OneCol-3.pdf
[4] 43 U.S.C. § 1344(a)(1) & (2).
[5] 43 U.S.C. § 1344(a)(3).

coming decades."[6] While the DPP notes that the need for imports has been decreasing significantly in the last decade due to growing domestic oil production, it asserts that without offshore drilling this trend is unlikely to continue.[7] However, this assertion is misleading for a number of reasons, and thus misconstrues the value and use of new offshore drilling sites in the future.

There is no need to develop these offshore oil and gas reserves for the nation's energy security. Onshore production and company interest, coupled with expected declining demand for oil, are expected to fulfill the nation's petroleum needs over the next 35 years (the time period for which projections are available in the latest government analysis). An ongoing supply glut, growing onshore production, and weak demand is projected to keep prices low and makes the economics of these proposed leases questionable, especially when considering the alternative uses of these offshore areas and environmental cost of drilling in these waters.

First, it is crucial to separate oil and gas: the two markets are different and face separate pressures and drivers. Offshore drilling is primarily associated with oil: around 20 percent of oil production is from federal offshore waters versus just around 5 percent of gas production.[8]

In the latest U.S. Energy Information Administration (EIA) *Annual Energy Outlook* (AEO 2018),[9] the differences between these commodities and their futures are clear: natural gas is becoming a bigger portion of our energy system, oil is not. In 2017, petroleum made up almost 39 percent of all energy consumed in the U.S. Natural gas was around 28 percent of total energy consumed.[10] By 2050, oil is projected to represent just 34 percent of energy demand. Natural gas will be 33 percent of total energy demand.[11]

Domestic natural gas production is expected to grow twice as fast as that of oil, though both are expected to see significant growth between now and 2050.[12] While both see growth in domestic production, domestic consumption trends are less similar. Natural gas consumption is expected to grow due to increasing industrial and power sector demand.[13] On the other hand, petroleum use is expected to decline somewhat. The transportation sector (which is the largest consumer of oil) sees a 30 percent reduction in gasoline use between now and 2050 due to rising vehicle fuel efficiency and exponentially growing sales of alternative vehicles, such as electric, hybrid, natural gas, and hydrogen vehicles.[14]

A. Oil and gas production is expected to increase, but due to onshore resources

Domestic oil production is expected to see strong growth, especially in the next few years. In 2018, the U.S. is expected to produce more than 10 million barrels of oil a day, breaking the previous U.S.

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[6] U.S. DEPARTMENT OF THE INTERIOR, BUREAU OF OCEAN ENERGY MGMT. 2019-2024 National Outer Continental Shelf Oil and Gas Leasing Draft Proposed Program, p. 1. JAN. 2018. [hereinafter "DPP"].Available at https://www.boem.gov/NP-Draft-Proposed-Program-2019-2024/
[7] *Id*. at page 5.
[8] *Id*. Figure 1-4 and 1-5.
[9] AEO 2018.
[10] Table 1 of the *Annual Energy Outlook 2018,* https://www.eia.gov/outlooks/aeo/tables_ref.php
[11] *Id*.
[12] AEO 2018.
[13] *Id*.
[14] *Id*.

record of 9.6 million set in 1970.[15] Production is expected to surpass 11 million barrels a day by 2019.[16] By the end of 2018, the U.S. is projected to be a larger oil producer than Saudi Arabia and then surpassing Russia to be the largest oil producer in the world by the end of 2019.[17]

This projected growth comes solely from onshore oil production (See Figure 1). Offshore oil production is projected to decrease between now and 2050. In the newest AEO projection, offshore production decreases from 1.84 million barrels a day in 2017 to just 1.59 million barrels a day, despite total oil production increasing from 9.24 to 11.3 million barrels over the same timeframe.[18] In percentage terms, offshore oil's contribution to U.S. production is projected to slip from around 20 percent today to 14 percent in 2050.[19]

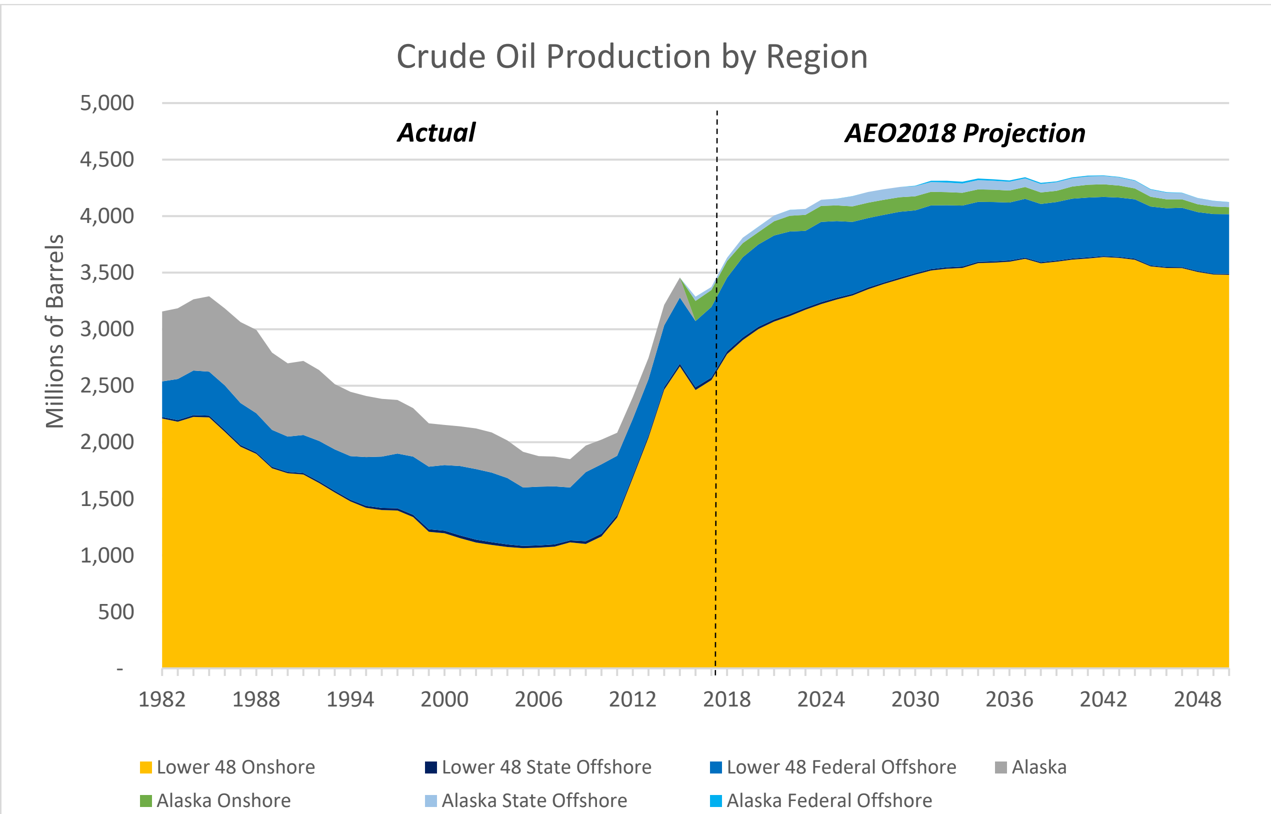

Figure 1. Historic Oil Production and AEO 2018 Oil Production Projections.

Recent company and investment firm decisions and statements confirm this shift in interest. Exxon Mobil announced it would triple oil and natural gas production from its operations in the Permian Basin (where EIA see the most oil production growth) of West Texas and New Mexico to more than 600,000 barrels of oil equivalent per day by 2025. Leading consultant firm Wood Mackenzie noted

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[15] U.S. Energy Information Administration. *Short Term Energy Outlook.* https://www.eia.gov/outlooks/steo/
[16] *Id*.
[17] Summers, J. "U.S. Crude Output on Track to Rival Giants Russia, Saudi Arabia. January 9, 2018. *Bloomberg*. Available at https://www.bloomberg.com/news/articles/2018-01-09/u-s-sees-domestic-crude-output-rising-to-records-in-2018-2019
[18] AEO 2018 Table 14: Oil and Gas Supply, https://www.eia.gov/outlooks/aeo/tables_ref.php
[19] *Id*.

that the oil "resurgence" they anticipate "does not necessarily mean a boom in demand for expensive rigs or a spike in deepwater drilling".[20] Instead, their optimistic oil outlook is from "cheaper, more easily developed shale fields onshore."[21] In fact, one of their consultants was quoted as saying "there will be little interest in drilling off the Atlantic and Pacific coasts: the returns simply are not there", concluding that current economic and market forces would "seem to eliminate the prospect of expansion on the Atlantic and Pacific coasts".[22]

While natural gas consumption is expected to grow, offshore production is unnecessary to meet this demand. The U.S. is already a net exporter of natural gas due to lower-cost, onshore shale production, and is expected to become a more significant exporter in the future due to new liquefied natural gas (LNG) terminals expanding the nation's export capabilities, despite growth in natural gas use.[23]

B. U.S. oil demand expected to decrease over next 35 years; global oil demand expected to peak by 2030

While new oil reserves are being discovered and developed, oil consumption is expected to peak and then decline in the longer term due to the rise of cost-effective, cleaner alternatives. Most significantly, new alternative vehicles and the rising fuel economy of vehicles have started to and will continue to put significant downward pressure on gasoline and petroleum demand. EIA projects gasoline use will fall by 1 percent a year over the next three decades even as total vehicle travel continues to grow due to population and economic growth.[24] This new trend is due to combination of more efficient vehicles as well as a rising interest in newer vehicle options, such as electric and hybrid options. In fact, under business-as-usual (i.e. no new policies), EIA now projects that alternative vehicles will grow from just 4 percent of the market today to more than 20 percent in 2050 – with a bulk of the increase from electric vehicles.[25]

EIA's most recent U.S. projection also fits with global projections. Bank of America Merrill Lynch, Wood Mackenzie, and McKinsey all now estimate that global oil demand will peak by 2030 due to growing sales and interest in electric vehicles.[26] Goldman Sachs and Bloomberg have predicted peak oil demand could occur as soon as 2025.[27] Even oil producers recognize and expect this fundamental

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[20] Passwaters, Mark. "After praise and panic, US offshore oil, gas plan to face tough market test." January 31, 2018. *S&P Market Intelligence.*
[21] *Id*.
[22] *Id*.
[23] *Id*.
[24] Table 7 of the *Annual Energy Outlook 2018,* https://www.eia.gov/outlooks/aeo/tables_ref.php
[25] *Id*.
[26] McKinsey & Company, "Is peak oil demand in sight?", June 2016, https://www.mckinsey.com/industries/oil-and-gas/our-insights/is-peak-oil-demand-in-sight; Woods Mackenzie, "The Rise and Fall of Black Gold", https://www.woodmac.com/news/feature/the-rise-and-fall-of-black-gold/; Longley, Alex, "BofA Sees Oil Demand Peaking by 2030 as Electric Vehicles Boom", *Bloomberg,* January 22, 2018, https://www.bloomberg.com/news/articles/2018-01-22/bofa-sees-oil-demand-peaking-by-2030-as-electric-vehicles-boom
[27] Reuters staff, "World oil demand could peak in 2024 on higher vehicle efficiency -Goldman Sachs", *Reuters*, July 24, 2017, https://uk.reuters.com/article/research-crude-goldman/world-oil-demand-could-peak-in-2024-on-higher-vehicle-efficiency-goldman-sachs-idUKL3N1KF3ER

shift to occur: Shell Oil and Statoil have both publicly noted that "peak oil demand could come as soon as the mid-2020s, though around 2030 is more likely."[28]

Slow global demand growth – even falling total demand – coupled with increasing production also mean that both government agencies and oil companies are estimating that oil prices will remain much lower and more stable than they have historically. In just the last five years, long-term oil price forecasts have fallen from $173/barrel to just $103/barrel (both in $2016) in 2040, or more than a 40 percent decline in value (See Figure 2).[29] Five years ago, EIA never expected oil prices to fall below $100 a barrel between 2015 and 2040.[30] Now, oil isn't expected to break the $100 threshold (inflation-adjusted) until 2037.[31]

Between the AEO 2017 forecast used by BOEM and the new AEO 2018 forecast, the price of oil has declined by around 3 to 4 percent for near-term price projections and by more than 5 percent for projections in the latter half of the forecasted period.[32]

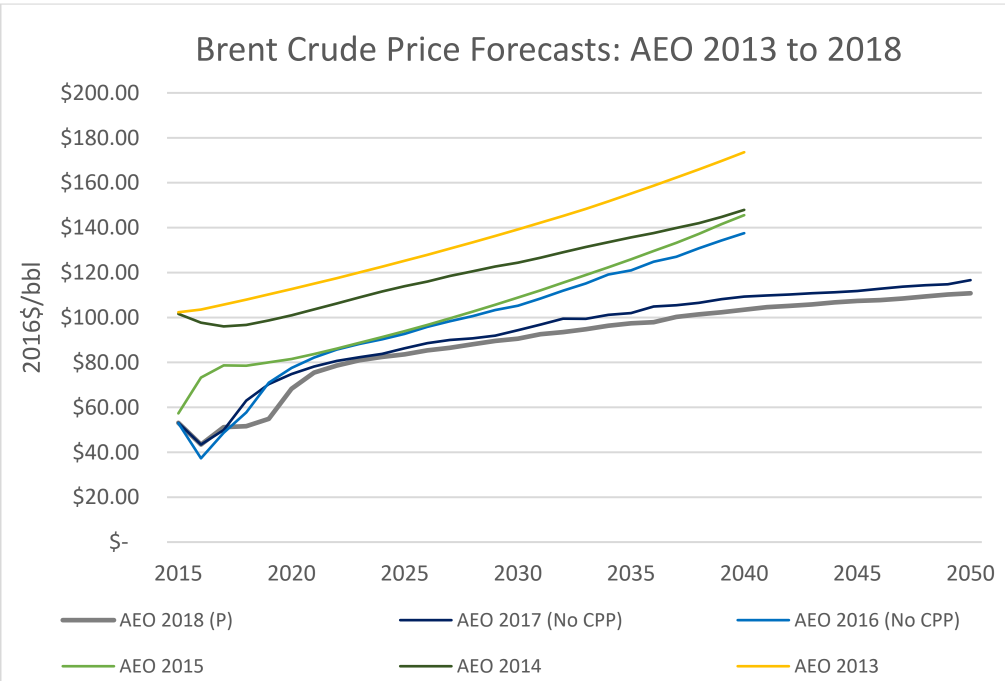

Figure 2. Brent Crude Oil Price Projections from Annual Energy Outlooks 2013 to 2018.

The price forecasts for gas have taken an even more drastic reduction in the last few years. Since the start of the decade, long-term gas forecasts have cratered – revised downwards by around 60 percent

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[28] Bousso, Ron and Karolin Schaps, "Shell sees oil demand peaking by late 2020s as electric car sales grow", *Reuters*, July 27, 2017, https://www.reuters.com/article/us-oil-demand-shell/shell-sees-oil-demand-peaking-by-late-2020s-as-electric-car-sales-grow-idUSKBN1AC1MG; Cook, Lynn and Elena Cherney, "Get Ready for Peak Oil Demand", *Wall Street Journal*, May 26, 2017, https://www.wsj.com/articles/get-ready-for-peak-oil-demand-1495419061

[29] AEO 2018*;* U.S. EIA, *Annual Energy Outlook 2013*, https://www.eia.gov/outlooks/aeo/archive.php

[30] U.S. EIA, *Annual Energy Outlook 2013*, https://www.eia.gov/outlooks/aeo/archive.php

[31] AEO 2018.

[32] AEO 2018*;* U.S. EIA, *Annual Energy Outlook 2017*, https://www.eia.gov/outlooks/aeo/archive.php

(See Figure 3).[33] Just between the AEO2017 forecast used by BOEM and the new AEO2018 forecast, natural gas prices have been revised downwards by 14 percent over the forecast period.[34] In fact, the median gas price case for the BOEM *Draft Proposal* of $5.15/mmbtu never materialized. The more recent projection has gas prices only rising to $4.89/mmbtu by 2050.

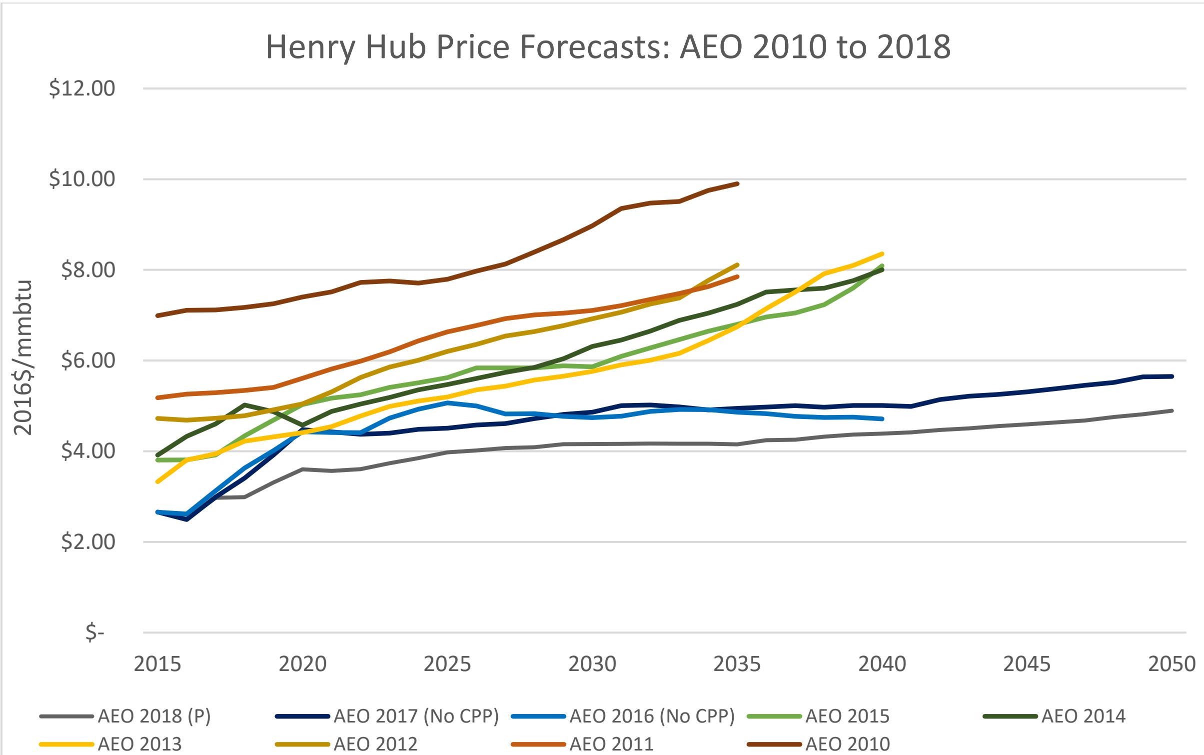


Figure 3. Natural Gas Price Projections from Annual Energy Outlooks 2010 to 2018.

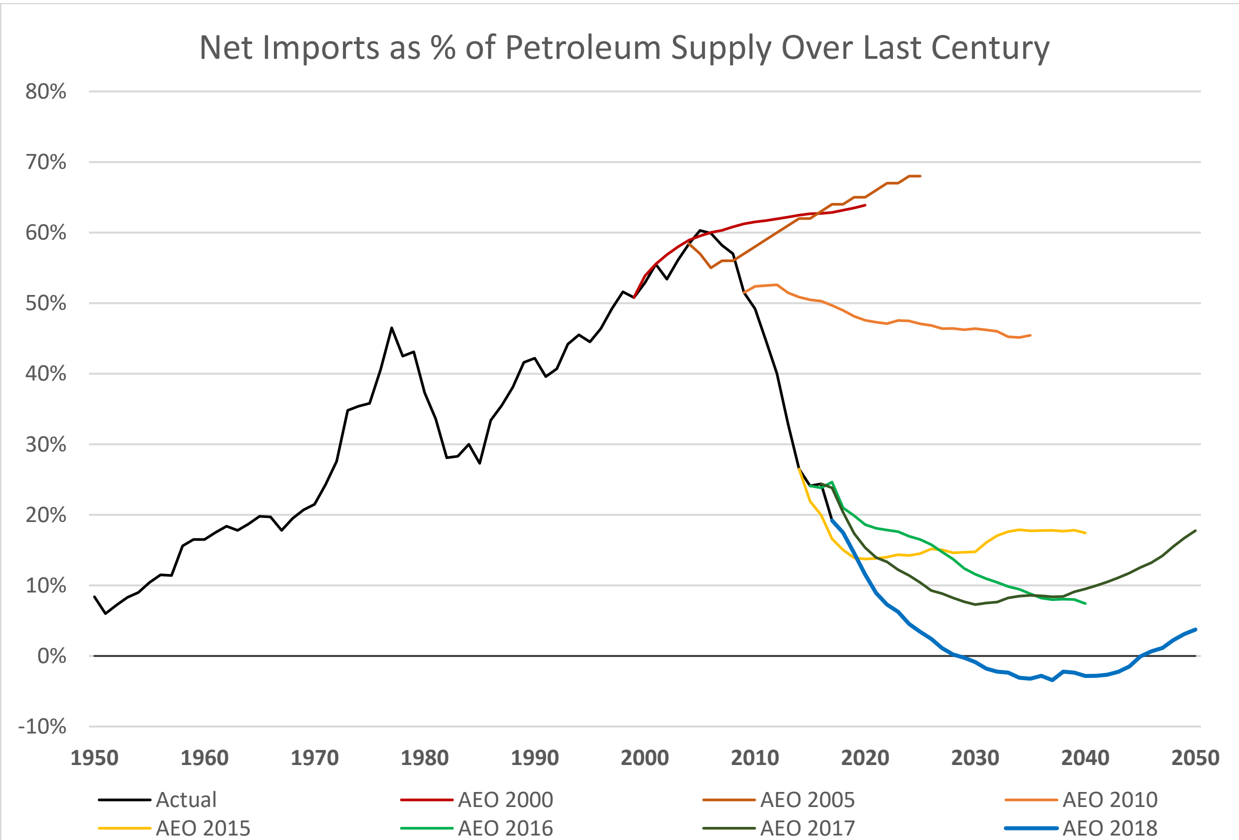
While these are the most recent government projections, it should be noted that EIA has also historically overestimated demand for oil, gas, and total energy. Between the government's forecasts from 1994 and 2016, EIA overestimated oil consumption 73 percent of the time (compared to actual consumption in the select years).[35] EIA overestimated gas consumption 65 percent of the time and total energy consumption 81 percent of the time during the same period.[36] This habitual overestimation is largely a product of EIA's inflated estimates of energy intensity (energy consumption per unit of real GDP) and industrial energy use. EIA has overestimated the energy intensity of the economy and industrial energy demand 87 and 86 percent of the time, respectively.[37] So, while EIA is projecting oil demand to remain rather flat and natural gas demand to rise moderately, it is likely that these findings actually overestimate future fossil fuel demand.

[33] AEO 2018*;* U.S. EIA, *Annual Energy Outlook 2010*, https://www.eia.gov/outlooks/aeo/archive.php
[34] AEO 2018*;* U.S. EIA, *Annual Energy Outlook 2017*, https://www.eia.gov/outlooks/aeo/archive.php
[35] U.S. EIA. *AEO Retrospective Review: Comparison of 2016 and Prior Reference Cases.* September 2017. Available at https://www.eia.gov/outlooks/aeo/retrospective/pdf/retrospective.pdf.
[36] *Id*.
[37] *Id*.

C. The U.S. is already expected to eliminate foreign dependence on oil without offshore development

While the DPP notes that the U.S. is expected to remain a net oil importer through 2050 despite a decrease in imports, the new AEO 2018 *forecasts the U.S. becoming a net exporter of oil by 2029*.[38] The U.S. is projected to be an overall net exporter of energy by 2022, due to significant gas exports.[39] This would be the first time the U.S. was a net exporter of energy since 1953.

It is important to note that this occurs without *any* substantial growth in offshore oil development. In fact, this is despite the projected decrease in offshore oil production in AEO 2018. Thus, BOEM's claim that offshore oil development is crucial for the nation's energy security is patently misleading. Imports have been decreasing over the last few years, and thanks to changes in oil demand driven by new, more efficient technology options and increased production in lower-cost, onshore sites, the U.S. is set to largely eliminate its dependence on imported oil without this offshore leasing program expansion.



D. The development of new offshore oil and gas reserves is inconsistent with U.S. and international climate commitments

The scientific consensus is nearly unanimous: the earth is warming, the climate is changing, and it's due overwhelmingly to the burning of fossil fuels. To restrain this human-driven climate change, the

[38] AEO 2018.
[39] *Id.*

international community has committed to limiting the average warming of the planet to no more than 2 degrees Celsius above preindustrial levels, while striving to limit it to 1.5 degrees to further reduce risk.[40] The Intergovernmental Panel on Climate Change (IPCC) has concluded that limiting warming to a 2-degree threshold will require significant reductions in greenhouse gas (GHG) emissions by the middle of this century—and net zero emissions globally by century's end.[41] For developed countries, like the United States, the IPCC has set a mid-century target of at least a 80 percent reduction in absolute GHG emissions below 1990 levels.[42]

In addition, as part of its nationally determined contribution (NDC) to the Paris Accord, the United States set an emissions reduction target of 26 to 28 percent by 2025 (relative to 2005 levels).[43] While the new administration has announced its intention to leave the Paris Accord, no formal change or process has been initiated. At this point the U.S. is still a formal party to the Accord.

As part of NRDC's work to address climate change, NRDC completed a robust modeling effort to determine the feasibility and costs of achieving the emission reductions necessary to stave off the worst impact of climate change (hereby noted as a "80x50 scenario").[44] This work confirms that the U.S. needs to drastically reduce its consumption of all fossil fuels – coal, oil, and natural gas – if it is to meet its climate commitments. Opening up new areas for fossil fuel development directly contradicts the findings of our analysis and hinders the nation's efforts to reduce the national climate footprint and meet formal requirements to the global community.

Our analysis shows that expanding proven clean energy solutions—most of which are already deployed at commercial scale today—can reduce U.S. GHG emissions across the entire economy 80 percent below 1990 levels by 2050. In this scenario, carbon emissions fall from around 5.1 billion tons today to less than 1 billion by 2050, due to investments in clean energy, including energy efficiency, renewable energy, electrification of vehicles and buildings, and lower-carbon fuels and carbon storage technologies that eliminate most of the emissions currently produced from fossil fuel use.[45] For example, wind and solar grow from about 8 percent of the nation's electricity mix to over 70 percent by 2050.[46] And while currently only about 20 percent of the country's energy use is related to electricity, this grows to close to half of all energy by 2050 due to aggressive investments in building and vehicle electrification. By 2050, our modeling finds that almost three fourths of cars must be full battery electric vehicles or plug-in hybrid electric vehicles to meet our climate commitments.[47]

These clean energy outcomes are not unreasonable. In 2017, renewables were 16 percent of the country's electricity mix, almost double their contribution at the start of the decade.[48] Without any new policies, renewables are expected to grow to 40 percent of the country's electricity supply by

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[40] International Panel on Climate Change [hereinafter "IPCC"], *Climate Change 2014, Synthesis Report*, Section SPM 3.4, 2014. Available at http://ar5-syr.ipcc.ch/ipcc/ipcc/resources/pdf/IPCC_SynthesisReport.pdf.
[41] *Id*.
[42] *Id*.
[43] The White House. "Fact Sheet: U.S. Reports Its 2025 Emissions Target to the UNFCCC." March 2015.
[44] Gowrishankar, Vignesh and Amanda Levin. *America's Clean Energy Frontier: The Pathway to A Safer Climate Future*. NRDC Report. September 2017. Available at https://www.nrdc.org/sites/default/files/americas-clean-energy-frontier-report.pdf
[45] *Id*.
[46] *Id*.
[47] *Id*.
[48] U.S. EIA, *Electric Power Monthly* (With Data for December 2017), February 27, 2018.

2050, surpassing nuclear and coal by the early 2020s and 2030s, respectively.[49] And a number of states are on track to procure more than half of their electricity from renewables by the end of the next decade.[50] Other countries are already above 70 percent non-hydro renewables. Denmark generated 74 percent of its power from non-hydro renewable in 2017, up from 40 percent in 2011.[51]

The clean energy investments made in this 80x50 Scenario result in around a 70 percent reduction in fossil fuel usage in 2050 compared to business-as-usual projections.[52] Compared to current levels, coal consumption falls by 90 percent, mainly from the power sector; natural gas consumption falls by around 66 percent, largely from the power and building sectors; and petroleum consumption falls by 55 percent, mainly from changes in the transportation sector. By 2030, oil consumption is already about 20 percent lower than current levels.

The much steeper declines in fossil fuel usage under an 80x50 approach call into question the need for any additional fossil fuel infrastructure. Over-investing in fossil fuel infrastructure could lead to stranded assets and higher economic and environmental costs, while also standing in the way of the United States achieving its climate goals. The proposed offshore leasing program would lock us into expensive infrastructure that is inconsistent with the nation's climate goals. Either the U.S. would waste economic capital on projects that would be prematurely abandoned or the U.S. would miss its climate commitments and risk potentially catastrophic impacts of climate change.

II. The Draft Proposed Program fails to consider important environmental information, as required by Section 18(a)(1) and 18(a)(2)(A), (G), and (H).

The Program must consider "the potential impact of oil and gas exploration on other resource values of the outer Continental Shelf and the marine, coastal, and human environments" as required by OCSLA.[53] It must also consider the "ecological characteristics of such regions," "the relative environmental sensitivity and marine productivity of different areas of the outer Continental Shelf," and "relevant environmental and predictive information for different areas of the outer Continental Shelf."[54] These factors "can be fully analyzed only at the program stage."[55]

A. The DPP fails to account for the full impacts of climate change

The Draft Proposed Program and the PEIS should analyze the full climate change impacts of fossil fuels developed as a result of the Five-Year Program. As described in Subsection C of Section V below, the DPP fails to account for the climate damages of exploration, development, production and transportation. Without fully analyzing the climate damages associated with this program, the DPP ignores vital pieces of environmental information.

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[49] AEO 2018.
[50] Lawrence Berkeley National Lab, *U.S. Renewable Portfolio Standards: 2017 Update*, August 2017.
[51] Sandbag and Agora, *The European Power Sector in 2017*, February 2018, https://sandbag.org.uk/wp-content/uploads/2018/01/EU-power-sector-report-2017.pdf
[52] The reference case reflects AEO 2013 "business-as-usual" projections. The full AEO2013 report is available at http://www.eia.gov/outlooks/archive/aeo13/
[53] 43 U.S.C. § 1344(a)(1).
[54] 43 U.S.C. § 1344(a)(2)(A),(G) and (H).
[55] *California v. Watt*, 668 F2d at 1306.

B. The DPP fails to consider the full range of impacts from oil spills

The Draft Program fails to adequately consider the direct, indirect, and cumulative impacts of oil spills. Further discussed in Sections III and V, the DPP fails to identify the full spectrum of wildlife that would be impacted by oil spills. The Draft Program also declines to analyze the potential cumulative impacts of catastrophic spills, because they are not "reasonably foreseeable."[56] But these potential impacts are clearly relevant and quite obvious, as detailed by the *Deepwater Horizon* blowout Natural Resources Damage Assessment (NRDA) and other studies of that spill, and described in detail in Subsection E of Section V of these comments. Such an analysis is doable, as further described in Section V.

C. The DPP fails to consider the full range of impacts from seismic exploration

The ocean is an acoustic world. Unlike light, sound travels extremely efficiently in seawater; and marine mammals and many fish depend on sound for finding mates, foraging, avoiding predators, navigating, communicating, and raising their young—in short, for virtually every vital life function. When loud sounds are introduced into the ocean, it degrades this essential part of the environment. Some biologists have analogized the increasing levels of noise from human activities to a rising tide of "smog" that has industrialized major portions of the marine environment off our coasts. This acoustic smog is already shrinking the sensory range of marine animals by orders of magnitude from pre-industrial levels.[57]

For offshore exploration, the oil and gas industry typically relies on arrays of airguns, which are towed behind ships and release intense impulses of compressed air into the water about once every 10-12 seconds.[58] A large seismic airgun array can produce effective peak pressures of sound higher than those of virtually any other man-made source save explosives;[59] and although airguns are vertically oriented within the water column, horizontal propagation is so significant as to make them, even under present use, one of the leading contributors to low-frequency ambient noise thousands of miles from any given survey.[60] It is well established that the high-intensity pulses produced by airguns can cause a range of impacts on marine mammals, fish, and other marine life, including broad habitat displacement, disruption of vital behaviors essential to foraging and breeding, loss of biological diversity, and, in some circumstances, injuries and mortalities.[61]

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[56] DPP

[57] Statement from Bode, M., Clark, C.W., Cooke, J., Crowder, L.B., Deak, T., Green, J.E., Greig, L., Hildebrand, J., Kappel, C., Kroeker, K.J., Loseto, L.L., Mangel, M., Ramasco, J.J., Reeves, R.R., Suydam, R., Weilgart, L., to President Barack Obama of Participants of the Workshop on Assessing the Cumulative Impacts of Underwater Noise with Other Anthropogenic Stressors on Marine Mammals (2009).

[58] It should be noted that deep-penetration seismic surveys are not used for renewable energy projects.

[59] National Research Council, *Ocean Noise and Marine Mammals* (2003).

[60] Nieukirk, S.L., Stafford, K.M., Mellinger, D.K., Dziak, R.P., and Fox, C.G., Low-frequency whale and seismic airgun sounds recorded in the mid-Atlantic Ocean, *Journal of the Acoustical Society of America* 115: 1832-1843 (2004).

[61] *See*, *e.g.*, Hildebrand, J.A., Impacts of anthropogenic sound, *in* Reynolds, J.E. III, Perrin, W.F., Reeves, R.R., Montgomery, S., and Ragen, T.J. (eds.), *Marine Mammal Research: Conservation beyond Crisis* (2006); Weilgart, L., The impacts of anthropogenic ocean noise on cetaceans and implications for management, *Canadian Journal of Zoology* 85: 1091-1116 (2007).

In the past, BOEM has minimized its analysis of seismic survey impacts at the program-planning stage, by adverting to separate analyses that the agency has conducted, on a regional basis, under NEPA. Undertaking other analyses, however, does not relieve the agency of the burden of fully considering seismic impacts here. First, industry demand for seismic surveys is predicated on the agency's decision to hold lease sales within particular planning areas, and this decision, of course, occurs at the program-planning stage, dislocated from the impact and alternatives analysis of the agency's separate NEPA reviews. When BOEM announced, in early 2010, that it would initiate a NEPA process in the Atlantic, in support of an anticipated lease sale off Virginia and, later, other lease sales in the region, it was hit by a flood of seismic permit applications proposing large-scale 2D surveys. Second, OCSLA requires consideration of a number of environmental factors at the program-planning stage that clearly implicate seismic surveys, such as "the potential impact of oil and gas exploration on other resource values of the outer Continental Shelf and the marine, coastal, and human environments., "the relative environmental sensitivity and marine productivity of different areas of the outer Continental Shelf," and "the potential for environmental damage and the potential for adverse impact on the coastal zone." 43 U.S.C. § 1344(a). Third, BOEM has not prepared programmatic NEPA analyses for the majority of the OCS planning areas now under consideration for leasing, including planning areas off New England, California, the Pacific Northwest, and much of Alaska. In short, the agency's conduct of separate programmatic NEPA reviews in some regions does not obviate its responsibility to thoroughly assess seismic survey impacts, and acoustic impacts generally, at the present planning stage.

