January 28, 2019

Ms. Jean Thurston
California Intergovernmental Renewable Energy Task Force Coordinator
Bureau of Ocean Energy Management
Office of Strategic Resources
760 Paseo Camarillo
Suite 102
Camarillo, California 93010

Submitted electronically

Re: Comments on the Call for Information and Nominations for Commercial Leasing for Wind Power Development on the Outer Continental Shelf Offshore California [*Docket No. BOEM-2019-0045*]

Dear Ms. Thurston:

On behalf of the Natural Resources Defense Council (NRDC), Environmental Defense Center (EDC), National Audubon Society (Audubon), California Coastal Protection Network, Defenders of Wildlife (Defenders), Surfrider Foundation, Sierra Club, and our millions of members, we submit these comments on the Bureau of Ocean Energy Management's (BOEM's) Call for Information and Nominations (Call) for Commercial Leasing for Wind Power Development on the Outer Continental Shelf (OCS) Offshore California. Our organizations are united in support of responsibly-developed offshore wind energy as a critically-needed climate change solution, and our organizations have long advocated for policies and actions needed to bring it to scale in an environmentally protective manner.

We applaud BOEM's substantial progress in advancing offshore wind energy development along the Atlantic Coast and are supportive of California also potentially benefitting from this innovative renewable energy opportunity. Advancing offshore wind to fight climate change, reduce local and regional air pollution, and grow a new industry that supports thousands of well-paying jobs is critical to our future, but we must also ensure offshore wind is developed responsibly and in a manner that protects our valuable marine life. Offshore wind development advances must include strong protections for valuable and vulnerable coastal and marine habitat and wildlife every step of the way. We urge BOEM to adopt an approach which engages stakeholders early and often in discussions on efforts to avoid, minimize, and mitigate any potential impacts to California's beloved ocean life.

In this letter, we address several central issues: 1.) we offer recommendations for how BOEM should proceed on offshore wind by working in partnership with the state of California, and other key stakeholders (See Section II below); 2.) we respond to BOEM's request for relevant "socioeconomic, biological, and environmental information" on the three Call Areas, sharing our initial review of relevant data for benthic habitat, fish, seabird, marine mammal, and sea turtle data (See Sections III through V below); and, 3.) we summarize several potential mitigation measures that could be used to help advance offshore wind (See Section VI and Appendix below).[1]

I. INTRODUCTION

Offshore wind energy must advance in an environmentally responsible manner that will minimize conflicts and enable additional development in the future while safeguarding vulnerable ocean habitats and wildlife, benefitting the environment and industry alike.

In California, our organizations have been deeply engaged both in advancing California's mandate to achieve 100 percent clean energy by 2045, including fostering the responsible development and siting of terrestrial wind energy. Further, our organizations have been working collaboratively with the California Energy Commission (CEC) and other state and local agencies to ensure that the process for siting offshore wind energy reflects the lessons learned from our onshore siting and development efforts. Offshore wind development may offer California an opportunity to tap into a sustainable, clean, fossil-free energy source that could help the state achieve its target goals to transition to 50 percent renewable electricity by 2026, to 60 percent by 2030, and to 100 percent by 2045.

Our continued development of fossil fuels has come at a great cost, exacerbating climate change, polluting air and water resources, and significantly harming public health and wildlife, among other impacts. In our oceans, climate change is already bleaching coral, displacing species, and acidifying the water, making it harder for shell-building organisms like oysters to grow shells and survive. In California, ocean acidification and warming waters are already having deleterious impacts on fisheries productivity.[2] We therefore need to embrace clean industries such as offshore wind while incorporating protections that will help defend marine life that is already stressed.

Several decades of offshore wind development in Europe suggest that offshore wind power can be developed responsibly in California, provided that all siting and permitting decisions are based on sound science and informed by key experts and stakeholders. The European experience shows us that avoiding sensitive habitat areas, requiring strong measures to protect wildlife throughout each stage of the development process, and comprehensive monitoring of wildlife and habitat before, during, and after construction are essential for the responsible development of offshore wind energy.[3]

Despite offshore wind's rapid growth in Europe, U.S. offshore wind remains a new industry, with the nation's first commercial project – Block Island Wind Farm (30 MW) – only coming online in December 2016. Given that the industry is in early stages in the United States, BOEM needs to rigorously review the potential impacts of offshore wind development on marine wildlife and habitat here in the United States and develop and adopt appropriate mitigation measures. Various potential impacts that may be associated with offshore wind construction and operations and could directly, indirectly, and cumulatively impact marine species and habitats in the coastal zone and offshore environment. The likelihood, nature, and significance of potential impacts will vary based on the siting, design, construction, and operation plans of specific projects.

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[1] For this letter we did not review sea turtle data extensively and did not assess potential impacts to bats.
[2] Chavez, F. P.*, Costello, C.*, Aseltine-Neilson, D., Doremus, H., Field, J. C., Gaines, S. D., Hall-Arber, M., Mantua, N. J., McCovey, B., Pomeroy, C., Sievanen, L., Sydeman, W., and Wheeler, S. A.(California Ocean Protection Council Science Advisory Team Working Group). 2017. Readying California Fisheries for Climate Change. California Ocean Science Trust, Oakland, California, USA.
[3] O'Brien, Sue. "Lessons learned from the European experience." Presentation at the *State of the Science Workshop on Wildlife and Offshore Wind Energy Development*. Nov. 13-14, 2018.

The national NGOs who are signatories to this letter have supported the progress of offshore wind development along the East Coast while also emphasizing the importance of protecting our living marine resources.[4] Of particular concern for East Coast development is the North Atlantic right whale, an iconic species and one of the planet's most endangered large whales, whose habitat is limited largely to the East Coast. Noise from site assessment, construction, and operations could potentially disrupt vital behaviors and cause habitat loss. And, increased vessel traffic associated with offshore wind development may exacerbate ship-strike risk for this species. NRDC, together with the National Wildlife Federation (NWF) and the Conservation Law Foundation (CLF), have negotiated agreements[5] with Mid-Atlantic and Northeast wind developers to reduce noise impacts and ship-strike risk during the initial site assessment phase of wind development as well as during construction and throughout the operation of the project.[6] This month, Vineyard Wind agreed to a set of mitigation measures to reduce noise impacts and limit ship speeds during the first commercial scale wind project in U.S. waters. These collaborative efforts demonstrate that offshore wind can develop in a way that protects wildlife. Through taking sensible actions guided by science, it is possible to minimize conflict and reduce impacts to already vulnerable marine life.

As detailed in NRDC, Audubon, and Defenders' September 2018 comment letter in response to FRN RFI Fed Reg 55228, there are some key differences between the East Coast and the West Coast in terms of offshore wind development. Offshore wind development on the East Coast has been possible due in large part to the shallow waters of the Atlantic Ocean's continental shelf. Offshore wind energy projects have historically been built in relatively shallow waters (0-30m) where it is possible to fix the foundations to the ocean floor. For the Block Island project, wind turbines were pile driven 200 feet below the seabed.[7] By comparison, the West Coast's continental shelf plunges steeply and quite close to shore, making shallow-water installation technology impossible. In addition to California's steep continental shelf, development is further complicated by the presence of numerous protected marine areas; drawing on extensive public engagement, the State of California and the United States Government have put necessary protective measures in place to preserve the state's abundance of living marine resources—from deep sea corals and fish to seabirds and marine mammals. Given the commitment the federal government and state of California have made to protecting California's marine environment, we believe offshore wind development can only proceed in a manner that safeguards these protected ocean habitats and species.

As BOEM advances offshore wind, the agency must bear in mind that preserving ecosystem function is also crucial to ocean health. It is essential that BOEM also preserve the ocean's ability to deliver its mitigatory benefits while boosting ocean health to build resilience to climate change. For example, protecting the eel grasses that carpet Humboldt Bay has the co-benefits of serving as a carbon sink and ameliorating the impacts of ocean acidification on local shellfish populations.[8]

We appreciate the opportunity to inform the offshore wind leasing process in California and hope these comments and information presented here and in the Appendix are informative and useful as BOEM proceeds with its efforts to develop a new renewable energy source in California. We urge BOEM to consider these comments, which provide environmental information on the three proposed Call Areas and the potential environmental impacts associated with offshore wind energy development.

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[4] In the Atlantic, NRDC and colleague organizations have fought for the federal investment tax for offshore wind and for state procurement policies including the solicitations currently under way in New York and New Jersey.
[5] http://www.clf.org/blog/going-above-and-beyond-deepwater-wind-adjusts-offshore-wind-construction-schedule-to-protect-right-whales/
[6] Deepwater Wind, Conservation Law Foundation Reach Agreement to Protect Right Whales During Block Island Wind Farm Construction – Press Release
[7] http://www.blockislandtimes.com/article/bi-wind-farm-foundations-completed/44158
[8] Merkel and Associates, Inc. Humboldt Bay Eelgrass Comprehensive Management Plan. 2014.

II. DEPARTMENT OF DEFENSE SHOULD NOT BE THE DE FACTO SITING AGENCY FOR OFFSHORE WIND DEVELOPMENT IN CALIFORNIA

We commend Department of Defense (DoD) and BOEM for establishing a cooperative process to identify potential areas for offshore wind development. However, we are concerned that the DoD use conflict discussions are elevating DoD's role in the BOEM leasing process to supersede other stakeholder priorities.

The DoD uses the California OCS intensively and extensively for military testing, training, and operations. These activities occur in the airspace, on the water, and throughout the water column on California's OCS.[9] The use of the California OCS for military purposes is so extensive that the conflicts with prospective offshore wind developments threaten the very potential of developing offshore wind on California's OCS. The Call states that, "DoD is currently reviewing additional detailed project information supplied by the offshore wind energy industry to determine if any of the areas previously identified by DoD as incompatible in the Morro Bay Call Area may be identified as compatible after further analyses." By engaging in private negotiations with offshore wind developers to discover areas of potential compatibility with offshore wind development on the Central Coast, BOEM, DoD, and industry become the sole parties to privileged and confidential information—a practice for offshore wind development that is contrary to the inclusive, science-based, and stakeholder-driven process we urge BOEM to conduct.

When one stakeholder entity is engaged in private negotiations with BOEM and developers, environmental or other stakeholder considerations run the risk of becoming of relatively lesser importance. Our concern is that rather than BOEM identifying and selecting an area with lower environmental sensitivities, the agency is endowing DoD with greater priority siting authority than that of other stakeholders. We urge BOEM to work with CEC and the Ocean Protection Council to conduct a comprehensive stakeholder-driven process that balances priorities and elevates environmental protections.

Our organizations and others have stated repeatedly that a state and/or federal stakeholder-driven process to identify areas of least conflict would provide a more streamlined process for decision making and reflect environmental and other concerns. We believe that BOEM, working in partnership with the state, should facilitate an inclusive and transparent process to identify least conflict lease areas.[10] The Desert Renewable Energy Conservation Plan (DRECP) and San Joaquin PV Least Conflict stakeholder process are examples of a state and federal partnership and a state-led stakeholder-driven effort that have facilitated more efficient and environmentally-sound permitting of renewable energy projects in California.

III. ECOLOGICAL CONSIDERATIONS FOR DEVELOPMENT IN CALIFORNIA CURRENT LARGE MARINE ECOSYSTEM

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[9] California Renewable Energy Task Force meeting, September 17, 2018, Department of Defense Engagement Activities, Steve Chung, U.S. Navy.

[10] We expect that many fishing communities would also support this approach. In April 2014, the Pacific Fisheries Management Council wrote a letter to BOEM stating the Council's preference for such a process.

The complexity and importance of California's marine ecosystem is well-documented, and includes ecological areas of global significance. The central coast of California contains one of the rarest bio-regions in the world, due to its location in the confluence of two major ocean currents, the mixing of which results in the highest biodiversity in the mainland United States. The California coast also includes hundreds of species that are not found anywhere else on the planet. The overlap of "oceanographic processes in the region fosters the transport of materials, such as nutrients and fish and invertebrate larvae between the marine islands and coastal habitats and are primary food sources that support biological communities."[11]

The Call Areas are situated in the California Current System (CCS) and located adjacent to the coastal Davidson Current, which carries warmer, more saline water from the south into the cooler, fresher water travelling from the north in the CCS.[12] The mixing of these different water masses makes the Call Areas highly dynamic and productive, and an ecologically important pelagic habitat for many fish species, marine mammals and seabirds.[13]

The ecological value of the California Current Ecosystem (CCE) is well known and well supported. The coast of California is home to four National Marine Sanctuaries (NMSs): Cordell Banks, Greater Farallones, Monterey Bay, and Channel Islands. The Monterey Bay NMS lies adjacent to the Morro Bay Call Area and near the Diablo Canyon Call Area. These Call Areas also fall within the nominated Chumash Heritage NMS. California's landmark network of 124 marine protected areas (MPAs) lies within State waters. Critically, the effectiveness of California's MPA network relies not only on the protections individual MPAs afford but on the connectivity of the entire MPA network.[14] The following discussions of benthic habitat, fish, seabirds, marine mammals, and sea turtles are intended to provide an overview of some of the most important biological resources the CCE sustains.