See Section III.A.3 for more discussion of the environmental impacts of seismic surveys, and Appendix A for more details on how seismic impacts detrimentally impact the marine environment.

III. The Draft Proposed Program's discussion of "relative environmental sensitivity" and marine productivity fails to comply with Section 18(a)(2)(G)

A. The species, habitat, and impacts inputs and analyses in the Proposed Program are irrational:

The species, habitat, and impacts inputs and analyses in the Proposed Program are irrational. The Proposed Program's environmental sensitivity analysis is based on a study conducted in 2014, "Evaluation of the Relative Environmental Sensitivity and Marine Productivity of the Outer Continental Shelf: Final Report" (RESA).[62] Overall, the RESA uses an extremely limited number of inputs. The study acknowledges that an ideal model would examine all ecological parameters and all potential impact causing factors, but explains that a limited number is used due to feasibility.[63] Although it may not be feasible to compare all ecological parameters and all potential impacts, the RESA provides no explanation as to why more parameters could not be used. Despite the abundant species diversity and habitat importance throughout the planning areas, the RESA selects only a handful of each for comparison between areas. This limits an accurate description of the sensitivity of each area, rendering the RESA misleading.

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[62] Evaluation of the Relative Environmental Sensitivity and Marine Productivity of the Outer Continental Shelf: Final Report. Prepared by URS, Normandeau Associates, RPS ASA, and LGL Ecological Research Associates for the Department of the Interior, Bureau of Ocean Energy Management. Herndon, Virginia. OCS Study BOEM 2014-616. https://www.boem.gov/ESPIS/5/5400.pdf [hereinafter "RESA"].

[63] RESA, p. 9

1. The selection and analysis of species is irrational:

The selection and analysis of species sensitivity is irrational. First, the RESA's comparison of fish resources is skewed, since no fish resource is identified for the Beaufort and Chukchi Seas. The RESA claims that this is because the area has no federally listed fish species but does not explain why some other factor cannot be used to determine the conservation importance of fish in the region.[64] The model places an undue emphasis on the role that fish species play in commercial fisheries, basing the sensitivity determination for ecological role on abundance as determined by landings and selecting two additional fish species for analysis based on their fisheries importance.[65]

The ecological role for marine mammals is also skewed, since it is based on Stock Assessment Reports, many of which are out of date, and sightings during offshore projects, which are not a reasonable method for determining population numbers.[66] Additionally, the RESA only includes four or fewer species of marine mammals in its analysis of each OCS region.[67] Many dozens of species of marine mammals inhabit and migrate within the Program Areas, including polar bears, many types of whales, dolphins, and seals. Different marine mammals, and different groups of marine mammals, have very different life histories, behaviors, habitat and nutritional needs, and other biological characteristics that could be impacted by this Program in different ways, to different extents, and at different times of year. Thus, the RESA excludes information that is key to understanding where (and under what conditions) oil and gas leasing should occur, which, as highlighted in Subsection B of Section II, is inconsistent with requirements under OCSLA.

A number of flaws render the sensitivity characterization of the Beaufort and Chukchi Seas irrational. In addition to combining the two areas, despite significant ecological differences between them and skewing the assessment because of the emphasis placed on commercial fisheries, as discussed above, the analysis also is skewed because it places emphasis on those species for which more information is available.[68] For these species, more information may exist precisely because they are doing better, are more abundant, or are non-cryptic. Additionally, because so many information gaps exist in the Arctic, this approach leads to a very incomplete picture of the sensitivity of the Arctic. The assessment of this region is also skewed because it places an emphasis on federally listed species and designated critical habitat but the greatest factor threatening Arctic species, climate change, has only recently become a basis for ESA listing decisions. Finally, the analysis for the Beaufort and Chukchi Seas is flawed because it examines sensitivity on a year-round basis, assuming that impacts occur year round but that species are only present on a seasonal basis. The RESA acknowledges that this results in a lower sensitivity analysis for Alaska.[69] However, many oil and gas activities will occur only during the summer, overlapping precisely with the time that so many species are present in the same area. The RESA therefore irrationally discounts the sensitivity of the Beaufort and Chukchi Sea environments. This issue can be resolved by assessing sensitivity at the most sensitive time of the year, and basing the comparison on those most sensitive periods.

2. The selection and analysis of habitat sensitivity is irrational

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[64] RESA, p. 19
[65] PESA, p. 13
[66] RESA, pp. 17-18
[67] RESA, pp. 19-20
[68] RESA, pp. 17-18
[69] RESA, p. 52

The RESA analysis of habitat is also flawed. First, the RESA assumes, without explanation, that the water column in the marine oceanic component has low sensitivity in all OCS regions.[70] For example, the deep waters of the Chukchi may be an important spawning area for Arctic cod and are designated as meeting the IMO PSSA designation criteria of critical habitat, dependency, spawning grounds, fragility, and bio-geographic importance.[71] In the deep waters of the Beaufort Sea, the offshore pack ice support the migrations of beluga and bowhead whales, and are designated as meeting the IMO PSSA designation criteria of critical habitat, dependency, spawning/breeding grounds, and fragility.[72] Given the sensitivity of these areas and others, the RESA should not have dismissed all deep offshore areas out of hand.

Second, the selection of habitats is flawed because the selection is based on geophysical features, rather than ecological role. The study admits that this methodology overlooks the importance of certain areas, such as feeding or spawning areas.[73] The RESA should consider ecological factors in its selection of habitat.

3. The analysis of impacts is irrational

The Proposed Program examines sensitivity by selecting categories of "impact factors" including oil spills, artificial light, collisions with above-surface structures, habitat disturbance, sound/noise, accidental spills, and vessel strikes.[74] Each impact is described in terms of areal range and probable areal range, depth range and probable depth range, impact scale, impact duration, and current level of development. This analysis is flawed in multiple ways.

First, by limiting the sensitivity analysis to only six impact factors, the analysis disregards the many other impact factors that should be considered, such as other impacts from vessel traffic, and water and air quality.

Second, the analysis of impacts from vessel strikes is irrational. For vessel strikes, the RESA assumes that the areal range of the impact is up to 3700m with probable of up to 1500m.[75] The study does not provide an explanation as to how this range was determined, and the number is completely arbitrary, having no relationship to the distance from a ship where the impacts occurs (which is the immediate location of the collision) nor to the distance ships will travel to conduct offshore activities (which can be thousands of miles for drilling in the Arctic, for example). Similarly, the RESA provides no basis for its determination that the impact scale is "moderate" (up to hundreds of kilometers), and this assumption must be justified.

The analysis of impacts from oil spills is also incomplete and misleading. The study assumes that the maximum areal range is an entire planning area, but the probable areal range is up to 1500m, and the probable depth range is 1500m. The study provides no explanation for these assumptions.[76] Although

[70] RESA, p. 21
[71] AMAP/CAFF/SDWG. Identification of Arctic marine areas of heightened ecological and cultural significance: Arctic Marine Shipping Assessment (AMSA) IIc (2013) at 48 [AMSA IIC Report].
[72] *Id.* at 59
[73] RESA p. 77
[74]DPP at 7-43
[75] RESA, p. D-7
[76] *Id.* D-10

the study states, "For the purposes of this model we will assume an oil spill as significant as the *Deepwater Horizon* blowout,"[77] the areal and depth ranges bear no relationship whatsoever to the geographical extent of impacts caused by the BP blowout (see Section V for a more detailed discussion of the impacts of the BP blowout).[78] Finally, the analysis of the duration of impacts from oil spills is irrational. The RESA assumes that the duration of impacts from an oil spill will be moderate, lasting for up to several months.[79] As recent studies have shown, the BP blowout left a 1,235-square-mile "bathtub ring" of oil on the ocean's floor[80] and 6 to 10 million gallons of oil from the spill buried in the seafloor.[81] These impacts are extensive and persistent and must be included in the RESA. As the D.C. Circuit has explained, the risks of spills that must be considered in the Program are not only the likelihood of the spill, but also the damage a spill would inflict, and how the impacts would be different in different areas.[82]

Additionally, the cumulative impacts assessment in the RESA is inadequate. Cumulative impacts are included as an "assessment of existing BOEM-regulated activities in a planning area or broad OCS region of interest relative to other planning areas or broad OCS regions."[83] Cumulative impacts are "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non- Federal) or person undertakes such other actions."[84] Thus, it is not rational for the RESA to limit its assessment of cumulative impacts solely with reference to existing BOEM-related activities.

In addition, the RESA unreasonably downplays the importance of cumulative impacts in the sensitivity analysis. The overall magnitude of an impact is based on an assessment of the impact duration, scale, and cumulative impact. The model arbitrarily assigns equal weight to impact duration and scale and a much smaller weight to cumulative impacts. The model provides no explanation for why cumulative impacts are considered so insignificant in determining relative environmental sensitivity.

The entire impacts assessment is irrational because it characterizes impacts in terms of duration (short term, moderate, chronic, or permanent) and scale (site specific, small, moderate, and large) without any reference to a development scenario. This is particularly arbitrary since BOEM has conducted extensive studies examining the overall impacts, based on a development scenario, in the planning areas. For example, in BOEM's 2015 supplemental EIS for the Chukchi Sea Lease Sale 193, an assessment of impacts is provided based on a development scenario. As other lease sale EISs in the past have done, the EIS estimates the amount of impacts based on information about the

[77] *Id.* D-11
[78] *Deepwater Horizon* oil spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. Retrieved from http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.
[79] RESA, D-11
[80] Valentine, D., *et al.* Fallout plume of submerged oil from *Deepwater Horizon.* Proceedings of the National Academies of Science, vol. 11 n. 45 (August 5, 2014). Available at http://www.pnas.org/content/111/45/15906.abstract
[81] Chanton, J., et al., Using Natural Abundance Radiocarbon To Trace the Flux of Petrocarbon to the Seafloor Following the *Deepwater Horizon* Oil Spill. Environmental Science and Technology. *Available at* http://pubs.acs.org/doi/abs/10.1021/es5046524?journalCode=esthag.
[82] *See California v. Watt,* 668 F2d at 1308 (stating "For example, an oil spill in an area of high environmental sensitivity would cause greater damage and therefore pose greater environmental risks than an equivalent oil spill in an area of lesser environmental sensitivity.")
[83] RESA, p. 24, 36
[84] 40 CFR 1508.7.

economically recoverable resource potential at an assumed price per barrel of oil. It is irrational for the RESA to ignore this information in its assessment of impacts. As the Court in *California v. Watt II* observed, "sensitivity to some environmental effects of OCS development is almost impossible to evaluate without considering the expected level of OCS activities."[85]

Finally, the analysis of seismic impacts is incomplete. BOEM points to its conduct of separate programmatic NEPA reviews for some regions; however, those reviews do not obviate its responsibility to thoroughly assess seismic survey impacts, and acoustic impacts generally, at the present planning stage. In conducting that assessment, BOEM must improve on the scientific validity of its recent Environmental Impact Statements for Atlantic (2014) and Gulf of Mexico (2017) geological and geophysical activities. In those documents, BOEM assumes that deep-penetration seismic airgun blasting impacts marine mammal at much smaller geographic scales than the best available science indicates; claims, without support or analysis, that extensive, repeated behavioral impacts on marine mammals will not affect recruitment and survival in species or populations; and completely discounts impacts on fish and invertebrates and the industries that depend on them. That approach is not supportable. In Appendix A, we summarize the types of adverse effects, and the studies, that BOEM must incorporate in its analysis.

BOEM, in its summary table of potential oil and gas activity stressors (DPP at 7-32), does not mark industrial noise as a potential stressor on coastal and estuarine, marine benthic, or marine pelagic habitats, suggesting that it will exclude impacts on acoustic habitat as an environmental factor impinging on its leasing decisions. That omission is inconsistent with the best available science.

Sound is widely recognized as an fundamental component of wildlife habitat, often playing a significant role in both marine and terrestrial ecology.[86] This component of habitat can be measured and managed, and, indeed, NOAA, in 2016, identified acoustic habitat as a conservation priority and the focus of a new management effort.[87] As NOAA and the scientific community have repeatedly observed, the degradation of acoustic habitat over large areas can have population-level impacts on marine mammals.[88]

The sound produced by airgun shots, while distinctly impulsive within some kilometers or tens of kilometers of the source, can sound virtually continuous at greater distances due to the effects of reverberation and multi-path propagation, with little diminution of the acoustic signal within the

[85] *California v. Watt*, 712 F.2d 584 (D.C. Cir. 1983) (Watt II).
[86] *See, e.g.*, Francis, C.D., and Barber, J.R., A framework for understanding noise impacts on wildlife: an urgent conservation priority, *Frontiers in Ecology and the Environment* 11: 305–313 (2013); Merchant, N.D., Fristrup, K.M., Johnson, M.P., Tyack, P.L., Witt, M.J., Blondel, P., and Parks, S.E., Measuring acoustic habitats, *Methods in Ecology and Evolution* 6: 257-265 (2015).
[87] Gedamke, J., Harrison, J., Hatch, L., Angliss, R., Barlow, J., Berchok, C., Caldow, C., Castellote, M., Cholewiak, D., De Angelis, M.L., Dziak, R., Garland, E., Guan, S., Hastings, S., Holt, M., Laws, B., Mellinger, D., Moore, S., Moore, T.J., Oleson, E., Pearson-Meyer, J., Piniak, W., Redfern, J., Rowles, T., Scholik-Schlomer, A., Smith, A., Soldevilla, M., Stadler, J., Van Parijs, S., and Wahle, C., Ocean Noise Strategy Roadmap (2016); Hatch, L.T., et al., Can you hear me here? *infra* n. 418.
[88] UNEP/CBD/SBSTTA/16/INF/12. Convention on Biological Diversity. 2012. Scientific synthesis on the impacts of underwater noise on marine and coastal biodiversity and habitats. Meeting report: Montreal 30 April – 6 May 2012; Gedamke, J., et al., *Ocean Noise Strategy Roadmap* (2016); Statement from C. Clark and 74 other marine scientists (Mar. 5, 2015), *supra* n. 87.

inter-pulse interval.[89] The potentially enormous scale of this acoustic footprint (visualized in Figure III-1 below) has been confirmed by studies in many regions of the globe, including the Arctic, Australia, the Gulf of Mexico, the northeast Atlantic, and Greenland, where it has been shown to raise ambient noise levels and mask whale calls from distances of thousands of kilometers.[90] This effect is extended further by the scale of the activity itself. In the Atlantic region, for example, the seismic industry submitted applications to shoot more than 90,000 miles of trackline during what would be the initial year of deep-penetration airgun surveys off the east coast, and BOEM, in its related Environmental Impact Statement, has projected the shooting hundreds of thousands of additional track miles, and lease areas, over the next several years.

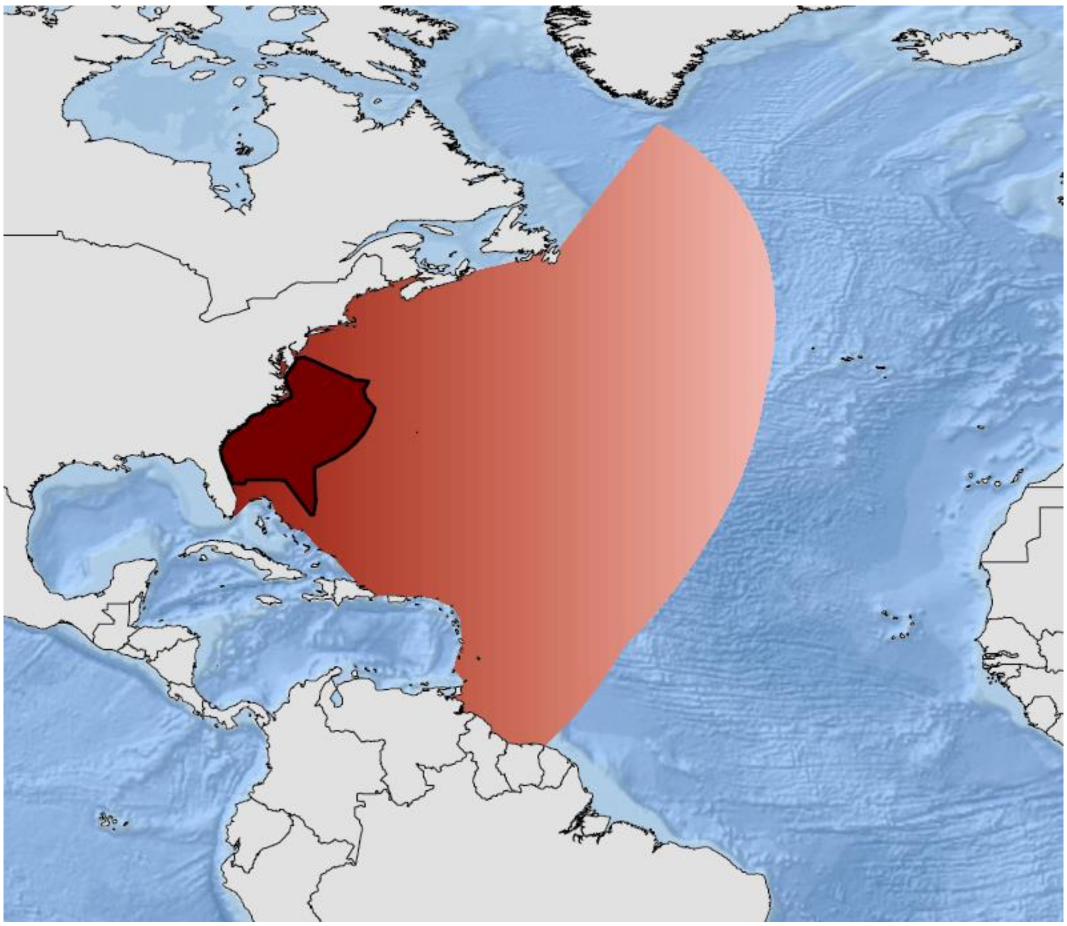

Figure III-1: Map of the combined seismic survey permit area and the potential acoustic footprint of seismic blasting within the permit area. A 3,000 km radius was used to define the extent of the footprint based on published data indicating that seismic blasts can be detected, under certain

[89] Guerra, M., et al., Quantifying seismic survey reverberation, *infra* n. 411; *see also* Nieukirk, S.L., et al., Sounds from airguns and fin whales, *infra* n. 411.

[90] *See, e.g.,* Gedamke, J., Ocean basin scale loss of whale communication space, *infra* n. 412; Nieukirk, S.L., et al., Sounds from airguns and fin whales, *infra* n. 410; Neukirk S.L., Stafford K.M., Mellinger D.K., Dziak R.P., and Fox C.G. (2004) Low frequency whale and seismic airgun sounds recorded in the mid-Atlantic Ocean. Acoustical Society of America, 115 (4): 1832-1843; Roth, E.H., et al., Underwater ambient noise on the Chukchi Sea continental slope, *infra* n. 412.

acoustic propagation conditions, a least 3,000 km from the source (Neukirk et al. 2004).[91] Acoustic propagation modeling was not undertaken in the production of this map, and so its purpose is solely illustrative.

BOEM must incorporate impacts on coastal, estuarine, and marine habitat as a factor in its consideration of the 5-Year Program.

B. Primary productivity should be factored into the RESA:

BOEM states that "it is important to include estimates of primary production in any analysis of environmental sensitivity related to OCS oil and natural gas activities.[92]" However, while a ranking of primary productivity rates was provided for each of the planning areas, quantitative productivity estimates were not included in the RESA.

The RESA states that quantitative values were not available for productivity.[93] Instead, the DPP relies on a study comparing productivity from 1998-2009.[94] Yet, the results of this analysis are not described or incorporated into the RESA. The RESA acknowledges, "Future iterations of this method could consider adding productivity to the relative environmental sensitivity" and fails to provide any explanation as to why productivity was not included in the analysis.[95]

The separate primary productivity analysis relies on historical data which does not account for the quickly growing primary productivity in the Beaufort and Chukchi Seas. In addition, the assessment of productivity in the Arctic is biased, since it looks at productivity on an annual average, rather than during seasonal peaks of productivity.[96] The assessment of productivity must take into account the quickly changing and seasonal rates of productivity in describing the sensitivity of the Arctic Ocean.[97] It should also be integrated into the overall RESA.

IV. The Draft Proposed Program's analysis of other uses of the sea under Section 18(a)(2)(D) is incomplete

Section 18(a)(2)(D) requires the Secretary to evaluate the various uses of the sea and seabed, "including fisheries, navigation, existing or proposed sea-lanes, potential sites of deepwater ports, and other anticipated uses of the resources and space of the Outer Continental Shelf." However, the DPP fails to include a thorough analysis of the broad span of impacts that could arise between competing activities in the OCS.

In particular, the analysis of other uses of the sea must consider the importance of offshore renewable energy in light of the nation's policy for a clean energy future and the Secretary's jurisdiction over

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[91] Nieukirk, S.L., et al., Low-frequency whale and seismic airgun sounds, *supra* n. 90.
[92] DPP, p. 7-54
[93] RESA, pp. 21-22
[94] DPP, p.7-52
[95] RESA, p. 78
[96] DPP, p. 7-55
[97] CAFF. *Life Linked to Ice: A guide to sea-ice-associated biodiversity in this time of rapid change.* CAFF Assessment Series No. 10. Conservation of Arctic Flora and Fauna, Iceland (October 2013).

both renewable and non-renewable OCS energy decisions. The DPP needs to in more depth explore compatibility between offshore wind and offshore oil and how to minimize potential conflicts in the exploitation of these resources in each of the planning areas. Both the Department of Energy (DOE) and Department of the Interior recognize that "a robust offshore wind industry would lead to significant positive environmental and economic external benefits"[98] and it is important to assess how offshore wind would be compatible with the Program at this stage.

The U.S. offshore wind industry launched in December 2016 with the start of commercial operations of Deepwater Wind's 30 megawatt Block Island Wind Farm in Rhode Island state waters.[99] Today there are a number of offshore wind projects in the planning phase and DOE sees the potential for 22 GW of offshore wind by 2030 and 86 GW by 2050.[100]

The benefits of offshore wind power are both unique and significant. For instance, offshore wind power can reduce electricity costs to consumers by providing additional energy during times of peak energy needs.[101] Offshore wind power, because it is virtually pollution-free, can improve air quality and reduce greenhouse gas emissions.[102] Additionally, offshore wind development in the United States has the potential to drive regional economic development and to support thousands of well-compensated jobs.[103]

And with rapid technological advancements in the industry, cost reductions are beginning to make offshore wind power cost-competitive with traditional forms of energy.[104]

The DPP must include a thorough analysis of the impacts of leasing on other industries.

V. The NEV/NSV analyses are flawed

The Draft Proposal considers the Net Social Value (NSV) of developing national OCS resources as one component of Section 18 criteria. The NSV analysis is intended to rank planning areas according to their respective values, using an evaluation of the estimated gross revenues and the economic, social and environmental costs of extracting resources. BOEM derives the NSV for each planning region starting with an estimate of the net economic value (NEV). The NEV is calculated as the estimated potential gross revenues less the private costs of exploration, development, production and transport. BOEM then subtracts the external costs, defined as environmental and social costs that are

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[98] United States Department of Energy and United States Department of the Interior, *National Offshore Wind Strategy: Facilitating the Development of the Offshore Wind Industry in the United States.* (September 2016) https://www.boem.gov/National-Offshore-Wind-Strategy/
[99] Deepwater Wind, "America's First Offshore Wind Farm Powers Up," December 12, 2016, http://dwwind.com/press/americas-first-offshore-wind-farm-powers/.
[100] Bureau of Ocean Energy Management, "Lease and Grant Information," https://www.boem.gov/Lease-and-Grant-Information/ (accessed March 5, 2018). And United States Department of Energy and United States Department of the Interior, *National Offshore Wind Strategy: Facilitating the Development of the Offshore Wind Industry in the United States.* (September 2016) https://www.boem.gov/National-Offshore-Wind-Strategy/.
[101] *Supra* note 98.
[102] *Id*.
[103] *Id*.
[104] *Id*.

incurred by society but not paid for by the companies responsible for conducting the drilling activities, from the NEV to find the NSV.

In general, a planning area with a low NSV is expected to be high-cost; the margin by which estimated gross revenues exceed the operating and external costs is small. The implication of a low NSV is that a high-fuel price environment is necessary for economic production and development. Conversely, a planning area with a high NSV is expected to generate revenues that significantly exceed the costs of exploration, development, production, transportation, and a limited set of environmental costs. The purpose of the NSV analysis is to identify planning areas of high relative value for fossil fuel production. However, BOEM's misinformed approach inflates the NSV and invalidates the conclusions of the analysis.

BOEM's quantification of the NSV is significantly flawed. First, the NEV is calculated based on inadequate characterizations of production and oil prices. In addition, the external costs factor omits the costs to society of greenhouse gas emissions. It also fails to fully account for the costs of seismic surveys (more fully documented in Appendix A) and the full range of costs associated with oil spills. As a consequence, the NSV is overestimated across the board and the evaluation of relative profitability of planning areas is erroneous.

A. Assumptions relating to production levels are flawed, overstating revenues and the NEV

BOEM's assumption that all unleased undiscovered economically recoverable resource (UERR) on the OCS (as of July 2019) are leased in the first year of the program and produced throughout the life of the National OCS Program conflicts with projections of demand and offshore oil production. As described in Subsection B of Section I above, demand for oil in the U.S. is expected to decline over the next 35 years, and global oil demand is expected to peak by 2030 and then decline. While domestic oil production is expected to grow in the near term, this growth is projected to occur onshore, rather than offshore.[105] Given these expectations, coupled with falling price forecasts for oil (and natural gas), it is unreasonable to assume that all unleased resources on the OCS would be leased in the first year of the program. Because BOEM relies on this assumption, it substantially overstates the gross revenues. This is important because the estimation of gross revenues is the first step in the NSV calculation. If gross revenues are exaggerated, then the Net Economic Value (NEV) is overvalued, leading to overall overestimation of the NSV. The bias in the gross revenue calculation is a critical deficiency that flows through the remainder of the analysis.

B. The selected range of oil price assumptions in the DPP is biased high and does not track current price points and trends

Another deficiency in the first step of the NEV calculation is the failure to analyze an adequate range of oil prices in estimating the potential gross revenues. As with the production assumption described in Subsection A above, this error skews the NEV calculation as well as the resulting NSV estimate. The DPP relies on the mid-range oil price point of $100/bbl as the basis of ranking the relative value

[105] AEO 2018 Table 14: Oil and Gas Supply https://www.eia.gov/outlooks/aeo/tables_ref.php

of the planning areas. This selection is misguided and unjustified. Expectations are that the global oil markets will remain oversupplied (driven by onshore oil production and relatively flat oil consumption projections) with Brent crude prices projected to hover in the range of $50-55/bbl through 2019. With AEO forecasting, demand as well as both short-term and long-term Brent crude price forecasts are continually revised lower (see Subsection B of Section I above). In particular, the low bound oil price of $40/bbl in the BOEM methodology does not capture the price dips that global oil markets experienced as recently as 2016, when Brent crude prices sank to a low of $28/bbl. Because the range of oil price points included in this analysis falls short of reflecting current market conditions, reliance on a benchmark of $100/bbl mischaracterizes the range or economic values and rankings of planning areas. NRDC recommends that BOEM adjust lower the range of oil prices analyzed based on current market conditions as well as the Brent crude price forecasts given in AEO projections. For example, AEO projects that Brent crude prices will stay below $120/bbl in 2050. Instead of analyzing $160/bbl as the high end of the oil price range, BOEM should adopt $120/bbl based on government projections. Similarly, the low end of the oil price range in the BOEM methodology should be grounded in observed market conditions and available projections. In order to reflect market dynamics, BOEM should revise the low end of the range of oil prices to $20-30/bbl. Finally, NRDC recommends that BOEM benchmark to an oil price that more accurately represents current and expected price trends. There are many ways in which BOEM could achieve this. For instance, instead of the $100/bbl benchmark assumption, BOEM could use a 3-year historical average or the average of the AEO projected prices for the 2019-2024 period. Ordering the planning areas according to these approaches would give a different result from a ranking based on a notional $100/bbl price. BOEM must improve its analysis by relying on oil price assumptions supported by real-world patterns.

C. The DPP misrepresents the costs and benefits of developing OCS areas for fossil fuel production

BOEM distorts the costs and benefits accounting of fossil fuel production in the OCS planning areas. Specifically, its misleading approach to cost and benefit accounting artificially exaggerates benefits, without a complete accounting for the climate damages of exploration, development, production and transportation. Fully accounting for the costs of these activities would include estimating GHG equivalency based on Global Warming Potential (GWP) factors supported by science and literature, and monetizing the damages of both air pollution and greenhouse gas emissions (climate pollution) from fossil fuel production and consumption.

BOEM performs its environmental and social costs through its in-house Offshore Environmental Cost Model (OECM). While the OECM's estimate of environmental costs includes air pollutants sulfur dioxide (SO2), oxides of nitrogen (NOx), volatile organic compounds (VOCs), and particulate matter (PM) that adversely affect human health and the environment, it neglects to estimate damages according to the Social Cost of Carbon (SCC) incurred by society from carbon dioxide emissions driving climate change. The SCC is an estimate of the impacts of each ton of carbon dioxide used in policymaking. It was developed based on extensive scientific and economic analysis from several agencies across the government, through a process including public review and comment period. The SCC has two important characteristics. First, since carbon pollution does not stop along borders and produces global impacts, it accounts for the damages that carbon dioxide emissions cause in other countries. Second, since greenhouse gases persist in the atmosphere for centuries, it gives weight to damages that emissions will cause to future generations. In 2030, each short ton of carbon pollution is estimated to cost $59 (2016$)[106].

While the OECM does not solve for climate damages, it does provide GHG emissions data for the planning areas and each of the three oil price scenarios for carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O) (see Table B-2 in the DPP).[107] BOEM converts the emissions of non-CO2 gases into CO2 equivalents using the Global Warming Potential (GWP) factors listed in the Intergovernmental Panel on Climate Change (IPCC's) Fifth Assessment Report. Since different GHGs can have different effects on the Earth's warming, the Global Warming Potential was developed to allow comparisons of the global warming impacts of different gases.[108] Specifically, GWP is a measure of how much energy the emission of one ton of a gas will absorb over a given period of time, relative to the emission of one ton of CO2. The larger the GWP, the more that a given gas warms the Earth compared to CO2 over a given time period. The carbon dioxide equivalent levels in Table B-2 are based on the 100-year Global Warming Potential (GWP) conversion factors. BOEM should have also considered the 20-year GWP factors in order to reflect the range of warming effects. As an example, methane traps 28-34 times more heat than carbon dioxide over a 100-year time frame. Over a 20-year time frame, methane is 84-87 times more powerful than carbon dioxide. BOEM'S adoption of the 100-year GWP means that its analysis understates the climate impacts associated with methane emissions from production alone by three times.

Total estimated GHG emissions associated with production for each of the planning areas and for each of the oil price cases are given in Table B-2.[109] In aggregate, GHG emissions total between 414 and 774 million tons. The low end of this range is the equivalent to the GHG emissions of over 88 million passenger vehicles driven for one year, or the CO2 emissions from the annual energy use of approximately 45 million homes.[110] The high end of the range is equal to the GHG emissions of over 165 million passenger vehicles driven for one year, or the CO2 emissions from the annual energy use of more than 83 million homes. For further context, the U.S. electricity sector, traditionally the highest-polluting sector of the economy, emitted 1.76 billion metric tonnes of carbon dioxide pollution in 2017.[111] Adding the GHG emissions from the OCS leasing proposed in the DPP would

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[106] Adjusted for inflation to 2016$, taken from: https://19january2017snapshot.epa.gov/climatechange/social-cost-carbon_.html

[107] Note Table B-2 shows the estimated emissions associated with the exploration and development of OCS resources for those areas that have hydrocarbon resource potential and/or development potential above negligible. The calculations in this discussion assume that the figures in Table B-2 represent cumulative emissions from production over the period 2019-2022.

[108] *See* EPA, "Greenhouse Gas Emissions: Understanding Global Warming Potentials." https://www.epa.gov/ghgemissions/understanding-global-warming-potentials (accessed March 8, 2018).

[109] NRDC believes that BOEM unintentionally swapped the $40 and $160 oil price scenario headers in Table B-2. The headers, rather than reading left to right "$160 Oil Price Case, $100 Oil Price Case, $40 Oil Price Case" should be reversed and instead read left to right "$40 Oil Price Case, $100 Oil Price Case, $160 Oil Price Case."

[110] *See* EPA, "Energy and the Environment: Greenhouse Gas Equivalencies Calculator." https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator (accessed March 8, 2018).

[111] AEO 2018

be like adding another 24 to 44 percent of the total U.S. electricity sector emissions, reversing the steady decline in emissions observed in recent years.[112]

Applying the 2020 Social Cost of Carbon (SCC) at a 3 percent discount rate to the CO2 equivalent levels of emissions for all planning areas given in Table B-2, climate damages total between $20 to $38 billion (2016$) over the 2019-2024 period. Assuming a 2.5% discount rate, the aggregate damages would total $30 to $56 billion dollars (2016$). It is important to note that while the SCC is a start towards a full accounting of climate damages, estimated SCC values still leave out a range of climate damages. For example, Table B-2 in the DPP provides the GHG emissions associated only with production. GHG emissions from consumption of the fossil fuels would far exceed the production emissions. This is evident in a November 2016 report that evaluated lifecycle GHG emissions associated with OCS production.[113] Counting emissions and damages from consumption is a critical component of the environmental cost of fossil fuel production in the OCS. Without adequate accounting for these critical components, the environmental costs in the DPP are gross underestimates, therefore skewing the NSVs.

The omission of climate damages from consumption in the BOEM analysis of NSV results in undervaluing the external costs and thereby inflating the NSV. It is critical that BOEM adjust its methodology to account for climate damages.

Additionally, BOEM notes, "While the NEV analysis treats the private expenditures from exploration, development, production, and transportation as costs, this spending can be considered a benefit in a broader macroeconomic context. For example, the use of labor and capital to search for and extract oil and gas resources contributes to the national income. Also, this spending generates regional economic impacts and multiplier effects that arise from factors such as the creation of jobs and investment in infrastructure." BOEM further mentions reducing dependence on foreign oil and national energy security as additional "non-monetized" benefits of OCS drilling. Counting these effects would be another deceptive tactic to bias the analysis in favor of leasing and drilling in the planning areas. In fact, the analysis fails to analyze the opportunity costs of production in the planning areas, neglecting the benefits associated with jobs, GDP, lower air and climate pollution.

The calculation of the NSV of developing the OCS in this analysis falls short of assessing a comprehensive range of outcomes. Its assumptions are premised on multiple fallacies that compound each other, leading to unsubstantiated NSV results that cannot be relied upon in decision making on developing areas of the OCS.

D. The analysis fails to account for the economic impacts of seismic surveys on fisheries

The DPP recognizes that noise from OCS oil and gas development activities has the potential to impact both "fish and fisheries" (DPP at 7-32 (Table 7-2)). It bears noting, however, that BOEM summarily dismissed such concerns in its recent NEPA analyses of seismic impacts in the Atlantic and Gulf of Mexico regions. The easy conclusion it drew in those instances does not stand up to the

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[112] *See* EIA, https://www.eia.gov/environment/ and Bloomberg New Energy Finance Sustainable Energy Factbook, available at: http://www.bcse.org/wp-content/uploads/2018-Sustainable-Energy-in-America-Factbook_Executive-Summary.pdf

[113] OCS Oil and Gas: Potential Lifecycle Greenhouse Gas Emissions and Social Cost of Carbon, available at: https://www.boem.gov/OCS-Report-BOEM-2016-065/

evidence, in various commercial fisheries, of catch rate decline in the vicinity of deep-penetration airgun surveys, nor of the impacts of seismic surveys on fish and invertebrates.

Airgun surveys have been shown to dramatically decrease catch rates of various commercial and recreational fish species (such as cod, haddock, and pollock), by 40–80% in some conditions, over thousands of square kilometers around a single array, indicative of substantial horizontal and/or vertical displacement.[114] One study found higher fish populations outside a seismic shooting area, indicating what is described as a "long-term" effect of seismic activity displacing fish away from these sound sources.[115] Similar reductions in catch rates (a 52% decrease in catch per unit effort relative to controls) have been demonstrated in the hook-and-line fishery for rockfish during seismic discharges off the California coast.[116] Namibian tuna fishers reported to their government of a significant decline in catch during seismic surveys conducted, from 2011 to 2013, within the albacore migratory route and around a seamount that is a hotspot for regional tuna fishing.[117] Similarly, the Australian Southern Bluefin Tuna Industry Association reportedly documented a significant shift in the tuna migration (an 80% reduction in sighting rates) during a 2011-2012 seismic survey, which took place directly within the migration path in the western Great Australian Bight. Decreased catch rates have led fishers in British Columbia, Norway, Namibia, and other jurisdictions to seek compensation for their losses from the industry.[118]

Additionally, as described in Subsection C of Section II above, and depicted in Figure III-1 (in Section III above) and Figure V-1, below, seismic surveys are known to harm commercially valuable fish and invertebrates, as well as forage fish and zooplankton.

Harm to fisheries and tourism, as well as to wildlife – the extent to which is depicted in the above figures – account for the broad and intense public engagement in the Atlantic over seismic surveys. BOEM must fully account for those impacts in the DPP.

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[114] Engås, A., Løkkeborg, S., Ona, E., and Soldal, A.V., Effects of seismic shooting on local abundance and catch rates of cod (*Gadus morhua*) and haddock (*Melanogrammus aeglefinus*), *Canadian Journal of Fisheries and Aquatic Sciences* 53: 2238-2249 (1996). *See also* Løkkeborg, S., Ona, E., Vold, A., Pena, H., Salthaug, A., Totland, B., Øvredal, J.T., Dalen, J. and Handegard, N.O., Effekter av seismiske undersøkelser på fiskefordeling og fangstrater for garn og line i Vesterålen sommeren 2009 [Effects of seismic surveys on fish distribution and catch rates of gillnets and longlines in Vesterålen in summer 2009], *Fisken og Havet*: 2-2010 (2010) (Institute of Marine Research Report for Norwegian Petroleum Directorate); Skalski, J.R., Pearson, W.H., and Malme, C.I., Effects of sounds from a geophysical survey device on catch-per-unit-effort in a hook-and-line fishery for rockfish (*Sebastes ssp.*), *Canadian Journal of Fisheries and Aquatic Sciences* 49: 1357-1365 (1992).

[115] Slotte, A., Hansen, K., Dalen, J., and Ona, E., 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 (2004).

[116] Skalski, J.R., et al., Effects of sounds from a geophysical survey device on catch-per-unit-effort, *supra* n. 114.

[117] Anonymous, Presentation given at the Benguela Current Commission 5th Annual Science Forum: Key issues and possible impacts of seismic activities on tunas, for the Large Pelagic and Hake Longlining Association in Namibia (Sept. 24, 2013) (provided to NRDC by the Namibian Ministry of Fisheries and Marine Resources).

[118] *See, e.g.*, British Columbia Seafood Alliance, Fisheries and offshore seismic operations: Interaction, liaison, and mitigation: The east coast experience (2004), *available at* bcseafoodalliance.com/documents/ Canpitt.pdf (accessed July 2017); Anonymous, Presentation given at the Benguela Current Commission 5th Annual Science Forum, *supra* n. 117.

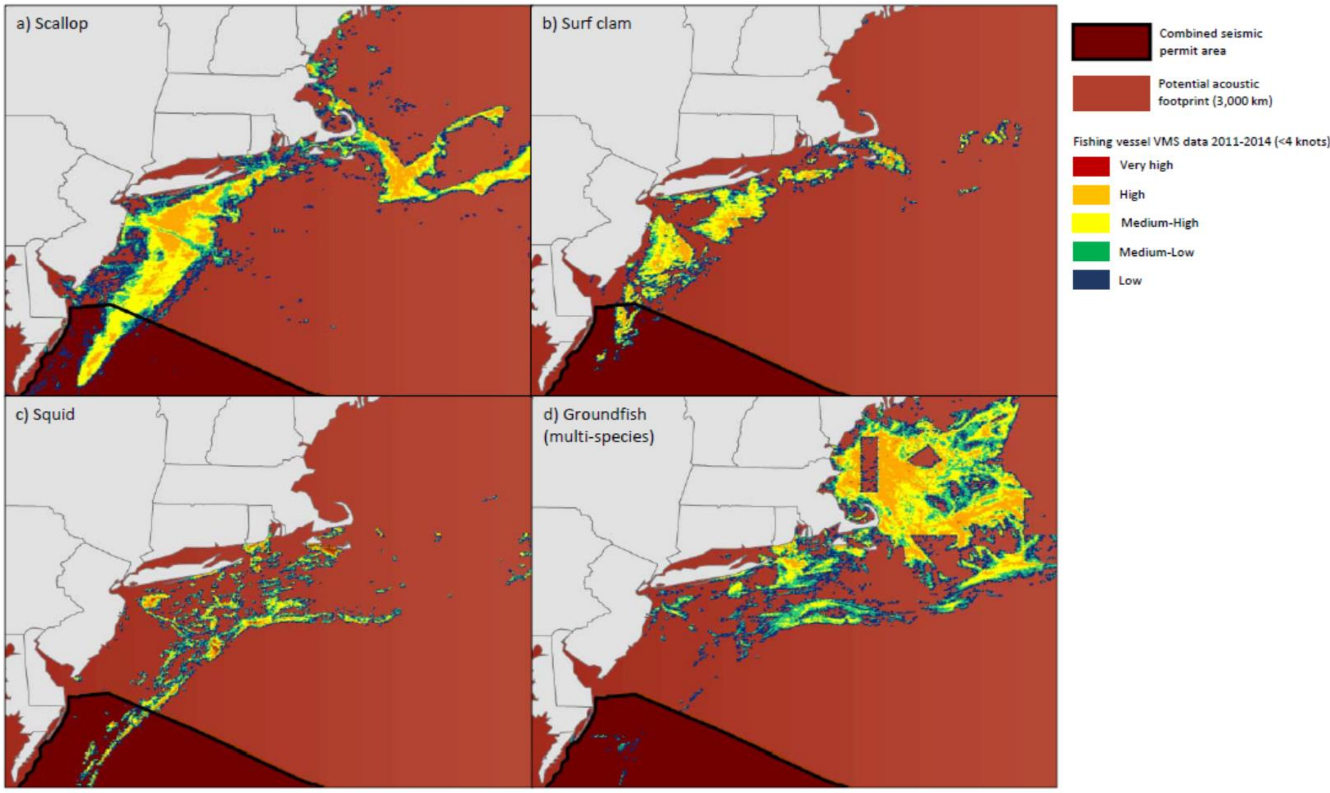

Figure V-1: Vessel monitoring system for fishing vessels traveling <4 knots for four economically important fisheries in the Northeast United States (a) scallop; b) Surf clam; c) Squid; and d) Multi-species groundfish) overlaid on the northern extent of the combined seismic permit area and the potential acoustic footprint of the seismic airgun blasts (3,000 km radius; based on Neukirk et al. 2004).[119] Vessel speeds of <4 knots are indicative of fishing activity (rather than transiting at higher speeds). Fishing data was generated by the NOAA NMFS Northeast Fisheries Science Center and sourced from the Mid-Atlantic Ocean Data Portal (http://portal.midatlanticocean.org/). Fishing data does not include comprehensive data from of Mid-Atlantic or data from the Southeast Atlantic.

E. Catastrophic oil spills should be considered in the NSV analysis

The decision to include an OCS area in the 5-year leasing program depends on determining the possible economic value to be realized from developing and producing reserves that may be found. This requires estimating reserves when the presence or size of reserves cannot be known until drilling takes place. This creates a condition of decision making under uncertainty, which the Department resolves using simulation models to derive statistically valid estimates that can then be used to estimate possible resource levels as well net economic and social value.

In estimating net social value, the Bureau confronts another problem with uncertainty, which is the potential costs to the economy and environment from oil spills. BOEM offers several reasons why the potential costs of catastrophic spills – spills greater than 100,000 gallons – are not considered in

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[119] Neukirk S.L., Stafford K.M., Mellinger D.K., Dziak R.P., and Fox C.G. (2004) Low frequency whale and seismic airgun sounds recorded in the mid-Atlantic Ocean. Acoustical Society of America, 115 (4): 1832-1843.

the NSV analysis. First, it points to the "unpredictable nature of catastrophic oil spills, including the many factors that determine their severity" leading to difficulty and uncertainty in calculating the costs. It points to "similar difficulties in calculating the risk.[120]"

The problem of estimating the costs of oil spills is the same problem as estimating the benefits of development: how to plan for uncertain events. Yet the DPP chooses to use a simulation approach to estimate one but not the other. The DPP should quantify the impact of catastrophic oil spills within this analysis.

This is not an unusual problem in managing the risks associated with a variety of industrial and other processes. Analytic processes for risk simulation using techniques such as Monte Carlo analysis (as is done with the estimation of oil reserves) or Bayesian networks have advanced considerably over the past several decades. The estimation of oil spill probabilities is not, therefore, something which cannot be ignored simply because there are relatively few catastrophic events. BOEM maintains, or should maintain, records of a variety of fault events on operating drilling and production activities that could form an adequate data record from which at least risked analysis of oil spills could be made, similar to those for oil and gas reserves.

It is the case that the estimation of oil reserves can be done based on data developed through seismic surveys, which, though in many cases data collected many years ago does provide the basis for analysis. In contrast there have been relatively few oil spills from which to develop a statistical analysis. But oil spills are the result of series of events which happen fairly frequently but which are usually either corrected in time or which are not accompanied by other events whose cumulative effect is to cause an oil spill.

Vulnerabilities in both the coastal and offshore environments can be identified (as they will have to be in the Environmental Impact Statement); these can also be quantified and incorporated into risk models that would allow estimation of the possible social costs, to be combined with the estimation of possible social benefits in the analysis of reserves. The location, size, and characteristics of vulnerabilities will vary across and within planning regions, providing information that will alter the calculation of net social benefits across and within planning areas and thus provide critical information to the five-year planning, lease sale, and permitting processes. The absence of any attempt to more fully estimate the social costs on the same basis as the social benefits constitutes a serious deficiency in any planning process and the decisions that result therefrom.

Further, the factors identified as influencing the impact of catastrophic spills are no different from those identified as influencing non-catastrophic spills. As factors affecting catastrophic spills, the agency lists "the volume of oil spilled, the duration of the spill, the proximity of the spill location to sensitive resources, meteorological conditions at the time of the spill (e.g., whether the wind is blowing toward shore), the type of oil spilled, and response and containment capabilities."[121] The agency does not explain how the factors influencing catastrophic spills are any more uncertain or unpredictable than those influencing non-catastrophic spills.

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[120] DPP, p. 5-19

[121] BOEM. 2015. Forecasting Environmental and Social Externalities Associated with Outer Continental Shelf (OCS) Oil and Gas Development – Volume 2: Supplemental Information to the 2015 Revised Offshore Environmental Cost Model (OECM). P. 64. Available at https://www.boem.gov/Forecasting-Environmental-Social-Externalities-Volume-2/

As detailed by the *Deepwater Horizon* blowout Natural Resources Damage Assessment (NRDA) and other studies on the spill, potential impacts from catastrophic oil spills are quite relevant and obvious:

- The oil spill contaminated more than 1,300 miles of coastline, at least 400 square miles of the deep ocean floor, and 57,500 square miles of surface water.[122]
- Some of the Gulf's most critical habitats were severely impacted, including up to 721 miles of salt marsh, 320 acres of globally significant seagrass beds, 600 miles of sand and dune habitats, and 4,300 square miles of open ocean *Sargassum* habitats that are essential for sea turtles and seabirds.[123]
- The spill caused the public to lose almost 17 million user days for outdoor recreation such as boating, recreational fishing, and beach-going. Total recreational use damages due to the spill are estimated at $693.2 million.[124]
- To date, over $56 billion has been (or will be) paid by BP, Halliburton and Transocean to address the clean-up, damages, penalties and environmental restoration required as a result of the *Deepwater Horizon* disaster.[125]
- The Gulf of Mexico commercial fishing industry was estimated to have lost $247 million as a result of post-spill fisheries closures. One study projects that the overall impact of lost or degraded commercial, recreational, and mariculture fisheries in the Gulf could be $8.7 billion by 2020, with a potential loss of 22,000 jobs over the same timeframe.[126]
- In 2010, as a result of post-spill fishing closures, shrimp landings decreased by 32 percent in Louisiana, 60 percent in Mississippi, 56 percent in Alabama, while menhaden landings in Louisiana decreased by 17 percent.[127]
- Tens of thousands of dolphins and whales were exposed to the oil spill. Endangered sperm whales suffered a seven percent decline in population, and the Gulf's resident Bryde's whale population, estimated at less than 40 whales, experienced a 22% decline in population. Recovery of this population is highly uncertain.[128]
- Bottlenose dolphins sustained significant impacts. In Barataria Bay and the Mississippi Delta, two heavily oiled areas, bottlenose dolphins have declined by more than half, and will require 50 years to rebound to pre-spill levels. More broadly, oil exposure has led to the largest die-off of bottlenose dolphins in the Gulf's history. Sub-lethal impacts have led to poor

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[122] MacDonald, I.R. et al, Natural and unnatural oil slicks in the Gulf of Mexico, *Journal of Geophysical Research: Oceans*, Vol. 120(12), pp.8364-8380, 2015; *Deepwater Horizon* Natural Resource Damage Assessment Trustees. (2016). *Deepwater Horizon* oil spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. Available at http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan. [hereafter cited as "NRDA" followed by the relevant page number].
[123] NRDA, at 4-197; 4-337; 4-396; 4-420; 4-429; 4-430.
[124] NRDA, at 4-649
[125] Kent, S. & Christopher Matthews, April 26, 2016, BP Results Still Hurt by Gulf of Mexico Spill, The Wall Street Journal, http://www.wsj.com/articles/bp-reports-first-quarter-pretax-loss-1461651961
[126] Alvarez, S., et al., A revealed preference approach to valuing non-market recreational fishing losses from the *Deepwater Horizon* oil spill, *Journal of Environmental Management*, Vol. 145, pp. 199-209, 2014; Sumaila, U.R., et al., Impact of the *Deepwater Horizon* well blowout on the economics of U.S. Gulf fisheries. Canadian Journal of Fisheries and Aquatic Sciences, Vol. 69(3), pp. 499¬–510, 2012, www.nrcresearchpress.com/doi/full/10.1139/f2011-171#.VKL_D14DxA
[127] Upton, H.F., The *Deepwater Horizon* Oil Spill and the Gulf of Mexico Fishing Industry, Congressional Research Service, February 17, 2011, http://fpc.state.gov/documents/organization/159014.pdf
[128] NRDA, at 4-599; 4-623; 4-624; 4-631.

reproductive health: between 2010-2015, more than 75% of pregnant dolphins observed within the oil footprint gave birth to dead or non-viable dolphin calves.[129]

- All five of the Gulf's sea turtles are either threatened or endangered, and as many as 202,600 sea turtles died or were injured as a result of oil spill contamination or spill response activities. This does not include numbers from foregone reproduction nor other unquantified injuries.[130]
- Nearly one million coastal and offshore seabirds are estimated to have died as a result of the oil spill.[131]

The DPP also fails to analyze the potential impacts from the use of dispersants in case of an oil spill. Dispersants increase the toxicity of oil to aquatic organisms in the water column, and thus significantly increased the level of contamination sustained in the Gulf following the *Deepwater Horizon* spill. Additionally, chemicals in the dispersants used were found to persist in the environment. More than two months after dispersants were injected at the wellhead, chemicals were found in the deep-sea plume 185 miles away from the well. More than six months after the spill, these chemicals were found on deep-sea corals, and traces were still found on beaches up to three years after the spill.[132]

Finally, the agency points toward the "numerous safeguards for OCS drilling, development, and production operations, which have increased in the post-*Deepwater Horizon* era" as justification for failing to fully account for potential oil spill costs and risks.[133] However, in December 2017 the Department of Interior's Bureau of Safety and Environmental Enforcement called to "amend, revise, or remove current regulatory provisions.[134]" Offshore drilling safeguards are critical to reduce the risk for oil spills and other catastrophic events, as detailed further in Section VII, and BOEM must fully account for potential oil spill costs, especially as BSEE attempts to reduce safeguards that make such occurrences less likely.

F. The NSV has additional gaps

In addition, BOEM monetizes recreation and air pollution, but declines to quantify costs for other environmental harms, including impacts on unique resources such as endangered species. As a result, environmental costs are greater in places where there are more people.[135] This undervalues some

[129] NRDA, at 4-623; 4-631; 4-633; 4-584.
[130] NRDA, summarizing data presented in p. 4-561, 4-565, 4-570, 4-518, and 4-569.
[131] Haney, C.J., Geiger, H.J., & Short, J.W., Bird mortality from the *Deepwater Horizon* oil spill. I. Exposure probability in the offshore Gulf of Mexico. *Marine Ecology Progress Series* Vol 513:225-237, 2014(a); Haney, C.J., Geiger, H.J., & Short, J.W., Bird mortality from the *Deepwater Horizon* oil spill, II, Carcass sampling and exposure probability in the coastal Gulf of Mexico, *Marine Ecology Progress Series*, vol. 513, pp. 239-252, 2014(b). The NRDA reports a much more conservative mortality rate for birds. The NRDA acknowledges the Haney et al. studies, but does not discuss them. A comment on these Haney studies was published by NRDA-affiliated researchers: Sackmann, B.S., & Becker, D.S., Bird mortality due to the *Deepwater Horizon* oil spill: Comment on Haney et al. (2014a,b), *Marine Ecology Progress Series*, Vol 534:273-277, 2015. A reply to this comment was also published: Haney, C.J., Geiger, H.J., & Short, J.W., Bird mortality due to the *Deepwater Horizon* oil spill: Reply to Sackmann & Becker (2015), *Marine Ecology Progress Series*, Vol 534:279-283, 2015.
[132] NRDA, p. 4-39.
[133] DPP, p. 7-37.
[134] 82 FR 61703.
[135] DPP, p. 5-20.

components of the environment and ignores the value of wilderness. While the costs to less populated places are therefore understated, the benefits are overstated, because the NEV is assessed on a national basis.

Finally, the NSV fails to quantify the potential coastal and onshore impact from additional offshore leasing.

The Proposed Program provides no appropriate basis for excluding the potential costs of catastrophic spills, unique resources including endangered species and wilderness, and coastal impacts from the analysis. The NSV should be reevaluated with these costs included.

VI. There should be no new leasing

As detailed above, further oil and gas leasing from America's OCS is surplus to the projected energy needs as well as contrary to what is required to avoid catastrophic impacts from climate change. Rather than open up an unprecedented span of the OCS to new leasing, BOEM should not be offering new leasing opportunities to industry. Doing so unnecessarily puts our ecologically and economically critical marine environments and coastal economies at risk to damage from oil spills and exploration or production noise. OCS leasing is all risk and no reward, and BOEM should therefore not include new leasing in the Program.

For these and related reasons, more fully elaborated below, we recommend the following.

A. Alaska should be excluded from the leasing program

The factors above, many of which apply in Alaska with special force, combined with the region's remoteness and harshness, the very largely pristine character of its OCS resources, and the stressors associated with disproportionate damage from climate change, make federal waters in Alaska a particularly bad choice for offshore drilling. Below, we discuss in detail how these factors apply in the Alaska planning areas where leasing has previously occurred.

1. The Beaufort and Chukchi Planning Area

As explained below, virtually all of the Arctic OCS is permanently off limits to oil and gas leasing and cannot lawfully be included in a Five Year Program. Moreover, none of it can prudently be leased. To ensure that offshore oil and gas leasing activities in the OCS "minimize adverse impacts to the natural and human environment, decisions about these activities must be grounded in strong science."[136] As the science overwhelmingly demonstrates, the risks of irreparable damage from oil spills and the certainty of damage from exploration, are far too great for it ever to be in the public interest to lease these areas.

Thus, President Obama used his authority to end oil and gas leasing in the U.S. Arctic because, in part, it "is a unique, vibrant, and vulnerable ecosystem that is home to several Federally listed and

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[136] National Commission on the BP *Deepwater Horizon* Oil Spill and Offshore Drilling. 2011. *Final Report to the President: Deep Water—the Gulf Oil Disaster and the Future of Offshore Drilling* [hereinafter "Presidential Oil Spill Commission Report"]. p. 302. Available at http://www.gpo.gov/fdsys/pkg/GPO-OILCOMMISSION/pdf/GPO-OILCOMMISSION.pdf

candidate species under the Endangered Species Act, including iconic and culturally valuable species, and upon which many Alaska Native communities rely for subsistence use and cultural traditions."[137] He expressly relied on the fact that Arctic exploration and development posed significant threats not remedied by then-recently adopted safety measures, owing to Arctic-specific factors—largely unavoidable—including "harsh environmental conditions, geographic remoteness, and a relative lack of fixed infrastructure."[138]

Moreover, the enormous timelines for bringing offshore Arctic oil to market mean that, even ignoring the powerful climate-based reasons to leave these fuels underground, American consumers would never benefit from their exploitation—making exploration and development of oil under the Beaufort and Chukchi Seas all downside for the U.S. public, who are, after all, its owners.

a. Leasing in the Chukchi and almost all the Beaufort Seas is illegal

The Secretary cannot lawfully schedule oil and gas leases anywhere in the Chukchi Sea, or almost anywhere in the Beaufort. Some 98 percent of the Arctic OCS was permanently withdrawn from leasing by President Obama.[139] He acted pursuant to OCSLA Section 12(a), which states that "The President of the United States may, from time to time, withdraw from disposition any of the unleased lands of the outer Continental Shelf."[140] Those withdrawals were, by their express terms, not time-limited. While the text of Section 12(a) delegates to presidents the power to create protected areas, like the Antiquities Act it does not authorize presidents to undo those designations, reserving that, instead, to Congress.

Accordingly, the U.S. Attorney General has found that such congressional delegations operate in one direction only: they do not imply a power to undo. "[I]f public lands are reserved by the President for a particular purpose under express authority of an act of Congress, the President is thereafter without authority to abolish such reservation."[141] The opinion explained that "the reservation made by the President under the discretion vested in him by the statute was in effect a reservation by the Congress itself," and that, except where Congress expressly provided, "the President thereafter was without power to revoke or rescind the reservation." While the opinion referred to the Antiquities Act, the legal rationale applies equally to Section 12(a)'s withdrawal authority. As explained by a previous Attorney General's opinion it quoted, "unless it be within the terms of the power conferred by that statute, the Executive can no more destroy his own authorized work, without some other legislative sanction, than any other person can."[142]

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[137] Obama, B. *Fact Sheet: President Obama Protects 125 Million Acres of the Arctic Ocean* [hereinafter "Obama Withdrawal Fact Sheet"], p.1. December 20, 2016. Official supporting rationale for presidential decision, available at http://www.presidency.ucsb.edu/ws/index.php?pid=123169 and https://www.doi.gov/sites/doi.gov/files/uploads/2016_arctic_withdrawal_fact_sheet_for_release.pdf.
[138] *Id.*
[139] Obama, B. *Presidential Memorandum—Withdrawal of Certain Portions of the United States Arctic Outer Continental Shelf from Mineral Leasing* (hereinafter "Obama Proclamation"). Dec. 20, 2016. https://obamawhitehouse.archives.gov/the-press-office/2016/12/20/presidential-memorandum-withdrawal-certain-portions-united-states-arctic.
[140] 43 U.S.C. § 1341(a).
[141] United States Attorney General, Proposed Abolishment of Castle Pinckney National Monument (39 U.S. Op. Atty. Gen. 185) (Sept. 26, 1938).
[142] *Id.*

b. Arctic Sea conditions are too harsh and unpredictable for safe development

Meteorologic and marine conditions in the Chukchi and Beaufort Seas mean no drilling in the OCS there is safe drilling. As the President's oil spill commission noted: "[t]he Alaskan Arctic is characterized by extreme cold, extended seasons of darkness, hurricane-strength storms, and pervasive fog—all affecting access and working conditions."[143] No amount of oversight and preparation can change the fact that the same conditions making human error there so disastrous also make it entirely predictable. The inordinately well-financed Shell drilling effort in 2012 in both seas illustrated this only too well, with the stress of environmental challenges translating into a sobering string of miscalculations, mistakes, and reversals by company personnel and contractors.[144]

In the Chukchi and Beaufort Seas, fog persists for long periods of time and weeklong storms occur with extreme winds.[145] Ocean currents flow in complex patterns reversing direction rapidly and varying significantly in both magnitude and local direction.[146] Subsurface circulation can be just as complex and trend in the opposite direction.[147] Waves run to 20 feet.[148] And even as climate change will likely continue to shrink the polar ice cap, that will likely be accompanied by significant increases in wave height extremes and wind intensification.[149] Indeed, winds already show an increasing trend over the past 30 years, and large waves over the past decade.[150]

Thus, even during the "open water" exploration and drill season, spill response would often be impossible. In a study of two sites in the Canadian Beaufort (a near shore site roughly as close close in as previously leased U.S. Beaufort Sea leases and another further offshore comparable to now-relinquished U.S. Chukchi leases), a study commission by the National Energy Board of Canada concluded that oil spill response countermeasures often could not be brought to bear effectively. Containment and recovery would be impossible for an average of 46 percent of the open water time from June through October for the near offshore site and 47 percent for the far offshore one.[151] Dispersants—whatever their marginal efficacy and irrespective of their environmental impacts,

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[143]National Commission on the BP *Deepwater Horizon* Oil Spill and Offshore Drilling, Final Report to the President: Deep Water The Gulf Oil Disaster and the Future of Offshore Drilling 302 (January 2011) [hereinafter National Oil Spill Commission Report]. http://www.gpo.gov/fdsys/pkg/GPO-OILCOMMISSION/pdf/GPO-OILCOMMISSION.pdf p. 263.
[144] Kroh, K. and M. Conathan. 2013. *Timeline: Documenting Shell's 2012 Arctic Drilling Debacle* (2013), https://thinkprogress.org/timeline-documenting-shells-2012-arctic-drilling-debacle-6258b89aeead/.
[145] Pew Environment Group. 2010. *Oil Spill Prevention and Response in the U.S. Arctic Ocean: Unexamined Risks, Unacceptable Consequences*. Available at http://www.pewtrusts.org/~/media/legacy/uploadedfiles/peg/publications/report/Oil20Spill20Preventionpdf.pdf.
[146] National Research Council. 2014. *Responding to Oil Spills in the U.S. Arctic Marine Environment*.
[147] *Id*.
[148] Pew Environment Group, *supra* n. 145.
[149] Khon, V.C. et al. 2014. Wave heights in the 21st century Arctic Ocean simulated with a regional climate model. 41 Geophys. Res. Letters 2956-61.
[150] National Research Council, *supra* n. 146.
[151] National Energy Board of Canada. 2011. *Spill Response Gap Study for the Canadian Beaufort Sea and Davis Strait*. Available at http://aleutianriskassessment.com/documents/A2A6V0_-_SL_Ross_Environmetal_Research_Limited_-_Spill_Response_Gap_Study_for_the_Canadian_Beaufort_Sea_and_the_Canadian_Davis_Strait.pdf. Because this study conservatively looked only at response availability during fully "open water" conditions and did not count other days from June through October when drilling would be allowed but some ice would be present, it very likely underestimated summer season days on which remediation would be ineffective.

discussed below—could not be applied aerially 54 percent of that time near shore, and 52 percent at the farther offshore site; for in situ burning the percentages were 50 and 52, respectively.[152]

Some of the gravest challenges to drilling operations and safety are associated with ice. Even in the summer, ice intrudes on drill sites,[153] as Shell found out in 2012, when within a day of finally sinking a drill bit into the Chukchi seafloor its rig had to cap operations and flee before a floe roughly the size of Manhattan.[154] Indeed, throughout the summer, ice conditions in the Chukchi and Beaufort Seas remain highly variable.[155] Moreover, at the end of the brief drill season, when freeze up comes, ice free waters transition to ice cover in a matter of days.[156] As new ice forms, it would rapidly encapsulate any spilled oil, to release it later on the surface during break up.[157] Once encapsulated, the oil could travel enormous distances over winter, as much as 1200 miles net of backtracking.[158]

c. The U.S. Arctic Ocean harbors extraordinary and unique biological resources

Some of the most productive and pristine marine ecosystems on Earth are found in Alaska's Arctic waters and coasts.[159] The assemblage of marine mammals found there is among the most diverse in the world, including ice seals, cetaceans, and walruses.[160] The waters of the Beaufort and Chukchi Seas are home to millions of migratory birds from virtually all continents[161] as well as one-fifth of the world's polar bears.[162] In addition to polar bears, numerous other supported species are listed or proposed for listing as threatened or endangered species under federal

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[152] *Id*.
[153] National Research Council, *supra* n. 146.
[154] Kim Murphy. *Ice threat halts Shell's drilling in Arctic Ocean after one day.* September 10, 2012. Available at http://articles.latimes.com/2012/sep/10/nation/la-na-nn-shell-ice-arctic-drilling-chukchi-20120910.
[155] *Id.*
[156] *Id.*
[157] LOOKNorth. 2014. *Oil Spill Detection and Modeling in the Hudson and Davis Straits, Final Report R-13-087-1096.*Available at http://www.nunavut.ca/files/2014-05-29%20Oil%20Spill%20Detection%20and%20Modelling%20Report.pdf (accessed August 16, 2017).
[158] National Research Council, *supra* n. 146; *see* also Presidential Oil Spill Commission, supra n. 136 at 302 ("oil-spill response efforts are complicated year-round by the remote location and the presence of ice, at all phases of exploration and possible production").
[159] Arctic Council. 2013. *Arctic Biodiversity Assessment: Status and trends in Arctic biodiversity – Synthesis* (hereinafter ABA). *p*. 31. Available at http://www.arcticbiodiversity.is/the-report/synthesis. In fact, the primary productivity of these waters is potentially much higher than scientists have previously estimated. A recent study has documented fall phytoplankton blooms throughout the Arctic. Ardyna, M. et al. 2014. *Recent Arctic Ocean sea ice loss triggers novel fall phytoplankton blooms*. Geophys. Res. Lett., 41, 6207–6212. This study provides additional insight into the earlier discovery by a National Aeronautic and Space Administration expedition, of phytoplankton production in waters under thin ice in the Chukchi that are richer than in any other ocean region. *See* Harrington, J.D. and M. Vinas. 2012. *NASA Discovers Unprecedented Blooms of Ocean Plant Life*. https://www.nasa.gov/home/hqnews/2012/jun/HQ_12-184_NASA_Discovers_Ocean_Plant_Life.html. Halpern, B.S., *et al*. 2008. *A global map of human impact on marine ecosystems*. 319 Science 948-952.
[160] Presidential Oil Spill Commission, supra n. 136 at 303.
[161] Holland-Bartels, L. and Pierce, B., eds. 2011. An evaluation of the science needs to inform decisions on Outer Continental Shelf energy develop in the Chukchi and Beaufort Seas, Alaska: U.S. Geological Survey Circular 1370 (hereinafter "USGS Report"). *See also* Presidential Oil Spill Commission, supra n. 136 at 303.
[162] IUCN Polar Bear Specialist Group. 2014. Summary of Polar Bear Population Status. http://pbsg.npolar.no/en/status/status-table.html.

law.[163] These include spectacled and Steller's eiders, Pacific walruses, and both fin and bowhead whales.[164]

Both seas have numerous areas of heightened ecological significance,165 including highly important habitat for marine mammals.[166] In putting them permanently off-limits to leasing, President Obama noted that the Department of Interior had identified a total of six Environmentally Important Areas (EIAs) in the two seas. These high value areas, far from substantiating limited set-asides, require a no-leasing regime throughout the Chukchi and Beaufort Seas. They "[d]emonstrate the interconnectedness of this ecosystem, as the ecologically significant resources within the EIAs could be dramatically impacted by activities outside of those areas."[167] The resources concentrated in the EIAs are vulnerable to exterior threats, including from oil exploration and development; thus "[c]omprehensive protection of the area is warranted, as limiting protection to the EIAs would fail to protect ecosystem function and services critical to the region. Additionally, a larger footprint is appropriate to account for the way in which oil could spread, if a spill were to occur, as the EIAs themselves will not adequately protect important species."[168]

d. Arctic Ocean resources are too vulnerable to expose to oil exploration and development

As rich as ecosystems are in the region, they are also highly vulnerable. An Arctic Council assessment notes the "numerical dominance of relatively few key species in Arctic food webs, together with highly variable web interactions (for instance leading to community-wide cycles) and environmentally driven fluctuations with cascading effects through entire ecosystems."[169]

Cascading consequences extend to human residents because biodiversity and the natural environment remain integral to the well-being of Arctic peoples, providing not only food but the everyday context and basis for social identity, cultural survival and spiritual life. These foods also lower the risk of metabolic diseases in residents who consume them regularly.[170] All of these important values are threatened by oil and gas activities.

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[163] NOAA Fisheries Service. 2014. *Endangered, Threatened, Proposed, Candidate, and Delisted Species in Alaska*. Available at https://alaskafisheries.noaa.gov/protectedresources/esa/ak_specieslst.pdf.
[164] U.S. Fish and Wildlife Service. 2014. Endangered, Threatened, Proposed, Candidate, and Delisted Species in Alaska. Available at https://www.fws.gov/alaska/fisheries/endangered/pdf/consultation_guide/4_species_list.pdf.
[165] AMAP/CAFF/SDWG. 2013. Identification of Arctic marine areas of heightened ecological and cultural significance: Arctic Marine Shipping Assessment (AMSA) IIc (hereinafter AMSA IIC Report). Available at http://www.caff.is/publications/view_document/251-arctic-marine-areas-of-heightened-ecological-and-cultural-significance-arctic-marine-shipping-assessment-amsa-iic. *See also* L. Speer, L. and T. L. Laughlin. 2011. *IUCN/NRDC Workshop to Identify Areas of Ecological and Biological Significance or Vulnerability in the Arctic Marine Environment: Workshop Report*, International Union for the Conservation of Nature, Natural Resources Defense Council.
[166] Clarke, J.T., M.C. Ferguson, C. Curtice, and J. Harrison. 2015. Biologically important areas for cetaceans within U.S. waters—Arctic Region. Aquatic Mammals 41(1): 94-103. DOI:10.1578/AM.41.1.2015.94.
[167] Obama Proclamation, *supra* n. 139 at 3.
[168] *Id.*
[169] ABA, *supra* n. 159 at 34.
[170] Wernham, A. 2007. Iñupiat Health and Proposed Alaskan Oil Development: Results of the First Integrated Health Impact Assessment/Environmental Impact Statement for Proposed Oil Development on Alaska's North Slope. 4 EcoHealth 500, 506, 507.