Benthic habitat and fishes

Benthic habitat is primarily classified based on physical substrate and depth.[15] In California, the geological shelf extends offshore to the shelf break, and has a steep change in slope, which occurs at 130 m in northern and central California and ranges from 80–145 m in southern California.[2] The Call Areas are located well offshore of the continental shelf 200 m isobath on the lower continental slope and range in depth from 500-1200 m. The habitats in these deeper regions of the continental slope off California are made up primarily of soft-bottom habitat; the dominant sediment type is thought to be mud.[16]

The seemingly featureless continental slope habitat is, in fact, an extremely rich ecosystem that supports infaunal and microbial communities that play an important role in nutrient cycling and CO_2 exchange.[17] The microbial ecology of the continental slope oxidizes methane and sequesters carbon into marine

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[11] *A Biogeographic Assessment of the Channel Islands National Marine Sanctuary: A Review of Boundary Expansion Concepts for NOAA's National Marine Sanctuary Program*, NOAA Technical Memorandum NOS NCCOS 21, November 2005. Available at: https://repository.library.noaa.gov/view/noaa/2161.

[12] https://www.cencoos.org/sites/default/files/documents/learn/oceanObserving/flowingoceanCCS.pdf

[13] https://earthobservatory.nasa.gov/images/87575/california-coastal-current

[14] Saarman E., Gleason M., Ugoretz J., Airamé S., Carr M., Fox E., Frimodig A., Mason T., Vasques J. (2013) "The role of science in supporting marine protected area network planning and design in California," Ocean and Coastal Management.

[15] Allen, M.J. 2006. Continental Shelf and Upper Slope. In: All LG, Pondella DJ, Horn MH (eds). The Ecology of Marine Fishes: California and Adjacent Waters [Internet]. University of California Press. Berkley, CA; [cited 2019 Jan 9]; p. 167-202. Available from: ftp://ftp.sccwrp.org/pub/download/DOCUMENTS/JournalArticles/488_continental_shelf.pdf

[16] Surpless KD, Ward RB, Graham SA. 2009. Evolution and Stratigraphic Architecture of Marine Slope Gully Complexes: Monterey Formation (Miocene), Gaviota Beach, California. Marine and Petroleum Geology [Internet]. [cited 2019 Jan 9]; 26(2):269-288. Available from: doi: 10.1016/ j.marpetgeo.2007.10.005

[17] Thurber AR, Sweetman AK, Narayanaswamy BE, Jones DOB, Ingels J, Hansman RL. 2014. Ecosystem function and services provided by the deep sea, Biogeosciences [Internet]. [cited 2019 Jan 9];11:941-3963. Available from: https://doi.org/10.5194/bg-11-3941-2014.

sediments and helps to mitigate climate change caused by these greenhouse gases.[18,19] Scientists are just beginning to understand these microbial communities and their critical role in the global carbon cycle. We do not currently have a comprehensive understanding of how these communities may react to localized or widespread disturbances to the deep-sea benthos.

Nutrient cycling is also an important component of these benthic communities. Nutrient cycling converts critical nutrients like nitrogen and phosphorus into biologically-useable forms that support the growth and reproduction of marine organisms.[20] The slope ecosystem also supports habitat-forming macro-invertebrates such as sponges and corals, which support commercially-important species of groundfish. Living organisms such as sponges, sea pens, gorgonians and other types of coral provide three-dimensional structure. This bio-genic shelter protects against predators and currents and provides firm substratum and increased food supply. These areas also are generally associated with high densities and diversity of fishes.[21]

Demersal and benthic fish habitat within the Call Areas largely consists of soft sediment and is likely muddy sea bottom with occasional rocky outcrops. The Pacific Fisheries Management Council (PFMC) has designated Habitat Areas of Particular Concern (HAPC), which are subsets of Essential Fish Habitat (EFH) that have a particularly important ecological role in fish life cycles or are especially sensitive, rare or vulnerable. HAPCs should be considered high priority areas for conservation because they are "rare, sensitive, stressed by development, or important to ecosystem function."[12] While the HAPC designation does not afford additional protections, the designation helps resource managers prioritize and focus their conservation efforts.[22] Overlap with HAPC occurs in all three Call Areas – in Humboldt it is 6.9 square nautical miles (nm^2); in Morro Bay, 39.3 nm^2, and in Diablo 231 nm^2 (See Figure 1 below).

In addition to overlapping with existing HAPC, the National Oceanic and Atmospheric Administration (NOAA) National Deep-Sea Coral and Sponge Database, comprising data from 1842 to the present day, identifies coral and sponge resources within all three Call Areas.[23] These resources have slow growth rates and are long-lived species that provide habitat for a range of other species including important commercial species like deep-living rockfishes and thornyheads. As an example, Black coral (Order Antipatharia) are extremely slow growing and long lived and have been aged to 174 years old in California, though likely live much longer – some species of black coral in other areas have been aged to over 1000 years old.[24]

The PFMC manages a total of 119 commercially-caught fish species off the California coastline under four fishery management plans: salmon, groundfish, Coastal Pelagic Species (CPS) and Highly Migratory

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[18] Wallmann K, Piñero E, Burwicz, E, Haeckel M, Hensen C, Dale A, Ruepke L. 2012. The Global Inventory of Methane Hydrate in Marine Sediments: A Theoretical Approach. Energies [Internet]. [cited 2019 Jan 9];5. Available from: doi:10.3390/en5072449

[19] Orcutt BN, Sylvan JB, Knab NJ, Edwards KJ. Microbial ecology of the dark ocean above, at, and below the seafloor. 2011. Microbiol Mol Biol Rev [Internet]. [cited 2019 Jan 9];75(2):361-422. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3122624/

[20] Bristow LA, Mohr W, Ahmerkamp S, Kuypers MMM. **2017** Nutrients that limit growth in the ocean. **Curr**. Biol. [Internet]. [cited 2019 Jan 9];27:74-478. Available from: https://www.sciencedirect.com/science/article/pii/S0960982217303287

[21] Buhl-Mortensen L, Vanreusel A, Gooday AJ, Levin LA, Priede IG, Buhl-Mortensen P, Gheerardyn H, King NJ, Raes M. 2010. Biological structures as a source of habitat heterogeneity and biodiversity on the deep ocean margins. Marine Ecology [Internet]. [cited 2019 Jan 9];31:21-50. Available from: doi:10.1111/j.1439-0485.2010.00359.x

[22] NOAA Fisheries West Coast Region: Essential Fish Habitat. National Oceanic and Atmoshpheric Administration [Internet]. [cited 9 Jan 2019]. Accessible from : https://www.westcoast.fisheries.noaa.gov/habitat/fish_habitat/hpac.html

[23] NOAA National Deep-Sea Coral and Sponge Database 1842 – present [Internet]. National Oceanic and Atmospheric Administration [cited 2019 Jan 9]. Available from: https://catalog.data.gov/dataset/noaa-national-deep-sea-coral-and-sponge-database-1842-present. Information is based on observations from trawl surveys, by-catch data and other scientific surveys

[24] Love M, Yoklavich M, Black B, Andrews A. 2007. Age of black coral (Antipathes dendrochristos) colonies, with notes on associated invertebrate species. BULLETIN OF MARINE SCIENCE [Internet]. [cited 2019 Jan 14];80:391-400. Available from: https://www.researchgate.net/publication/228350918_Age_of_black_coral_Antipathes_dendrochristos_colonies_with_notes_on_associated_invertebrate_species

Species (HMS).[25] Many of the fishing grounds of these species overlap with all three Call Areas.[26] Coastal fish stocks in the region comprise a minority of the fish biomass of the region. The fish species and stocks that harvest the massive productivity of this region are primarily migrating species.[27] CPS, such as sardines, anchovy and mackerel, are generally found from the surface down to approximately 1000 m, but are not solely associated with the seafloor. HMS, such as sharks and tunas, are pelagic species that have wide geographic distributions and undertake migrations of significant but variable distances for feeding and reproduction purposes.

In contrast to many demersal species, CPS and HMS are generally not ecologically linked to seafloor habitat features.[28] Determination of EFH for CPS and many HMS are largely based upon a thermal range bordered within the geographic area where a CPS species is present at any life stage. EFH for these species is therefore derived from distributional (presence/absence) data, oceanographic data (e.g., sea surface temperatures) and relationships between oceanographic variables.[29]

Along the California coastline, abiotic habitat varies greatly between seasons and years and often determines prey abundance of CPS and HMS species.[30] Abiotic habitat fluctuations are also strongly impacted by El Niño/La Niña cycles and the Pacific Decadal Oscillation (PDO).[31] This variability means that the abundance of CPS and HMS along the California coast also varies greatly between seasons and years. The most well-known example of this is the fluctuation in abundance of sardine and anchovy species.[32] The significance of the spatial and temporal variability in CPS and HMS abundance means that impacts caused by offshore wind farm development on these populations will be difficult to quantify, particularly in short term. Without due consideration of the importance of the interactions between CPS and HMS with wind farm developments, consequences will likely be ecosystem-wide due to the important role they play as prey species for mammals and birds and in food web structure respectively.[33]

The habitat features of CPS and HMS may be dynamic because their habitat is associated with fronts, upwellings, and downwellings. This habitat fluidity means that CPS and HMS often appear in different areas from year to year depending on abiotic habitat conditions (e.g., temperature, productivity, etc.). In contrast, groundfish species are more closely tied to fixed habitat structures and generally experience lower levels of abiotic habitat variability as compared to CPS and many HMS. For this reason, it is easier to define fixed habitat areas for groundfish species than for CPS and HMS. As such, much of the California coast has been designated EFH for sheepshead, sturgeon skate and steelhead. It should, however, be noted that benthic habitat is important for some CPS during certain stages of their life cycle. For example, market squid needs benthic substrate to attach their egg cases to, although this is usually in much shallower, coastal water than the Call Areas (e.g., Monterey Bay, Carmel Bay and the Channel Islands).[34]

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[25] http://www.fisherycouncils.org/pacific/

[26] Although much of the general information presented herein relates to all fish species in the Call Areas, Groundfish are discussed in terms of HAPC.

[27] Parrish, Nelson & Bakun, Transport Mechanisms and Reproductive Success of Fishes in the California Current. Biological Oceanography, 1981.

[28] Note: although many shark species are classified as demersal and HMS, they are often wide ranging foragers.

[29] https://www.westcoast.fisheries.noaa.gov/publications/habitat/essential_fish_habitat/coastal_pelagic_appendix_d.pdf

[30] https://www.westcoast.fisheries.noaa.gov/publications/habitat/essential_fish_habitat/coastal_pelagic_krill_appendix_12.pdf

[31] https://sealevel.jpl.nasa.gov/science/elninopdo/

[32] Chavez et al. From Anchovies to Sardines and Back: Multidecadal Change in the Pacific Ocean. Science. 2003.

[33] Andrew F. Johnson. MarEcoFish. Personal communication..

[34] Zeidberg et al. Estimation of spawning habitats of market squid (Doryteuthis opalescens) from field surveys of eggs off Central and Southern California. Marine Ecology. 33(3):1-11 · 2011

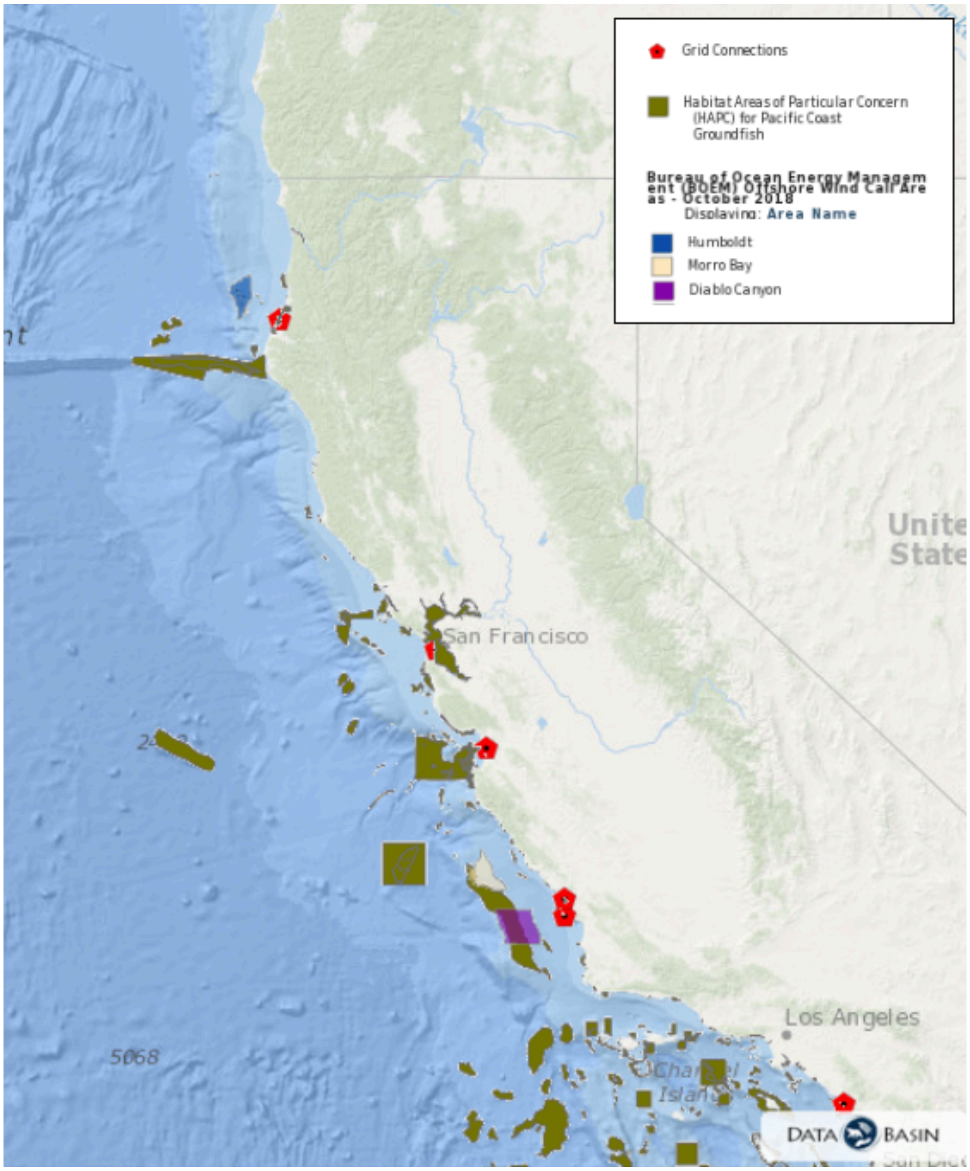

Figure 1. Bureau of Ocean Energy Management (BOEM) Offshore Wind Call Areas with the Pacific Fisheries Management Council (PFMC) Habitat Areas of Particular Concern (HAPC) for Groundfish showing overlap with the Humboldt, Morro Bay and Diablo Call Areas.