Protection of the Beaufort and Chukchi Seas is particularly important in light of the increasing impacts of climate disruption, including surface water warming, loss of sea ice, and ocean acidification in the region.[171] "Such conditions and stressors may increase the vulnerability of these species and habitat and reduce their resilience to impacts of oil and gas activities."[172] The sea ice is critical for survival of many Arctic species and dictates or influences oceanic and ecological processes and connections.[173] Its loss reduces vital habitat for seals, polar bears, walrus, and other ice-dependent species.[174] The rapidity of change dictates that even where adaptation is possible, for many species it will mean not evolutionary change but northward displacement, a strategy of severely limited utility in the high latitudes entailing, as it necessarily does, the reduction of available surface area for habitat.[175] Climate change in the Arctic is also leading to increased storms, sea level rise, melting permafrost, and coastal erosion. The cold and low salinity of the water make the Arctic more susceptible to acidification,[176] which is affecting the oceanographic and ecological systems of the Arctic in far- reaching ways.[177]

e. Spill response in the Arctic Ocean would be ineffective

The best available science demonstrates that oil spills cannot be cleaned up in the Arctic, and that oil can travel for thousands of miles across the region, should a spill occur. The most distinctive and greatest risk of a spill in the Arctic is the risk that a blowout will continue, unabated, throughout the long winter. In the fall, the "quick transition from open-water to 100% ice means that the ability to respond degrades very rapidly."[178] At that point, it becomes impossible to stop a blowout. In addition, the oil becomes encapsulated in ice, where it can travel for over a thousand miles before being released during the spring breakup.[179]

Even in the short "open water" season, ice floes, hurricane-strength storms, and extensive fog would affect access and working conditions during spill response.[180] In an assessment of two sites in the U.S. Beaufort and Chukchi Seas, a study commission by BOEM concluded mechanical recovery would be impossible for an average of 43 percent of the time from July

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[171] Chapin, S., et al. 2014. Alaska. *Climate Change Impacts in the United States: The Third National Climate Assessment*, Melillo, J. et al, eds. U.S. Global Change Research Program. pp. 514-536. Available at http://nca2014.globalchange.gov.
[172] Obama Proclamation, *supra* n. 139 at 4.
[173] Eamer, J. et al. 2013. *Life Linked to Ice: A guide to sea-ice-associated biodiversity in this time of rapid change.* CAFF Assessment Series No. 10. Conservation of Arctic Flora and Fauna, Iceland. Available at http://www.caff.is/publications/view_document/254-life-linked-to-ice-a-guide- to-sea-ice-associated-biodiversity-in-this-time-of-rapid-change.
[174] Obama Proclamation, *supra* n. 139 at 3.
[175] ABA, *supra* n. 159 at 94.
[176] Arctic Monitoring & Assessment Programme. 2013. Arctic Ocean Acidification Assessment: Summary for Policymakers. Available at https://www.amap.no/documents/doc/amap-arctic-ocean-%20acidification-assessment-summary-for-policy-makers/808.
[177] Andreev, A. et al.. 2010. *The Distribution of the Carbonate Parameters in the Waters of Anadyr Bay of the Bering Sea and in the Western Part of the Chukchi Sea.* 50 *Oceanology* 39, 49.
[178] Nuka Planning Group, LLC. 2014 *Estimating an Oil Spill Response Gap for the U.S. Arctic Ocean*. p. 28 (hereinafter Response Gap Analysis). Available at http://www.nukaresearch.com/files/140910_Arctic_RGA_Report_FNL.pdf.
[179] Presidential Oil Spill Commission, *supra* n. 136 at 302.
[180] *Id.*

through October.[181] Dispersants could not be applied every one out of five days, and *in situ* burning would be possible to attempt only two-thirds of the time.[182]

The difficulty with conducting oil and gas operations in the Arctic is exacerbated by the fact that so little infrastructure exists in the region. As succinctly summarized by a Commandant of the U.S. Coast Guard, "there is nothing up there to operate from at present and we're really starting from ground zero."[183]

"The lack of infrastructure in the Arctic would be a significant liability in the event of a large oil spill. . . . It is unlikely that responders could quickly react to an oil spill unless there were improved port and air access, stronger supply chains and increased capacity to handle equipment, supplies and personnel."[184] Yet, even with sufficient infrastructure in place, response capacity would be severely limited in the Arctic. Even in the much calmer waters of the Gulf of Mexico, oil spill response methods were woefully ineffective, and in any event, "cannot simply be transferred to the Arctic."[185] These existing, inadequate technologies have not been sufficiently tested in realistic Arctic conditions.[186]

Oil from a major spill in the Arctic Ocean could readily affect waters and coasts throughout the U.S. Arctic and beyond.[187] Even with conservative parameters, drawn from industry and agency sources, modeling using OilMap predicts a high likelihood of widespread impacts from oil releases in a series of credible spill scenarios. These impacts occur even on the implausible assumption that spill response measures work as well as they did in the *Deepwater Horizon* disaster in 2010, although conditions in the Arctic are far harsher and responders far harder to mobilize than in the Gulf of Mexico.[188]

While this analysis shows oil spreading widely even when blowouts were capped quickly and relief wells drilled in record time, some of the worst impacts were from a well failure in October in the Chukchi Sea, too late to control prior to the onset of winter pack ice. That scenario has a projected 100 percent likelihood of shoreline impacts in Alaska and Russia. Under the same scenario in the Beaufort Sea, to the east, coastlines were shown to be almost certain to be oiled in both Alaska and Canada.

Areas at risk include the coastline of the pristine and iconic Arctic National Wildlife Refuge, home to the greatest density of polar bear maternity dens in the U.S. Also threatened is sensitive shoreline habitat for nursing beluga whales, ice seals, and many other species. Offshore, oil is likely to cover highly productive and vulnerable marine areas protected by presidential order just last year. These include Barrow Canyon, an important stopping place for migrating whales and high densities of summering seabirds like shearwaters, eiders, and loons. They also include Hanna Shoal, a critical

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[181] Response Gap Analysis, *supra* n. 178 at ii.
[182] *Id.*
[183] Zabarenko, D., *Arctic Oil Spill Would Challenge Coast Guard*. REUTERS. June 20, 2011. Available at https://www.reuters.com/article/us-arctic-oil/arctic-oil-spill-would-challenge-coast-guard-idUSTRE75J6O620110620.
[184] National Research Council, *supra* n. 146.
[185] National Oil Spill Commission Report, *supra* n. 143 at 303-04.
[186] National Research Council, *supra* n. 146.
[187] *See* West, M. 2016. *The Fate of the Arctic in Offshore Oil Blowouts.* Available at https://www.nrdc.org/sites/default/files/fate-oil-arctic-ocean-blowouts-report.pdf.
[188] *Id.* at 19.

area for the Pacific walrus, ice seals, and the polar bears that feed on them,[189] which all three Chukchi scenarios showed had a 60 percent or greater chance that oil would reach. Canadian and Russian marine areas are under threat as well and so is the biologically and economically critical Bering Strait.

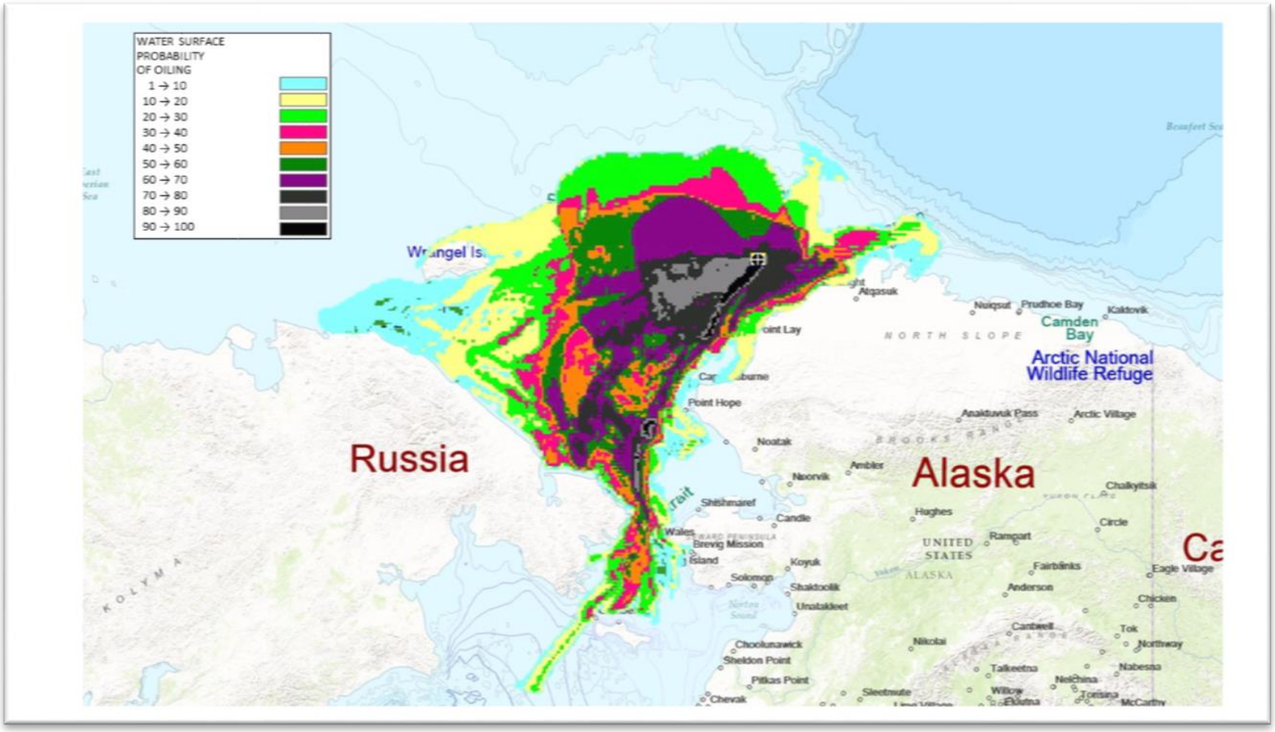

Figure VI-1: Chukchi late season blowout trajectory probabilities prior to freeze up.

[189] Speer and Laughlin, T., *supra* n. 165.

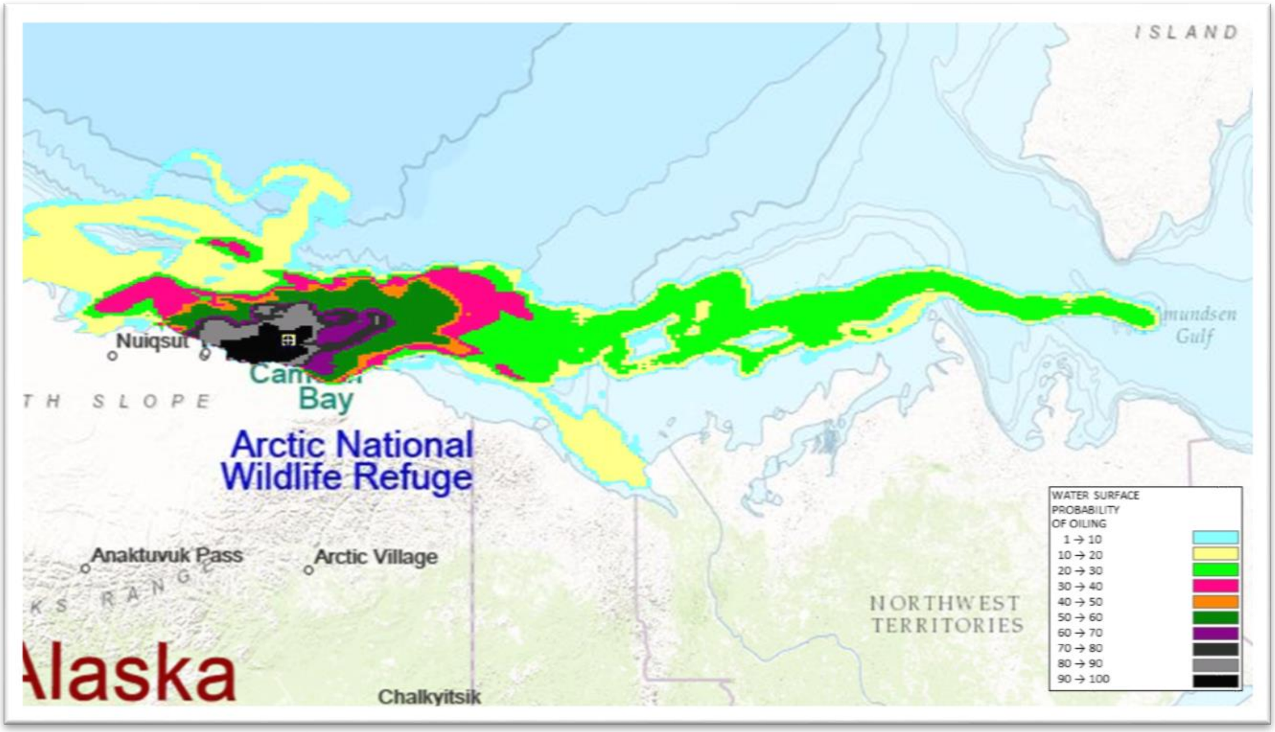

Figure VI-2: Beaufort Mid-season trajectory probabilities for blowout halted by relief well in 33 days.

f. Spill countermeasures would cause serious damage to Arctic resources

The mode of operation of dispersants – breaking up oil, distributing it throughout the water column, and settling dispersant-oil mixtures on the ocean floor – combined with their demonstrated toxicity, especially when mixed with oil,[190] makes them of particular concern in the Arctic. Arctic ecosystems are characterized by relatively short and simple food chains—for example "phytoplankton-zooplankton-fish-seal-polar bear or phytoplankton-zooplankton-whale."[191] Such ecological simplicity poses inherent risks—losing a single species can have extremely serious repercussions.[192] This vulnerability is aggravated by the fact that Arctic ecosystems are sharply limited in functional redundancy, making them among the most fragile ecosystems on Earth.[193] Characteristically lower rates of reproduction among Arctic species, as well as stresses induced through climate change-related fluctuations in temperature, ice cover, and ocean acidity, only serve to further compound the ecosystems' vulnerability.[194]

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[190] *See, e.g.,* Rico-Martínez, R., T.W. Snell, and T.L. Shearer. 2013. "Synergistic Toxicity of Macondo Crude Oil and Dispersant Corexit 9500A® to the Brachionus Plicatilis Species Complex (Rotifera)." *Environmental Pollution* 173: 5-10.

[191] Chapman, P.M. and M. J. Riddle. 2005. Toxic effects of contaminants in polar marine environments. Environmental Science & Technology 5:200–207. See also Harner T. 1997. Organochlorine contamination of the Canadian Arctic and speculation on future trends. Int. J. Environment and Pollution. 8(1/2): 51-72.

[192] Barcott, B. 2011. *In Thawing Arctic, Fragile Food Web at Risk of Unraveling*. InsideClimate News. 23 Feb. 2011. Available at http://insideclimatenews.org/news/20110223/arctic-food-web-climate-change-polar-bears-part-i.

[193] Chapman and Riddle, *supra* n. 191.

[194] *Id.* and Barcott, *supra* n. 192.

The region's short food chains anchored in benthic productivity and constrained by the short "open water" season, are highly vulnerable to the effects of toxic oil-dispersant mixtures settling on the sea bottom. These risks are particularly acute for seabed feeders like walruses, which consume large volumes of benthic organisms and may bioaccumulate toxins they contain, or may conversely find dispersant-fouled essential feeding grounds too depauperate to support their populations. The risks are all the more serious because of the acknowledged lack of good data on the functioning of Arctic marine ecosystems. Even in much better studied and understood pelagic systems like the Gulf of Mexico, serious dispersant impacts continue to come to light.[195] Added to the potentially severe environmental consequences for Arctic Ocean species and systems is the possibility that dispersant exposure has contributed to the documented human lifespan impacts of working to clean up major oil spills in Alaska.[196]

g. Arctic Ocean oil would not benefit U.S. consumers

Finally, quite apart from the numerous ways in which exploration and development of Arctic Ocean oil resources is contrary to the public interest, they offer no rational upside to Americans. These fuels could not make it to market until after we need to be largely finished transitioning away from reliance on fossil fuels, not expanding access to them. In addition to the time needed for the many-layered OCSLA approval process, the small annual window for exploration and development activities, the inevitable interruptions during those windows for ice flows, whale migrations, rough weather, and equipment failures, and the current lack of infrastructure mean that these fuels could not reach American consumers for decades. Thus, in 2015, before Shell abandoned its Arctic Ocean drilling effort altogether, its CEO said production was still about 15 years off.[197] Shell was working on Chukchi Sea leases, won in 2008 bidding, which were authorized in the 2002-2007 Five Year Program that, in turn, was adopted in 2001. Shell, in other words, before finally concluding that its extremely well-funded and expensive offshore development effort in the Chukchi made no commercial sense, was contemplating 29 years of lead time from adoption of a Five-Year Program to oil delivery. And, of course, were the Trump administration to persist in its ill-advised course of drafting a new Five-Year Program, it is still years from adopting one, putting delivery, even if production were actually achieved, at something like 2050.

2. The Cook Inlet Planning Area

The other OCS planning area in Alaska where leasing has occurred is Cook Inlet, a semi-enclosed tidal estuary in south central Alaska. No oil and gas exploration or development should be allowed there in the future.

Cook Inlet is home to a variety of marine mammal species, such as Steller sea lions and harbor porpoises, and bird and fish species, such as salmon, eulachon, and Pacific cod. Among the most

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[195] *See, e.g.,* DeLeo, D.M., D.V. Ruiz-Ramos, I.B. Baums, and E.E. Cordes. 2015. Response of deep-water corals to oil and chemical dispersant exposure. Deep-Sea Research II. Available at http://dx.doi.org/10.1016/j.dsr2.2015.02.028. All three species of coral examined showed more severe declines from exposure to dispersants and dispersant-oil mixtures than from oil alone.

[196] *See, e.g.,* King, T. *Oil Worker life spans and dangerous times in a world of BP and greed*. Salem-News. June, 30, 2012. Available at http://www.salem-news.com/articles/june302010/oil-lifespans.php.

[197] Splash 247. *Shell CEO says oil production in Arctic probably 15 years away*. Sept. 18, 2015. Available at: http://splash247.com/shell-ceo-says-oil-production-in-arctic-probably-15-years-away/.

significant and vulnerable of these species is the small Cook Inlet population of endangered beluga whales (*Delphinapterus leucas*). According to a status review by the National Marine Fisheries Service (NMFS), this population faces a 26% probability of becoming functionally extinct within the next 100 years, and a 70% probability of extinction within 300 years.[198] The U.S. Marine Mammal Commission has repeatedly called for a suspension of geophysical surveys and other disruptive activities in the Inlet, given the individual and cumulative impacts these activities may have on the population's recovery.

The population of Cook Inlet beluga whales has declined precipitously in the last 30 years. In 1979, the estimated population of Cook Inlet beluga whales was approximately 1,300.[199] By 2012, the year of the last published abundance survey, the population had dropped over 75% to only 312 whales.[200] Despite a cessation of subsistence hunting in 1999, the population of Cook Inlet beluga whales has not rebounded. In fact, it declined at an average rate of 0.6% per year between 2002 and 2012.[201]

Among the most serious threats faced by beluga whales from oil and gas activity in Cook Inlet is anthropogenic noise. Like all cetaceans, Cook Inlet beluga whales depend on sound for vital life functions, such as to navigate, find food, locate mates, avoid predators, and maintain social cohesion. Artificial man-made noise introduced into their environment can disturb beluga whales and interfere with these and other behaviors. As NMFS acknowledged in its Final Rule listing the Cook Inlet beluga whale as endangered, and in its Conservation Plan for the Cook Inlet Beluga Whale, anthropogenic noise may impact the survival and recovery of the population.[202] NMFS also noted the particular vulnerability of Cook Inlet belugas to noise, citing the vital importance of acoustics for these animals in the highly turbid waters of the upper Inlet, the encroachment of "large and small vessels, aircraft, oil and gas drilling, marine seismic surveys, pile driving and dredging" on Cook Inlet, and the substantial literature demonstrating the impacts of noise on this species.[203]

Prior development in and around Cook Inlet aggravates these impacts. In addition to significant biological costs, noise over time is also likely to lead to chronic stress in marine mammals, a particular concern for populations in relatively urbanized marine environments.[204] The condition is associated across mammalian species with higher mortality and morbidity and reduced reproductive

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198 Hobbs, R. and Shelden, K.. 2008. *Supplemental status review and extinction assessment of Cook Inlet belugas (Delphinapterus leucas)*.
199 NMFS. 2008. Conservation Plan for the Cook Inlet Beluga Whale (*Delphinapterus leucas*).
200 Hobbs, R.C., Sims, C.L., and Shelden, K.E.W. 2012. *Estimated abundance of belugas in Cook Inlet, Alaska, from aerial surveys conducted in June 2012*. Available at http://alaskafisheries.noaa.gov/protectedresources/whales/beluga/abundance/2012estimates.pdf.
201 Allen, B.M., and Angliss, R.P. 2014. *Alaska marine mammal stock assessments, 2013*. NOAA Tech. Memo. NMFS-AFSC-277.
202 73 Fed. Reg. 63919, 62922 (Oct. 22, 2008) ("noise…may have some impact on this population…"); NMFS, Conservation Plan, *supra* n. 199, at 5 ("This Conservation Plan reviews and assesses the known and possible threats influencing Cook Inlet beluga whales…Potential human impacts include subsistence harvest, poaching, fishing, pollution, vessel traffic, tourism and whale watching, coastal development, noise, oil and gas activities, and scientific research").
203 *Id*. at 63087-88.
204 *See* Wright, A.J., *et al.*. 2007. *Do marine mammals experience stress related to anthropogenic noise?* International Journal of Comparative Psychology 20:274-316.

success, and with a variety of pathologies including immuno-suppression, heart disease, and physical malformations and other defects in the young.[205] Notably, noise has already been demonstrated to stimulate production of stress hormones in belugas, the amount increasing with the level of exposure.[206] Cook Inlet belugas are at risk of chronic stress from increased ensonification of their diminished range, together with increases in the other stressors discussed in these comments.[207]

B. The Pacific Region should be excluded from the leasing program

1. America's Pacific Ocean economy

The Pacific region should be excluded from the 2019-2024 Five Year Program. To include Washington Oregon, and California in the 2019-2024 Five-Year Program would drastically threaten each state's thriving ocean and coastal economies, all of which are wholly dependent on healthy marine ecosystems. From a resource perspective, the social and economic value of the West Coast's marine renewable resources far exceed those that new or expanded offshore oil and gas production would provide.

Given their stunning natural beauty and abundant biodiversity, it is no surprise that ocean tourism and recreation contribute a significant amount to the western coastal states' economies. To preserve the West Coast's world class marine ecosystems, the federal government has responded to tribes, local communities, and local and state elected officials by protecting some of the region's invaluable marine treasures. California is home to the United States' largest and most comprehensive network of National Marine Sanctuaries, and Washington's Olympic Coast National Marine Sanctuary attracts three million visitors annually.[208] Favoring ocean protection over mineral and/or fossil fuel extraction has been enormously beneficial to the West Coast states' marine ecosystems and the fishermen and businesses that depend on them. These states' investments in conservation have imparted benefits that far surpass use of these marine areas for extractive purposes would provide.

In 2014, Washington, Oregon, and California's ocean GDP was valued at $56.3 billion.[209] The coastal tourism and recreation sector contributes $24.1 billion to that number—nearly 42.8 percent of

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[205] *Id. See also* Rolland, *et al*. 2012. *Evidence that ship noise increases stress in right whales.* The Royal Society Publishing 10.1098/rspb.2011.2429 (2012) (finding that a decrease in ship noise following September 11th resulted in lower levels of stress-related fecal hormone metabolites (glucocorticoids) in North Atlantic right whales: "a large body of literature has demonstrated that chronic stress, assessed by persistently elevated GCs, can lead to detrimental effects on health and reproduction across a variety of vertebrate taxa").

[206] Romano, T.A., *et al.* 2004. *Anthropogenic sound and marine mammal health: measures of the nervous and immune systems before and after intense sound exposure*. Can. J. Fish. Aquat. Sci. 61:1124-1134. The production of stress hormones is one (but not the only) measure of a stress response.

[207] Wright *et al.*, *supra* n. 204.

[208] Galvanized by the seminal 1969 Santa Barbara oil spill, California has led the United States in marine protection. California has the United States' largest network of National Marine Sanctuaries: Greater Farallones National Marine Sanctuary, Cordell Bank National Marine Sanctuary, Monterey Bay National Marine Sanctuary, and Channel Islands National Marine Sanctuary. The state's commitment to marine protection also extends to state waters—in 1999, California passed the Marine Life Protection Act, which created 124 Marine Protected Areas in state waters comprising approximately 16 percent of California's coastal waters.

[209] National Ocean Economics Program, Market Data, Ocean Economics (Washington, Oregon, and California Ocean GDP). Available at http://www.oceaneconomics.org/Market/ocean/oceanEcon.asp

the Pacific states' ocean GDP.[210] The West Coast fishing industries contribute over $2 billion in ocean GDP, and most importantly, provided a total of 15,296 fishing jobs in 2014.[211] The tourism and recreation sector of each West Coast state provided a total 498,274 jobs in 2014.[212] For all three West Coast states, the tourism and recreation sectors are growth industries for both ocean GDP and jobs—since 2005, jobs in the tourism and recreation sector have climbed 18.5 percent.[213]

Of the three states in the Pacific planning region, California is the only one with current commercial oil and gas production in its offshore waters. Given that California is more vulnerable to oil and gas development than Oregon or Washington because of its greater oil and gas resources and existing oil and gas infrastructure, much of the discussion here focuses on California.

California's ocean waters and unique marine ecosystems help drive its $41.8 billion ocean economy.[214] The state's devastating 1969, 1997, and 2015 oil spills illustrate the unacceptable risks expanded oil and gas production would pose to California's marine ecosystems and the many industries they support.

The 1969 Santa Barbara oil blow-out spilled more than 8.4 million gallons of oil into the ocean, covering more than 800 square miles and contaminating miles of beaches. The oil spill killed thousands of birds and other wildlife, and wreaked havoc on the local tourism and fishing industries.[215] In 1997, another offshore oil spill off Vandenberg Air Force Base caused substantial environmental harm. In 2015, Santa Barbara again experienced the impacts of an oil spill on the marine environment when the Plains All American Pipeline spilled more than 140,000 gallons of heavy crude oil, much of which reached the ocean. This spill had devastating impacts to the marine environment as well as the Southern California coastline, reaching as far as the Channel Islands and Los Angeles County. The spill killed hundreds of seabirds, dolphins, and sea lions, closed State Parks and popular public beaches, shut down more than a hundred square miles of fishing grounds, and devastated the local tourism industry.[216] These three oil spills illustrate the ecological and economic damages of offshore oil and gas drilling, and underscore the fact that oil spills are inevitable where offshore drilling occurs. The West Coast states cannot afford to suffer the consequences of an offshore oil spill.

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[210] National Ocean Economics Program, Market Data, Ocean Economics (Washington, Oregon, and California/Tourism and Recreation). Available at http://www.oceaneconomics.org/Market/ocean/oceanEcon.asp.
[211] National Ocean Economics Program, Market Data, Ocean Economics (Washington, Oregon, and California/Living Resources/All). Available at http://www.oceaneconomics.org/Market/ocean/oceanEcon.asp.
[212] *Id.*
[213] *Id.*
[214] National Ocean Economics Program, Market Data, Ocean Economics (California GDP). Available at http://www.oceaneconomics.org/Market/ocean/oceanEcon.asp. $41.8 billion is the average of the California ocean GDP for all sectors from 2005 to 2014.
[215] *State of California v. Norton*, at 1176-1177; NOAA Incident News Santa Barbara Well Blowout, available at https://incidentnews.noaa.gov/incident/6206.
[216] *People of the State of California v. Plains All American Pipeline Company, L.P.*, Santa Barbara County Superior Court Case No. 1495051, Indictment, May 16, 2016; California Department of Fish and Wildlife Office of Oil Spill Prevention and Response, *Refugio Oil Spill Response Evaluation Report,* May 2016; Refugio Oil Spill Incident Updates; Refugio Response Joint Information Center, Fact Sheet regarding beach closures: http://www.refugioresponse.com/go/doc/7258/2541530/index.html.

Economic data and trends associated with marine protection illustrate the benefits of investments in a non-extractive use of the United States' OCS resources. The tourism and recreation portion of California's ocean economy plays an outsize role in employment and contribution to the State's GDP—it comprises the largest portion of the ocean economy and contributes more jobs than all of the other sectors. In 2014, California's tourism and recreation sector generated $19.5 billion in GDP, nearly 50 percent of the ocean sector's contribution to California's GDP.[217] Most significantly, the tourism and recreation sector of the ocean economy has grown 35 percent since 2005, underscoring that this non-extractive path is a powerful economic engine for the state.[218]

In contrast, the "oil and gas exploration and production" (O&G) sector of California's ocean GDP has declined 10 percent during the same period of time—falling from $5.13 billion in 2005 to $4.66 billion in 2014.[219] Employment data for the tourism and recreation sector contrast starkly with those of the O&G sector and affirm the social value of the tourism and recreation economies. In 2014, the tourism and recreation sector provided 400,056 jobs, an increase of 19.5 percent since 2005.[220] In contrast, in 2014, the O&G sector provided 8,775 jobs. Contrary to the argument that increased oil and gas production will bring jobs to California, relying on the state's thriving tourism and recreation and renewable energy industries will provide economic and social benefits that far surpass those the offshore O&G industry can offer. This observation also applies to the United States generally—the tourism and recreation sector is the largest employment sector of the U.S. ocean economy, providing more than 2.2 million jobs in 2014, which constitutes 19.4 percent growth in employment in this sector since 2005, whereas oil and gas employment provided only 164,420 jobs in 2014.[221]

Many coastal communities' economic and social well-being is wholly dependent on commercial fishing. In 2017, NOAA reported that several commercial fishing dependent communities on the West Coast have "disproportionally high social vulnerability" and would be "heavily impacted by shocks to commercial fishing revenues."[222] West Coast commercial fisheries are already experiencing declines due to warming waters and ocean acidification, and new offshore drilling on the West Coast would introduce additional stressors that could dramatically affect the well-being of the West Coast's many commercial fishing-dependent communities.[223] The physical characteristics

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[217] National Ocean Economics Program, Market Data, Ocean Economics (California, All counties, Tourism & Recreation Employment and Minerals/Oil & Gas Exploration and Production). Available at http://www.oceaneconomics.org/Market/ocean/oceanEcon.asp.
[218] *Id.*
[219] National Ocean Economics Program, Market Data, Ocean Economics (California, All counties, Minerals/Oil & Gas Exploration and Production/Employment/GDP). Available at http://www.oceaneconomics.org/Market/ocean/oceanEcon.asp.
[220] National Ocean Economics Program, Market Data, Ocean Economics (California, All counties, Tourism and Recreation/Employment). Available at http://www.oceaneconomics.org/Market/ocean/oceanEcon.asp.
[221] *Id.*
[222] Ecosystem Status Report of the California Current for 2017: A Summary of Ecosystem Indicators Compiled by the California Current Integrated Ecosystem Assessment Team (CCIEA); https://doi.org/10.7289/V5/TM-NWFSC-139, accessed February 13, 2018.
[223] The Ocean Acidification and Hypoxia (OAH) Task Force Report states, "OAH will have severe environmental, ecological and economic consequences for the West Coast, and requires a concerted regional management focus. OAH is a problem that is expected to grow in intensity with far greater impacts to come, particularly along the West Coast, where regional ocean circulation patterns dramatically heighten the potentially devastating effects of OAH. Chan, F., Boehm, A.B., Barth, J.A., Chornesky, E.A., Dickson, A.G., Feely, R.A., Hales, B., Hill, T.M., Hofmann, G., Ianson, D., Klinger, T., Largier, J., Newton, J., Pedersen, T.F., Somero, G.N., Sutula, M., Wakefield, W.W.,

of the California Current Ecosystem (CCE) are "highly variable," and NOAA notes that the "livelihoods of fishers in the CCE are heavily influenced by such variability."[224] Exacerbating fishers' social vulnerability by expanding oil and gas development in California or initiating oil and gas development in Washington or Oregon would have far-reaching deleterious impacts on fishers' lives, their communities, and the social and economic well-being of these coastal regions.

In choosing to expand the West Coast states' marine protections such as the region's five National Marine Sanctuaries and state Marine Protected Areas, federal and state agencies and the people of the West Coast have affirmed that these marine areas confer greater value to the United States and West Coasters in their protected state than if used for extractive purposes.

2. The Pacific Region's OCS resource potential is minute and speculative

Setting aside the imperative of curbing CO_2 emissions by reducing, rather than increasing, domestic fossil fuel production, developing Pacific OCS oil reserves would be a poor investment because California, Oregon, and Washington's oil and gas resources are minute in the context of U.S. energy demand. The West Coast states have minimal oil and gas resources and little, if any, coastal infrastructure to support offshore oil and gas development in Washington, Oregon, Northern California and Central California. The lack of infrastructure to produce and transport oil and gas in Washington, Oregon, and Central and Northern California would make oil and gas production an exceptionally uneconomical investment.

Of the 89.87 billions of barrels (Bbo) of Risked Undiscovered Technically Recoverable Oil and Gas Resources (UTRR) on the United States' OCS, the Pacific is estimated to contain 10.20 Bbo–just 11.3 percent of the total.[225] There is little oil in each of the four Pacific planning areas.

Contextualizing the Pacific's potential oil resources in terms of daily U.S. oil consumption illustrates how short term and meager a contribution Pacific OCS development would have in meeting U.S. energy needs. If developed, Washington and Oregon's offshore oil would be commercially exhausted in ten days.[226] Fully developing California's OCS oil would meet U.S. energy needs for 329 days. In other words, the Pacific OCS only contains enough economically recoverable oil to meet U.S. energy

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Waldbusser, G.G., Weisberg, S.B., and Whiteman, E.A. The West Coast Ocean Acidification and Hypoxia Science Panel: Major Findings, Recommendations, and Actions. California Ocean Science Trust, Oakland, California, USA. April 2016.

224 This variability is due to annual and decadal variations in El Niño, Pacific Decadal Oscillation, and marine heat wave events, CCIEA.

225 Fact Sheet: Assessment of Undiscovered Oil and Gas Resources of the Nation's Outer Continental Shelf, 2016, Bureau of Ocean Energy Management.