The information presented in Table 1 for CPS and HMS –all of which are commercially caught species– show the wide distribution of fishing activity off the California coast. California's recreational fisheries effort is concentrated on the near-shore OCS while the commercial fisheries effort extends further offshore. Since all three Call Areas begin between approximately 19-24 nm offshore and extend between 32-49 nm offshore, it is likely that there will be significant overlap with commercial fisheries effort in some form, whether it be active fishing or fishing vessel transits through the Call Areas.

Species name		General distribution	Presence in call area (2016*)			Important forage species	Notes
Common	Scientific		Diablo Canyon	Morro Bay	Humboldt		
Pacific sardine[35]	*Sardinops sagax*	Mexico to Alaska	Med.	Med.	Low	Yes	Appear seasonally in north
Pacific (chub) mackerel[36]	*Scomber japonicus*	Mexico to Alaska	High	High	Low	Yes	Most abundant south of Point Conception
Northern anchovy[37]	*Engraulis mordax*	Mexico to British Columbia	High	High	Low	Yes	N, central & S subpopulations
Jack mackerel[38]	*Trachurus symmetricus*	Mexico to Alaska	High	High	High	Yes (only smaller Y1-Y2 individuals)	Most abundant S California. Offshore late spring to early fall
Market Squid[15]	*Doryteuthis opalescens*	Mexico to Alaska	Med.	Med.	High	Yes	Most abundant between Baja and Monterey Bay

Table 1. Coastal Pelagic Species (CPS) present off the California coast. Data based on relative, approximate extractions from Pacific Fisheries Management Council (PFMC) stock assessment reports.[39] Data for market squid comes from 2001.[40]

Group	Species name		West coast US distribution		
	Common	Scientific	Juvenile	Adults	Adult SST range
Sharks	Common Thresher	*Alopias vulpinus*	Occur within 2 to 3 miles of the coast. Santa Barbara county through to Monterey Bay. Near surface waters.	Range extends north to Columbia River mouth	13 to 25°C
	Pelagic Thresher	*Alopias pelagicus*	South of Mexican border	Santa Rosa - Cortes ridge, San Diego - Long Beach	14 to 28°C
	Bigeye Thresher	*Alopias superciliosus*	Southern California coastal waters	South of Monterey Bay to San Diego	15 to 24°C
	Shortfin Mako	*Isurus Oxyrhinchus*	Mexico to San Francisco coastal waters	Channel Islands and outer banks of Southern California Bight	15 to 25°C
	Blue Shark	*Prionace glauca*	Oceanic waters – Mexico to Alaska		8 to 21°C
Tunas	Albacore	*Thunnus alalunga*	Oceanic waters – Mexico to Alaska		15 to 19°C

[35] http://www.pcouncil.org/wp-content/uploads/2017/05/Appendix-C-2017-sardine-assessment-NOAA-TM-NMFS-SWFSC-576.pdf
[36] http://www.pcouncil.org/wp-content/uploads/2017/05/Appendix-B-2017-Pacific-Mackerel-Projection-Estimate.pdf
[37] https://www.pcouncil.org/coastal-pelagic-species/fishery-management-plan-and-amendments/northern-anchovy-fmp/
[38] https://www.pcouncil.org/coastal-pelagic-species/current-season-management/#monitored
[39] https://www.pcouncil.org/coastal-pelagic-species/background-information/
[40] Final Market Squid Fishery Management Plan (Final MSFMP) Section 1 - 18 Chapter 2. Background: A Description of the Species, the Fishery, and Social and Economic Components of the Market Squid Fishery. 2005.

	Bigeye	*Thunnus obesus*	Oceanic waters – Mexico to Point Conception / Monterey Bay		10 to 15°C
	Northern Bluefin	*Thunnus orientalis*	Mexico to Canada	No regular habitat inside US West coast EEZ	17 to 23°C
	Skipjack	*Katsuwonus pelamis*	No regular habitat inside US West coast EEZ	Oceanic waters – Mexico to Point Conception	18 to 33°C
	Yellowfin	*Thunnus albacares*	Oceanic waters – Mexico to Point Conception	No regular habitat inside US West coast EEZ	18 to 31°C
Other*	Striped Marlin	*Tetrapturus audax*	No regular habitat inside US West coast EEZ	Mexico to Point Hueneme	20 to 25°C
	Broadbill swordfish	*Xiphias gladius*	Mexico to Oregon	Southern and Central California	25 to 29°C
	Dorado / Mahimahi	*Coryphaena hippurus*	Coastal waters Mexico to Santa Rose-Cortes Bank	Oceanic waters – Mexico to Point Conception	19 to 24°C

Table 2. Commercially caught, Highly Migratory Species (HMS) present off the California coast[41]. *Other may also include Opah (*Lampris guttatus*) and Basking (*Cetorhinus maximus*), Megamouth (*Megachasma pelagios*) and Great White (*Carcharadon carcharias*) sharks.

Current HAPC types – estuaries, canopy kelp, seagrass, rocky reefs and "areas of interest"[42] – do not include a specific pelagic classification. If attempts are made to demarcate areas of special interest for California's CPS and HMS relative to the Call Areas, the important connection between banks, canyons and seamounts and oceanic productivity is an important consideration.

The mobile habitat and variable geographic distributions of CPS and HMS mean that attempting to specifically demarcate areas of fish presence for CPS along the California coast is a difficult task. Historic catch records of CPS and HMS show a wide distribution within and between species that varies temporally. For this reason, at the time of this letter, scientists believe it is not possible to specifically demarcate areas of importance for one CPS or HMS over another at a resolution of the Call Areas.[43]

Instead, we summarize the main CPS and note their abundance in each call area based on the latest NOAA stock assessments (2016) (Table 1) and note the approximate distributions of HMS based on the best available NOAA reporting (Table 2).

Call Area	Commercial fishery restriction	EFH	EFH Conservation Area
Diablo Canyon	Yes	Yes	Yes
Morro Bay	Yes	Yes	Yes
Humboldt	No	Yes	No

Table 3. Approximate distances of Call Areas offshore and their overlap with extant commercial fishery restrictions, Essential Fish Habitat (EFH) and EFH Conservation Areas.

[41] https://www.westcoast.fisheries.noaa.gov/publications/habitat/essential_fish_habitat/highly_migratory_species_appendix_f.pdf
[42] This includes submarine features such as banks, seamounts, and canyons
[43] Johnson, Andrew F for MarFishEco. Final Fish and Fisheries report prepared for NRDC.

The Diablo Canyon and Morro Bay Call Areas already have some commercial fishery restrictions in place while the Humboldt Call Area does not. Similarly, while all Call Areas overlap with EFH designations, only the Diablo Canyon and Morro Bay Call Areas overlap with EFH Conservation Areas, which are areas closed to specific types of fishing.

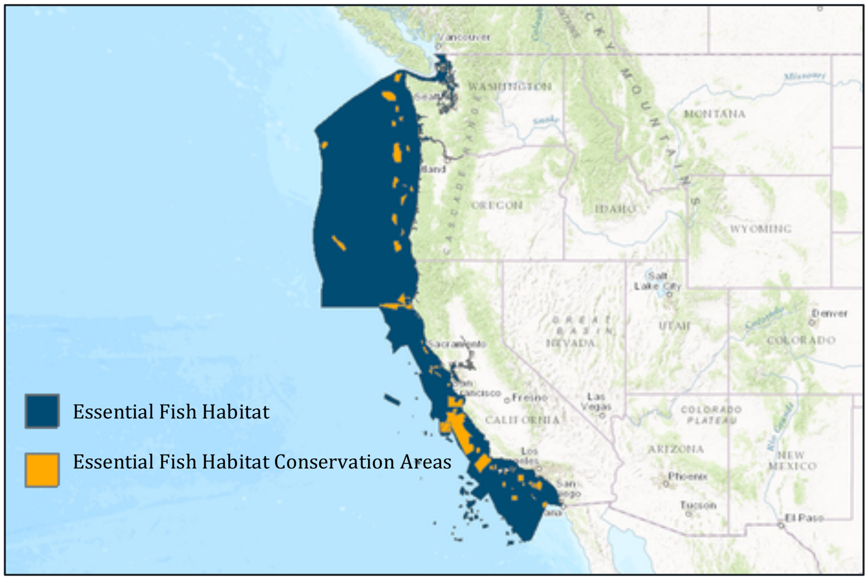

Figure 2. Map showing areas designated Essential Fish Habitat (EFH) and Essential Fish Habitat Conservation Areas. (Map adapted from databasin.org)

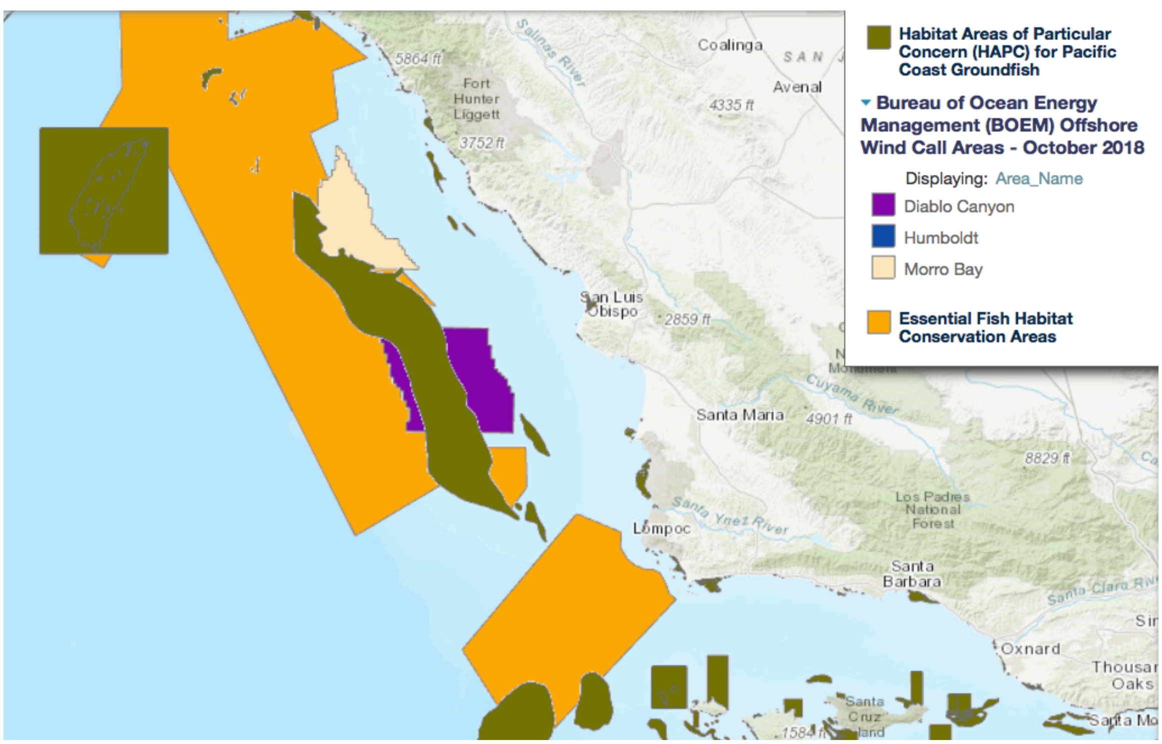

Figure 3. Map showing Habitat Areas of Particular Concern **(**HAPC) and Essential Fish Habitat (EFH) Conservation Areas overlay with Morro Bay and Diablo Canyon Call areas. (Map adapted from databasin.org.)