226 U.S. Energy Information Administration, https://www.eia.gov/naturalgas/crudeoilreserves/pdf/usreserves.pdf; Fact Sheet: Assessment of Undiscovered Oil and Gas Resources of the Nation's Outer Continental Shelf, 2016, Bureau of Ocean Energy Management. This scenario was developed assuming the price of oil is $60 per barrel and natural gas is $3.20 per cubic feet—both generous estimates for economically recoverable resources. There is an estimated a total of 6.45 billion barrels of oil and 8.29 million cubic feet of natural gas on the Pacific OCS. This amounts to about 11% of the total U.S. OCS gas and 8% of the total natural gas. In 2016, the United States consumed a total of 7.19 billion barrels of petroleum products, an average of about 19.63 million barrels per day. At this rate, the estimates predict how long these resources would last.

demand for less than one year.[227] The Pacific's OCS gas reserves would make an even less significant contribution to U.S. domestic gas production. Of the four OCS planning areas in the Pacific, Washington/Oregon, Northern California, Central California, and Southern California, Washington/Oregon is estimated to contain a fraction of the Pacific estimate, 0.40 Bbo, with Northern, Central, and Southern California containing slightly larger, but still modest, oil resources.[228]

Jeopardizing the health of the Pacific region's irreplaceable marine resources and thriving fishing, tourism, and recreation economies in favor of short-lived oil and gas production would be illogical. To trade off long term growth in favor of a short-lived energy sources that would ultimately degrade Washington, Oregon, and California's robust economies plainly contradicts the courses these states have charted.

3. Biological value of the California Current Large Marine Ecosystem (CCLME)

The Pacific Coast marine habitats are among the most productive and diverse in the world. Along the coast, major upwelling centers nourish the coastal waters, fueling them with nutrients from the deep. A vast range of habitats, including kelp forests, eel grass, estuarine nurseries, wetlands, rocky reefs and pinnacles, intricate hydrocorals, diverse sponges, sandy beaches, steep canyons, and the margins of offshore islands support a remarkable variety of ocean life, including hundreds of species of fish and dozens of species of birds and marine mammals.[229] The coast and ocean areas of the West Coast host many iconic places that are also biodiversity hot spots. For example, California's Farallon Islands support a growing population of the almost extirpated northern fur seals, threatened Steller sea lions, numerous other marine mammals, and the largest seabird colony in the continental United States, with thirteen different species breeding on the islands.[230] And, every year, more than 20,000 gray whales travel a migratory route between the Arctic and Baja. [231]

The West Coast's offshore and coastal waters are classified as a Large Marine Ecosystem, a term that captures the extensive and integrated marine habitat that underpins the abundant marine life offshore Washington, Oregon, and California.[232] The California Current Large Marine Ecosystem (CCLME) is one of five of a class of Large Marine Ecosystems that are characterized by cold, nutrient-rich coastal upwelling that generate areas of high primary productivity.[233] The California Current itself is

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[227] *Id.*
[228] Mean estimates UTRR in Bbo: Washington/Oregon, 0.40; Northern California, 2.08; Central California, 2.40; Southern California, 5.32. Fact Sheet: Assessment of Undiscovered Oil and Gas Resources of the Nation's Outer Continental Shelf, 2016, Bureau of Ocean Energy Management.
[229] Oceana, Protecting the Oregon Coast: Identifying and Protecting Important Ecological Areas (2011), http://oceana.org/en/news-media/publications/reports/protecting-the-oregon-coast-identifying-and-protecting-important-ecological-areas (accessed August 8, 2014).
[230] *Farallon National Wildlife Refuge*, http://www.fws.gov/refuges/profiles/index.cfm?id=81641 (accessed February 08, 2012).
[231] Oceana, *supra* n. 229, at 2.
[232] M.C. Aquarone and S. Adams, "Large Marine Ecosystems of the World," Chapter XIV-44 California Current: LME #3, http://www.lme.noaa.gov/index.php?option=com_content&view=article&id=69:california-current-lme-3&catid=16&Itemid=114, accessed February 16, 2018
[233] *Id.*

more than 2000 miles long and contains more than 400 estuaries and bays.[234] The California Current's coastal upwelling generates areas of high primary productivity. These high-productivity areas provide the conditions for the anchovy, sardine, and pelagic fish species that support commercial fisheries and the abundant marine mammals that use the CCLME as an essential migratory corridor. The DPP itself notes that the California Current System "hosts a wide variety of marine mammals, seabirds, sea turtles, marine fishes, and invertebrates."[235]

The CCLME is distinct from the waters that surround it. If offshore oil drilling were expanded in Washington, Oregon, or California waters, seismic blasting, additional background noise, offshore oil rigs, or an oil spill would harm the CCLME and likely displace wildlife from it. In assessing the potential risk and sensitivity of Washington, Oregon, and California's ecosystems to expanded or new offshore oil and gas development, it is crucial to consider the high fidelity of marine species to the CCLME. Results from a nine-year study that tracked 4,306 animals across 23 species found that the California Current "is a highly retentive area…and is an attractive area for animals undergoing long migrations from the western and central North Pacific and the Gulf of Alaska. Pacific bluefin and yellowfin tuna spent more significantly more time in the CCLME than scientists expected from models of the region.[236] Several species (tunas, white, mako and salmon sharks, leatherback sea turtles and blue whales) had substantial residency periods within, or were return migrants to, the CCLME".[237] Altering the CCLME by introducing or expanding offshore oil and gas development would irreparably harm the many species that are dependent upon the CCLME for its unique physical and biological characteristics—the habitat it provides cannot be replicated or substituted. Given the broad and multitudinous array of species the California Current supports, West Coast offshore waters are a wholly inappropriate place to drill.

The DPP also notes the tremendous variety of coastal and pelagic species that reside throughout all of the Pacific planning areas, "…many of the species listed below can be found in greater or lesser numbers *across the entire region*" and, "Large baleen whales such as blue, fin, and gray whales; sea lion and several kinds of seals; seabirds such as albatrosses, gulls, and brown pelicans; and large, open-water, predatory species such as great white sharks *are present along the entire west coast, as are* Dall's porpoise, Scoters, rockfish, herring, and salmon species."[238] The CCLME provides habitat for a multitude of species throughout the entirety of the planning area.

The presence of the abundant commercial fish species, endangered marine mammals, seabirds, and fragile deep-sea corals, is reason enough that offshore drilling would be an inappropriate and incompatible additional use of the West Coast's offshore waters. Yet, the extent to which the CCLME is a unique and integrated ecosystem is further reason that the Pacific Region should be excluded from the Final Five-Year Plan—the system functions as a whole, so a disturbance to one part of the ecosystem would impact many other parts of the marine ecosystem. Offshore oil and gas drilling would add ecosystem stressors such as noise, habitat loss, increased traffic, and pollution. As

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[234] *Id.*
[235] BOEM. Draft Proposed Program, p. 7-12.
[236] B.A. Block, I.D. Jonsen, A.J. Winship, et al., "Tracking apex marine predator movements in a dynamic ocean," Nature, Volume 000, January 2011.
[237] *Id.*
[238] *Id.*, emphasis added.

discussed previously, a large oil spill would lead to wildlife fatalities, habitat loss, and deleterious impacts to commercial fisheries, and tourism economies, among other impacts.

4. Pacific region consistency with state goals and policies

Section 18 of the Outer Continental Shelf Lands Act (OCSLA) enumerates “principles” the Secretary of the Interior must consider in determining the size, timing, and location of leasing. Applying these principles to the four Pacific planning areas strongly indicates that the Pacific region should be excluded in the 2019-2024 Five-Year Program. While the Secretary’s independent analysis of the Pacific region should lead to this conclusion, the historic context of leasing decisions with respect to the Pacific is noteworthy.

The Pacific has been excluded from the Five-Year Program since the conclusion of the 1987-1992 Five-Year Program, a decision multiple administrations, both Republican and Democrat, have made. Consistent with BOEM’s decisions over the past 25 years, in 2014, BOEM concluded the Pacific should not be included in the 2017-2022 Five Year Program. BOEM based that decision on the agency’s analysis of the region with respect to Section 18 of OCSLA:

> The four planning areas off the Pacific coast were not included for potential leasing in the 2017-2022 Program. This determination was consistent with the requirements of Section 18 of the Act, which gives priority leasing consideration to areas where the combination of previous experience; local, state, and national laws and policies; and expressions of industry interest indicate that potential leasing and development activities could be expected to proceed in an orderly manner. The exclusion of the Pacific coast in the 2012-2017 Program is consistent with the long-standing interests of the west coast states, as framed in an agreement that the governors of California, Washington, and Oregon signed in 2006.[239]

Washington, Oregon, and California’s public commitment to preserving and protecting their coastal and marine resources is long standing and well-documented. In the West Coast Governors’ Agreement on Ocean Health of 2006, the Governors agreed to reinforce “our opposition to oil and gas leasing, exploration, and development off our coasts.”

All West Coast Governors and Senators have opposed inclusion of the Pacific in the 2019-2024 Leasing Program.[240] Eighty-four percent of the Washington and Oregon Congressional delegation sent a bi-partisan letter to Secretary Zinke stating that their states “have made clear through local, state, and federal action, as well as extensive public comment, that oil and gas lease sales off the Pacific Coast are not in the best interest of our economies or environment.”[241] On March 5, 2018, 77

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[239] Department of the Interior, Bureau of Ocean Energy Management, Request for Information and Comments on the Preparation of the 2017-2022 Outer Continental Shelf (OCS) Oil and Gas Leasing Program, Federal Register/Vol. 79, No. 115/Monday, June 16, 2014.

[240] Office of Washington Governor Jay Inslee. “West Coast governors condemn Trump Administration’s pursuit of Pacific Coast offshore drilling.” https://www.governor.wa.gov/news-media/west-coast-governors-condemn-trump-administration%E2%80%99s-pursuit-pacific-coast-offshore, accessed February 13, 2018.

[241] Reichert, D., and J. Herrera-Beutler. Letter to Secretary Zinke re: Offshore Drilling in Washington State. https://reichertforms.house.gov/uploadedfiles/reichert-herrera_beutler_offshore_drilling_washington_state_zinke_letter.pdf, accessed February 13, 2018.

state legislators from Washington, Oregon, and California joined a letter by a total of 227 state legislators representing 17 coastal states, opposing the 2019-2024 Draft Proposed Program.[242]

In California, the Pacific state most vulnerable to expanded oil and gas drilling, the state has continued to underscore its opposition to expanded offshore oil and gas development since the West Coast Governors' Agreement was promulgated. In December 2016, Governor Jerry Brown requested then President Barack Obama to permanently withdraw California from new oil and gas leasing.[243] The State Lands Commission passed a resolution the same month in support of the federal government's prohibition on new oil and gas leasing in federal waters.[244] In May 2017, the California State Senate adopted Senate Resolution 35 with overwhelming, and bi-partisan, support, which resolves that the Senate, "strongly and unequivocally supports the current federal prohibition on new oil or gas drilling in federal waters offshore California, opposes attempts to modify the prohibition, and will consider any appropriate actions to maintain the prohibition."[245] At local, state, and federal levels, California's policies state explicitly that OCS development for oil and gas is inconsistent with its laws, goals, and policies.

More importantly, the West Coast states are committed to powering their economies and future growth with renewable energy and to reducing their dependence on fossil fuels. All three West Coast states are founding members of the Under 2 Coalition, an alliance of sub-national governments that have agreed to reduce their greenhouse gas (GHG) emissions towards net-zero by 2050. Washington, Oregon, and California have made public commitments to reduce their GHG emissions by 80-95% of 1990 levels by 2050.[246] For each of these states, expanded fossil fuel development is inconsistent with its clean energy policies and goals.

5. Opposition to offshore oil and gas drilling along the Pacific is overwhelmingly negative

As of February 14, 2018, 34 West Coast municipalities and dozens of local, state and federal elected officials had formally opposed offshore drilling and/or seismic airgun blasting.[247]

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[242] National Caucus of Environmental Legislators. OCS Oil and Gas Leasing Program Sign on Letter. Available at https://www.ncel.net/wp-content/uploads/2018/03/OCS-Oil-and-Gas-Leasing-Program-Sign-On-Letter.pdf, accessed March 5, 2018.

[243] Myers, J. 13 December 2016. "Gov. Brown asks President Obama to permanently ban new drilling off California's coast." *Los Angeles Times.* Available at http://www.latimes.com/politics/essential/la-pol-ca-essential-politics-updates-gov-jerry-brown-asks-obama-to-1481660169-htmlstory.html

[244] Resolution by The California State Lands Commission Supporting
The Federal Government's Prohibition of New Oil and Gas Leasing
in The Outer Continental Shelf Offshore California, http://www.slc.ca.gov/About/News_Room/2016/docs/12-06-16_Resolution.pdf.

[245] SR 35: Relative to New Outer Continental Shelf oil and gas leasing in federal waters offshore California. http://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180SR35

[246] Under 2 Coalition Fact Sheet, http://under2mou.org/wp-content/uploads/2015/05/Under2-Coalition-Two-Pager-Nov-2017.pdf, accessed March 2, 2018.

[247] Opposition to New Offshore Drilling in the Pacific, http://usa.oceana.org/pacific-drilling, accessed February 13, 2018.

Public opposition to any new drilling in the Pacific would be an extremely costly and time-intensive hurdle for developers to overcome that would render potential oil and gas development along the West Coast unattractive. In particular, businesses that oil and gas drilling would threaten are vocally stating their grave concerns about prospective oil and gas development. The Business Alliance for Protecting the Pacific Coast (Alliance) had over 1,050-member businesses as of February 13, 2018. These Alliance members span a breadth of West Coast companies including those in the fishing, service, surfing, clean energy investing, retail, and apparel industries.

In California both republican and democratic constituencies have asserted resolutely that offshore oil and gas development is inconsistent with the state's commitment to protecting its $41.2 billion ocean economy and weaning the United States from fossil fuel dependence into a truly energy independent future. The majority – 69 percent – of Californians actively oppose new oil and gas drilling off the California coast.[248] That majority includes Californians from across the political spectrum, underscoring the truly bi-partisan nature of this issue.

In light of the necessity of transitioning away from fossil fuels, the West Coast's thriving coastal and ocean economies, and the region's commitment to aggressively transitioning to low-carbon energy systems, the Pacific Coast is unsuitable for inclusion in the Five-Year Program.

C. The Atlantic region should be excluded from the leasing program

1. America's Atlantic Ocean economy

Opening America's Atlantic to oil and gas exploration and development threatens vitally important segments of the U.S. economy, as well as the livelihoods of many of the 70 million Americans who live along the East Coast.[249] The DPP itself calls attention to the fact that "Commercial and recreational fishing, ocean-dependent tourism, and commercial shipping and transportation are important economic uses in and along all the Atlantic planning areas" noting the popular and lucrative seashores and state parks which dot the U.S. Atlantic's shoreline; the fish and shellfish caught offshore the North Atlantic that feed our nation; and that 10 percent of total U.S. imports and exports pass through North Atlantic Planning Area ports and more than 40 percent of the world's marine commerce annually traverses the Florida Straits.[250] While reflecting on pieces of the region's significant ocean economic value, the DPP understates its overall ocean-related revenue stream: in 2014 (latest year available), the U.S. Atlantic Ocean economy contributed roughly $92 billion to the country's gross domestic product (GDP).[251] More than 60 percent of this wealth stems from tourism,

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[248] Californians & the Environment, Public Policy Institute of California, Statewide Survey, July 2017. Mark Baldassare Dean Bonner David Kordus Lunna Lopes.
[249] United States Census 2010, "Interactive Population Map," https://www.census.gov/2010census/popmap/. National Oceanic and Atmospheric Administration (hereinafter NOAA), "NOAA's List of Coastal Counties for the Bureau of Census," https://www.census.gov/geo/landview/lv6help/coastal_cty.pdf, accessed July 13, 2017.
[250] Bureau of Ocean Energy Management (hereinafter BOEM), *2019-2024 National Outer Continental Shelf Oil and Gas Leasing Draft Proposed Program* (hereinafter DPP), 2018, chapter 6, pp. 28, 29, https://www.boem.gov/NP-Draft-Proposed-Program-2019-2024/.
[251] National Ocean Economics Program, "Ocean Economy Data," 2014, http://www.oceaneconomics.org/Market/ocean/oceanEcon.asp.

recreation, and the fishing and seafood industries, which largely depend on a clean ocean, clean beaches, and abundant fish and wildlife.[252] Together these industries alone employ more than 1 million people, supporting 80 percent of all Atlantic Ocean-based jobs.[253] Offshore drilling poses the risk of oil spills ruining Atlantic beaches and contaminating water, harming important ecosystems and habitats that are critical to the regional economy – to communities and local jobs, and to the food and recreation the coastline provides the nation.

All three Atlantic Region fishery management councils have registered opposition to offshore oil and gas leasing. In an August 2017 letter to BOEM Dr. Christopher Moore, Executive Director of the Mid-Atlantic Fishery Management Council (MAFMC), notes:

> Over the past decades, the Council has implemented management programs that support sustainable fisheries and rebuild overfished stocks. These efforts have necessitated sacrifice from the commercial and recreational fishing sectors in the form of economic losses and foregone fishing opportunities. The Council is concerned about the potential for negative impacts on the marine ecosystem and cautions against oil and gas development in the absence of better information to understand the direct, indirect, and cumulative impacts of these activities to the region … the Council is concerned that impacts of development would not be localized … While the Council recognizes the importance of energy exploration to U.S. economic security, the Council also notes the Mid-Atlantic is rich in marine biodiversity and contains ecologically sensitive areas that are highly important in social, economic, and cultural currency of the region.[254]

On January 30, 2018, the New England Fishery Management Council (NEFMC) stated its intent to call on BOEM to exclude East Coast waters from the DPP.[255] Michelle Duval, Chair of the South Atlantic Fishery Management Council, addressed the topic in early 2017: "The Council supports [BOEM's] past denial of geophysical and geological permit applications to conduct airgun seismic surveys in the Mid and South Atlantic Planning Areas of the Atlantic Ocean and removal of the Atlantic Program Area from the 2017-2022 Outer Continental Shelf Oil and Gas Leasing Program."[256]

U.S. Secretary of Commerce Wilbur Ross has identified open ocean aquaculture as a promising opportunity to help address the nation's $14 billion annual seafood trade deficit; this burgeoning

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[252] National Ocean Economics Program, "Ocean Economy Data," 2014, http://www.oceaneconomics.org/Market/ocean/oceanEcon.asp.
[253] National Ocean Economics Program, "Ocean Economy Data," 2014, http://www.oceaneconomics.org/Market/ocean/oceanEcon.asp.
[254] Mid-Atlantic Fishery Management Council, Letter from Christopher Moore to Kelly Hammerle, August 7, 2017, https://static1.squarespace.com/static/511cdc7fe4b00307a2628ac6/t/5991f921a5790a58dd6c980f/1502738723565/2019to2024Program_MAFMC_Comments_2017-08-07.pdf.
[255] Whittle, Patrick, "Fishing managers: Oil drilling in Atlantic is a bad idea," *Associated Press*, February 2, 2018, https://bangordailynews.com/2018/02/02/news/nation/fishing-managers-oil-drilling-in-atlantic-is-a-bad-idea/.
[256] South Atlantic Fishery Management Council, Letter from Michelle Duval to Secretary Zinke re: SAFMC Position on Energy Development and Seismic Testing, April 25, 2017, https://usa.oceana.org/sites/default/files/662/safmc_letter_2017-04-25.pdf.

industry would also be impacted in the case of a spill.[257] NOAA's *Marine Aquaculture Strategic Plan FY 2016-2020* set a target to expand the volume of sustainable U.S. marine aquaculture production by at least 50 percent by 2020 and, accordingly, in October 2017 NOAA's National Sea Grant College Program awarded $9.3 million in grants for 32 projects, including a demonstration to commercial-scale fish net pen offshore southwest Florida.[258] In 2015, the Northeastern Massachusetts Aquaculture Center at Salem State University received the first open offshore aquaculture permit in the Atlantic for a 33-acre blue mussel farm located approximately eight miles offshore Cape Ann, Massachusetts.[259] An major oil spill would wipe out the Administration's hopes for this industry. The DPP should consider potential conflicts.

Atlantic areas utilized by the U.S. Department of Defense (DOD) and the National Aeronautics and Space Administration (NASA) conflict with offshore oil and gas leasing. The DPP points to existing Atlantic U.S. Navy training and testing areas and NASA's Wallops Flight Facility (WFF), which serves as a critical testing location for orbital launch technologies, and the former space launch site, Kennedy Space Center.[260] The Mid and South Atlantic Region areas were similarly considered and rejected in the *2017-2022 Outer Continental Shelf Oil and Gas Leasing Proposed Program*:

> In addition to potential conflicts with commercial fishing and ocean-dependent tourism, oil and gas activity in the Mid- and South Atlantic Program Area raises concerns with regard to DOD activities in these areas … DOD's assessment identifies much of the area offshore Virginia, as well as significant portions of the Program Area offshore North Carolina, as areas that should not be made available for oil and gas development, as such development would be incompatible with DOD's activities. Additionally, DOD recommends that significant acreage of the Mid- and South Atlantic Program Area not be made available for placement of oil and gas structures due to conflicts with DOD activities. These areas of DOD concern significantly overlap the known geological plays and available resources. DOD's significant competing use of the ocean highlights the incompatibility between the many and

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[257] NOAA, "Aquaculture in the United States," Accessed January 26, 2018, http://www.nmfs.noaa.gov/aquaculture/aquaculture_in_us.html. American Fisheries Society. "Offshore Aquaculture: What's All the Fuss About? AFS Offers Expertise on Policy Debate," *Fisheries News and Science*, December 1, 2017, https://fisheries.org/2017/12/offshore-aquaculture-whats-all-the-fuss-about-afs-offers-expertise-on-policy-debate/.

[258] NOAA, *Marine Aquaculture Strategic Plan FY 2016-2020*, October 2015, http://www.nmfs.noaa.gov/aquaculture/docs/aquaculture_docs/noaa_fisheries_marine_aquaculture_strategic_plan_fy_2016-2020.pdf. Sea Grant. *Aquaculture's Future Through the 10-Year Sea Grant Aquaculture Vision*, October 2016, http://seagrant.noaa.gov/Portals/0/Documents/Handouts/SG50-AquacultureVision_Oct2016.pdf. Carney, Brooke, "Sea Grant announces $9.3 million for aquaculture research and industry support," NOAA Sea Grant, October 31, 2017, http://seagrant.noaa.gov/News/Article/ArtMID/1660/ArticleID/1656/Sea-Grant-announces-93-million-for-aquaculture-research-and-industry-support.

[259] Salem State University, "Offshore Mussel Farm Project," https://salemstate.instructure.com/courses/1166744/pages/offshore-mussel-farm-project, accessed December 21, 2017. Northeast Ocean Data, "First Shellfish Farm in Atlantic Federal Waters Facilitated by the Northeast Ocean Data Portal," http://www.northeastoceandata.org/casestudies/ offshore-shellfish-aquaculture/, Accessed December 21, 2017. Shekhtman, Lonnie, "US waters create potential for shellfish farming," *Boston Globe*, November 23, 2014, https://www.google.com/amp/s/www.bostonglobe.com/business/2014/11/23/musseling/85M5oCVF8XorWFuAFVVo8M/amp.html.

[260] DPP, pp. 6-29,6-30.

> longstanding competing uses in the Atlantic and oil and gas activities in those areas … In addition to conflicts with DOD … BOEM received comments from NASA indicating that there is potential for oil and gas activities in the U.S. Atlantic to impact operations at its WFF…[261]

DOD and NASA's concerns were raised in March 2016 and, to date, information has not been provided to reverse issues noted by these agencies less than two years ago. Current DPP opposition has pointed to an October 2015 DOD study which reveals offshore drilling would likely uproot military's operations in Hampton Roads, VA and that relocation of even one aircraft carrier from Naval Station Norfolk could result in $1 billion reduction in Hampton Roads economic activity.[262] DOD and NASA pushback here focuses on the Mid and South Atlantic as the North Atlantic and Straits of Florida had already been removed at the first stage of the current program's development due to public opposition and a lack of resource potential.[263]

a. The Atlantic cannot afford a BP disaster

The sorry fact is that a "low-probability, high-impact event" like the BP *Deepwater Horizon* disaster *will* occur again – and if the Atlantic Region falls victim in much the same manner as the Gulf of Mexico, a spill alongside the East Coast would devastate the Atlantic's marine life and communities. As detailed in Section V, the 2010 BP oil spill contaminated more than 1,300 miles of coastline, at least 400 square miles of the deep ocean floor, and 57,500 square miles of surface water.[264] An equivalent disaster in the Atlantic could – depending on currents and weather – coat beaches from Savannah to Boston.

Of the seven known vulnerable coral sites within 15 miles of the BP wellhead, four sustained injury attributable to *Deepwater Horizon* oil with 75 percent of coral colonies in the site closest to the wellhead and 50 percent of coral colonies in the second-closest site injured.[265] Deep-sea coral communities along the Atlantic's outer continental shelf edge and in submarine canyons could be similarly harmed. Deep-sea corals, some of which are estimated to be hundreds to thousands of years old, are highly vulnerable to human disturbance and grow only millimeters a year so any harm they

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[261] BOEM, *2017-2022 Outer Continental Shelf Oil and Gas Leasing Proposed Program*, 2016, Summary of the Proposed Program Decision, pp. 9-10, https://www.boem.gov/2017-2022-Proposed-Program-Decision/.
[262] Mayfield, Adrienne Marie. "Hampton Roads could lose $1B aircraft carrier to Florida with offshore drilling, councilman says," *Southside Daily*, January 25, 2018, https://southsidedaily.com/local-news/2018/01/25/billions-in-virginia-military-assets-at-stake-with-offshore-drilling/.
[263] BOEM, *2017-2022 Outer Continental Shelf Oil and Gas Leasing Draft Proposed Program*, 2015, chapter 9, p. 9-10, https://www.boem.gov/2017-2022-DPP/.
[264] *Deepwater Horizon* Natural Resource Damage Assessment Trustees (hereinafter NRDA), *Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement*, 2016, chapter 4, pp. 28, 30, 57, http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan. MacDonald, I.R., et al., "Natural and Unnatural Oil Slicks in the Gulf of Mexico," *Journal of Geophysical Research: Oceans* 120, no. 12 (2015): 8364-8380, http://onlinelibrary.wiley.com/doi/10.1002/2015JC011062/full.
[265] NRDA, *Final Programmatic Damage Assessment*, chapter 4, p. 253. White, H.K., et al., "Impact of the *Deepwater Horizon* oil spill on a deep-water coral community in the Gulf of Mexico," *Proceedings of the National Academy of Sciences*, 109, no. 50 (2012): 20303-20308. Fisher, CR, et al., "Footprint of *Deepwater Horizon* blowout impact to deep-water coral communities," *Proceedings of the National Academy of Sciences*, 111, no. 32 (2014): 11744-11749.

sustain can take many lifetimes to recover from.[266] The Mid-Atlantic Fishery Management Council recently established the Frank R. Lautenberg Deep Sea Coral Protection Area to protect coral habitats from destructive fishing gear.[267] Shallow-water coral reefs in southeast Florida contribute roughly $8.5 billion to the local economy.[268] Any of these vulnerable and valuable coral treasures could be harmed by oil and gas drilling activities along the Atlantic.

As detailed above in Section V, the *Deepwater Horizon* spill severely impacted The Gulf of Mexico commercial fishing industry, with damages expected to total $8.7 billion by 2020.[269] Estuaries provide habitat for more than 75 percent of the nation's commercial fish catch, and even more of its recreational catch; the impacts from degraded, oiled estuaries are lengthy and severe.[270]

Oil and gas leasing anywhere in the Atlantic Region – the North, Mid, or South Atlantic and the Straits of Florida – could spoil beaches and harm the tourism and fishing industries far beyond the confines of the lease area. In the Northeast Region, a 2015 study found 40 percent of coastal residents identified availability of nearby marine recreational opportunities as the deciding factor for living in the area and average respondents noted a value of $263.29 in recent total trip expenditures (*e.g.*, food, lodging, travel); in 2014, Mid-Atlantic respondents spent an average of $71.06 per coastal visit.[271] In 2016, East Coast fishermen landed nearly 1.3 billion pounds of fish and shellfish worth more than $2 billion.[272] Recreational fishermen took nearly 34 million fishing trips along the East Coast in 2015 and spent more than $10.5 billion—more than $2.4 billion on the eastern coast of

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[266] NRDC, *The Atlantic's Deep Sea Treasures: Discoveries from a New Frontier of Ocean Exploration*, November 2014, https://www.nrdc.org/sites/default/files/atlantic-deep-sea-treasures-IB.pdf. Risk, M.J., et al., "Lifespans and Growth Patterns of Two Deep-sea Corals: Primnoa resedaeformis and Desmophyllum cristagalli." *Hydrobiologica* 471 (2002): 125- 131.; Roark, E.B., et al., "Extreme Longevity in Proteinaceous Deep-sea Corals." *PNAS* 106, no. 13 (2009): 5204-5208.

[267] National Oceanic and Atmospheric Administration, "NOAA Fisheries Announces New Mid-Atlantic Deep Sea Coral Protection Area," December 14, 2016, https://www.greateratlantic.fisheries.noaa.gov/mediacenter/2016/december/14_mid-atlantic_coral_protection_area.html.

[268] NOAA, "Coral reefs support jobs, tourism, and fisheries," accessed February 3, 2018, https://floridakeys.noaa.gov/corals/economy.html.

[269] McCrea-Strub, A., et al., "Potential impact of the *Deepwater Horizon* Oil Spill on Commercial Fisheries in the Gulf of Mexico," *Fisheries* 36, no. 7 (2011): 332-336. http://www.tandfonline.com/doi/abs/10.1080/03632415.2011.589334. Sumaila, U.R., et al., "Impact of the *Deepwater Horizon* Well Blowout on the Economics of U.S. Gulf Fisheries," *Canadian Journal of Fisheries and Aquatic Sciences* 69, no. 3 (2012): 499-510. http://www.nrcresearchpress.com/doi/abs/10.1139/f2011-171#.WjqDP9-nFPY.

[270] NOAA, National Ocean Service, "Estuaries and Humans," https://oceanservice.noaa.gov/education/pd/estuaries/estuarieshumans.html, accessed February 2, 2017.

[271] Point 97, SeaPlan, and The Surfrider Foundation, *Characterization of Coastal and Marine Recreational Activity in the U.S. Northeast*, report developed for the Northeast Regional Planning Body, October 2015, http://archive.neoceanplanning.org/wp-content/uploads/2015/10/Recreation-Study_Final-Report.pdf. The Surfrider Foundation, Point 97, The Nature Conservancy, and Monmouth University's Urban Coast Institute, *U.S. Mid-Atlantic Coastal and Ocean Recreation Study*, July 2014, http://surfridercdn.surfrider.org/images/uploads/publications/MidAtlanticCoastalandOceanRecreationStudyReport.pdf.

[272] NOAA Fisheries, Fisheries Statistics Division, "Annual Commercial Landings Statistics," 2016, https://www.st.nmfs.noaa.gov/commercial-fisheries/commerciallandings/annual-landings/index.

Florida alone.[273] Oil spills ignore state boundaries; they can be carried great distances by currents to beaches along the coast and impact fish species that move throughout the region.

b. The Atlantic region cannot afford seismic exploration

As discussed in Sections III and V, even before drilling begins, the search for oil and gas deposits beneath the seafloor is harmful to our state's marine life and the jobs it supports. The explosive noise from seismic airguns has been proven to cause massive disruption to marine life, from whales to zooplankton, and to kill or injure many fish and shellfish species, including those of commercial importance to the Atlantic Region like squid, lobster, and scallops.[274] Given its enormous environmental footprint, a seismic test taking place off the coast of Virginia would impact some marine species, including endangered whales, as far as New York and New England.[275] In 2015, seventy-five marine scientists warned that the proposed introduction of seismic to the East Coast is likely to have "significant, long-lasting, and widespread impacts on the reproduction and survival" of both fish and marine mammal populations in the region.[276]

[273] National Marine Fisheries Service, *Fisheries Economics of the United States*, 2015, U.S. Department of Commerce, NOAA Tech. Memo NMFS-F/SPO-170, May 2017, https://www.st.nmfs.noaa.gov/Assets/economics/publications/FEUS/FEUS-2015/Report-Chapters/FEUS%202015-AllChapters_Final.pdf.

[274] Aguilar de Soto, N., et al., "Anthropogenic Noise Causes Body Malformations and Delays Development in Marine Larvae," *Scientific Reports* 3 (October 2013), http://www.nature.com/articles/srep02831. Day, R.D., et al., "Assessing the Impact of Marine Seismic Surveys on Southeast Australian Scallop and Lobster Fisheries," *FRDC Report 2012/008*, University of Tasmania, Hobart, 2016, http://ecite.utas.edu.au/122358; Fewtrell, J.L., and R.D. McCauley, "Impact of Air Gun Noise on the Behavior of Marine Fish and Squid," *Marine Pollution Bulletin* 64, no. 5 (2012): 984-993, http://www.sciencedirect. com/science/article/pii/S0025326X12000872; McCauley, R., et al., "Widely Used Marine Seismic Survey Air Gun Operations Negatively Impact Zooplankton," *Nature Ecology & Evolution* 1 (June 22, 2017): 1-8, http://www.ecomarres.com/downloads/seismic.pdf. McCauley, R.D., J. Fewtrell, and J. Popper, "High Intensity Anthropogenic Sound Damages Fish Ears," *Journal of the Acoustical Society of America* 113, no. 1 (January 2003): 638-642, http://www.reviewboard.ca/upload/project_document/1182875770_133.PDF. Solé, M., et al., "Ultrastructural Damage of Loligo vulgaris and Illex coindetii Statocysts After Low Frequency Sound Exposure," *PLoS ONE* 8, no. 10 (October 2013): 1–12, http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0078825. Solé, M., et al., "Sensitivity to Sound of Cephalopod Hatchlings," presentation at Oceanoise2017 Conference, Vilanova i la Geltrú, Barcelona, May 8-12, 2017, http://oceanoise2017.com/wp-content/uploads/2017/05/OCEANOISE2017_AbstractBooklet_online.compressed.pdf. Weilgart, L., "A Review of the Impacts of Seismic Airgun Surveys on Marine Life," submitted to the Convention on Biological Diversity Expert Workshop on Underwater Noise and Its Impacts on Marine and Coastal Biodiversity, February 25-27, 2014, London, https://www.cbd.int/ doc/meetings/mar/mcbem-2014-01/other/mcbem-2014-01-submission-seismic-airgun-en.pdf. Weilgart, L., "The Impacts of Anthropogenic Ocean Noise on Cetaceans and Implications for Management," *Canadian Journal of Zoology* 85, no. 11 (2007): 1091-1116, http://www.nrcresearchpress.com/doi/abs/10.1139/Z07-101#.WaBqVU3rumQ.

[275] *See*, for example, Castellote, M., et al., "Acoustic and behavioural changes by fin whales (Balaenoptera physalus) in response to shipping and airgun noise," *Biological Conservation* 147 (2012): 115-122, https://www.sciencedirect.com/science/article/pii/S0006320711004848. Nieukirk, S.L., et al., "Sounds from airguns and fin whales recorded in the mid-Atlantic Ocean, 1999-2009," *Journal of the Acoustical Society of America* 131 (2012): 1102-1112, http://asa.scitation.org/doi/abs/10.1121/1.3672648.

[276] Statement from C. Clark, Cornell University, and 74 other marine scientists to the President of the United States (Mar. 5, 2015) (concerning the impacts of proposed seismic surveys on the mid-Atlantic and South Atlantic region).

In the past 12 months, the National Oceanic and Atmospheric Administration has declared an "unusual mortality event" for three species of Atlantic whales: humpback whales in April, North Atlantic right whales in August, and minke whales in January.[277] With an increase in deaths and strandings for several whale species, setting off explosive noise—24 hours per day for years on end—to explore resources of questionable amount for an industry unwanted by communities throughout the region (*See*, Section IV for a discussion of offshore wind's advance throughout the Atlantic) seems foolhardy at best, criminal at worst.

2. The Atlantic's biological value

From an ecological perspective, the Atlantic Ocean is an interconnected network of unique geographic features and rare, threatened, and endangered marine species. In this fluid system, impacts from oil and gas spills are not localized, and sound pollution from seismic exploration spreads to blanket the entire seaboard with noise. To underscore the importance of this interconnected system along the Atlantic coast, it is worth noting several of the unique and critical areas that are part of this system.

a. Atlantic canyons in the North and Mid-Atlantic

One array of features – the canyons of the North and Mid-Atlantic – was deemed so valuable that the Obama Administration permanently removed them from offshore oil and gas development on December 20, 2016. This acreage is permanently off limits to inclusion in any leasing program, withdrawn from all mineral disposition under OCSLA 12(a).

The 3.8 million acres includes 31 submarine canyons in the Atlantic Ocean (stretching from offshore of the Chesapeake Bay to the Canadian border).[278] The Obama White House called these canyons "majestic geologic features carved by glacial runoff or by rivers that once flowed overland and were submerged by rising seas after the last ice age, have incredible ecological importance. The massive underwater canyons are home to many species and have been the subject of scientific exploration and discovery since the 1970s."[279] These "critical ecological hotspots" contain an incredible abundance of marine life, vivid cold-water corals that are hundreds or thousands of years old; multitudes of whale species, including the highly endangered North Atlantic right whale (on a trajectory for

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[277] NOAA Fisheries, 'Marine Mammal Unusual Mortality Events," http://www.nmfs.noaa.gov/pr/health/mmume/events.html. NOAA Fisheries, "NOAA declares deaths of minke whales on Atlantic coast an unusual mortality event," NOAA press brief, http://www.noaa.gov/media-advisory/noaa-declares-deaths-of-minke-whales-on-atlantic-coast-unusual-mortality-event.

[278] Statement by the President on Actions in the Arctic and Atlantic Oceans, National Archives and Records Administration, Accessed August 17, 2017. https://obamawhitehouse.archives.gov/the-press-office/2016/12/20/statement-president-actions-arctic-and-atlantic-oceans. U.S. Department of the Interior (hereinafter DOI), Press Release, "Secretary Jewell Applauds President's Withdrawal of Atlantic and Arctic Ocean Areas from Future Oil and Gas Leasing," December 20, 2016, https://www.doi.gov/pressreleases/secretary-jewell-applauds-presidents-withdrawal-atlantic-and-arctic-ocean-areas-future.

[279] DOI, *Fact Sheet: Unique Atlantic Canyons Protected from Oil and Gas Activity. Department of the Interior*, Accessed February 2, 2018, https://www.doi.gov/sites/doi.gov/files/uploads/atlantic_canyons_fact_sheet_for_release.pdf.

extinction in 20 years);[280] a range of shellfish and fish, like the powerful bluefin tuna; seabirds that rely on the nutrient-rich waters; sea turtles; and new species not known to live anywhere else on Earth.[281] The designation reinforces actions by the MAFMC to safeguard these canyons and surrounding deep sea coral areas – the Frank R. Lautenberg Deep Sea Coral Protection Area – from destructive fishing gear.[282]

The DPP offers Atlantic Region Program Option 2 to remove these canyons from leasing consideration, citing their "exceptional ecological values," but to truly conserve these valuable areas from the harm of an oil spill anywhere along the seaboard, the entire Atlantic Region should receive needed protections through withdrawal from the Five-Year Plan.[283]

b. Essential fish habitat and key habitat areas identified in the recent NEFMC's Omnibus Essential Fish Habitat Amendment

Ocean waters off the New England coast contain a diversity of complex benthic habitats, including extensive mudflats, sandy offshore banks, rocky ledges, deep submarine canyons and massive seamounts. This habitat diversity and structural complexity contribute to the region's historically highly-productive fisheries and rich fishing tradition.

In a multiyear progress, the NEFMC established critical areas for protection from damaging commercial fishing gear; these areas deserve safeguards from additional threats, such as oil and gas development. The NEFMC's Omnibus Essential Fish Habitat Amendment – ratified by NOAA in January 2018 – identifies specific New England ocean areas highly important for fisheries conservation and/or particularly vulnerable to human disturbance: "The underlying premise of this amendment is that there are habitats linked to higher survival and/or growth rates of juvenile fish that are vulnerable to the adverse effects of fishing."[284] The protection of these areas is key to New England's ability to ensure the long-term viability of stocks like Atlantic herring, sea scallops, and red crab. Several of the below mentioned areas may overlap with protections recommended by this Amendment.

c. The continental shelf/slope break

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[280] NOAA Fisheries, "North Atlantic Right Whales (*Eubalaena glacialis*)," July 2017, http://www.nmfs.noaa.gov/pr/species/mammals/whales/north-atlantic-right-whale.html. Pennisi, Elizabeth, "The North Atlantic Right Whale Faces Extinction," *Science*, November 7, 2017, http://www.sciencemag.org/news/2017/11/north-atlantic-right-whale-faces-extinction.
[281] DOI, *Fact Sheet: Unique Atlantic Canyons Protected from Oil and Gas Activity. Department of the Interior*, Accessed February 2, 2018, https://www.doi.gov/sites/doi.gov/files/uploads/atlantic_canyons_fact_sheet_for_release.pdf.
[282] MAFMC, "NOAA Fisheries Announces Final Rule on Mid-Atlantic Council's Frank R. Lautenberg Deep Sea Coral Protection Area,"December 14, 2016, http://www.mafmc.org/newsfeed/2016/noaa-fisheries-announces-final-rule-on-mid-atlantic-councils-frank-r-lautenberg-deep-sea-coral-protection-area.
[283] BOEM, DPP, 2018, "2019–2024 National OCS Oil and Gas Leasing Draft Proposal on the Size, Timing, and Location of Sales," p. 11, https://www.boem.gov/NP-Draft-Proposed-Program-2019-2024/.
[284] New England Fishery Management Council. "NMFS Approves 'Majority' of Council's Habitat Amendment," January 8, 2018, http://s3.amazonaws.com/nefmc.org/NMFS-Approves-%E2%80%9CMajority%E2%80%9D-of-Council%E2%80%99s-Habitat-Amendment.pdf.

The Atlantic's continental shelf/slope break that the canyons cut into is itself a hotspot of marine biodiversity – a place of steep edges, a mixing zone of currents, and sharp temperature gradients.[285] Highly endangered North Atlantic right whales migrate annually through continental shelf waters between calving grounds off South Georgia and Florida in the winter and feeding areas in the waters off New England in the summer. NOAA's North Atlantic right whale Biologically Important Area (BIA) migratory corridor is defined from shore to the continental shelf break along the entire U.S. East Coast from feeding areas in the Gulf of Maine to calving areas off Florida.[286]

d. The Gulf of Maine/Cashes Ledge

The Gulf of Maine, a semi-enclosed sea bounded by Georges and Browns Banks, New England shorelines, and Nova Scotia, is one of Earth's most productive marine systems.[287] As the north's icy Labrador Current meets the warm Gulf Stream at the northern edge of its loop pattern and is impacted by the Bay of Fundy's intense tides, nutrient-rich waters perfect for phytoplankton production flood the Gulf's banks, ledges, and coastal shelf, allowing a wide diversity of marine life to flourish, from forage species like herring and menhaden to large tunas, whales, marine mammals, and birds. Scientists have identified several distinct sub-regions in the Gulf of Maine, and jewels like Georges Bank, Stellwagen Bank, Jordan Basin, and Jeffreys Ledge are important refuges for rare marine animals and key to maintaining productive fish stocks for generations of fishing families.[288]

The Gulf's mountain range of Cashes Ledge rises up from basins hundreds of feet deep to a ledge roughly 40 feet from the surface.[289] The ledge's peak, Ammen Rock, punctures the ocean current, resulting in a nutrient and oxygen-rich water mix, feeding the Atlantic's deepest and largest cold-water kelp forest, a source of food for much of the area's diverse and abundant marine life.[290] Cashes Ledge is a place of restoration for iconic New England fish, such as cod and pollock, and rare species like the Atlantic wolfish; migrating schools of bluefin tuna, sea turtles, and blue and basking sharks are common here.[291] It is also the site of BIAs for feeding minke, sei, fin, and humpback whales.[292]

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[285] Fautin D., et al., "An overview of marine biodiversity in United States waters." *PLoS ONE* 5, no. 8 (2010): e11914.
[286] LaBreque E., et al., "Biologically Important Areas for Cetaceans within U.S. waters – East Coast Region." *Aquatic Mammals* 41, no. 1 (2015): 17-29.
[287] Townsend D.W., "Influences of oceanographic processes on the biological productivity of the Gulf of Maine." *Aquatic Sciences* 5, no. 3 (1991): 211-230.
[288] Kelley N.E., et al., "Biodiversity of the deep-sea continental margin bordering the Gulf of Maine (NW Atlantic); Relationships among sub-regions and to shelf systems." *PLoS ONE* 5, no. 11 (2010): e13832; Incze L.S., et al., "Biodiversity knowledge and its application in the Gulf of Maine area." In *Life in the world's oceans: diversity, distribution and abundance. Blackwell Publishing, Oxford, UK* (2010): 43-63; Stokesbury K.D.E., et al., "High densities of juvenile sea scallop (*Placopecten magellanicus*) on banks and ledges in the central Gulf of Maine." *Journal of Shellfish Research* 29, no. 2 (2010): 369-372.
[289] Uchupi E., "Structural framework of the Gulf of Maine." *Journal of Geophysical Research* 71, no. 12 (1966): 3013-3028.
[290] Witman J.D. and Lamb R.W., "Persistent differences between coastal and offshore kelp forest communities in a warming Gulf of Maine." *PLoS ONE* 13, no. 1 (2018): e0189388.
[291] Kraus S.D., et al., "Scientific assessment of a proposed Marine National Monument off the Northeast United States." *Scientific briefing for press and interested parties. Final version* 31 (2016).
[292] LaBreque E., et al., "Biologically Important Areas for Cetaceans within U.S. waters – East Coast Region." *Aquatic Mammals* 41, no. 1 (2015): 17-29.

Feeding and mating BIAs and Critical Habitat designated under the Endangered Species Act (ESA) for North Atlantic right whales are also found in this region.[293] A small and resident population of harbor porpoises also resides in the Gulf.[294]

e. Northeast Canyons and Seamounts Marine National Monument

The Northeast Canyons and Seamounts Marine National Monument, located about 150 miles southeast of Cape Cod, protects a spectacular underwater seascape inhabited by an extraordinary diversity of life.[295] The canyons and seamounts are home to centuries-old coral, dolphins, whales (including the endangered sperm whale), Atlantic puffins, and other seabirds and sea turtles. The monument's underwater canyons rival the Grand Canyon in size and scale, and the seamounts rise higher than any mountain east of the Rockies.[296] The area, with its unique geological features, has been the site of active scientific exploration and of the discovery of species of coral found nowhere else on earth, as well as of other rare fish and invertebrates.

f. Cape Hatteras

Another area of critical importance lies about twenty miles offshore from Cape Hatteras and is one of the U.S.'s most diverse and productive marine ecosystems. It is uniquely positioned where the warm Gulf Stream swings close to shore and meets the cool Labrador Current to the north, dynamic ocean fronts provide a sustained source of nutrients, supporting an abundance of marine life, from plankton, invertebrates, and forage fish, to large marine predators such as tuna, swordfish, sharks, seabirds, and marine mammals.[297] Cape Hatteras is considered to have the highest marine mammal biodiversity of any area along the East Coast[298] and endangered species, including fin, humpback, and sperm whales, occur at unusually high densities.[299] NOAA has determined Cape Hatteras to be a BIA, as part of the migratory corridor for the endangered North Atlantic right whale.[300] Four of the six species of sea turtle found along the U.S. East Coast nest by the beaches of Cape Hatteras National Seashore: vulnerable leatherbacks, endangered loggerhead and green turtles, and the rarest sea turtle in the world, the critically endangered Kemp's Ridley. These species occur at high densities in the waters

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293 "Designated Critical Habitat; North Right Whale; Final Rule." 59 *Federal Register* 226 (3 June 1994), 28805-28835.
294 LaBreque E., et al., "Biologically Important Areas for Cetaceans within U.S. waters – East Coast Region." *Aquatic Mammals* 41, no. 1 (2015): 17-29.
295 NOAA, "First marine national monument created in Atlantic," Accessed August 14, 2017. http://www.noaa.gov/news/first-marine-national-monument-created-in-atlantic.
296 The White House, "Presidential proclamation – Northeast Canyons and Seamounts Marine National Monument." *The White House Office of the Press Secretary* (September 15, 2016). Available at: https://obamawhitehouse.archives.gov/the-press-office/2016/09/15/presidential-proclamation-northeast-canyons-and-seamounts-marine
297 Fautin D., et al., "An overview of marine biodiversity in United States waters." *PLoS ONE* 5, no. 8 (2010): e11914.
298 Byrd, B.L., et al., "Strandings as indicators of marine mammal biodiversity and human interactions off the coast of North Carolina," Fishery Bulletin 112, no. 1 (2014): 1-23.
299 Halpin, P.N., et al., "OBIS-SEAMAP: The world data center for marine mammal, sea bird and sea turtle distributions," *Oceanography* 22, no. 2 (2009):104-115.
300 LaBreque E., et al., "Biologically Important Areas for Cetaceans within U.S. waters – East Coast Region." *Aquatic Mammals* 41, no. 1 (2015): 17-29.

immediately offshore from Cape Hatteras[301] and are known to migrate offshore to feeding grounds in the Mid- and South Atlantic Bight.[302]

g. Nearshore corridor

Along the east coast there is a migratory pathway, approximately 22 miles from the shoreline, where marine mammals, sea turtles, and fish gather. Loggerhead, Kemp's ridley, and leatherback turtles travel seasonally nearby this strip, 12 miles from shore. This nearshore corridor is also an important foraging area for seabirds and nursery ground for important crab and fish species. Key nursery areas include the mouths of the Chesapeake and Delaware Bays.[303] BIAs for nine small and resident populations of bottlenose dolphins have been identified by NOAA within the Southeast Atlantic's nearshore corridor, ranging from the Northern North Carolina Estuarine System south to the Florida Bay.[304]

The DPP proposes Atlantic Region Program Option 3 to add a coastal buffer of 25 nautical miles along the shoreline to "accommodate concerns such as military use, fish and marine mammal migration, and other nearshore uses"; however, this strip of proposed siting restrictions would fail to protect the area to the level needed to ensure its ecological and economic value.[305]

h. Charleston Bump

The Atlantic network also includes the Charleston Bump, a deepwater, rocky ocean bottom feature 80-100 miles southeast of Charleston, South Carolina. The Bump rises from the Blake Plateau that lies beyond the edge of the continental shelf off South Carolina and Georgia. The Bump deflects the Gulf Stream offshore away from the eastern coast of the U.S., causing eddies and other current features that are considered "Essential Fish Habitat."[306] The combination of rocky bottom and complex currents is attractive to large pelagic fish such as marlins, sailfish and swordfish. Satellite tagging data show that it is an important feeding and spawning area for swordfish.[307] The area is also home to the only known population of wreckfish and the only known spawning site for wreckfish in

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[301] Halpin, P.N., et al., "OBIS-SEAMAP: The world data center for marine mammal, sea bird and sea turtle distributions," *Oceanography* 22, no. 2 (2009):104-115.
[302] McClellan C.M., et al., "Conservation in a complex management environment: The by-catch of sea turtles in North Carolina's commercial fisheries," *Marine Policy* 35 (2011): 241-248. Griffin D.B., et al. "Foraging habitats and migration corridors utilized by a recovering subpopulation of adult female loggerhead sea turtles: implications for conservation." *Marine Biology* 160 (2013): 3071-3086.
[303] NOAA, *Fishery Management Plan for Atlantic Tunas, Swordfish and Sharks: Environmental Impact Statement, Part 1*. Northwestern University. April 1999.
[304] LaBreque E., et al., "Biologically Important Areas for Cetaceans within U.S. waters – East Coast Region." *Aquatic Mammals* 41, no. 1 (2015): 17-29.
[305] BOEM, DPP, 2018, "2019–2024 National OCS Oil and Gas Leasing Draft Proposal on the Size, Timing, and Location of Sales," p. 11, https://www.boem.gov/NP-Draft-Proposed-Program-2019-2024/.
[306] Sedberry, G.R., et al., "The Charleston Bump: An island of essential fish habitat in the Gulf Stream," *American Fisheries Society Symposium* 25 (2001): 3-24.
[307] Sedberry, G.R., et al., *The role of the Charleston Bump in the life history of Southeastern U.S. marine fishes. Final Report*. Prepared by South Carolina Department of Natural Resources. November 2000.

the western North Atlantic.[308] The hard bottom areas of the Bump support deep-water corals that grown in mounds and pinnacles and extend several meters above the bottom.[309]

i. North Atlantic right whale calving grounds offshore Georgia and northeastern Florida

The coasts of Georgia and Northeastern Florida are also key areas for marine wildlife. From mid-December through late-March, pregnant North Atlantic right whales give birth in ESA Critical Habitat calving grounds off Georgia and northeastern Florida. The designated Critical Habitat calving grounds encompass waters from the shore out to 17 miles from Altamaha River, Georgia, to Jacksonville, Florida, and the shore out to almost 6 miles from Jacksonville to Sebastian Inlet, Florida.[310] However, survey data suggest that calving North Atlantic right whales routinely use broader habitat than that defined by the Critical Habitat designation; NOAA therefore has defined the calving BIA as encompassing waters of 25 meter water depth between Cape Canaveral, Florida, and Cape Lookout, North Carolina.[311]

3. Offshore oil and gas drilling along the Atlantic lacks support

In addition to the obvious ecological and economic reasons for excluding the Atlantic Region from any drilling plan, is the overwhelming opposition to drilling from communities along the coast. As of February 2018, more than 170 East Coast municipalities and over 1,200 local, state and federal elected officials had formally opposed offshore drilling and/or seismic airgun blasting.[312] By August 2017, 41,000 businesses and 500,000 commercial fishing families opposed east coast offshore drilling as part of the Business Alliance for Protecting the Atlantic Coast.[313] More than 1.4 million public comments opposing offshore drilling were submitted to the Obama administration in opposition to offshore drilling. In addition, there has been a strong bipartisan push from lawmakers against opening this coast to drilling, given the risk it poses to local economics and communities.

Due to much of this input from communities, citizens and business, in 2016 BOEM concluded the Atlantic should not be included in the 2017-2022 Five Year Program based on risks to the current economies:

> An important consideration in removing the Mid- and South Atlantic Program Area from the Proposed Program is concern regarding competing uses of the Program Area

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[308] *Supra* n. 306.
[309] Sedberry, G.R. (2009-07-29). "A Profile of the Charleston Bump," NOAA, Revised June 9, 2010, http://oceanexplorer.noaa.gov/explorations/islands01/background/islands/sup11_bump.html.
[310] *Id*.
[311] LaBreque E., et al., "Biologically Important Areas for Cetaceans within U.S. waters – East Coast Region." *Aquatic Mammals* 41, no. 1 (2015): 17-29.
[312] Oceana, "Grassroots Opposition to Offshore Drilling and Exploration in the Atlantic Ocean and Eastern Gulf of Mexico, http://usa.oceana.org/climate-and-energy/grassroots-opposition-offshore-drilling-and-exploration-atlantic-ocean-and.
[313] Business Alliance for Protecting the Atlantic Coast, accessed August 14, 2017, http://protectingtheatlanticcoast.org/business-opposition-grows-stronger-in-opposition-to-offshore-oil-exploration-and-drilling/.

> and the potential harm that oil and gas development could pose to those existing uses. The range, number and nature of conflicts in the Atlantic are unique to the region and require additional work to deconflict prior to including a lease sale in the Program. As expressed by many stakeholders, ocean-dependent tourism, commercial and recreational fishing, and commercial shipping and transportation are established and important economic uses in and along the coast of the Mid- and South Atlantic Program Area that could be potentially impacted by oil and gas activity … Numerous stakeholders, including many citizens living along the Atlantic coast and their public officials, expressed concern that oil and gas activities and their potential impacts could jeopardize existing economic activities and the health of important contributors to coastal economies.[314]

Opposition has only grown since that time. Currently, more than 160 cities and towns along the coast have passed resolutions opposing offshore drilling and/or seismic testing for oil and gas, wanting to keep their communities safe from natural and economic disaster.[315]

The Atlantic Region holds important biological value that would be jeopardized by offshore oil and gas activities. Further, the health of the Atlantic economy is inextricably linked to healthy coasts and oceans. Based on the unique and important ecology of the Atlantic, the major economies based on fishing, tourism and recreation, the overwhelming local opposition and finally the DOD and NASA conflicts, the Atlantic simply does not belong in any plan to explore or develop offshore oil and gas resources.

D. The Florida Straits, Dry Tortugas and Florida Keys should be excluded from the leasing program

1. South Florida's ocean economy

The Straits of Florida, made up of a curved channel between the Florida Peninsula and the Bahama Platform and Cuba, connect the Gulf of Mexico with the Atlantic Ocean.[316] The Florida Keys coral reef, the third-largest reef system on the planet, is also part of the Florida Straits.[317] It extends nearly 200 miles southwest from Biscayne Bay near Miami to the Dry Tortugas.[318] The Dry Tortugas, located at the western end of the Florida Reef system about 70 miles from Key West, are made up of seven islands and their surrounding shoals and waters.[319]

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[314] BOEM, *2017-2022 Outer Continental Shelf Oil and Gas Leasing Proposed Program*, 2016, Summary of the Proposed Program Decision, pp. 8-11, https://www.boem.gov/2017-2022-Proposed-Program-Decision/.
[315] Oceana, "Grassroots Opposition to Offshore Drilling and Exploration in the Atlantic Ocean and Eastern Gulf of Mexico," February 12, 2018, http://usa.oceana.org/climate-and-energy/grassroots-opposition-offshore-drilling-and-exploration-atlantic-ocean-and.
[316] The Strait of Florida, NOVA Southeastern University, Accessed February 26, 2018 https://cnso.nova.edu/messing/strait-of-florida/
[317] The South Florida Ecosystem, Multi-Species Recovery Plan for South Florida, Fish and Wildlife Service, p2-9. Accessed February 26, 2018. https://www.fws.gov/verobeach/msrppdfs/sfecosystem.pdf
[318] The South Florida Ecosystem, Multi-Species Recovery Plan for South Florida, Fish and Wildlife Service, p2-9. Accessed February 26, 2018. https://www.fws.gov/verobeach/msrppdfs/sfecosystem.pdf
[319] National Park Service, U.S. Department of the Interior, Dry Tortugas National Park

The Straits of Florida and the coral reef ecosystems found there are also major contributors to local economies. "NOAA suggests that coral reefs in southeast Florida have an asset value of $8.5 billion, generating $4.4 billion in local sales, $2 billion in local income, and 70,400 full and part-time jobs."[320] And in the Dry Tortugas, a National Park Service report shows that 64,865 visitors to Dry Tortugas in 2014 spent $3,783,600 in communities near the park.[321]

2. The biological and cultural value of the straits of Florida

In addition to generating jobs and economic value to Florida communities, the Straits of Florida have important biological, cultural, and historical value. Located at the southern edge of the Gulf Stream, the channel making up the Florida Straits is an important biodiversity hotspot: over 687 species of marine life are found in one concentrated region in the Florida Straits, more than in any other place in the Atlantic Ocean.[322] The Florida Straits also have the Atlantic's greatest concentration of endemic species – wildlife found nowhere else on earth, according to a United Nations Food and Agriculture Organization (FAO)-initiated study.[323] The Florida Straits and surrounding areas that contain such an abundance of unique wildlife have been recognized and protected for many years, and would be placed at unnecessary risk should any oil and gas exploration or development occur nearby.

The area is rich in marine life, birds and shipwrecks, and has a long history that underscores its cultural and ecological significance.[324] President Franklin D. Roosevelt designated Fort Jefferson, a brick fortress built in the 1840s and its surrounding waters totaling 47,125 acres a national monument under the Antiquities Act in January 1935. The monument was expanded in 1983 and Congress redesignated it as Dry Tortugas National Park on October 26, 1992. According to the National Park Service, "Dry Tortugas was established to protect the island and marine ecosystems of the Dry Tortugas, to preserve Fort Jefferson and submerged cultural resources such as shipwrecks, and to allow for public access in a regulated manner."[325] The marine ecosystems in this area are home to abundant wildlife including sea turtles, sharks, reef fish, birds and about 30 species of coral.[326]

Florida, Fort Jefferson, Self-Guided Tour. Accessed February 26, 2018. https://www.nps.gov/drto/planyourvisit/upload/sgftweb.pdf

320 Florida Keys National Marine Sanctuary. National Marine Sanctuaries/National Oceanic and Atmospheric Administration. Accessed February 27, 2018. https://floridakeys.noaa.gov/corals/economy.html

321 National Park Service. Dry Tortugas National Park. Accessed February 27, 2018. https://www.nps.gov/drto/learn/news/tourism-to-dry-tortugas-national-park-creates-4-million-in-economic-benefits.htm

322 St Petersburg Times Online. Florida Straits hosts most diverse sea life. Accessed February 26, 2018. http://www.sptimes.com/2003/08/12/State/Florida_Straits_hosts.shtml

323 Conservation International: Greatest Diversity of Fish in Entire Atlantic Found Just Off Florida Coast. Accessed February 26, 2018. https://www.conservation.org/NewsRoom/pressreleases/Pages/081203-Greatest-Diversity-of-Fish-in-Entire-Atlantic-Found-Just-Off-Florida-Coast.aspx

324 National Park Service, U.S. Department of the Interior, Dry Tortugas National Park. Accessed February 26, 2018. https://www.nps.gov/drto/planyourvisit/basicinfo.htm

325 National Park Service, Dry Tortugas, History & Culture. Accessed February 26, 2018. https://www.nps.gov/drto/learn/historyculture/index.htm

326 National Park Service, Dry Tortugas, Animals. Accessed February 26, 2018. https://www.nps.gov/drto/learn/nature/animals.htm

The Dry Tortugas are not the only area in this region Congress has recognized as sensitive and in need of protections. Threats to areas surrounding the Florida Keys during the 1980s, including drilling proposals, water quality issues and coral reef health concerns, led Congress to pass a bill establishing the Florida Keys Marine Sanctuary.[327] The bill was signed into law by President George H. W. Bush in 1990.[328] The sanctuary incorporated the Key Largo and Looe Key sanctuaries and today, the sanctuary protects 2,900 square nautical miles of Florida Keys coastal and ocean waters.[329] The Florida Keys Marine Sanctuary is home to more than 6,000 species of marine life, shipwrecks, seagrass beds and mangroves.[330] A spill near these protected waters would be devastating to the region, which many leaders have taken great care to preserve and protect.

3. The Straits of Florida ecosystem cannot afford oil and gas exploitation-induced stressors

Coral reefs globally and off South Florida have been experiencing bleaching and increased die offs and should not be exposed to the added stressors that oil and gas exploration and exploitation would cause. According to the National Ocean Service, "When corals are stressed by changes in conditions such as temperature, light, or nutrients, they expel the symbiotic algae living in their tissues, causing them to turn completely white."[331] According to the Florida Department of Environmental Protection (referencing NOAA), bleaching events have steadily increased in frequency and severity during the last few decades.[332] Given the crisis currently faced by coral reefs in this region, and globally, we should be focused on addressing this complex problem, not introducing potential further harm.

NOAA's Office of Response and Restoration states that "Once oil comes into contact with corals, it can kill them or impede their reproduction, growth, behavior, and development. The entire reef ecosystem can suffer from an oil spill, affecting the many species of fish, crabs, and other marine invertebrates that live in and around coral reefs."[333] Introducing this type of risk to an already stressed system puts the Straits of Florida region's rich historical, ecological, and economic value in jeopardy.

E. The Gulf of Mexico should be excluded from the leasing program

There should be no new leasing in the Gulf of Mexico under this new five-year plan. Eight years ago, a BP blowout killed 11 workers and gushed millions of barrels of toxic crude oil into some of the richest marine life habitats anywhere in the world. This ongoing disaster threw tens of thousands of

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[327]Florida Keys National Marine Sanctuary, National Marine Sanctuaries/National Oceanic and Atmospheric Administration. History of Florida Keys National Marine Sanctuary. Accessed February 26, 2018. https://floridakeys.noaa.gov/history.html?s=about
[328] *Id.*
[329] *Id.*
[330] The Key West Aquarium. Florida Keys Marine Life. Accessed February 26, 2018. https://www.keywestaquarium.com/category/florida-keys-marine-life
[331] National Ocean Service, What Is Coral Bleaching? Accessed February 27, 2018 https://oceanservice.noaa.gov/facts/coral_bleach.html
[332] Florida Department of Environmental Protection. Coral Disease. Accessed February 27, 2018. https://floridadep.gov/sites/default/files/Bleaching-and-Disease.pdf
[333] National Oceanic and Atmospheric Administration. Office of Response and Restoration. Accessed February 27, 2018. https://response.restoration.noaa.gov/about/media/how-do-oil-spills-affect-coral-reefs.html

fishermen, oystermen, shrimpers, and others out of work. It made food unsafe to eat and air unsafe to breathe and has resulted in widespread health problems for the people of the Gulf, where oil spread out across more than 1,300 miles of coastal lands and marsh. It is still taking a toll on marine life.

The disaster in the Gulf affirmed that there is no way to take the risk out of what is an inherently dangerous industrial operation at sea. Thousands of oil, gas, and chemical spills are reported in the Gulf every year and the region is still at risk of another catastrophe like the BP disaster. Moreover, from sea level rise and extreme storms fueled by climate change, to coastal erosion, the Gulf of Mexico is on the front line of the impacts from the oil and gas industry.

1. The Eastern Gulf of Mexico should be excluded

There should be no lease sales scheduled in the Eastern Gulf of Mexico. In 2006, Congress passed the Gulf of Mexico Energy and Security Act which created a moratorium on oil and gas drilling through 2022 in most of the eastern Gulf of Mexico (within 125 miles off the Florida coastline in the Eastern Planning Area, and a portion of the Central Planning Area).[334] There is a very strong Congressional effort to extend this moratorium on the Eastern Gulf for a wide variety of reasons including potential harm to coastal economies, spills and impacts to ecosystems, and Department of Defense use of the area. Regardless of the success of that effort, excluding the Eastern Gulf from leasing is in the local and national interest.

a. The Eastern Gulf's ocean economy

Florida's tourism and fishing economy simply cannot afford another BP type spill. And this is especially true for Gulf areas that are still recovering from the BP *Deepwater Horizon* Disaster. As noted in Section V of these comments, the Gulf of Mexico commercial fishing industry was estimated to have lost $247 million as a result of initial post spill fisheries closures.[335] In 2014, tourism, recreation, and fishing – industries dependent on a healthy ocean – in the Gulf contributed $14.7 billion to the GDP, providing over 330,000 jobs.[336] Tourism and fishing based on Florida's Gulf coast contributed $8.6 billion to the state's economy in 2014, supporting over 192,000 jobs.[337]

The fisheries of the Eastern Gulf have, themselves, made significant economic contributions and they are distributed in such a way that drilling anywhere in the Eastern Gulf of Mexico Planning Area opens fisheries and the economic opportunities they provide to the significant threat of a spill. Here

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[334] Gulf of Mexico Energy Security Act of 2006. Division C – Other Provisions. https://www.boem.gov/GOMESA/
[335] McCrea-Strub, A., et al., Potential impact of the *Deepwater Horizon* oil spill on commercial fisheries in the Gulf of Mexico, Fisheries, Vol. 36(7), pp. 332–336, 2011
[336] National Ocean Economics Program, "Ocean Economy Search Results," Center for the Blue Economy at Middlebury Institute of International Studies at Monterey, *available at* http://oceaneconomics.org/Market/ocean/oceanEconResults.asp?IC=N&dataSource=E&selState=82&selState=89&selCounty=All&selYears=2014&selToYear=none&selSector=2&selSector=6&selIndust=All&selValue=All&selOut=display&noepID=4252.
[337] National Ocean Economics Program, "Ocean Economy Search Results," Center for the Blue Economy at Middlebury Institute of International Studies at Monterey, *available at* http://oceaneconomics.org/Market/ocean/oceanEconResults.asp?IC=N&dataSource=E&selState=82&selState=89&selCounty=All&selYears=2014&selToYear=none&selSector=2&selSector=6&selIndust=All&selValue=All&selOut=display&noepID=4252.

are three examples of highly valuable fisheries managed by the Gulf of Mexico Fishery Management Council (GMFMC) with essential fish habitat (EFH) in the Eastern Gulf:

i. *Shrimp* – In 2016, the landed value of shrimp species throughout the Gulf of Mexico came to $413 million.338 The landed value of shrimp generated $47 million in Florida.339 Shrimps' EFH in the Gulf of Mexico stretches from Texas to the Florida Straits, from the shoreline to ocean floor depths of 100 fathoms in some areas.340 In the Eastern Gulf, the EFH generally extends to ocean floor depths of 35 fathoms.341

ii. *"Reef fish"* – The landed value of species managed by the GMFMC as "reef fish" came to $64 million in 2016.342 Those species include, but are not limited to red grouper, yellowedge grouper, red snapper, vermillion snapper, golden tilefish, greater amberjack, gag, and scamp. Reef fish EFH is broad, covering the entire Gulf of Mexico coast to a depth of 100 fathoms.343

iii. *Spiny Lobster* – In 2016, the landed value of spiny lobster from the Gulf of Mexico was $39 million.344 The species' Gulf of Mexico EFH consists of a strip from Tarpon Springs, Florida, south to Naples, Florida, in depths 5 to 10 fathoms, as well as areas north of the Florida Keys, out to depths of 15 fathoms.[345]

As previously stated in Section V, the BP *Deepwater Horizon* spill also cost the public almost 17 million user days for outdoor recreation such as boating, recreational fishing, and beach-going. Total recreational use damages due to the spill are estimated at $693.2 million.[346] In the Eastern Gulf of Mexico, where tourism, fishing and recreation are such critical economic drivers, tax-payers and coastal communities would carry the burden of serious economic risk if the moratorium on oil exploration and drilling is lifted for the benefit of oil company profits.