Seabirds

Conspicuous and ubiquitous marine vertebrates, seabirds have long been recognized as valuable ecosystem indicators,[44] and observations of seabirds can, for example, provide information on oceanographic conditions,[45] ecosystem variability,[46] prey availability,[47] and ecosystem shifts due to ocean warming.[48] Further, as a group, they play a large role in global marine trophic webs as top consumers—for example, three species from the CCE can consume >60,000 metric ton of forage fish in a single breeding season.[49] Seabirds species, in general, are k-selected: they tend to live a very long-time and raise a single chick when they breed, meaning that population trajectories rely on high adult survival so that individuals can cumulatively accrue reproductive fitness over a long lifetime. Thus, similar to other long-lived taxa such as marine mammals and some fish groups, premature mortality of adults from human impacts can lead to population decline. Almost 30 percent of the world's seabird species are globally threatened, and the majority of populations are in decline.[50] Indeed, a study by Paleczny *et al.* (2015) demonstrated a 70 percent decline in the world's monitored seabirds, with the most prominent declines in pelagic seabirds.[51] The rapidly-deteriorating status of the world's seabirds has led to calls for urgent policy changes to address the major threats to seabirds, which include fisheries bycatch, habitat loss, invasive species, contamination, and climate change.[52]

Over 75 species of seabirds frequent the CCE, including year-round residents, seasonal residents, or long-distance migrators *en route* to breeding or wintering grounds. While many species exploit waters close to shore, many prefer to forage in offshore waters at or beyond the continental shelf[53] following concentrations of prey that can often occur far offshore in the CCE.[54]

Important Bird Areas (IBAs) occur directly east along the coastline from all three Call Areas, at distances of <16.2 nm shoreward. Because of the vicinity of the Call Areas to regions of significant biological importance to seabirds, the seabird populations that rely on these habitats may be at an increased risk for negative impacts from offshore wind energy infrastructure (OWEI), including possible collision, habitat displacement, barrier effects, and contamination.

Using a predictive model constructed from seabird occurrence data and environmental covariates, Nur *et al*. (2011) identified spatially-restricted seabird hotspots throughout the extent of the CCE, including regions off Cape Mendocino (near the Humboldt Call Area),[55] as well as around the Channel Islands (near

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[44] Furness and Camphuysen (1997), "Seabirds as Monitors of the Marine Environment"; Piatt and Sydeman (2007), "Seabirds as Indicators of Marine Ecosystems."
[45] Santora et al. (2017), "Biogeography of Seabirds within a High-Latitude Ecosystem: Use of a Data-Assimilative Ocean Model to Assess Impacts of Mesoscale Oceanography."
[46] Gagne et al. (2018), "Trophic Signatures of Seabirds Suggest Shifts in Oceanic Ecosystems."
[47] Lyday et al. (2015), "Shearwaters as Ecosystem Indicators: Towards Fishery-Independent Metrics of Fish Abundance in the California Current"; Kitaysky, Piatt, and Wingfield (2007), "Stress Hormones Link Food Availability and Population Processes in Seabirds."
[48] Carpenter-Kling et al. (2019), "Gentoo Penguins as Sentinels of Climate Change at the Sub-Antarctic Prince Edward Archipelago, Southern Ocean."
[49] Warzybok et al. (2018), "Prey Switching and Consumption by Seabirds in the Central California Current Upwelling Ecosystem: Implications for Forage Fish Management."
[50] IUCN (2019)
[51] Paleczny et al. (2015), "Population Trend of the World's Monitored Seabirds, 1950-2010."
[52] McCauley et al. (2015), "Marine Defaunation: Animal Loss in the Global Ocean."
[53] Allen, Pondella, and Horn (2006), *The Ecology of Marine Fishes: California and Adjacent Waters*. California's Continental Shelf ranges from 0.27 nm to 97.2 nm offshore.
[54] Ainley et al. (2015), "Seabird Flight Behavior and Height in Response to Altered Wind Strength and Direction."
[55] Nur et al. (2011), "Where the Wild Things Are : Predicting Hotspots of Seabird Aggregations in the California Current System"

the Morro Bay Call Area). Additionally, an analysis of seabird abundance data from shipboard transects in the southern CCE and also found persistent hotspots of seabird abundance in the Southern California Bight, as well as north of Point Conception near the proposed Morro Bay Call Area.[56] Over 15 species breed in southern and central California, primarily in the Channel Islands of the Southern California Bight and on southeast Farallon Island off the coast of San Francisco. In the higher latitudes of the CCE, the region north and northwest of Cape Mendocino is another significant region of seabird breeding and foraging activity[57] and is commonly frequented by two out of the three species of North Pacific albatross. Another notable location of seabird importance on the northern California coast is Castle Rock, the second largest seabird colony in California, which hosts large colonies of breeding storm-petrels, cormorants, and alcids, located ~40.5 nm north of the Humboldt Call Area. This distance from the Humboldt Call Area is well within the possible flight range of most foraging seabird species.

Marine Mammals and Sea Turtles

The CCE boasts the presence of an extensive diversity and density of large marine species including marine mammals and sea turtles.[58] This range and abundance of large marine species creates unique challenges for offshore wind energy development. Large baleen whales including blue (*Balaenoptera musculus*), grey (*Eschrichtius robustus*), humpback (*Megaptera novaeangliae*), fin (*Balaenoptera physalus*), minke (*Balaenoptera acutorostrata*), and North Pacific right (*Eubalaena japonica*) inhabit the area. Additionally, the CCE boasts populations of sperm, killer, sei and multiple species of beaked whales – all of which of are protected under the Endangered Species Act and/or Marine Mammal Protection Act. The CCE also hosts high densities of a number of pinniped and dolphin species.

Within California waters, NOAA has designated Biologically Important Areas (BIAs) for a number of whale species. BIAs are areas identified by expert consultation to be reproductive areas, feeding areas, migratory corridors, and areas in which small and resident populations are concentrated (See Figure 4). They are identified using available data sources, including boat-based and aerial survey data, tracking data and expert opinion.[59] BIAs have an outsized importance in the feeding habitat for cetaceans— although the areas comprise less than five percent of the overall West Coast area, the vast majority of sightings for each species (77 to 89 percent) occur within BIAs.[60]

Because of this unique assemblage of large whales and their conservation status, there are additional environmental concerns for offshore wind development, and the potential need for additional caution in California waters that do not exist in European waters where most offshore wind energy – and the only floating turbine development – currently exists.

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[56] Santora and Sydeman (2015). , "Persistence of Trophic Hotspots and Relation to Human Impacts within an Upwelling Marine Ecosystem."
[57] Nur et al. (2011), "Where the Wild Things Are : Predicting Hotspots of Seabird Aggregations in the California Current System"; Sowls et al. (1980), "Catalog of California Seabird Colonies"; Guy et al. (2013), "Overlap of North Pacific Albatrosses with the U.S. West Coast Groundfish and Shrimp Fisheries."
[58] Block, B.A., Jonsen, I.D., Jorgensen, S.J., Winship, A.J., Shaffer, S.A., Bograd, S.J., et al. (2011). Tracking apex marine predator movements in a dynamic ocean. *Nature* 475(7354)**,** 86-90. doi: 10.1038/nature10082.
[59] Calambokidis, J., Steiger, G.H., Curtice, C., Harrison, J., Ferguson, M.C., Becker, E., et al. (2015). 4. Biologically important areas for selected cetaceans within US waters-west coast region. *Aquatic Mammals* 41(1)**,** 39.
[60] Id.

Definition of Biologically Important Areas

For cetacean species with distinct migrations that separate feeding and breeding areas, three types of biologically important areas were identified:

- **Reproductive Areas**: Areas and months within which a particular species or population selectively mates, gives birth, or is found with neonates or other sensitive age classes.
- **Feeding Areas**: Areas and months within which a particular species or population selectively feeds. These may either be found consistently in space and time or may be associated with ephemeral features that are less predictable but can be delineated and are generally located within a larger identifiable area.
- **Migratory Corridors**: Areas and months within which a substantial portion of a species or population is known to migrate; the corridor is typically delimited on one or both sides by land or ice.

A fourth type of biologically important area was also identified:

- **Small and Resident Population**: Areas and months within which small and resident populations occupying a limited geographic extent exist.

excerpted from https://cetsound.noaa.gov/important

Figure 4. National Oceanic and Atmospheric Administration (NOAA) definition of Biologically Important Areas (BIAs). Excerpted from CetSound.noaa.gov

IV. POTENTIAL ENVIRONMENTAL RISKS ASSOCIATED WITH FLOATING OFFSHORE WIND TECHNOLOGY

Deployment of commercial-scale floating turbines is a recent development. Given that the industry is in early stages, the near- and long-term environmental impacts are largely unknown. Floating offshore wind turbines may have deleterious impacts on marine wildlife through: habitat loss; collision with turbines and project-associated vessels; entanglement; operational noise; and electromagnetic fields (EMF). In the proposed Call Areas, the potential for impacts to marine mammals, seabirds, sea turtles, and fish habitat are of particular concern.

BOEM is well-aware that California's deep bathymetry means that floating wind turbines are the only practical offshore wind technology for commercial scale wind farms in California's offshore waters. While there are risks associated with floating technology, floating technology avoids some of the significant environmental impacts of some types of fixed offshore wind platforms. For example, in contrast to the pile driving that may be required for tower installation in shallower depths, floating technology can be anchored using less acoustically impactful anchors or suction buckets.[61] In addition, floating platforms and associated anchors and cables can be fully removed from the environment during decommissioning.[62]

[61] Reifolo L., Lanfredi C., Azzellino A., Tomasicchio G., Felice D, Penchev V., Vicinanza D. Offshore Wind Turbines: An Overview on the Marine Environment, International Society of Offshore and Polar Engineers, 2016.
[62] Id.

Immediately below we describe potential environmental impacts to benthic habitat, fishes, seabirds, and marine mammals of offshore wind development within the CCE in the categories of: habitat loss, collision and entanglement, noise, and EMF.

Habitat Loss

Benthic communities
The chief risk floating technology poses to marine benthic habitat is habitat loss and degradation due to the anchors and attached mooring cables. No floating offshore wind farm studies to date have shown major deleterious effects on benthic communities or reefing fish; however, the time scales over which these devices have been monitored do not enable an examination of whether benthic communities have reached equilibrium or whether reefing communities are in balance with nearby populations.[63] Studies of pile-driven offshore wind farms areas in Europe indicate that development does cause shifts in the macrobenthic community,[64] suggesting that this may also be a concern for floating technologies.

Research indicates that mooring lines and anchors may not remain in the same place, particularly in high sea states. Models have indicated that mooring lines may move across the seafloor, thereby affecting benthic habitat, in direct relation to increasing wave height. For example, in an experiment with six meter (m) waves, more than 60 square miles of benthic habitat were affected.[65] At offshore wind farms, the interaction between turbine foundations and local hydrodynamics affect sediment characteristics by reducing flow and preventing the re-suspension of finer sediments and sand around a device.[66] In addition, alteration of the natural hydrodynamics near turbine foundations can result in bottom scour.[67] Bottom surveys of any project areas will be necessary to fully assess potential impacts to benthic habitat. The nautical charts of the area indicate that the bottom is mud and/or clay, yet data on the Call Areas' bottom profile and habitat composition are sparse.[68]

The benthic footprint and level of impact will depend entirely on the type of system selected and the exact location of deployment. Our cursory assumption based on the depths of the Call Areas, is that all types of floating offshore wind energy platforms (semi-submersible, spar-buoy, tension leg), moorings (taut-leg, catenary, semi-taut) and anchoring systems (drag-embedded, driven pile, suction pile, gravity anchor) could be used.[69] It will be important to consider that impacts vary depending on the type of platform, moorings and anchoring developers utilize. A taut-leg mooring system coupled with suction pile anchors

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[63] De Backer, A., Van Hoey, G., Coates, D., Vanaverbeke, J., and Hostens, K. 2014. Similar diversity-disturbance responses to different physical impacts: Three cases of small-scale biodiversity increase in the Belgian part of the North Sea. Marine Pollution Bulletin 84(1-2):251 262. doi: 10.1016/j.marpo1bul.2014.05.006.
Lindeboom, HJ, et al. Short-term ecological effects of an offshore wind farm in the Dutch coastal zone: a compilation. Environmental Research Letters 2011; 6(3):035101.
Lindeboom, H., Degraer, S., Dannheim, J., Gill, A., and Wilhelmsson, D. 2015. Offshore wind park monitoring programmes, lessons learned and recommendations for the future. Hydrobiolgia 756:169 180. doi: 10.1007/ s10750-015-2267-4.
[64] De Backer et al. 2014.
Coates, DA., Deschutter, Y., Vincx, M., and Vanaverbeke, J. 2013. Enrichment and shifts in macrobenthic assemblages in an offshore wind farm area in the Belgian part of the North Sea. Marine Environmental Research 95: 1-12.
[65] Krivtsov, V., and Linfoot, B. 2012. Disruption to benthic habitats by moorings of wave energy installations: A modelling case study and implications for overall ecosystem functioning. Ecological Modelling 245:121 124. doi:10.1016/j.ecolmodel.2012.02.025, http://tethys.pnnl.gov/publications/disruption-benthic-habitats-moorings-wave-energy-installations-modelling-case-study.
[66] Coates, D. A., Deschutter, Y., Vincx, M., and Vanaverbeke, J. 2014. Enrichment and shifts in macrobenthic assemblages in an offshore wind farm area in the Belgian part of the North Sea. Marine Environmental Research 95:1 12. doi: 10.1016/j.marenvres.2013.12.008.
[67]Chen, L., Lam, W., and Shamsuddin, A. 2013. Potential Scour for Marine Current Turbines Based on Experience of Offshore Wind Turbine. Paper Presented at the International Conference on Energy and Environment 2013, Putrajaya, Malaysia; Copping et al. 2016.
[68] NOAA Nautical Chart 18700, Point Conception to Point Sur and NOAA Nautical Chart 18620 Point Arena to Trinidad Head.
[69] Rhodri J, Costa Ros M. 2015. Floating Offshore Wind: Market and Technology Review: Prepared for the Scottish Government [Internet]. [cited 2019 Jan 9]. Available from: https://www.carbontrust.com/media/670664/floating-offshore-wind-market-technology-review.pdf

would have the smallest benthic footprint and should be assessed to determine if this combination is appropriate for the conditions in the Call Areas.

Fish

As described in Section III, habitat for CPS and HMS is largely defined by water temperature and can be highly variable between seasons and years. The thermal habitat preferences of CPS and HMS are not likely to be impacted by the offshore windfarm development as the presence of the floating turbines and moorings will unlikely change local water temperatures significantly, with the exception of having some shading effects due to offshore wind platforms.[70] It is noteworthy that increased sedimentation during construction and regular operations and maintenance from seabed disturbance may have an impact on demersal and benthic fish species. There may be impacts on pelagic species if certain life stages of CPS or HMS use benthic habitat for spawning or egg-laying.[71]

Marine mammals

While there is little data or knowledge on how marine mammals will respond to the permanent introduction of physical structures, such as mooring lines and cables resulting from offshore wind development, or the surface platforms, some research indicates that if enough large static objects are placed in the marine environment, larger marine mammals may avoid the area altogether, keeping them from important feeding, mating, rearing, or resting habitats, or from vital movement and migratory corridors.[72]

Seabirds

Offshore wind projects have the potential to harm birds through disturbance and habitat loss or damage.[73] Disturbance to birds can occur during wind farm construction and continue due to post-construction operations and maintenance (O&M) activities. These disturbances may lead directly to expulsion and thus loss of territory for certain species of birds. For example, research at Horns Rev offshore wind farm located in Denmark's offshore waters found that changes in distributions of divers, common scoter, and common guillemot/razorbills were observed, and these species of birds tended to avoid the wind farm site and the two and four km zones around the wind farm.[74] Conversely, some species, such as gull and tern, showed a preference for the wind farm area in this study, possibly increasing risk of collision for selected species.

Some bird species are known to actively change course to travel around perimeters of wind-farms and/or avoid the area in response to increased ship traffic. This avoidance can lead to increased energetic costs when traveling to and from breeding/foraging sites[75] and result in a functional loss of habitat.[76] This would be especially true if more wind farms were built in the foraging areas or along the migration routes

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[70]Offshore wind farms and marine mammals: impacts & methodologies for assessing impacts - https://tethys.pnnl.gov/sites/default/files/publications/Offshore_Wind_Farms_EC_Workshop.pdf

[71] Andrew F. Johnson, MarEcoFish.

[72] Malcolm, I., Godfrey, J., and Youngson, A. 2010. Review of Migratory Routes and Behaviour of Atlantic Salmon, Sea Trout and European Eel in Scotland's Coastal Environment: Implications for the Development of Marine Renewables. Report published by Marine Scotland Science, Caithness, UK. Pp. 77.

[73] Snyder B, Kaiser MJ. Ecological and economic cost-benefit analysis of offshore wind energy. Renewable Energy 2009;34(6):1567e78.
Sun X, Huang D, Guoqing W. The current state of offshore wind energy technology development. Energy 2012; 41:298-312.

[74] Petersen IK, Christensen TK, Kahlert J, Desholm M, Fox AD. Final results of bird studies at the offshore wind farms at Nysted and Horns Rev, Denmark. Denmark: Report to Dong Energy and Vattenfall A/S, National Environmental Research Institute; 2006. http://www.folkecenter.net/mediafiles/folkecenter/pdf/Final_results_of_bird_studies_at_the_offshore_wind_farms_at_Nysted_and_Horns_Rev_Denmark.pdf.

[75] Drewitt and Langston (2006), "Assessing the Impacts of Wind Farms on Birds"; Masden et al. (2010), "Barriers to Movement: Modelling Energetic Costs of Avoiding Marine Wind Farms amongst Breeding Seabirds"; Masden et al. (2009), "Barriers to Movement: Impacts of Wind Farms on Migrating Birds."

[76] Furness, Wade, and Masden (2013), "Assessing Vulnerability of Marine Bird Populations to Offshore Wind Farms"; Dierschke, Furness, and Garthe (2016), "Seabirds and Offshore Wind Farms in European Waters : Avoidance and Attraction."

of birds and together cause significant contributions to cumulative impacts, as suggested by some studies.[77] Increased energetic costs can have observable impacts on adult condition and reproductive success, particularly during the breeding season. Increased energetic costs can also have population-level impacts during the non-breeding season in years of poor ocean conditions. The demographic consequences of disturbance on populations should be modeled for species of high-displacement risk.[78] Mendel *et al.* (2019) recently demonstrated significant changes in distribution patterns of loons after the development of OWEI in the German North Sea. The results showed that loons were likely avoiding both turbine footprints and the associated increased ship traffic.[79]

While some species are displaced by OWEI through avoidance (e.g., loons, gannets, divers, fulmars), other species may be attracted to turbines for opportunities for roosting, preening, and socializing (e.g., cormorants, gulls).[80] Some vessel-attracted species such as gulls, may also be attracted to OWEI areas due to increased shipping traffic. Further, fouling species that colonize the base of wind turbines may create an artificial reef, resulting in increased feeding opportunities within an offshore wind development. Fish may be attracted to these bases due to the reef effect as well as shelter from fishing vessels. Consistent with this prediction, seabirds have been observed feeding within OWEI—their presence has been attributed to increased fish stocks aggregating around offshore wind platforms.[81]

Collision and entanglement risk

Marine Mammals – Collision

There is no direct evidence that large marine mammals are at risk from colliding with turbine platforms, mooring lines, or draped power cables associated with OWEI, or any other existing infrastructure associated with the offshore petrochemical industry, the closest parallel to marine renewables moorings.[82] However, floating wind turbines of this scale have not yet been developed in important habitat for large baleen whales and so the potential impacts to naïve animals remain unforeseen. While fixed submerged structures are likely to pose little collision risk, cables, chain, power lines, and components free-moving on the surface or in the water column (i.e., the mooring lines and cables of floating turbines) will pose a much higher risk of collision.[83]

Collisions with ships are currently a leading cause of baleen whale mortality on the West Coast.[84] Increased vessel traffic associated with site assessment, construction, and operations and maintenance poses an increased ship strike risk for marine mammals, and particularly baleen whales. The risk of serious injury and mortality from a collision with a vessel significantly increases when that vessel is traveling at a speed of 10 knots or greater.[85] BOEM should carefully consider adopting regulatory

[77] Id.
[78] Pirotta et al. (2018), "Understanding the Population Consequences of Disturbance."
[79] Mendel et al. (2019), "Operational Offshore Wind Farms and Associated Ship Traffic Cause Profound Changes in Distribution Patterns of Loons (Gavia Spp.)."
[80] Dierschke, Furness, and Garthe (2016), "Seabirds and Offshore Wind Farms in European Waters : Avoidance and Attraction."; Leopold, Dijkman, and Teal, L. (2011). "Local birds in and around the Offshore Wind farm Egmond aan Zee (OWEZ) (T-0 & T-1, 2002-2010)". NoordzeeWind report
[81] Krijgsveld et al. (2011), "Effect Studies Offshore Wind Farm Egmond Aan Zee"; Vanermen et al. (2011), . "Seabirds & Offshore Wind Farms: Power and Impact Analyses 2010."
[82] Copping et al. 2016.
[83] Wilson, B., Batty, R.S., Daunt, F., and Carter, C. 2007.Collision risks between marine renewable energy devices and mammals, fish, and diving birds. Report to the Scottish Executive, Scottish Association for Marine Science, Oban, Scotland, PA37 1QA; Inger et al. 2009.
[84] Rockwood, R. C., Calambokidis, J., & Jahncke, J. (2017). High mortality of blue, humpback and fin whales from modeling of vessel collisions on the US West Coast suggests population impacts and insufficient protection. *PloS one*, *12*(8), e0183052.
[85] Conn, P. B., & Silber, G. K. (2013). Vessel speed restrictions reduce risk of collision-related mortality for North Atlantic right whales. *Ecosphere*, *4*(4), 1-16.

measures to limit the vessel speeds of offshore wind project-associated vessels both within eventual Wind Energy Areas (WEAs) and along primary transit routes.

Marine Mammals – Entanglement

The extensive network of inter-array cables that interconnects turbines to one another and connects the turbines to the floating substation raises questions about the risks of entanglement, and whether this cable network has the potential to disrupt migratory species, such as whales. Large marine animals may be at risk from colliding with or becoming entrapped in dense configurations of mooring lines,[86] particularly in large-scale arrays. Entrapment can be defined as physically trapping a marine animal or causing confusion in or around a set of mooring lines.[87] This is of particular concern for OWEI that are designed to be deployed with multiple mooring lines and inter-array cables in close proximity to each other.

Risk of entanglement as a result of floating offshore wind development has been determined to be relatively modest[88] given that the moorings are tight and constructed of large diameter line or chain—when lines have less curvature than fishing lines for example, the risk of loop creation and subsequent entanglement is relatively low. It is important to note, however, that the inter-array power cables connecting turbines are likely to have greater curvature and will sit roughly 100 m below the surface. It is likely that marine mammal species will be able to detect the large diameter mooring lines, either through echolocation, vibrations detected through vibrissae (in the case of pinnipeds) or basic acoustic detection (hearing) as lines and cables produce noise in proportion to current flow.[89] This detection may occur at a distance to as little as a tenth of a meter. However, how marine mammals, and particularly migratory baleen whales, may respond to a large network of cables within the water column is unknown.

Entanglement risk at floating turbines could be influenced by a number of factors including:[90]

- The geometry of the mooring lines (i.e., taut versus draped)
- The depth of the draping of mooring lines
- Whale behavior near turbines
- Detection of mooring lines, which will be influenced by the configuration and material, used for mooring lines, as well as the extent and type of movement of mooring lines in the water column.

No entanglement in mooring lines or related gear has been reported for floating turbines in Scotland since operation began in October of 2017;[91] killer, long-finned pilot, sperm, fin, and minke whales occur in Scottish waters, although this area does not represent an equivalent high-use migratory corridor for large whales as observed in the CCE.[92] However, large baleen whales are considered to be of the greatest risk because of their large body size and foraging habits, according to a report to the Scottish Government.[93] Baleen whales are particularly sensitive as they forage by feeding with their mouths open and therefore may be entangled through the mouth, and any smaller diameter cables may become lodged behind the jaw or baleen and be difficult to remove without human aid.[94] Species with large appendages such as humpback whales or leatherback turtles also have a greater propensity for entanglement. If entanglement were to occur, it may occur as a result of a lack of detection, or attraction to lines as a result of the aggregating effect of floating objects such as floating turbines. Floating objects, such as turbines, can

[86] Benjamins et al. 2014.
[87] Id.
[88] Id.
[89] Id.
[90] Copping, A., Grear, M., and Sanders, G. (2018). Risk of whale encounters with offshore renewable energy mooring lines and electrical cables [Presentation]. Presented at the Environmental Interactions of Marine Renewables 2018, Kirkwall, Orkney, Scotland, UK.
[91] Personal communication, Caroline Carter, Scottish National Heritage
[92] https://www.nature.scot/sites/default/files/2017-07/Naturally%20Scottish%20-%20Whales%2C%20Dolphins%20and%20Porpoises.pdf
[93] Benjamins et al. (2014).
[94] Id.

serve as attractants to forage fish and their marine megafauna predators and this can be particularly prominent in less productive areas such the Call Areas further offshore. Large whales have also been anecdotally observed using surfaces to rub against to presumably remove parasites or scratch itches, which may increase entanglement risk.[95]

Marine Mammals – Secondary Entanglement

Research indicating that Abandoned, Lost or otherwise Discarded Fishing gear (ALDFG) or other marine debris may become caught among moorings and platforms and pose a secondary entanglement risk is a concern.[96] Floating wind turbines are expected to remain in the marine environment for the operational lifetime of a given project, before either being replaced or decommissioned. If ALDFG or marine debris are held in the water column for extended periods, they would present a novel and significantly heightened entanglement or bycatch risk for a wide range of species, including those otherwise too small to be adversely affected (e.g., pinnipeds, small cetaceans, and seabirds). While little is currently known about the likelihood of this occurring, the potential for secondary entanglement cannot be discounted and requires further research. Entanglement, including that in fishing gears, has been demonstrated to lead to population-level impacts in a number of marine mammal species. For example, on the East Coast, humpback whales are thought to have an up to 12.1 percent annual entanglement rate,[97] with annual severe entanglement rates at 3 percent,[98] and entanglement from fishing gear is the primary driver of the highly endangered North Atlantic right whale's rapid decline.[99]

While offshore wind farms are deployed, the cable and mooring line surfaces will be colonized by many different species of marine algae and invertebrates unless stringent antifouling measures are taken. If such biofouling communities are able to establish themselves and are allowed to develop, the combined mass of such communities may influence the behavior of the moorings over time. The presence of biofouling communities will increase the surface roughness of both devices and moorings and could increase opportunities for derelict fishing gears and other marine debris becoming attached.[100] Such changes could modify existing entanglement risks to marine megafauna.[101]

Seabirds - Collision

Collision is the most conspicuous risk of OWEI to flying seabirds[102] and the risk of such collisions off the coast of California is not well known, making this an important factor for BOEM to consider when evaluating the appropriateness of offering an area for commercial lease. Collision can be a significant enough predicted risk to have previously halted OWEI development at some sites.[103] Notably, results from a large-scale data-intensive study (the "Offshore Renewables Joint Industry Program (ORJIP) Bird Collision and Avoidance Study") determined that seabird-turbine collision rates at offshore wind farms were significantly lower than anticipated due to birds avoiding the wind farms altogether (macro-avoidance).[104] While this is a promising finding, it is important that planners do not extrapolate results from one region to another, since the species composition and regional wind characteristics will be different across regions (and, as discussed above, there may also be detrimental energetic consequences as result of area avoidance or habitat loss).