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338 National Ocean Economics Program, "Natural Resources - Commercial Fish Species Search," Center for the Blue Economy at Middlebury Institute of International Studies at Monterey, *available at* http://oceaneconomics.org/LMR/fishSearch.asp.
339 *Id.*
340 Southeast Regional Office, "Shrimp Essential Fish Habitat (EFH)," NOAA Fisheries (2014) *map available at* http://sero.nmfs.noaa.gov/maps_gis_data/habitat_conservation/efh_gom/images/shrimp_efh_gom.pdf.
341 *Id.*
342 *Supra* n. 338.
343 Southeast Regional Office, "Reef Fish Essential Fish Habitat (EFH)," NOAA Fisheries (2014) *map available at* http://sero.nmfs.noaa.gov/maps_gis_data/habitat_conservation/efh_gom/images/reef_fish_efh_gom.pdf.
344 *Supra* n. 338.
345 Southeast Regional Office, "Spiny Lobster Essential Fish Habitat (EFH)," NOAA Fisheries (2014) *map available at* http://sero.nmfs.noaa.gov/maps_gis_data/habitat_conservation/efh_gom/images/spiny_lobster_efh_gom.pdf.
346 *Deepwater Horizon* Natural Resource Damage Assessment Trustees, *Deepwater Horizon* oil spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. National Oceanic and Atmospheric Administration (NOAA), February 2016. Accessed February 2017, www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan (accessed February 2017)

In addition to potential impacts to communities, ecosystems and economies, the Department of Defense has requested that this area be excluded from drilling due to its importance for military training and testing exercises.[347] Based on these multifarious factors, leaders in Florida from both parties are pressing for an extended moratorium in the Eastern Gulf.[348,349]

b. The biological value of the Eastern Gulf

There are also vulnerable and endangered subspecies and populations of marine wildlife and ecologically important areas in the eastern Gulf of Mexico that offer further justification for not issuing new leases. These include:

i. *Gulf of Mexico whale*— On December 2, 2016, NMFS proposed listing the Gulf of Mexico Bryde's whale (hereafter, "Gulf of Mexico whale"), a subspecies of Bryde's whale (*Balaenoptera edeni*), as "endangered" under the Endangered Species Act.[350] The Gulf of Mexico whale was also recently listed as "Critically Endangered" by the IUCN Red List of Threatened Species[351] and experts have raised the need for rapid action to eliminate human-induced death and injury to these whales.[352] The reasons for listing are manifold: the most recent abundance estimate numbered the Gulf of Mexico Bryde's whale at 33 individuals (CV+1.07),[353] making it one of the most endangered whales on the planet; its habitat is severely limited, comprising only a portion of the DeSoto Canyon in the northeastern Gulf of Mexico;[354] and it is considered at

[347]Department of the Air Force. Office of the Chief of Staff. June 27, 2017. https://www.billnelson.senate.gov/sites/default/files/06.27.17%20CSAF%20Letter%20to%20Sen%20Nelson%20Re%20Moratorium%20on%20Leasing%20Land.pdf

[348] Office of Marco Rubio, US Senator for Florida. Rubio Introduces Legislation to Extend Eastern Gulf Drilling Moratorium, May 4, 2017. Accessed February 27, 2018, https://www.rubio.senate.gov/public/index.cfm/press-releases?ID=23C4DB2C-7410-4875-93CC-30C61A8FE9BD;

[349] Office of Bill Nelson, US Senator for Florida. Nelson files bill to block expansion of offshore drilling, April 27, 2017. Accessed February 26, 2018, https://www.billnelson.senate.gov/newsroom/press-releases/nelson-files-bill-to-block-expansion-of-offshore-drilling

[350] NOAA. Notice of 12-month finding on a petition to list the Gulf of Mexico Bryde's whale as Endangered under the Endangered Species Act (ESA), 81 Fed. Reg. 88639, 88639-88656 (Aug. 12, 2016). https://www.federalregister.gov/documents/2016/12/08/2016-29412/endangered-and-threatened-wildlife-and-plants-notice-of-12-month-finding-on-a-petition-to-list-the

[351] International Union for Conservation of Nature and Natural Resources. Balaenoptera edeni (Gulf of Mexico Subpopulation). http://www.iucnredlist.org/details/117636167/0

[352] Corkeron, P. and Kraus, S. D., "Baleen whale species at risk of extinction," Nature, vol. 554, p. 169, 8 February, 2018.

[353] NOAA-NMFS, "Bryde's whale (*Balaenoptera edeni*): Northern Gulf of Mexico Stock," NOAA-NMFS Stock Assessment Report, May 2016, https://www.nefsc.noaa.gov/publications/tm/tm238/263_f2015_brydes.pdf.

[354] K.D. Mullin and G.L. Fulling, *Abundance of cetaceans in the oceanic northern Gulf of Mexico*, 1996-2001, Marine Mammal Science 787-807 (2004); K. Maze-Foley and K.D. Mullin, Cetaceans of the oceanic northern Gulf of Mexico: *Distributions, group sizes and interspecific associations*, 8 Journal of Cetacean Research and Management 203–213 (2006); A. Širović, H.R. Bassett, S.C. Johnson, S.M. Wiggins, and J.A. Hildebrand, *Bryde's whale calls recorded in the Gulf of Mexico*, 30 Marine Mammal Science 399-409 (2014); Anonymous, *Bryde's whale (*Baleanoptera edeni*): Northern Gulf of Mexico stock, in* G.T. Waring, E. Josephson, K. Maze-Foley, and P.E. Rosel (eds.), *U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments—2015*, at 263-268 (2016).

high risk of extinction from a myriad of direct and indirect human stressors.[355] Notably, energy production and noise from seismic surveys are considered to be "high" threats to this endangered subspecies.[356] Modelling suggests that almost half of the whale's already severely restricted habitat was affected by the *Deepwater Horizon* oil spill in 2010.[357] In addition, the peak frequencies of Bryde's whale vocalizations, recently modeled by NMFS with a source level of 152 dB in 100 Hz 1/3-octave band, makes the population extremely vulnerable to loss of communication space from seismic exploration.[358] Other identified threats that would be exacerbated by oil and gas exploration and drilling in the eastern Gulf of Mexico include marine debris, operational discharge, oil spill and spill response, vessel collision, disturbance, and noise.[359]

Virtually all reported sightings of Bryde's whales, made during several series of springtime abundance surveys in the northern Gulf, have occurred within the northern part of the DeSoto Canyon, suggesting a highly limited range.[360] Similarly, passive acoustic surveys detected Bryde's whales only within the DeSoto Canyon, despite commensurate effort in other locations in the Central and Eastern Gulf.[361] Indeed, long-term distributional data indicate that energy exploration and production in the Central Gulf may have led to a contraction of the whales' habitat, essentially an "abandonment of the northwestern [Gulf]" into the waters of the DeSoto Canyon, an area with relatively less

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355 NOAA. Notice of 12-month finding on a petition to list the Gulf of Mexico Bryde's whale as Endangered under the Endangered Species Act (ESA), *supra* n. 350.

356 P.E. Rosel, P. Corkeron, L. Engleby, D. Epperson, K.D. Mullin, M.S. Soldevilla, and B.L. Taylor, *Status review of Bryde's whales (*Balaenoptera edeni*) in the Gulf of Mexico under the Endangered Species Act* (2016) (NOAA Tech. Memo. NMFS-SEFSC-692), http://sero.nmfs.noaa.gov/protected_resources/brydes_whale/documents/bryde_s_whale_status_review__final.pdf.

357 *Deepwater Horizon* Natural Resource Damage Assessment Trustees, "Chapter 4. Injury to Natural Resources," in: "*Deepwater Horizon* oil spill: Final programmatic damage assessment and restoration plan (PDARP) and final programmatic environmental impact statement (PEIS)" (2016), http://www.gulfspillrestoration.noaa.gov/sites/default/files/wp-content/uploads/Chapter-4_Injury_to_Natural_Resources_508.pdf.

358 M.-N.R. Matthews, A. Schlesinger, and D. Hannay, *Cumulative and chronic effects in the Gulf of Mexico: Estimating reduction of listening area and communication space due to seismic activities in support of the BOEM Geological and Geophysical Activities Draft Programmatic Environmental Impact Statement*, *in* BOEM, *Gulf of Mexico OCS Proposed Geological and Geophysical Activities Draft Programmatic Environmental Impact Statement*, at App. K (NMFS-directed study of cumulative and chronic efforts of geophysical surveys in the Gulf of Mexico)

359 *Supra* n. 356.

360 K.D. Mullin and G.L. Fulling, *Abundance of cetaceans in the oceanic northern Gulf of Mexico*, 20 Marine Mammal Science 787-807 (2004); K. Maze-Foley and K.D. Mullin, Cetaceans of the oceanic northern Gulf of Mexico: *Distributions, group sizes and interspecific associations*, 8 Journal of Cetacean Research and Management 203–213 (2006); Anonymous, *Bryde's whale (*Baleanoptera edeni*): Northern Gulf of Mexico stock*, *in* G.T. Waring, E. Josephson, K. Maze-Foley, and P.E. Rosel (eds.), *U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments—2015*, at 263-268 (2016).

361 A. Širović, H.R. Bassett, S.C. Johnson, S.M. Wiggins, and J.A. Hildebrand, *Bryde's whale calls recorded in the Gulf of Mexico*, 30 Marine Mammal Science 399-409 (2014).

noise pollution than other areas of the Gulf.[362] This area has accordingly been identified by NOAA as a "biologically important area" for the resident Gulf of Mexico whale.[363] As detailed in the Status Review, the biologically important area identified by NOAA does not fully capture the extent of important habitat within the DeSoto Canyon. Specifically, the BIA is designated between 100 m and 300 m depth from Pensacola, Florida, to south of Tampa, Florida. However, sightings have also occurred at 302 and 392 depth, in the region west of Pensacola, leading NMFS to recommend that the area be defined out to the 400 m depth contour and to Mobile Bay, Alabama.

The DeSoto Canyon, including the recommended extension to the 400 m depth contour and the portion which falls within BOEM's Central Planning Area, should be entirely excluded from leasing, as should Gulf areas that significantly propagate sound into the DeSoto Canyon. These measures would also afford protection to other cetaceans that rely on the Canyon (including a resident population of endangered sperm whale, see below) and also the hard, soft and black coral, which provide a habitat for large numbers of sea basses, drums, and snappers.[364]

ii. *Sperm whale*— Multidisciplinary research conducted since 2000 clearly demonstrates that the northern Gulf of Mexico is also home to a small, resident, and evolutionarily distinct stock of sperm whale that is genetically, physiologically, and behaviorally differentiated from other Atlantic Ocean stocks.[365] The sperm whale is listed as "endangered" under the Endangered Species Act, and therefore the northern Gulf of Mexico stock is considered strategic under the Marine Mammal Protection Act. The best estimate of abundance for this stock is 763 individuals (CV=0.38) with a minimum population estimate of 560 whales. Gulf of Mexico sperm whales were directly affected by the *Deepwater Horizon* oil spill.[366] 33 individuals were directly observed to be swimming in *Deepwater Horizon* surface oil or with oil on their bodies during spill response activities.[367] NOAA estimated that the *Deepwater Horizon* spill caused the death of 6% of the population, as well as reproductive failure in 7% of females, and another 6% suffered adverse health

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[362] P.E. Rosel and L.A. Wilcox, *Genetic evidence reveals a unique lineage of Bryde's whales in the northern Gulf of Mexico*, 25 Endangered Species Research 19-34 (2014).
[363] E. LaBrecque, C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin, *Biologically important areas for cetaceans within U.S. waters—Gulf of Mexico region*, 41 Aquatic Mammals 30-38 (2015).
[364] Thompson, M.J., et. al, "Ecology of Live Bottom Habitats of the Northeastern Gulf of Mexico: A Community Profile," *Contractor Report for U.S. Geological Survey* (January 1999; pg. 40), *available at* https://www.boem.gov/ESPIS/3/3196.pdf.
[365] NOAA-NMFS, "Sperm whale (Physeter microcephalus): Northern Gulf of Mexico stock," May 2016, http://www.nmfs.noaa.gov/pr/sars/pdf/stocks/atlantic/2015/f2015_spermgmex.pdf
[366] *Id*.
[367] NOAA, " *Deepwater Horizon* Oil Spill Final Programmatic Damage Assessment and Restoration Plan (PDARP) and Final Programmatic Environmental Impact Statement (PEIS), Chapter 4: Injury to Natural Resources," pg 4-599, (February 2016), *available at* http://www.gulfspillrestoration.noaa.gov/sites/default/files/wp-content/uploads/Chapter-4_Injury_to_Natural_Resources_508.pdf.

impacts.[368] Sperm whales, in general, show high sensitivity to noise pollution evidence suggests that seismic surveys may decrease foraging effort (i.e., the number of echolocation 'clicks' the whales emit to locate prey decrease in frequency when exposed to seismic air-gun blasts).[369]

It is well established, on this basis of historic whaling records, mark-recapture data, and extensive surveys, including by GulfCet II and the Sperm Whale Seismic Study, that the Mississippi Canyon area (further discussed in the Western and Central GOM section below) constitutes an important year-round feeding and breeding habitat for the Gulf of Mexico sperm whale,[370] most likely due to the nutrient-rich, freshwater plume from the Mississippi Delta.[371] Nearly all sightings of females and mother-calf groups have occurred there, strongly suggesting that the canyon functions as a nursery ground.[372] Habitat models also indicate a high probability of suitable habitat in the De Soto Canyon and western Florida. Specifically, there exists an area of important sperm whale habitat along the continental shelf west of the Florida Keys and

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[368] NOAA, " *Deepwater Horizon* Oil Spill Final Programmatic Damage Assessment and Restoration Plan (PDARP) and Final Programmatic Environmental Impact Statement (PEIS), Chapter 4: Injury to Natural Resources," pgs. 4-624, 4-625, 4-627), (February 2016) ***available at*** http://www.gulfspillrestoration.noaa.gov/sites/default/files/wp-content/uploads/Chapter-4_Injury_to_Natural_Resources_508.pdf.

[369] Miller, P. J. O., M. P. Johnson, P. T. Madsen, N. Biassoni, M. Quero and P. L. Tyack. 2009. Using at-sea experiments to study the effects of airguns on the foraging behavior of sperm whales in the Gulf of Mexico. Deep-Sea Res. I 56: 1168-1181.

[370] Townsend, C.H., The distribution of certain whales as shown by logbook records of American whaleships, Zoologica: Scientific Contributions of the New York Zoological Society 19: 3-50 (1935); Weller, D.W., Würsig, S.K., Lynn, S.K., and Schiro, A. Preliminary findings on the occurrence and site fidelity of photo-identified sperm whales (*Physeter macrocephalus*) in the northern Gulf of Mexico, *Gulf of Mexico Science* 18: 35-39 (2000); Baumgartner, M.F., Mullin, K.D., May, L.N., and Leming, T.D., Cetacean habitats in the northern Gulf of Mexico, *Fishery Bulletin* 99(2): 219-239 (2001); Jochens, A., Biggs, D., Benoit-Bird, K., Engelhardt, D., Gordon, J., Hu, C., Jaquet, N., Johnson, M., Leben, R., Mate, B., Miller, P., Ortega-Ortiz, J., Thode, A., Tyack, P., and Würsig. B., Sperm Whale Seismic Study in the Gulf of Mexico: Synthesis report (2008) (Minerals Management Service report); Engelhaupt, D., Hoelzel, A.R., Nicholson, C., Frantzis, A., Mesnick, S., Gero, S., Whitehead, H., Rendell, L., Miller, P., De Stefanis, R., Caňadas, A., Airoldi, S., and Mignucci-Giannoni. A.A., Female philopatry in coastal basins and male dispersion across the North Atlantic in a highly mobile marine species, the sperm whale (*Physeter microcephalus*), *Molecular Ecology* 18: 4193-4205 (2009); NMFS, Final recovery plan for the sperm whale (*Physeter microcephalus*), (Dec. 21, 2010); Mate, B., Satellite tracking of sperm whales in the Gulf of Mexico in 2011: A follow-up to the *Deepwater Horizon* oil spill (Oct. 6, 2011) (vers. 2.7); Biggs, D.C., Jochens, A.E., Howard, M.K., DiMarco, S.F., Mullin, K.D., Leben, R.R., Mulle-Karger, F.E., and Hu, C., Eddy forced variations in on- and off-margin summertime circulation along the 1000-m isobath of the Northern Gulf of Mexico, 2000–2003, and links with sperm whale distributions along the Middle Slope, *in* Sturges, W., and Lugo, A. (eds.), *Circulation in the Gulf of Mexico: Observations and Models* (2013) (publication of the American Geophysical Union).

[371] Davis, R.W., Ortega-Ortiz, J.G., Ribic, C.A., Evans, W.E., Biggs, D.C., Ressler, P.H., Cady, R.B., Leben, R.R., Mullin. K.D., and Würsig, B., Cetacean habitat in the northern oceanic Gulf of Mexico, *Deep-Sea Research* 49: 121-142 (2002).

[372] *E.g.*, Weller, D.W., et al., Preliminary findings on the occurrence and site fidelity of photo-identified sperm whales (*Physeter macrocephalus*) in the northern Gulf of Mexico," *supra* n. 370*;* Jochens, A., et al., Sperm Whale Seismic Study in the Gulf of Mexico: Synthesis report, *supra* n. 370.

Tortugas,[373] likely due to the influence of the Loop Current, and its associated eddies, on primary productivity in the area.[374]

The Mississippi and DeSoto Canyons, and the important habitat area west of Florida, including the portion which falls within BOEM's Central Planning Area, should be entirely excluded from leasing, as should Gulf areas that significantly propagate sound into these areas.

iii. *Coastal bottlenose dolphin*— Coastal waters of less than 20 m depth constitute the entire range of the Gulf's celebrated coastal and near-coastal/ inshore bottlenose dolphins (*Tursiops truncatus truncatus*). This ecotype comprises 31 identified stocks across the Northern Gulf, many of which have best population estimates well below 100 individual animals.[375]

These dolphins are in crisis. From February 2010 through 2014, dolphin communities from the Texas border to Franklin County, Florida experienced a die-off that was unprecedented in its duration and magnitude, involving many hundreds of animals and disproportionately affecting neonates and calves.[376] Animals sampled in Barataria Bay, an area that was inundated with oil from the Macondo spill, showed signs consistent with adrenal toxicity, and were five times more likely than the control sample in Sarasota to have moderate to severe lung disease.[377] Many observers witnessed them swimming in and around the spill, demonstrating their inability—studied during previous spills—to avoid sheens and emulsified oil.[378] In all, NMFS estimates that 38% of coastal bottlenose dolphins were killed in the recent Unusual Mortality Event ("UME"), that 37% of pregnancies were lost, and that 30% are suffering from adverse health effects.[379]

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[373] Mullin, K.D. and G.L. Fulling 2004. Abundance of cetaceans in the oceanic northern Gulf of Mexico. Mar. Mamm. Sci. 20(4): 787-807; Maze-Foley K. & Mullin KD. 2006. Cetaceans of the oceanic northern Gulf of Mexico: Distributions, group sizes and interspecific associations. *Journal of Cetacean Research and Management*, 8, 203-213.
[374] Oey L-Y. et al. 2005. *Loop Current, rings and related circulation in the Gulf of Mexico: A review of numerical models and future challenges*. In: Sturges W. & Lugo-Fernandez A. (Eds.). *Circulation in the Gulf of Mexico: Observations and models.* Geophysical Monograph Series, 161, pp.31-56. American Geophysical Union, Washington D.C.
[375] *See passim* G.T. Waring, E. Josephson, K. Maze-Foley, and P.E. Rosel (eds.), *U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments—2015*, at 275-357 (2016).
[376] NOAA, *2010-2014 Cetacean Unusual Mortality Event in Northern Gulf of Mexico*, (2015), Accessed August 2014, http://www.nmfs.noaa.gov/pr/health/mmume/cetacean_gulfofmexico.htm.
[377] L.H. Schwacke, 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, *Health of common bottlenose dolphins (Tursiops truncatus) in Barataria Bay, Louisiana, following the Deepwater Horizon oil spill*, 48 *Environmental Science & Technology* 93-103 (2014).
[378] M.A. Smultea and B. Wűrsig, *Behavioral reactions of bottlenose dolphins to the Mega Borg oil spill, Gulf of Mexico 1990*, 21 Aquatic Mammals 171-181 (1995).
[379] NOAA, *NRDA-funded marine mammal monitoring, presentation to the National Academy of Science, Effective Approaches for Monitoring and Assessing Gulf of Mexico Restoration Activities* (Oct. 22, 2015); *see also* S.M. Lane, C.R. Smith, J. Mitchell, B.C. Balmer, K.P. Barry, T. McDonald, C.S. Mori, P.E. Rosel, T.K. Rowles, T.R.

The coastal habitat of these small, highly vulnerable dolphin communities, as well as waters that present a heightened risk of behavioral disruption from seismic or a heightened risk of future oil contamination within the dolphins' coastal habitat, should be excluded from all new leasing. So should areas where activities would propagate noise into these habitats. BOEM must afford some opportunity for recovery from the population damages caused by the *Deepwater Horizon* spill.

iv. *Sea turtles*— Once so numerous that Gulf locals "used to say sea turtles were so many that you could walk across water like Jesus by stepping on their backs," sea turtle populations in the Gulf of Mexico have dropped precipitously.[380] Today, there are five species of turtles that inhabit the Gulf, each listed as endangered under the Endangered Species Act: loggerhead turtle (*Caretta caretta*), Leatherback Turtle (*Dermochelys coriacea*), Hawksbill Turtle (*Eretmochelys imbricate*), Kemp's Ridley Turtle (*Lepidochelys kempii*), Green turtle (*Chelonia mydas*).

The planning areas proposed for leasing contain critical habitat for loggerhead and leatherback turtles. The loggerhead's critical reproductive areas included the beaches of Alabama and Florida, and its key range includes the southern quarter of the eastern planning area.[381] Studies suggest that the area from Mississippi Canyon to De Soto Canyon are critical habitat for leatherbacks.[382]

Were oil development to proceed in the Eastern Gulf of Mexico, these turtle species would likely be adversely impacted. The increase in ocean noise pollution would have direct and indirect impacts on sea turtle populations including "physical auditory impacts (temporary threshold shift), behavioral disruptions, long-term impacts, masking, and adverse impacts on the food chain. Low-frequency sound transmissions could potentially cause increased surfacing and avoidance from the area near the sound source."[383] Seismic surveys could also potentially harm turtles nearby. Finally, the discharge of oil from tankers has been shown to already significantly affect Kemp's ridely, loggerhead, green, and hawksbill sea turtles in the eastern Gulf of Mexico.[384]

Speakman, F.I. Townsend, M.C. Tumlin, R.S. Well, E.S. Zolman, and L.H. Schwacke, *Reproductive outcome and survival of common bottlenose dolphins sampled in Barataria Bay, Louisiana, USA, following the Deepwater Horizon oil spill*, 282(1818) *Royal Society Proceedings: Biological Science* 20151944 (2015).

[380] Davis, J.E., "The Gulf: The Making of an American Sea" Liveright (2017) New York, pg. 143

[381] BOEM, "Final Multisale Environmental Impact Statement, Gulf of Mexico OCS: Oil and Gas Lease Sales: 2017 – 2022" Volume 2, p. 4-261 (March 2017) *available at* https://www.boem.gov/BOEM-EIS-2017-009-v2/.

[382] *Id.* at 4-314.

[383] *Id* at 4-319.

[384] Valverde R.A., Holzwart K.R. (2017) Sea Turtles of the Gulf of Mexico. In: Ward C. (eds) Habitats and Biota of the Gulf of Mexico: Before the *Deepwater Horizon* Oil Spill. Springer, New York, NY

An expansion of drilling in the Western or Central Gulf Planning Area or the introduction of it in the Eastern Gulf would exacerbate the harms.

2. The Western and Central Gulf should be excluded

The Western and Central Gulf of Mexico should be excluded from the 2019-2024 program. As detailed above and in Section V, oil exploration and exploitation, in particular the *Deepwater Horizon* blowout, has already caused drastic negative economic, environmental, and health consequences in the Gulf that are still being felt today. The Gulf of Mexico cannot afford another disaster like the *Deepwater Horizon* blowout and should not be open to new leasing.

a. The Central and Western Gulf economy

In 2014, tourism and fishing in the Gulf contributed $14.7 billion to the GDP, providing over 330,000 jobs.[385] In the same year, tourism, recreation, and commercial fishing contributed over $6 billion to the GPD of Texas, Mississippi, Louisiana, and Alabama, providing over 138,000 jobs to those coastal states.[386]

Shrimp, as well as pelagic fisheries, provide a particularly high-value contribution to the Central and Western Gulf economy. In 2016, the landed value of shrimp species throughout the Gulf of Mexico came to $413 million.[387] The essential fish habitat (EFH) for shrimp in the Gulf of Mexico is large: it stretches from Texas to the Florida Straits, from the shoreline to ocean floor depths of 100 fathoms in some areas.[388]

In 2016, species managed by the Gulf of Mexico Fishery Management Council (GMFMC) as "coastal migratory pelagics" had a landed value in the Gulf of $6.8 million.[389] This classification includes cobia, king mackerel, and Spanish mackerel. Coastal migratory pelagics' EFH in the Gulf of Mexico spans the entire coastline under GMFMC's jurisdiction to a depth of 100 fathoms.[390]

b. The biological value of the Western and Central Gulf

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[385] National Ocean Economics Program, "Ocean Economy Search Results," Center for the Blue Economy at Middlebury Institute of International Studies at Monterey, *available at* http://oceaneconomics.org/Market/ocean/oceanEconResults.asp?IC=N&dataSource=E&selState=82&selState=89&selCounty=All&selYears=2014&selToYear=none&selSector=2&selSector=6&selIndust=All&selValue=All&selOut=display&noepID=4252.

[386] National Ocean Economics Program, "Ocean Economy Search Results," Center for the Blue Economy at Middlebury Institute of International Studies at Monterey, *available at* http://oceaneconomics.org/Market/ocean/oceanEconResults.asp?IC=N&dataSource=E&selState=1&selState=22&selState=28&selState=48&selCounty=All&selYears=2014&selToYear=none&selSector=2&selSector=6&selIndust=All&selValue=All&selOut=display&noepID=4252

[387] National Ocean Economics Program, "Natural Resources - Commercial Fish Species Search," Center for the Blue Economy at Middlebury Institute of International Studies at Monterey, *available at* http://oceaneconomics.org/LMR/fishSearch.asp.

[388] Southeast Regional Office, "Shrimp Essential Fish Habitat (EFH)," NOAA Fisheries (2014) *map available at* http://sero.nmfs.noaa.gov/maps_gis_data/habitat_conservation/efh_gom/images/shrimp_efh_gom.pdf.

[389] National Ocean Economics Program, "Natural Resources - Commercial Fish Species Search," Center for the Blue Economy at Middlebury Institute of International Studies at Monterey, *available at* http://oceaneconomics.org/LMR/fishSearch.asp.

[390] Southeast Regional Office, "Coastal Migratory Pelagic Resources Essential Fish Habitat (EFH)," NOAA Fisheries (2014) *available at* http://sero.nmfs.noaa.gov/maps_gis_data/habitat_conservation/efh_gom/.

Mississippi Canyon.— As discussed above in Subsection 1b. of this section, it is well established that the Mississippi Canyon in the North-central Gulf constitutes important habitat, and perhaps nursery grounds, for the Gulf's small, biologically distinct population of sperm whales.[391] Canyons are also important habits for numerous species of fish and sharks, and corals in Mississippi Canyon have been found to house egg cases for a species of catshark.[392] Unfortunately, the Canyon was heavily exposed to both oil and dispersants, particularly Corexit 9527 and Corexit 9500A, following the *Deepwater Horizon* blowout in 2010.[393] Given the persistence of oil in the marine environment, the Canyon may be contaminated for decades.[394] Sperm whales sampled in the Canyon during a post-spill biopsy study showed levels of nickel and chromium—two genotoxic metals found in Macondo oil—that were two to five times higher than the global mean for the species.[395]

There are numerous other threatened and endangered species, including five different species of sea turtle, Gulf sturgeon, smalltooth sawfish, and several different coral species inhabiting the Gulf of Mexico.[396] These biologically rich areas should not be exposed to risks from new oil and gas leasing, especially when they are still feeling the effects from the BP spill.

c. Industry interest lags existing opportunities for leasing

As of February 2018, the oil and gas industry has leased over 14.5 million acres of public waters in the Western and Central Gulf of Mexico planning areas.[397] Of those, it's producing in only about 4 million acres, leaving more than 10 million acres of existing leases on the table for development.[398] No more leasing is needed or should be conducted in the Gulf. (It's notable that the Gulf of Mexico Lease Sale 249 on August 16, 2017, the first lease sale under the current Five-Year Leasing Program, generated only light industry interest, with companies bidding on only 90 out over 14,000 blocks.) Instead, there should be accelerated work done, in consultation with communities and workers in the region, helping to ensure that as fossil fuel production ramps down over time, there is a smooth transition that connects the skilled workforce with the clean energy jobs of the future.

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[391] *Supra* notes 370, 372.

[392] Fernandez-Arcaya, U. et. al. 2017. Ecological Role of Submarine Canyons and Need for Canyon Conservation: A Review. *Frontiers in Marine Science.* 4:5. Available at https://www.frontiersin.org/articles/10.3389/fmars.2017.00005/full

[393] E.B. Kujawinski, M.C. Kido Soule, D. L. Valentine, A.K. Boysen, K. Longnecker, and M.C. Redmond, *Fate of dispersants associated with the Deepwater Horizon oil spill*, 45 Environmental Science & Technology 1298–1306 (2011); NOAA, EPA, Department of the Interior, Department of Homeland Security, and University of New Hampshire, Environmental Response Management Application (ERMA) Deepwater Gulf Response (2014) response.restoration.noaa.gov/erma

[394] C.H. Peterson, S.D. Rice, J.W. Short, D. Esler, J.L. Bodkin, B.E. Ballachey, and D.B. Irons, *Long-term ecosystem response to the Exxon Valdez oil spill*, 302 Science 2082-2086 (2003).

[395] J.P. Wise, Jr., J.T.F. Wise, C.F. Wise, S.S. Wise, C. Gianios,, Jr., H. Xie, W.D. Thompson, C. Perkins, C. Falank, and J.P. Wise, Sr., *Concentrations of the genotoxic metals, chromium and nickel, in whales, tar balls, oil slicks, and released oil from the Gulf of Mexico in the immediate aftermath of the Deepwater Horizon oil crisis: Is genotoxic metal exposure part of the Deepwater Horizon legacy?* 48 Environmental Science and Technology 2997-3006 (2014).

[396] NOAA Fisheries: Southeast Region Protected Resources Division. "Gulf of Mexico's Threatened and Endangered Species. Available at http://sero.nmfs.noaa.gov/protected_resources/section_7/threatened_endangered/Documents/gulf_of_mexico.pdf

[397] Bureau of Ocean Energy Management, "Combined Leasing Report" (February 1, 2018) *available at* https://www.boem.gov/2018-02-Lease-Stats/.

[398] *Id.*

For these reasons, there should be now new leasing in the Western or Central Gulf of Mexico.

VII. Regulatory reforms are not fully implemented and crucial safety measures are at risk

Adequate oil safety reforms have not been implemented since the 2010 BP disaster. The bipartisan National Commission on the BP *Deepwater Horizon* disaster found "no less than an overhauling of both current industry practices and government oversight is now required."[399]

The DPP declines to consider an option that defers leasing until regulatory reforms are in place. It claims, "Although there is always the potential for accidents resulting in an oil spill and/or gas release, industry, USCG, BSEE, and BOEM require numerous safeguards for OCS drilling, development, and production operations, which have increased in the post-*Deepwater Horizon* era."[400]

Yet many of the fundamental recommendations have not yet been implemented, and those that have been are being targeted for rollback or repeal. President Trump in April 2017 issued an Executive Order, "Implementing an America-First Offshore Energy Strategy," which directed various agencies to take steps to weaken regulations governing offshore oil exploration and exploitation.[401] Among others, the executive order directs reconsideration and revision of the Well Control Rule designed to help prevent another BP-type disaster.

Co-chairmen of the National Commission on the BP *Deepwater Horizon* Oil Spill and Offshore Drilling recently commented on the executive order, "President Trump's April 28 executive order on offshore energy threatens to abolish [the few] safety improvements [put into place since the BP spill] … [t]he commission members are unanimous in their view that the actions proposed in the president's executive order are unwise."[402] Further it has been noted that "… the industry has tended to focus on the kind of day-to-day accidents [*e.g.*, slips and falls, routine hazards] that are easy both to measure and to resolve … But they don't … do much to reduce the risk of a catastrophic accident like the one that destroyed the *Deepwater Horizon* … it's less clear that the industry has learned the deeper lesson about preventing low-probability events."[403]

The Interior Department Bureau of Safety and Environmental Enforcement's (BSEE) December 29, 2017 Proposed Rule, appearing at 82 Fed. Reg. 61703, would significantly revise and weaken the Oil

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[399] National Oil Spill Commission Report, *supra* n. 143 p. 293

[400] Draft Proposed Program, p. 7-37

[401] Executive Order, "Implementing an America-First Offshore Energy Strategy" https://www.boem.gov/Executive-Order-13795/

[402] Graham, Bob and William K. Reilly, "Trump's Risky Offshore Oil Strategy," *New York Times*, July 5, 2017, https://www.nytimes.com/2017/07/05/opinion/trump-oil-drilling-energy-gulf.html.

[403] Casselman, Ben. "Five Years After the BP Oil Spill, the Industry Is Still Taking Big Risks," *FiveThirtyEight*, April 20, 2015, https://fivethirtyeight.com/features/five-years-after-the-bp-oil-spill-the-industry-is-still-taking-big-risks/.

and Gas Sulphur Operations on the OCS – Oil and Gas Production Safety Systems Rule.[404] The rule proposes eliminating several of the safety precautions recommended by the BP Oil Spill Commission, including third party certification of safety equipment. It also incorporates weak industry standards as its own regulatory safety standards, essentially undermining the entire federal regulatory system.[405]

New leasing is not only not needed for United States energy security, but with safety recommendations from the National Commission and other expert bodies not fully implemented, and crucial safety rules under attack, it is entirely too risky to our coastal communities and economies. The Proposed Program should not open any new areas to leasing.

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Sincerely,

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[404] Bureau of Safety and Environmental Enforcement. BSEE Proposes Revisions to Production Safety Systems Regulations, December 28, 2017. https://www.bsee.gov/newsroom/latest-news/statements-and-releases/press-releases/bsee-proposes-revisions-to-production

[405] NRDC comments on RIN 1014-AA37

Appendix A: Environmental Impacts of Seismic Surveys

1. Environmental Impacts of Seismic Surveys on Marine Mammals

The impacts of airgun surveys are felt by many marine mammal species on an extraordinarily wide geographic scale, including by baleen and sperm whales, whose vocalizations and acoustic sensitivities overlap most extensively with the enormous low-frequency energy that airguns put in the water. In baleen whales, for example, seismic airguns have repeatedly been shown to disrupt behaviors essential to foraging and mating over vast areas of the ocean, on the order in some cases of 100,000 square kilometers and greater, and across a wide range of behavioral contexts (foraging, breeding, and migrating).[406] Notably, recent work on western North Pacific gray whales has linked seismic exploration, together with shore-based piling, to significant reductions in the probability of calf survival—by about two standard deviations—in that endangered baleen whale population.[407] In sperm whales, airguns have been demonstrated to compromise foraging success at moderate levels of exposure on important feeding grounds; in some areas, it has been found to silence the species over great distances.[408] As numerous commentators have observed, such impacts experienced repeatedly and at the geographic scale of populations can accumulate to population-level harm.[409]

Similarly, seismic surveys are known to elevate background levels of noise, masking conspecific calls and other biologically important signals, compromising the ability of marine wildlife to communicate, feed, find mates, and engage in other vital behavior.[410] The intermittency of airgun pulses hardly mitigates this effect since their acoustic energy spreads over time and can sound

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[406] *E.g.*, Castellote, M., Clark, C.W., and Lammers, M.O., Acoustic and behavioural changes by fin whales (Balaenoptera physalus) in response to shipping and airgun noise, *Biological Conservation* 147: 115-122 (2012); Cerchio, S., Strindberg, S., Collins, T., Bennett, C., and Rosenbaum, H., Seismic surveys negatively affect humpback whale singing activity off Northern Angola, *PLoS ONE* 9(3): e86464 (2014); Blackwell, S.B., Nations, C.S., McDonald, T.L., Thode, A.M., Mathias, D., Kim, K.H., Greene, C.R., Jr., and Macrander, M., Effects of airgun sounds on bowhead whale calling rates: Evidence for two behavioral thresholds, *PLoS ONE* 10(6): e0125720 (2015).