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[95] Id.
[96] Copping et al. 2016.
[97] Robbins, J. (2009). Scar-based inference into Gulf of Maine humpback whale entanglement: 2003–2006. *Report to National Marine Fisheries Service, Northeast Fisheries Science Center, Woods Hole, MA. NOAA Contract# EA133F04SE0998*.
[98] Robbins, J., and Mattila, D.K. (2001). Monitoring entanglements of humpback whales (Megaptera novaeangliae) in the Gulf of Maine on the basis of caudal peduncle scarring. *Unpublished report to the Scientific Committee of the International Whaling Commission: SC/53/NAH25*.
[99] https://www.fisheries.noaa.gov/species/north-atlantic-right-whale
[100] Id.
[101] Id.
[102] Cook et al. (2018), "Quantifying Avian Avoidance of Offshore Wind Turbines: Current Evidence and Key Knowledge Gaps."
[103] Id.
[104] Skov et al. (2018). "ORJIP Bird Collision and Avoidance Study. Final report – April 2018."

The CCE is frequented by an abundance of Procellariforms, such as albatross, that are very large, gliding seabirds that may not as effectively avoid the areas as other more maneuverable seabirds.[105] Further, even small rates of mortality can have major impacts on species that are of critical conservation concern, such as Short-Tailed Albatross and Ashy Storm-Petrel.

In general, it is thought that the species most vulnerable to collision risk are those whose distributions overlap with wind farms and do not avoid wind farms, that have a greater percentage of flight time within the rotor sweep zone, and that fly at night when visual acuity is poorer.[106] As a first approach to evaluating species-specific risk to OWEI, planners and managers should become familiar with the work of Kelsey *et al.* (2018) and Adams *et al.* (2016). These scientists used a generalized framework to rank seabird species of the CCE based on population vulnerabilities as well as vulnerabilities to wind-turbine collision and displacement.[107] It is then critical that subsequent studies model precise species-specific risks to bird-turbine collision risk using empirical data collected at each site,[108] incorporating wind and wave conditions, seabird behavioral state and detailed flight characteristics, and turbine features, etc. Measurements of flight behavior at sites should also occur in each season, since seasonality will influence behavior and wind/wave conditions, and, accordingly flight characteristics.[109]

Seabirds - Secondary Entanglement

Underwater mooring lines may pose an entanglement risk for diving seabirds if the underwater infrastructure accumulates derelict fishing gear, such as nets and hooks/lines.[110] As discussed for marine mammals, it will be important for scientists to evaluate "snagging risk" of derelict fishing gear on cables within proposed mooring systems for floating turbines. OWEI developers could, for example, follow the recommendations outlined in Benjamins *et al*. (2014) to conduct a qualitative risk assessment that would facilitate risk management and the development of mitigation strategies in early development of OWEI.[111]

Fish – Secondary Entanglement

Secondary entanglement is of particular concern for fish because ALDFG continues to catch marine species. In turn, fish and other creatures caught in the abandoned gear can serve as a bait for other, larger predators, causing more unintended catch and death of these predators. For example, a school of CPS could become caught in an abandoned fishing net that is snagged on a wind turbine platform or mooring line. These CPS then act as bait for larger fish and eventually large HMS that come to feed off these fish and subsequently get caught by the nets. It is likely that with increased biofouling, there will be an increased risk of fishing gear entanglement as the windfarm structures become increasingly textured and rough with marine life. It is important to note that there is a tradeoff between the use of biocides to keep the mooring lines and platforms free from marine life to decrease the risk of gear entanglement and the potential for biocides to leach pollutants.

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[105] Ainley et al. (2015), "Seabird Flight Behavior and Height in Response to Altered Wind Strength and Direction."

[106] Kelsey et al. (2018), "Collision and Displacement Vulnerability to Offshore Wind Energy Infrastructure among Marine Birds of the Pacific Outer Continental Shelf"; Adams et al. (2016), "Collision and Displacement Vulnerability among Marine Birds of the California Current System Associated with Offshore Wind Energy Infrastructure."

[107] Kelsey et al. (2018), "Collision and Displacement Vulnerability to Offshore Wind Energy Infrastructure among Marine Birds of the Pacific Outer Continental Shelf"; Adams et al. (2016), "Collision and Displacement Vulnerability among Marine Birds of the California Current System Associated with Offshore Wind Energy Infrastructure."

[108] Ainley et al. (2015), "Seabird Flight Behavior and Height in Response to Altered Wind Strength and Direction."

[109] Id.

[110] Benjamins et al. (2014), "Understanding the Potential for Marine Megafauna Entanglement Risk from Marine Renewable Energy Developments." Scottish Natural Heritage Commissioned Report No. 791

[111] Benjamins et al. (2014), "Understanding the Potential for Marine Megafauna Entanglement Risk from Marine Renewable Energy Developments." Scottish Natural Heritage Commissioned Report No. 791.

Noise

Detrimental impacts from noise on marine wildlife are one of the most prominent issues of concern when considering offshore wind, given the crucial importance of sound to marine wildlife and the large environmental footprint of anthropogenic noise. Underwater noise may also result in habitat loss and displacement of marine mammals from the area. A benefit of floating wind technology is the reduced noise produced during the development of a floating wind turbine array relative to pile-driven turbines in shallower waters. However, after an offshore wind farm becomes operational, operational turbines will produce low levels of underwater noise, and associated maintenance activities and will last over the lifetime of the wind farm.[112]

Marine mammals

The greatest concerns regarding noise impacts on marine mammals include the potential to mask sounds made by marine mammals for communication, locating prey, and navigation.[113] Risks may include changes in marine mammals' behavior for hunting, swimming, rearing, mating, resting, and avoiding underwater threats, as well as changes in migratory patterns if sufficient noise is generated.[114] Importantly, as the scale of projects increase, the cumulative impacts of underwater sound may increase and cause additional masking or other effects at greater distances from the source.[115]

While low-level operational noises are considered to have a low impact on marine mammals due to the low-intensity and low-frequency of the noise,[116] these low levels may still result in habitat displacement for some sensitive species.[117] For example, changes of behavior were observed for seals and harbor porpoises at two wind farms in Denmark during their operation and the number of these marine mammals was found to be reduced within the development area.[118] The potential for habitat displacement to continue over the long term remains an area of active research.

Fish

It is important to consider the construction, operational and decommissioning noise from floating turbine systems, the increase in vessel traffic in areas with new turbine structures, and potential resonance from mooring cables and water currents/movement. Offshore wind developments may alter fish habitat if fish are attracted to a device by its physical presence or the sound emanating from it. Fish are able to detect vibration through their lateral line and inner ear and many species are well known to be able to discriminate between sounds and many use acoustic signals to attract mates to spawn.[119] In addition to turbines generating sounds that may mask fish hearing, there is experimental data showing that exposing fish to turbine sounds over long periods of time resulted in tissue damage.[120] Impacts are likely to be greater on long-lived, slow reproducing species, such as sharks and rays. Potential impacts to commercial

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[113] Kastelein, R., van Heerden, D., Gransier, R., and Hoek, L. 2013. Behavioral Responses of a Harbor Porpoise (Phocoena phocoena) to Playbacks of Broadband Pile Driving Sounds. Marine Environmental Research 92:206 214; Clark, C., Ellison, W., Southall, B., Hatch, L., Van Parijs, S., Frankel, A., and Ponirakis, D. 2009. Acoustic masking in marine ecosystems: intuitions, analysis, and implication. Marine Ecology Progress Series 395:201 222. doi: 10.3354/Meps08402.

[114] Richardson, W. J., Greene Jr, C. R., Malme, C. I., & Thomson, D. H. (2013).*Marine mammals and noise*. Academic press.

[115] Copping et al. 2016.

[116] Tougaard, J. 2015. Underwater Noise from a Wave Energy Converter Is Unlikely to Affect Marine Mammals. PLoS ONE 10(7): e0132391. doi:10.1371/journal.pone.0132391; Sun et al. 2012

[117] Thomsen, F., Lüdemann, K., Kafemann, R. & Piper, W. (2006) Effects of offshore wind farm noise on marine mammals and fish. COWRIE Report.

[118] Snyder et al. 2009.

[119] e.g. Hawkins and Amorim, Spawning Sounds of the Male Haddock, Melanogrammus aeglefinus. Environmental Biology of Fishes. 2000.

[120] Halvorsen, M., Casper, B., Woodley, C., Carlson, T., and Popper, A. 2012. Threshold for onset of injury in Chinook salmon from exposure to impulsive pile driving sounds. PloS one 7(6):e38968. doi: 10.1371/journal.pone.0038968.

fisheries must also be taken into consideration as well as to forage fish which provide critical resources to seabirds and shorebirds.[121]

Electromagnetic Fields (EMF)

Inter-array cables have the potential to affect magnetosensitive species. Introduction of additional EMF into the marine environment can potentially disrupt or alter animals' ability to detect or respond to natural magnetic signatures, potentially altering their survival, reproductive success, or migratory patterns.[122] The highest sensitivity taxa known are the elasmobranchs, the jawless fish (Agnatha), and sturgeons, paddlefish, and relatives (the chondrosteans),[123] but also include marine mammals, sea turtles, bony fish, crustacea (lobsters and prawns) and mollusca (snails, bivalves, cephalopods).[124] The potential for EMF to cause an impact is considered most likely for organisms living on or near the seabed (e.g., eggs, larvae, benthic or demersal species), especially species with limited mobility or in critical habitat areas, because mobile species are able to avoid/move away from areas with EMF if they need to.[125]

In general, little is known about the potential impacts of EMF on marine organisms.[126] If there are any consequences for magnetosensitive species of exposure to EMF from OWEI, then they are most likely to be associated with multiple encounters with the EMF over a short timescale.[127] For example, if several individuals were diverted from their migratory paths on each encounter with an EMF emitted from a cable, then the accumulated cost in terms of time wasted and energy used in diversion could compromise the animals.[128] Another possible cumulative effect could occur if animals continue to be attracted to EMF associated with OWEI because the emission resembles the bioelectric field of potential food sources.[129] If the animals continue to respond to every encounter with perceived bioelectric fields then this hunting of inanimate items may result in lack of food gain and also energetic compromise.[130]

V. SITE-SPECIFIC CONSIDERATIONS

HUMBOLDT CALL AREA

Benthic communities

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[121] Bailey et al. 2014.
[122] EPRI 2013
[123] Normandeau Associates Inc., Exponent Inc., Timothy Tricas, and Andrew Gill. 2011. "Effects of EMFs from Undersea Power Cables on Elasmobranchs and Other Marine Species." U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Regulation, and Enforcement, Pacific OCS Region, Camarillo, CA. OCS Study BOEMRE 2011-09; Gill, A.B., Bartlett, Thomsen, F. 2012. Potential interactions between diadromous fishes of U.K. conservation importance and the electromagnetic fields and subsea noise from marine renewable energy developments. Journal of Fish Biology 81(2):664 695.
[124] Wiltschko, W. & Wiltschko, R. (2005) Magnetic orientation and magnetoreception in birds and other animals. Journal of Comparative Physiology A – Neuroethology and Sensory Neural and Behavioral Physiology, 191, 675–693. doi: DOI: 10.1007/s00359-005-0627-7; Luschi, P., Benhamou, S., Girard, C., Ciccione, S., Roos, D., Sudre, J. & Benvenuti, S. (2007) Marine turtles use geomagnetic cues during open-sea homing. Current Biology, 17, 126–133; Gould, J.L. (2008) Animal navigation: the evolution of magnetic orientation. Current Biology, 18, R482–R484. *doi: DOI:* 10.1016/j.cub.2008.03.052; Copping et al. 2016.
[125] Woodruff, D.L., V.I. Cullinan, A.E. Copping, and K.E. Marshall. 2013. Effects of Electromagnetic Fields on Fish and Invertebrates: Task 2.1.3: Effects on Aquatic Organisms: Fiscal Year 2012 Progress Report: Environmental Effects of Marine and Hydrokinetic Energy. PNNL-22154. Pacific Northwest National Laboratory (PNNL), Richland, WA (US); Gill, A.B., I. Gloyne-Phillips, J.A. Kimber, P. Sigray. 2014. Marine renewable energy, electromagnetic fields and EM-sensitive animals. In: Humanity and the Sea: marine renewable energy and the interactions with the environment. Eds. M. Shields and A. Payne.
[126] Copping et al. 2016.
[127] Gill et al. 2012.
[128] Masden et al. 2009
[129] Kimber, J.A., Sims, D.W., Bellamy, P H. and Gill, A.B. 2014. Elasmobranch cognitive ability: using electroreceptive foraging behaviour to demonstrate learning, habituation and memory in a benthic shark. Animal Cognition 1-11.
[130] Gill et al. 2012

The Humboldt Call Area ranges in depth from approximately 500 m to 1100 m, and there is limited information available on the benthos. The assumption based on existing maps is that the benthos is primarily comprised of soft-sediment. Recent work by Yoklavich *et al.* 2016[131] with an Autonomous Underwater Vehicle (AUV) characterized 21,352 m^2 of seafloor habitat approximately 50 km to the north and south of the Call Area at a depth of 695-1169 m. Yoklavich *et al*. found soft mud sediments (85 percent) and some mixed rock (12 percent) and observed 13,758 (20 species) corals, 2549 (8 species) sponges and 5580 (18 species) fishes.[132] This observed diversity and density of species provides strong evidence that a thorough benthic survey should occur in the Call Area to identify areas with high levels of diversity and abundance to provide siting guidance to minimize benthic impacts.

The Call Area is sited between two submarine canyons, Trinidad Canyon approximately 8.6 nm to the north west, and Eel Canyon, approximately 4.9 nm to the south. Submarine canyons are well documented to serve as habitats, nurseries, forage areas, refugia, and carbon sequestration and storage areas.[133] It is unknown how development in proximity to these canyons may affect the canyons' ecosystem functions and services they provide.

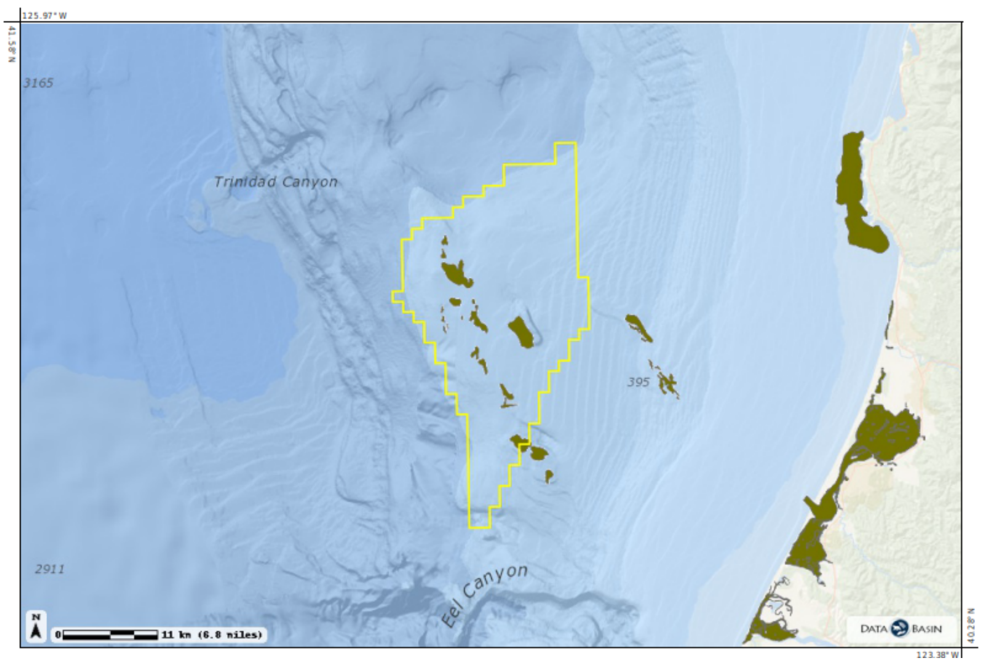

Figure 5. Detail of the Bureau of Ocean Energy Management (BOEM) Humboldt Call Area shown in yellow outline overlapping with the Pacific Fisheries Management Council (PFMC) Habitat Areas of Particular Concern (HAPC) for Groundfish shown in olive. The HAPC overlaps 7.96 mi^2 with the Humboldt Call Area.

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[131] Yoklavich, Mary, M. Elizabeth Clarke, Tom Laidig, Erica Fruh, Lisa Krigsman, Jeff Anderson, Jeremy Taylor, and Chris Romsos. 2016. A characterization of deep-sea coral and sponge communities in areas of high bycatch in bottom trawls off northern California. NOAA Technical Memorandum NMFS-SWFSC-556 (39 p.) [Internet]. [cited 2019 Jan 9]. Available from https://swfsc.noaa.gov/publications/TM/SWFSC/NOAA-TM-NMFS-SWFSC-556.pdf

[132] Id.

[133] Fernandez-Arcaya U, Ramirez-Llodra E, Aguzzi J, Allcock AL, Davies JS, Dissanayake A, Harris P, Howell K, Huvenne VAI, Macmillan-Lawler M, Martín J, Menot L, Nizinski M, Puig P, Rowden AA, Sanchez F, Van den Beld IMJ. 2017. Ecological Role of Submarine Canyons and Need for Canyon Conservation: A Review. Frontiers in Marine Science [Internet]. [cited 2019 Jan 9];4. Available from: DOI=10.3389/fmars.2017.00005

Species of concern

Seabirds- Species of particular concern
While there are no designated NMSs or Pelagic IBAs in the vicinity of the Humboldt Call Area, the waters in this region have been identified as an important and persistent hotspot of seabird occurrence.[134]

Phoebastria Albatross spp.: Short-tailed (*Phoebastria albatrus*), black-footed (*P. nigripes*) and Laysan (*P.immutabilis*) are the only three albatross species in the North Pacific Ocean and all occur throughout the CCE, although Laysan albatross typically range farther offshore and are much more uncommon in the CCE than black-footed and short-tailed albatross. Black-footed and short-tailed albatross are common in waters near the continental shelf break; indeed, the best predictor of black-footed occurrence in a recent seabird predictive habitat model was distance to the 1000 m isobath (i.e., the continental shelf break).[135]

The offshore waters offshore Cape Mendocino that overlap with the Humboldt Call Area were identified as a persistent and important area for CCE seabirds in a predictive model (See Figure 6, Nur *et al.* 2011).[136,137]

Juvenile, subadult, and adult short-tailed albatrosses heavily frequent this region for foraging, and potentially molting, grounds in late summer through October.[138] Guy *et al*. (2013) found both black-footed and short-tailed albatross to frequent waters north of 36°N and towards the shore from the 2000 m isobath.[139] Short-tailed albatross are listed as endangered in the United States, Japan, and Canada and as Vulnerable by the International Union for Conservation of Nature (IUCN). The IUCN lists Black-footed albatross as Near Threatened and are a species of special concern in the United States and Canada.[140] Black-footed albatrosses can display high site fidelity to their foraging/molting grounds during the post-breeding season,[141] and birds that demonstrate less behavioral flexibility may be more vulnerable to displacement risks. Furthermore, albatrosses are large-bodied, gliding birds that would be less able to avoid a collision with a turbine if they entered an OWEI-developed area—albatrosses in the Humboldt Call Area may be vulnerable to both collision and displacement risks.

Marbled Murrelets: As described above, marbled murrelets do not forage offshore in the regions of the Humboldt Call Area; however, they do inhabit waters shoreward from the Call Area and thus are susceptible to impacts from OWEI shore-associated activities.

Marine Mammals and Sea Turtles

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[134] Nur et al. (2011), "Where the Wild Things Are : Predicting Hotspots of Seabird Aggregations in the California Current System"; Sowls et al. (1980), "Catalog of California Seabird Colonies"; Guy et al. (2013), "Overlap of North Pacific Albatrosses with the U.S. West Coast Groundfish and Shrimp Fisheries."
[135] Id.
[136] Id.
[137] Due to OWEI site selection being limited by a maximum depth threshold ~1000 m, all three Call Areas are positioned over or near the 1000 m isobath (shelf break), and thus overlap with habitat for seabirds that are continental shelf break foragers.
[138] Orben et al. (2018), "Ontogenetic Changes in At-Sea Distributions of Immature Short-Tailed Albatrosses Phoebastria Albatrus.; "Guy et al. (2013), "Overlap of North Pacific Albatrosses with the U.S. West Coast Groundfish and Shrimp Fisheries"; Suryan and Kuletz (2018), "Distribution,
Habitat Use, and Conservation of Albatrosses in Alaska" (available online, for an English version contact Kathy_kuletz@fws.gov or Rob.Suryan@noaa.gov).
[139] Orben et al. (2018), "Ontogenetic Changes in At-Sea Distributions of Immature Short-Tailed Albatrosses Phoebastria Albatrus.; "Guy et al. (2013), "Overlap of North Pacific Albatrosses with the U.S. West Coast Groundfish and Shrimp Fisheries"; Suryan and Kuletz (2018), "Distribution,
Habitat Use, and Conservation of Albatrosses in Alaska" (available online, for an English version contact Kathy_kuletz@fws.gov or Rob.Suryan@noaa.gov).
[140] USFWS. 2002. COSEWIC. 2007.
[141] Conners (2015) "Comparative Behavior, Diet, and Post-Breeding Strategies of Two Sympatric North Pacific Albatross Species", Dissertation – University of California, Santa Cruz

Blue whales: Blue whales are listed as "endangered" under the Endangered Species Act and are "depleted" under the Marine Mammal Protection Act.[142] In contrast to some other protected cetaceans, blue whale populations have not increased over the last 20 years.[143]

Blue whale habitat overlap with the Humboldt Call Area varies according to the data source; however, the Call Area does not overlap with blue whale BIAs. Blue whales are found primarily on the continental shelf, and have greater probability of occurring in waters off California than offshore Washington or Oregon.[144] Blue whales' foraging habitat shifts because it depends on large scale oceanographic conditions (i.e., Pacific Decadal Oscillation) as the animals follow krill populations.[145] Tracking data show that the Humboldt Call a]Area overlaps with the core and overall home ranges of a number of blue whales (overall home range: 10-16 of 171 tagged individuals; core home range: 1-9 individuals).[146] Yet, during the summer months, WhaleWatch predicts some of the highest densities of blue whales (approximately 3 individuals per cell) will overlap with all three Call Areas;[147] Becker *et al*.[148] predicts the same for the Humboldt Call Area. Future shifts in feeding habitat may, however, occur under climate change and this requires further research.

Grey whales: The Humboldt Call Area does not overlap with grey whale feeding BIAs, as all grey whale feeding BIAs occur on the continental shelf and in coastal nearshore waters, and further north of the Call Areas, primarily in Washington and Oregon.[149] Similarly, migration corridors and BIAs occur close to shore (within 5.4 nm). It is important to note that in defining BIAs, NOAA included a 25.4 nm buffer. The buffer represents the potential path of some individuals that move farther offshore during annual grey whale migrations. The southbound migration occurs from October through March (peak December through March) and the northbound migration occurs from January through July (peak April through July).[150] This buffer overlaps with more than half of the footprint of all three Call Areas; however, since it is a buffer region, overlap is of less concern. It is possible that with new data on migration and movement patterns of grey whales, these areas may emerge has important habitat with more certainty.

Humpback whales: Concentrations of humpback whales are known to increase with proximity to shore.[151] Humpback whale feeding BIAs occur approximately 10.8 nm closer to the shore than the Call Areas. NOAA Southwest Fisheries Science Center (SWFSC) density models, which are based on ship-based surveys, predict the Humboldt Call Area to overlap with regions of high or moderate density for humpback whales, however it should be noted that humpbacks were not sighted in that area during any of the six cruise years.[152]

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[142] http://www.fisheries.noaa.gov/pr/species/mammals/whales/blue-whale.html.
[143] Calambokidis, et al., 2015.
[144] Croll, D.A., Marinovic, B., Benson, S., Chavez, F.P., Black, N., Ternullo, R., et al. (2005). From wind to whales: trophic links in a coastal upwelling system. *Marine Ecology Progress Series* 289**,** 117-130.; Keiper, C., Calambokidis, J., Ford, G., Casey, J., Miller, C., and Kieckhefer, T.R. (2011). "Risk assessment of vessel traffic on endangered blue and humpback whales in the Gulf of the Farallones and Cordell Bank National Marine Sanctuaries". (Bolinas, CA: Oikonos.).
[145] Calambokidis et al (2015).
[146] Irvine, L.M., Mate, B.R., Winsor, M.H., Palacios, D.M., Bograd, S.J., Costa, D.P., et al. (2014). Spatial and temporal occurrence of blue whales off the US West Coast, with implications for management. *PLoS One* 9(7)**,** e102959.
[147] Hazen, E.L., Palacios, D.M., Forney, K.A., Howell, E.A., Becker, E., Hoover, A.L., et al. (2016). WhaleWatch: a dynamic management tool for predicting blue whale density in the California Current.
[148] Becker, E.A., Forney, K.A., Fiedler, P.C., Barlow, J., Chivers, S.J., Edwards, C.A., et al. (2016). Moving towards dynamic ocean management: how well do modeled ocean products predict species distributions? *Remote Sensing* 8(2)**,** 149.
[149] Calambokidis et al (2015).
[150] Id.
[151] Keiper et al. (2011).
[152] Becker, E.A., Foley, D., Forney, K., Barlow, J., Redfern, J., and Gentemann, C. (2012). Forecasting cetacean abundance patterns to enhance management decisions. *Endangered Species Research* 16**,** 97–112; Becker et al. (2016).