[407] Cooke, J.G., Weller, D.W., Bradford, A.L., Sychenko, O., Burdin, A.M., Lang, A.R., and Brownell, R.L., Jr., Updated population assessment of the Sakhalin gray whale aggregation based on the Russia-US photoidentification study at Piltun, Sakhalin, 1994-2014 (Nov. 2015) (Western Gray Whale Advisory Panel Doc. WGWAP/16/17).

[408] *E.g.*, Miller, P.J.O., Johnson, M.P., Madsen, P.T., Biassoni, N., Quero, M. and Tyack, P.L., Using at-sea experiments to study the effects of airguns on the foraging behavior of sperm whales in the Gulf of Mexico, *Deep-Sea Research I* 56: 1168-1181 (2009); Bowles, A.E., Smultea, M., Wursig, B., DeMaster, D.P., and Palka, D., Relative abundance and behavior of marine mammals exposed to transmissions from the Heard Island Feasibility Test, *Journal of the Acoustical Society of America* 96: 2469-2484 (1994).

[409] *E.g.*, Clark, C.W., and Gagnon, G.C., Considering the temporal and spatial scales of noise exposures from seismic surveys on baleen whales (2006) (IWC Sci. Comm. Doc. IWC/SC/58/E9); Parsons, E.C.M., Dolman, S.J., Jasny, M., Rose, N.A., Simmonds, M.P., and Wright, A.J., A critique of the UK's JNCC seismic survey guidelines for minimising acoustic disturbance to marine mammals: Best practice? *Marine Pollution Bulletin* 58: 643-651 (2009); Nowacek, D.P., Clark, C.W., Mann, D., Miller, P.J., Rosenbaum, H.C., Golden, J.S., Jasny, M., Kraska, J., Southall, B.L., Marine seismic surveys and ocean noise: Time for coordinated and prudent planning, *Frontiers in Ecology and the Environment* 13(7): 378-386 (2015).

[410] Nieukirk, S.L., Mellinger, D.K., Moore, S.E., Klinck, K., Dziak, R.P., and Goslin, J., Sounds from airguns and fin whales recorded in the mid-Atlantic Ocean, 1999-2009, *Journal of the Acoustical Society of America* 131: 1102-1112 (2012).

virtually continuous at distances from the array.[411] Indeed, the enormous scale of this acoustic footprint in some locations has been confirmed by studies in many regions of the globe, including the Arctic, the northeast Atlantic, Greenland, and Australia, where it has been shown to raise ambient noise levels and mask whale calls from distances of thousands of kilometers.[412] Even in the Gulf of Mexico, where complex bathymetry can limit acoustic propagation, cumulative ambient noise metrics are elevated in some areas from surveys taking place as far as 500 kilometers away, according to a recent NOAA-directed modeling effort.[413] The agency's analysis found that seismic surveys have substantially reduced the sensory range available to virtually all marine mammal species there.[414]

In short, the biological impacts of seismic surveys include, but are not limited to:[415]

- *Disruption of essential vocalizations*. Seismic airgun noise can cause whales to stop producing vocalizations essential to breeding success, individual and cooperative foraging, predator avoidance, and mother-calf interactions.[416]
- *Direct disruption of foraging*. Seismic airgun noise can disrupt feeding behavior and significantly reduces foraging success even in whales that are frequently exposed to airgun noise.[417]
- *Masking and loss of communication space.* Seismic airgun noise can shrink the space whales need to communicate with their conspecifics, interfering over a vast scale with foraging,

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[411] *Id.*; Guerra, M., Thode, A.M., Blackwell, S.B., Macrander, A.M., Quantifying seismic survey reverberation off the Alaskan North Slope, *Journal of the Acoustical Society of America* 130: 3046-3058 (2011).
[412] Gedamke, J., Ocean basin scale loss of whale communication space: potential impacts of a distant seismic survey, Biennial Conference on the Biology of Marine Mammals, November-December 2011, Tampa, FL (2011) (abstract); Nieukirk, S.L., et al., Sounds from airguns and fin whales, *supra* n. 410; Nieukirk, S.L., et al. Low-frequency whale and seismic airgun sounds, *supra* n. 90; Roth, E.H., Hildebrand, J.A., Wiggins, S.M., and Ross, D., Underwater ambient noise on the Chukchi Sea continental slope, *Journal of the Acoustical Society of America* 131: 104-110 (2012).
[413] BOEM, Gulf of Mexico OCS Proposed Geological and Geophysical Activities Draft Programmatic Environmental Impact Statement, at K-19 (2016) (NMFS-directed study of cumulative and chronic efforts of geophysical surveys in the Gulf of Mexico). Available at https://www.boem.gov/BOEM-EIS-2016-049-v3/
[414] *Id.* at K-28 to K-31.
[415] For a general review of seismic impacts on marine mammals, see Weilgart, L., A review of the impacts of seismic airgun surveys on marine life (2013) (submitted to the Convention on Biological Diversity Expert Workshop on Underwater Noise and Its Impacts on Marine and Coastal Biodiversity, 25-27 Feb. 2014, London, UK); *see also* Weilgart, L.S., The impacts of anthropogenic ocean noise on cetaceans, *supra* n. 274.
[416] *E.g.*, McDonald, M.A., Hildebrand, J.A. and Webb, S.C., Blue and fin whales observed on a seafloor array in the Northeast Pacific, *J. Acoustical Soc'y of America* 98: 712-21 (1995); Di Iorio, L., and Clark, C.W., Exposure to seismic survey alters blue whale acoustic communication, *Biology Letter* 6: 51–54 (2010); Castellote, M., et al., Acoustic and behavioral changes by fin whales, *supra* n. 406; Blackwell, S.B., et al., Effects of airgun sounds on bowhead whale calling rates, *supra* n. 406; Cerchio S., et al. Seismic surveys negatively affect humpback whale singing activity, *supra* n. 406.
[417]*E.g.*, Miller, P.J.O., Using at-sea experiments to study the effects of airguns, *supra* n. 408. *See also* Pirotta, E., Brookes, K.L., Graham, I.M. and Thompson, P.M., Variation in harbour porpoise activity in response to seismic survey noise, *Biology Letters* 10(5): 20131090 (2014); Isojunno, S., Curé, C., Kvadsheim, P.H., Lam, F.-P.A., Tyack, P.L., Wensveen, P.J., and Miller, P.J.O., Sperm whales reduce foraging effort during exposure to 1-2 kHz sonar and killer whale sounds, *Ecological Applications* 26(1): 77-93 (2016).

breeding, mother-calf contact, and other essential behavior. The noise also interferes with the animals' ability to hear other biologically important sounds.[418]

- *Large-scale habitat avoidance or abandonment.* Seismic airgun noise can displace marine mammals from preferred feeding, breeding, and migratory habitat, over both the short- and long-term, with potentially serious energetic consequences.[419]
- *Startle response and sensitization.* Seismic airgun blasts, with their extremely rapid onset time, can induce a startle response, sensitizing animals to sound and causing longer-term avoidance.[420]
- *Impacts on prey species.* Seismic airgun noise can kill, injure, and disrupt the behavior of marine mammal prey species, from zooplankton to fish.[421]
- *Temporary and permanent hearing loss.* Seismic airgun noise can induce temporary or permanent hearing loss, impairing the animals' ability to feed, breed, and communicate.[422]
- *Increased injury and mortality risk.* Seismic airgun noise can exacerbate the risk of marine mammal stranding and vessel collision, of mother-calf separation, and of other mechanisms of injury and mortality.[423]
- *Physiological stress.* Seismic airgun noise can induce acute and, over time, chronic physiological stress, which may compromise the health of individual marine mammals and reduce reproductive success.[424]

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[418] *E.g.*, Clark, C.W., Ellison, W.T., Southall, B.L., Hatch, L., Van Parijs, S.M., Frankel, A., and Ponirakis, D., Acoustic masking in marine ecosystems: intuitions, analysis, and implication, *Marine Ecology Progress Series* 395: 201-222 (2009); Hatch, L.T., Wahle, C.M., Gedamke, J., Harrison, J., Laws, B., Moore, S.E., Stadler, J.H., and van Parijs, S.M., Can you hear me here? Managing acoustic habitat in U.S. waters, *Endangered Species Research* 30: 171-186 (2016).

[419] *E.g.*, Bain, D.E. and Williams, R., Long-range effects of airgun noise on marine mammals: Responses as a function of received sound level and distance (2006) (IWC Sci. Comm. Doc. IWC/SC/58/E35); Clark C.W., and Gagnon, G.C., Considering the temporal and spatial scales of noise exposures, *supra* n. 409; Rosel, P.E., and Wilcox, L.A., Genetic evidence reveals a unique lineage of Bryde's whales in the northern Gulf of Mexico, *Endangered Species Research* 25: 19-34 (2014).

[420] *E.g.*, Götz, T., and Janik, V.M., Repeated elicitation of the acoustic startle reflex leads to sensitisation in subsequent avoidance behaviour and induces fear conditioning, *BMC Neuroscience* 12: 30 (2011).

[421] *E.g.*, McCauley, R.D., Day, R.D., Swadling, K.M., Fitzgibbon, Q.P., Watson, R.A., and Semmens, J.A., Widely used marine seismic survey air gun operations negatively impact zooplankton, *Nature Ecology & Evolution* 1: art. 0195 (2017); Aguilar de Soto, N., Delorme, N., Atkins, J., Howard, S., Williams, J., and Johnson, M., Anthropogenic noise causes body malformations and delays development in marine larvae, *Scientific Reports* 3: art. 2831 (2013).

[422] *E.g.*, Lucke, K., Siebert, U., Lepper, P.A., and Blanchet, M.-A., Temporary shift in masked hearing thresholds in a harbor porpoise (*Phocoena phocoena*) after exposure to seismic airgun stimuli, *Journal of the Acoustical Society of America* 125: 4060-4070 (2009); NMFS, Technical guidance for assessing the effects of anthropogenic sound on marine mammal hearing: Underwater acoustic thresholds for onset of permanent and temporary threshold shifts (2016) (NOAA Tech. Memo. NMFS-OPR-55).

[423] *E.g.*, Hildebrand, J.A., Impacts of anthropogenic sound, *supra* n. 61; Nowacek, D.P., Johnson, M.P., and Tyack, P.L., Right whales ignore ships but respond to alarm stimuli, *Proceedings of the Royal Society of London, Pt. B: Biological Sciences* 271: 227-231 (2004); Cooke, J.G., et al., Updated population assessment of the Sakhalin gray whale aggregation, *supra* n. 407; Gray, H., and Van Waerebeek, K., Postural instability and akinesia in a pantropical spotted dolphin, *Stenella attenuate*, in proximity to operating airguns of a geophysical seismic vessel, *Journal for Nature Conservation* 19: 363-67 (2011).

[424] *E.g.*, Rolland, R.M., Parks, S.E., Hunt, K.E., Castellote, M., Corkeron, P.J., Nowacek, D.P., Wasser, S.K. and Kraus, S.D., Evidence that ship noise increases stress in right whales, *Proceedings of the Royal Soc'y. B* 279(1737): 2363-2368 (2012).

- *Loss in cetacean biodiversity.* Seismic airgun noise is associated over the long term with a loss in the biodiversity of cetacean species.[425]

Beyond airguns, other sources of noise used in OCS oil and gas development, such as drilling, dynamic positioning, vessel transit, infrastructure construction and decommissioning, and high-resolution geophysical surveys, are known to impact marine wildlife, including marine mammals. Some of these sources were previously thought to be of small concern given their acoustic specifications or their comparatively low power or higher-frequency output compared with seismic airgun arrays. For example, a relatively low-frequency (center carrier frequency of 12 kHz) multibeam echosounder, employed by Exxon, was found to be the "most plausible and likely behavioral trigger" of a mass stranding of melon-headed whales on Madagascar, in 2008. Even though echosounders are directed towards the seafloor, such equipment could still easily propagate noise at levels above 120 decibels—a level frequently associated with the onset of significant behavioral impacts in some marine mammal species—over a greater than 30 km radius, as a report on the Madagascar strandings found.[426]

With the development of compact data tags[427] and the continued refinement of locational passive acoustic monitoring, research scientists can now detect and track animals over greater periods of time and across longer distances, allowing them to retrieve a continuous account of the tracked animal's response to a disruptive stimulus or document changes in the vocalizations of multiple animals over, in some cases, very large scales. With this expanded access to data, scientists are finding that behavioral disruptions are occurring at much lower noise exposure levels than what BOEM, following the National Marine Fisheries Service, currently accepts as the threshold for behavioral impacts,[428] and at much larger distances than what onboard Marine Mammal Observers are capable of observing. These lower exposure levels and wider disturbance areas are particularly pertinent to OCS oil and gas development activities, given the likelihood of multiple and concurrent seismic airgun surveys and the additional physical disturbance and harassment resulting over time from drilling, offshore construction and demolition, and increased vessel traffic.

For these reasons and others, a group of seventy-five marine scientists considering the impacts of seismic surveys on marine species on the Atlantic OCS concluded that the introduction of extensive seismic prospecting "is likely to have significant, long-lasting, and widespread impacts on the reproduction and survival of… marine mammal populations in the region."[429] Their expert

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[425] Parente, C.L., Araújo, J.P., and Araújo, M.E., Diversity of cetaceans as tool in monitoring environmental impacts of seismic surveys, *Biota Neotropica* 7(1): 49-55 (2007). *See also* Shannon, G., McKenna, M.F., Angeloni, L.M., Crooks, K.R., Fristrup, K.M., Brown, E., Warner, K.A., Nelson, M.D., White, C., Briggs, J., McFarland, S., and Wittemyer, G., A synthesis of two decades of research documenting the effects of noise on wildlife, *Biological Reviews* 91: 982-1005 (2016).

[426] Southall, B.L., Rowles, T., Gulland, F., Baird, R. W., and Jepson, P.D., Final report of the Independent Scientific Review Panel investigating potential contributing factors to a 2008 mass stranding of melon-headed whales (*Peponocephala electra*) in Antsohihy, Madagascar (2013) (BOEM-sponsored investigation).

[427] Data tags or "DTAGS" are data-logging devices that are attached to animals to record conditions such as depth, acoustical exposure, vector, temperature, and chemical conditions. Once fixed to a subject animal, DTAGS can intimately record the animal's responses to environmental conditions such as noise exposure.

[428] $160dB_{RMS}$ re: 1µPa for behavioral disruption for impulsive noise (e.g., impact pile driving), $120dB_{RMS}$ re: 1µPa for behavioral disruption for non-pulse noise (e.g., vibratory pile driving, drilling).

[429] Statement from C. Clark et al. and 74 other marine scientists (Mar. 5, 2015), *supra* n. 87.

assessment was that a "negligible impact" finding, *i.e.*, a finding that these activities would have "only a negligible impact on marine species and populations," is "not supported by the best available scientific evidence.

2. Environmental Impacts of Seismic Surveys on Fish and Invertebrates

The past decade has seen expansive research on the impacts of anthropogenic noise on fish and invertebrates, which are far more available to study than marine mammals. As a consequence, the literature is now replete with papers demonstrating a wide range of impacts, on a wide range of taxa, from seismic airgun noise and continuous low-frequency noise. In summary, the best available science indicates the impacts of seismic on marine mammal prey species will:

- Cause harm to a wide variety of fish and marine invertebrate species, over massive geographic areas, in both the immediate and long term;
- Result in a wide range of impacts to individuals and populations, including mortality and physical injury, impairment of hearing and other vital sensory functions, compromised health, reductions in recruitment, and changes to natural behaviors and acoustic masking of biologically important sounds that may reduce reproductive potential and foraging success and increase the risk of predation; and
- Potentially result in ecosystem-level effects, with concomitant impacts on marine mammals, by significantly reducing the abundance and diversity of zooplankton over vast areas and inducing changes in community composition due to the aggregation of individual- and population-level impacts across multiple fish and invertebrate species.

More specifically, impulsive noise from seismic airgun blasts:

i. *Causes severe physical injury and mortality*. Research into the impacts of exposure to pile driving (which generates similar acute, high-intensity, low-frequency sound as seismic operations) has shown substantial damage to the internal organs of fish, including the swim bladder, liver, kidney, and gonads.[430] For marine invertebrates, exposure to near-field low-frequency sound may cause anatomical damage. Strikingly, zooplankton abundance was found to decline by up to 50% (in 58% of the species examined) up to three quarters of a mile from a single airgun source (volume: 150 cubic inches) in the 24 hours following exposure; krill larvae were completely wiped out.[431] Pronounced sensory organ ("statocyst") and internal organ damage was observed in seven

[430] Casper, B.M., Popper, A.N., Matthews, F., Carlson, T.J., and Halvorsen, M.B., Recovery of barotrauma injuries in Chinook salmon, *Oncorhynchus tshawytscha,* from exposure to pile driving sound, *PLoS ONE* 7(6): e39593 (2012); Halvorsen, M.B., Casper, B.M., Woodley, C.M., Carlson, T.J., and Popper, A.N., Threshold for onset of injury in Chinook salmon from exposure to impulsive pile driving sounds, *PLoS ONE* 7(6): e38968 (2012); Casper, B.M., Halvorsen, M.B., Matthews, F., Carlson, T.J., and Popper, A.N., Recovery of barotrauma injuries resulting from exposure to pile driving sound in two sizes of hybrid striped bass, *PLoS ONE* 8(9): e73844 (2013); Halvorsen, M.B., Zeddies, D.G., Chicoine, D., and Popper, A.N., Effects of low-frequency naval sonar exposure on three species of fish, *Journal of the Acoustical Society of America* 134: EL205-EL210 (2013); Halvorsen, M.B., Casper, B.M., Carlson, T.J., and Popper, A.N., Presentation at Oceanoise2017 Conference (May 8-12, 2017).
[431] McCauley, R.D., et al., Widely used marine seismic survey air gun operations negatively impact zooplankton, Nature Ecology and Evolution 1(7): 195. June 22, 2017.

stranded giant squid after nearby seismic surveys.[432] Exposure of scallops to seismic signals was found to significantly increase mortality, particularly over long periods of time after exposure.[433]

ii. *Damages the hearing and sensory abilities of fish and marine invertebrates*. For fish, the high-intensity of airgun emissions may damage hair cells and cause changes in associated hearing capabilities. Exposure to repeated emissions of a single airgun caused extensive damage to the sensory hair cells in the inner ear of the caged pink snapper; the damage was so severe that no repair or replacement of hair cells was observed for up to 58 days after exposure.[434] Airgun exposure was found to cause damaged statocysts in rock lobsters and spiny lobsters up to a year following exposure.[435] It was hypothesized that the devastating impacts of a single seismic airgun on zooplankton was, at least in part, due to severe statocyst damage.[436]

iii. *Impedes development of early life history stages.* Early life history stages of some groups of fish and invertebrates may be more susceptible to the impacts of underwater noise. Exposure to a single seismic airgun resulted in complete mortality of krill larvae up to three quarters of a mile from the source.[437] Repeated exposure to nearby seismic sound caused slower development rates in the larvae of crabs[438] and scallops.[439] Lesions on the statocysts of squid and cuttlefish appeared 48 hours following noise exposure in adults, whereas the same degree of damage was observed immediately after exposure in hatchlings.[440]

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[432] Guerra, Á., González, Á.F., and Rocha F., A review of the records of giant squid in the north-eastern Atlantic and severe injuries in *Architeuthis dux* stranded after acoustic explorations, *ICES CM* 200: 29 (2004).
[433] Day, R.D., McCauley, R.D., Fitzgibbon, Q.P, Hartmann, K., and Semmens, J.M., Exposure to seismic air gun signals causes physiological harm and alters behavior in the scallop *Pecten fumatus*, *PNAS* 114: E8537-E8546 (2017); see also Day, R.D., McCauley, R., Fitzgibbon, Q.P., and Semmens, J.M., Assessing the impact of marine seismic surveys on Southeast Australian scallop and lobster fisheries (2016) (Fisheries Research & Development Corporation Report 2012-008-DLD).
[434] McCauley R.D., et al., High intensity anthropogenic sound damages fish ears, The Journal of the Acoustic Society of America, 113(1): 638 (2003).
[435] Day, R.D., et al., Assessing the impact of marine seismic surveys on Southeast Australian scallop and lobster fisheries, *supra* n. 433; J. Semmens, R.D. Day, Q.P. Fitzgibbon, K. Hartmann, and C. J. Simon, "Are seismic surveys putting bivalve and spiny lobster fisheries at risk," Presentation at Oceanoise 2017 Conference, Vilanova I la Geltru, Barcelona, Spain, 8-12 May, 2017. *Available at (pg. 92):* http://oceanoise2017.com/wp-content/uploads/2017/05/OCEANOISE2017_AbstractBooklet_online.compressed.pdf.
[436] McCauley, R.D., et al., Widely used marine seismic survey air gun operations negatively impact zooplankton, *supra* n. 431.
[437] *Id*.
[438] Christian, J.R., Mathieu, A., Thompson, D.H., White, D., and Buchanan, R.A., Effect of seismic energy on snow crab (*Chionoecetes opilio*) (2003) (Environmental Studies Research Fund File No. CAL-1-00364).
[439] Aguilar de Soto, N., et al., Anthropogenic noise causes body malformations and delays development in marine larvae, *supra* n. 421.
[440] Solé, M., Lenoir, M., Fortuño, J.M., van der Schaar, M., and André, M., Presentation at Oceanoise2017 Conference: Sensitivity to sound of cephalopod hatchlings (May 8-12, 2017).

iv. *Induces stress that physically damages marine invertebrates and compromises fish health*. Experimental seismic noise has been shown to affect primary stress hormones (adrenaline and cortisol) in Atlantic salmon[441] and European seabass have shown elevated ventilation rates, indicating heightened stress, in response to seismic surveys;[442] elevated stress hormones and chemicals have also been recorded in sea bass following airgun exposure.[443] Invertebrates may exhibit common immune suppression and compromised ability to maintain homeostasis, with similar responses observed in scallops and spiny lobsters up to 120 days post-exposure,[444] potentially affecting the long-term health of associated fisheries.[445]

v. *Causes startle and alarm responses that interrupt other vital behaviors, such as feeding and reproduction.* Airgun discharges elicit varying degrees of startle and alarm responses in fish, including escape responses and changes in schooling patterns, water column positions, and swim speeds.[446] Startle and alarm responses have been observed in captive fish several kilometers from the sound source, with European sea bass and the lesser sand eel responding at

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441 Sverdrup, A., Kjellsby, E., Krüger, P., Fløysand, R., Knudsen, F., Enger, P., Serck-Hanssen, G., and Helle, K., Effects of experimental seismic shock on vasoactivity of arteries, integrity of the vascular endothelium and on primary stress hormones of the Atlantic salmon, *Journal of Fish Biology* 45: 973-995 (1994).

442 Radford, A.N., Lèbre, L., Lecaillon, G., Nedelec, S.L., and Simpson, S.D., Repeated exposure reduces the response to impulsive noise in European seabass, *Global Change Biology* 22: 3349-3360 (2016).

443 Santulli, A., Modica, A., Messina, C., Ceffa, L., Curatolo, A., Rivas, G., Fabi, G., and D'Amelio, V., Biochemical responses of European sea bass (*Dicentrarchus labrax* L) to the stress induced by offshore experimental seismic prospecting, *Marine Pollution Bulletin* 38: 1105-1114 (1999).

444 Day, R.D., et al., Exposure to seismic air gun signals causes physiological harm and alters behavior, *supra* n. 433; Day, R.D., et al., Assessing the impact of marine seismic surveys on Southeast Australian scallop and lobster fisheries, *supra* n. 433; Semmens, J., et al., Presentation at Oceanoise2017 Conference: Are seismic surveys putting bivalve and spiny lobster fisheries at risk? *supra* n. 435.

445 Day, R.D., et al., Assessing the impact of marine seismic surveys on Southeast Australian scallop and lobster fisheries, *supra* n. 433.

446 Skalski, J.R., et al., Effects of sounds from a geophysical survey device on catch-per-unit-effort, *supra* n. 114; Santulli, A., Modica, A., Messina, C., Ceffa, L., Curatolo, A., Rivas, G., Fabi, G., and D'Amelio, V., Biochemical responses of European sea bass (*Dicentrarchus labrax* L) to the stress induced by offshore experimental seismic prospecting," *Marine Pollution Bulletin* 38: 1105-1114 (1999); Wardle, C.S., Carter, T.J., Urquhart, G.G., Johnstone, A.D.F., Ziolkowski, A.M., Hampson, G., and Mackie, D., Effects of seismic air guns on marine fish, *Continental Shelf Research* 21: 1005-1027 (2001); Hassel, A., Knutsen, T., Dalen, J., Skaar, K., Løkkeborg, S., Misund, O.A., Østensen, Ø., Fonn, M., and Haugland, E.K., Influence of seismic shooting on the lesser sandeel (*Ammodytes marinus*), *ICES Journal of Marine Science* 61: 1165-1173 (2004); Boeger, W.A., Pie, M.R., Ostrensky, A., and Cardoso, M.F., The effect of exposure to seismic prospecting on coral reef fishes, *Brazilian Journal of Oceanography* 54: 235-239 (2006); Fewtrell, J.L., and McCauley, R.D., Impact of air gun noise on the behavior of marine fish and squid, *Marine Pollution Bulletin* 64: 984-993 (2012); Hansen, R., Silve, L.D., Karlsen, H.E., and Handegaard, N.O., Presentation at Oceanoise2017 Conference: Playback of seismic airgun signals and infrasound elicit evasive swimming responses in the Atlantic mackerel (*Scomber scombrus*) (May 8-12, 2017); Forland, T.N., Hansen, R.H., Karlsen, H.E., Kvadsheim, P.H., Andersson, M., Linné, M., Grimsbí, E., and Silve, L.D., Presentation at Oceanoise2017 Conference: Behavior of penned Atlantic mackerel exposed to increasing levels of seismic airgun pulses (May 8-12, 2017).

distances up to 2.5 and 5 km from a seismic source, respectively.[447] Startle responses are also commonly observed in marine invertebrates; jetting and inking – behaviors typically induced by ambush predators – have been observed in squid;[448] scallops have shown a distinctive flinching response in response to airgun signals and persistent alterations in reflex behavior following exposure;[449] and oysters close their valves and stop feeding.[450] Field studies suggest that airgun exposure can lead to schools of fish to move lower in the water column[451] and squid have been observed to shelter in the quiet area near the ocean surface.[452]

Seismic noise can also cause significant shifts in distribution that may compromise life history behaviors. For example, during seismic surveying, with the survey vessel no closer than 9 kilometers, reef fish abundance on the inner continental shelf of North Carolina declined by 78% during evening hours when fish habitat use was usually highest.[453] Observed effects on the catch and abundance of commercially important fish species, described in Subsection D below, are indicative of significant shifts in horizontal and vertical distribution, in some cases over large areas of ocean.

vi. *Alters predator avoidance behaviors that may reduce probability of survival.* Airgun exposure may have population-level implications if predation rates increase due to sound-induced behavioral changes. Scallops, rock lobster, and spiny lobster were slower to right themselves after exposure to airguns, increasing their chance of mortality from predation.[454] Some fish and

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[447] Santulli, A., et al., Biochemical responses of European sea bass (*Dicentrarchus labrax* L) to the stress induced by offshore experimental seismic prospecting, *supra* n. 446; Hassel, A., et al., Influence of seismic shooting on the lesser sandeel, *supra* n. 446.
[448] Fewtrell, J.L., and McCauley, R.D., Impact of air gun noise on the behavior of marine fish and squid, *supra* n. 446; Samson, J.E., Mooney, T.A., Gussekloo, S.W.S., and Hanlon, R.T., Graded behavioral responses and habituation to sound in the common cuttlefish *Sepia officinalis, Journal of Experimental Biology* 217: 4347-4355 (2014); Mooney, T.A., Samson, J.E., Schlunk, A.D., and Zacarias, S., Loudness-dependent behavioural responses and habituation to sound by the longfin squid (*Doryteuthis pealeii*), *Journal of Comparative Physiology A* 202(7): 489-501 (2016).
[449] Day, R.D., et al., Exposure to seismic air gun signals causes physiological harm and alters behavior, *supra* n. 433; Day, R.D., et al., Assessing the impact of marine seismic surveys on Southeast Australian scallop and lobster fisheries, *supra* n. 433.
[450] Charifi, M., Sow, M., Ciret, P., Benomar, S., and Massabuau, J.-C., The sense of hearing in the Pacific oyster, *Magallana gigas*, *PLoS ONE* 12: e0185353 (2017).
[451] Chapman, C. and Hawkins, A., The importance of sound in fish behavior in relation to capture by trawls, *FAO Fisheries and Aquaculture Report* 62(3): 717-718 (1969); Slotte, A., et al., Acoustic mapping of pelagic fish distribution and abundance in relation to a seismic shooting area, *supra* n. 115.
[452] McCauley, R.D., et al., Marine seismic surveys: Analysis and propagation of air-gun signals; and effects of air-gun exposure on humpback whales, sea turtles, fishes, and squid. Prepared for Australian Petroleum Production Exploration Association, *supra*.
[453] Paxton, A.B., Taylor, J.C., Nowacek, D.P., Dale, J., Cole, E., Voss, C.M., and Peterson, C.H., Seismic survey noise disrupted fish use of a temperate reef, *Marine Policy* 78: 68-73 (2017).
[454] Day, R.D., et al., Exposure to seismic air gun signals causes physiological harm and alters behavior, *supra* n. 433; Day, R.D., et al., Assessing the impact of marine seismic surveys on Southeast Australian scallop and lobster

invertebrates may become habituated to sound and show fewer responses over exposure trials;[455] however, habituation may also make individuals less sensitive to predatory cues and increase their vulnerability to predation.

The biological impact of continuous low frequency noise, which is produced by seismic surveys over long distances:

i. *Damages the hearing and sensory abilities of fish and marine invertebrates.* Continuous noise physically damages hair cells in fish ears456 and the "statocysts" of marine invertebrates, including octopus, squid, and cuttlefish, that are responsible for their balance and position.457 This damage can lead to permanent or temporary hearing loss in both groups.458 Young individuals appear to be most sensitive; three species of cephalopod hatchlings showed more severe lesions in less time (almost immediately after sound exposure) than adults.459 Even temporary loss of hearing or sensory capability can compromise an individual's chance of survival and the important role that they play in the larger marine ecosystem.

ii. *Induces stress that physically damages marine invertebrates and compromises fish health*. When exposed to continuous noise, marine invertebrates, including

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fisheries, *supra* n. 433; Semmens, J., et al., Presentation at Oceanoise2017 Conference: Are seismic surveys putting bivalve and spiny lobster fisheries at risk? *supra* n. 435.

[455] Fewtrell, J.L. and McCauley, R.D., Impact of air gun noise on the behaviour of marine fish and squid, *supra* n. 446; Samson, J.E., et al., Graded behavioral responses and habituation to sound in the common cuttlefish, *supra* n. 448; Mooney, T.A., et al., Loudness-dependent behavioural responses and habituation to sound by the longfin squid, *supra* n. 448.

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prawns and mussels, produce stress chemicals that degrade their DNA, alter gene expression, damage proteins, and elicit an immune response.[460] Fish exhibit increases in ventilation and metabolic rate[461] and release stress chemicals, such as cortisol, [462] following noise exposure. Noise-induced cortisol exposure can compromise the long-term health of the individual.[463]

iii. *Masks important biological sounds essential to survival*. Many fish communicate using frequency ranges that overlap least with the natural background noise of the ocean.[464] Similarly, the sensory systems of marine invertebrates are attuned to natural background noise conditions. Continuous noise pollution raises the background noise level and reduces the distance over which individuals of a species can communicate with one another,[465] which can have negative consequences for survival and reproduction.

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iv. *Reduces reproductive success, potentially jeopardizing the long-term sustainability of fish populations*. Noise can mask courtship vocalizations necessary for successful mating[466] and can also disrupt other social behaviors such as nest-digging, antipredator defense, and other social interactions necessary to successfully rear young.[467] Gobies and damselfish spend less time caring for their nests under noisy conditions,[468] and common goby males exposed to noise had significantly fewer egg clutches and eggs hatched earlier than under ambient conditions.[469] Nesting success of the oyster toadfish was significantly lower in areas where their mating calls were masked.[470] In Atlantic cod, exposure to noise during spawning resulted in a significant reduction in total egg production and fertilization rates, which reduced the total production of viable embryos by over 50%.[471] Startle responses and faster yolk sac consumption have been observed in newly hatched Atlantic cod, which then grew to a smaller size than hatchlings not exposed to noise; this demonstrates that noise can impact survival related measures during development.[472]

v. *Interrupts feeding behaviors and induces other species-specific effects that may increase the risk of starvation, reduce reproduction, and alter community structure*. Increased noise has been found to lead to significantly less foraging

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activity in fish, as individuals are startled,[473] take shelter,[474] or undertake an escape response.[475] The common cockle also suspends feeding and buries deeper into the sand in response to noise.[476] Disturbance from noise can force fish to feed at night when prey availability is also lowest,[477] which also result in an altered and likely sub-optimal diet composition.[478] In cases where fish and crabs are still able to locate prey, noise results in an increase in food handling errors and a reduced ability to discriminate between food and non-food items, consistent with a shift in attention.[479] Interruption of natural behaviors may, over the long-term, disrupt important ecosystem processes, such as the nutrient cycling carried out by sediment-dwelling invertebrates.[480]

vi. *Increases risk of predation of fish and marine invertebrates, reducing survival and reproduction, and altering community structure*. Response time to predators was significantly slower and the type of anti-predator behavior more variable in hermit crabs[481] and damselfish[482] exposed to noise. European eels were 50% less likely and 25% slower to show a startle response to an 'ambush' predator, and were caught more than twice as quickly by a 'pursuit' predator;[483]

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eels in poor condition were more likely to exhibit these behaviors than healthy individuals.[484] Shore crabs exhibit a 'freeze' response to noise, making them more vulnerable to predation from natural predators.[485] Noise can increase the foraging success of predatory species less affected by noise; for example, more than twice as many prey were consumed by the dusky dottyback in field experiments when motorboats were passing, compared to under ambient conditions.[486] This has the potential to disrupt community composition with potentially cascading effects up the food chain.

vii. *Compromises the orientation of fish larvae with potential ecosystem-level affects*. Most settlement stage fish move towards the component of coral reef noise that is produced by marine invertebrates to orient towards suitable settlement habitat.[487] The number of settlement stage coral reef fish larvae that moved towards a recording of natural coral reef with boat noise added was found to be 13% less than with the natural sound alone. In addition, 44% moved away from the noise playback compared to only 8% during the natural reef playback.[488] Overall, fewer fish settled to reefs with added boat noise compared to reefs with only reef noise.[489] In the lab, settlement-stage larvae (~20 days old) exposed to man-made noise developed an attraction to that noise rather than the natural noise of the reef, whereas wild-caught larvae showed an attraction to reef noise and responded adversely to man-made noise.[490] Noise pollution can therefore affect the natural behavior of reef fish at a critical stage in their life history, and can disrupt the community composition of natural ecosystems.[491]

[484] Purser, J., et al., Condition-dependent physiological and behavioural responses to anthropogenic noise, *supra* n. 461.
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