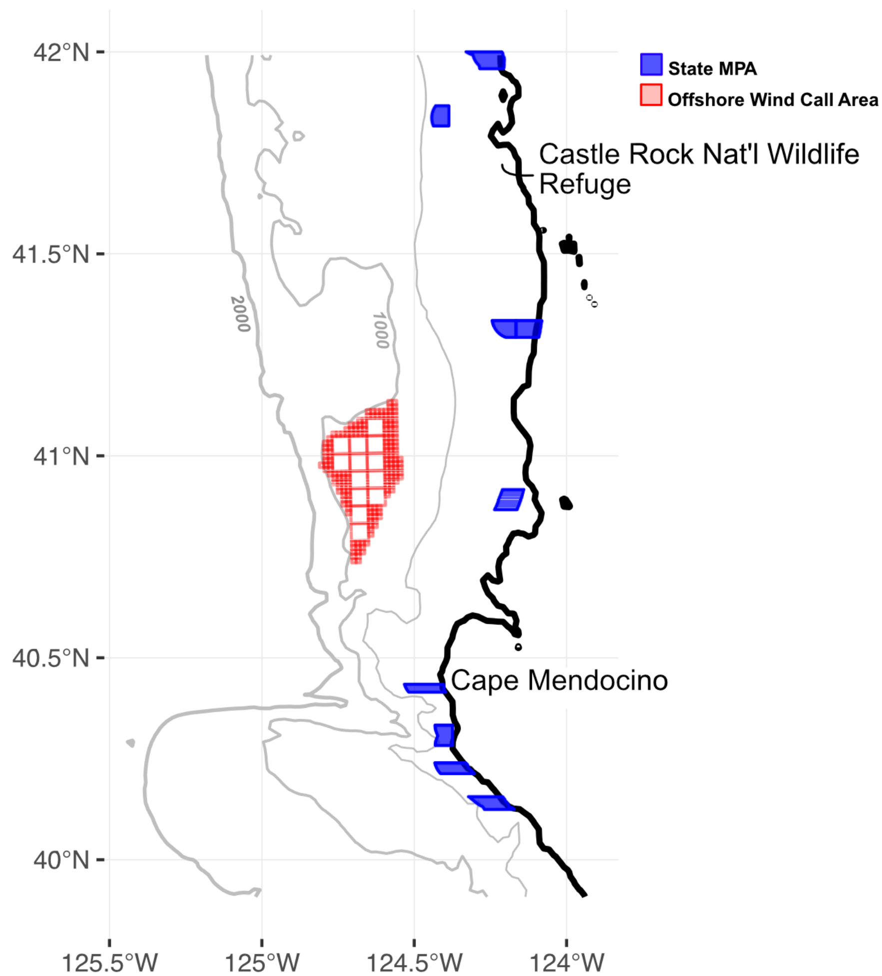


Figure 6. The Humboldt Call Area sits offshore from a network of coastal state MPAs and coastal IBAs (coastal IBAs not shown).

Fin whales: Fin whales occur in both pelagic and coastal waters, and where they feed primarily on krill and fish. Current research suggests that only some fin whales undergo long distance migrations, with some individuals even remaining resident in warmer waters of Southern California.[153] The variability in movements make BIAs difficult to define and thus have not been designated. Satellite tagging-based habitat suitability models suggest the Humboldt Call Area falls in a low density or low-moderate habitat suitability region.[154] Shifts in feeding habitat may, however, occur under climate change.

Minke whales: Minke whales in California are usually sighted on the continental shelf.[155] Populations in inland California waters are thought to be resident populations that establish home ranges, though

[153] Calambokidis et al (2015).
[154] Scales, K.L., Schorr, G.S., Hazen, E.L., Bograd, S.J., Miller, P.I., Andrews, R.D., et al. (2017). Should I stay or should I go? Modelling year-round habitat suitability and drivers of residency for fin whales in the California Current. *Diversity and Distributions* 23(10), 1204-1215; Becker et al. (2016).
[155] Carretta, J.V., Oleson, E., Weller, D.W., Lang, A.R., Forney, K.A., Baker, J., et al. (2014). "U.S. Pacific Marine Mammal Stock Assessments: 2013". US Department of Commerce, NOAA Technical Memorandum, NMFS-SWFSC-532).

individuals in Alaska migrate to warmer waters for breeding.[156] The population size and status are unknown, and little is known about individual movements, making impacts and potential overlap with the Call Area difficult to assess.

North Pacific right whales: Potential overlap of North Pacific right whale habitat with the Call Areas is unknown. Very limited information exists on the distribution of North Pacific right whales, though sightings have occurred almost exclusively in Alaska; those that exist in California were not in the vicinity of the Humboldt call area.[157] Sightings have occurred in Mexican waters and thus there is some evidence that they travel through California waters to reach reputed breeding grounds in Southern California or Mexico in the summer months,[158] though how many animals utilize this migratory route is unconfirmed.[159]

Leatherback Sea Turtles:
The Humboldt Call Area does not fall within Critical Habitat for leatherback sea turtles designated under the Endangered Species Act.[160] All three Call Areas may overlap with high density areas that were identified from habitat modeling approaches.[161]

MORRO BAY AND DIABLO CANYON CALL AREAS

As detailed in our previous comment letter, the Morro Bay and Diablo Canyon Call Areas are located in proximity to multiple protected areas. The Morro Bay Call Area is immediately outside the southwest corner of the Monterey Bay NMS. Further, the Diablo Canyon Call Area and southeast corner of the Morro Bay Call Area, transmission cables, and floating substations would be located within the currently nominated Chumash NMS. Both of these areas protect a number of vital marine resources, including feeding and migratory habitat for federally protected marine mammals and seabirds, as well as habitat for other federally threatened and endangered species. The potential for offshore wind development to have negative impacts on the effectiveness of the Monterey Bay NMS and the suitability of siting offshore wind inside of, or in immediate proximity to, a NMS are important considerations.

Our organizations are concerned about the potential for offshore wind development to have a negative impact on Sanctuary resources if sited either within the nominated Chumash NMS, or adjacent to, the Monterey Bay NMS. We therefore recommend that BOEM evaluate the potential impacts of any wind development located in proximity to a NMS extremely carefully, undertake the necessary studies to fill any data gaps, and proceed incrementally with any developments, so that the activities associated with offshore wind development and operations can be modified in order to avoid impacts to the marine life and habitats within the NMS.

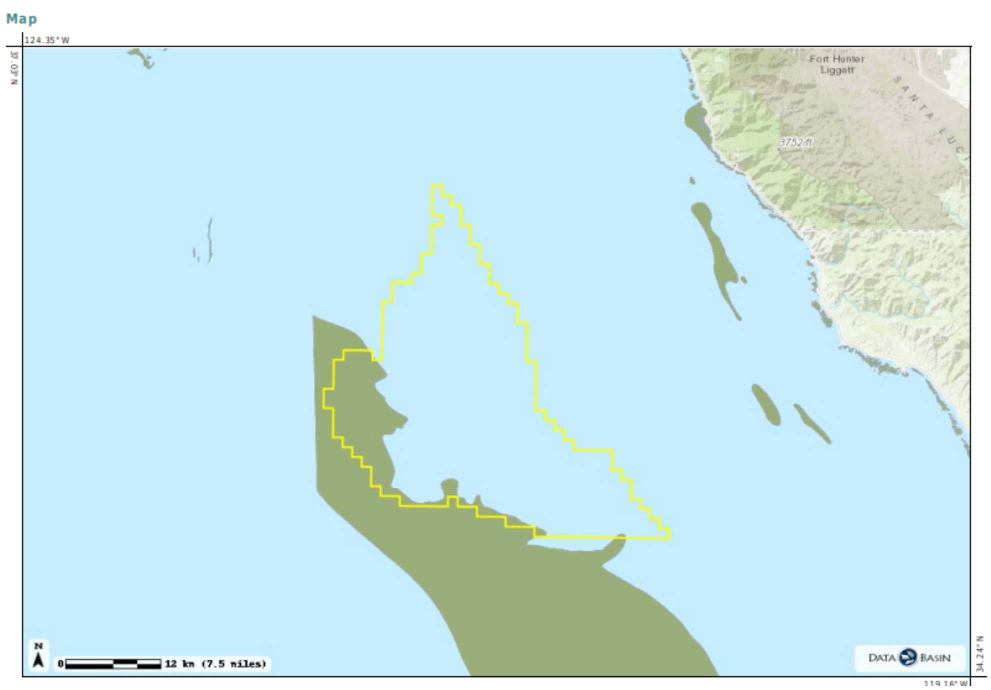
Within State waters, protecting California's landmark network of MPAs is important. Critically, the effectiveness of California's MPA network relies not only on the protections individual MPAs afford, but

[156] https://www.fisheries.noaa.gov/species/minke-whale
[157] National Marine Fisheries Service. 2013. Recovery plan for the North Pacific right whale (*Eubaleana japonica*). National Marine Fisheries Service, Office of Protected Resources, Silver Spring, MD; Brownell Jr, R.L., and Clapham, P.J. (2001). Conservation status of North Pacific right whales. *Journal of Cetacean Research and Management* (2), 269-286.
[158] Crance, J.L, Berchok, C.L., Wright, D.L., and Clapham, P. (2018). Can their Pacific cousins be saved? The plight of the North Pacific right whales and a comparison of two very different populations. Poster presentation. North Atlantic Right Whale Consortium 2018 Annual Meeting, New Bedford, MA, USA, 7-8 November, 2018.
[159] https://www.fisheries.noaa.gov/species/north-pacific-right-whale
[160] https://www.westcoast.fisheries.noaa.gov/maps_data/endangered_species_act_critical_habitat.html
[161] Eguchi, T., Benson, S.R., Foley, D.G., and Forney, K.A. (2017). Predicting overlap between drift gillnet fishing and leatherback turtle habitat in the California Current Ecosystem. *Fisheries Oceanography* 26(1), 17-33.

on the connectivity of the entire MPA network.[162] There are 10 California MPAs located directly shoreward of the proposed lease areas. In evaluating commercial wind development's potential interactions with the Monterey Bay NMS and nominated Chumash NMS, which each include state MPAs, it is also important to consider overall impacts to the MPA system.

The Morro Bay Call Area is located approximately 20 nm north and northwest of Santa Lucia Bank, a geologic feature that attracts cetaceans, commercially important fish, and ecologically important benthic communities.[163] The Monterey Bay NMS's Davidson Seamount is also a biologically rich geologic feature located roughly 45 nm west of the Morro Bay Call Area. It is not clear whether or how a commercial wind farm would interfere with migratory pathways between Santa Lucia Bank and the Monterey Bay NMS, yet the potential for interaction should be considered in evaluating the suitability of the proposed Call Area, given that any projects would be located between Davidson Seamount and the Monterey Bay NMS.

Benthic communities
There is limited information available on the benthic composition and habitat within the Morro Bay Call Area. The Davidson Seamount is located approximately 16.2 nm west of the Call Area and is part of the Monterey Bay NMS and designated as a HAPC. As stated above, the Call Area abuts the Monterey Bay NMS southwest and southern boundary, and Santa Lucia Bank is located directly south of the Call Area. The Bank rises to 400 m from the surface and is part of a persistent upwelling cell.[164,165] This Call Area has a 24.4 nm^2 overlap with HAPC.



[162] Saarman E., Gleason M., Ugoretz J., Airamé S., Carr M., Fox E., Frimodig A., Mason T., Vasques J. (2013) "The role of science in supporting marine protected area network planning and design in California," Ocean and Coastal Management.
[163] Minerals Management Service, Proposed 1983 Outer Continental Shelf Oil and Gas Lease Sale. General information on deep sea reefs in Kaplan, B., C.J. Beegle-Krause, D. French McCay, A. Copping, S. Geerlofs, eds. 2010. "Updated Summary of Knowledge: Selected Areas of the Pacific Coast." OCS Study BOEMRE 2010-014. US Department of Interior, Bureau of Ocean and Energy Management, Regulation, and Enforcement, Pacific OCS Region, Camarillo, CA.
[164] Hendy IL, Pedersen TF, Kennett JP,Tada R. 2004. Intermittent existence of a southern Californian upwelling cell during submillennial climate change of the last 60 kyr. Paleoceanography [Internet]. [cited 2019 Jan 9];19:PA3007. Available from: doi:10.1029/2003PA000965.
[165] Proposed Chumash Sanctuary: Area 2 [Internet]. Northern Chumash Tribal Council [cited 2019 Jan 9]. Available from: https://chumashsanctuary.com/area/area-2/

Figure 7. Detail of Bureau of Ocean Energy Management (BOEM) Morro Bay Call area shown in yellow outline overlapping with the Pacific Fisheries Management Council (PAMC) Habitat Areas of Particular Concern (HAPC) for groundfish shown in olive. The HAPC overlaps 45.2 mi^2 with the Morro Bay Call Area.

The Diablo Call Area has limited information available on the benthos and ranges in depth from approximately 550 m to 1100 m. The western portion of the Call Area is located directly on Santa Lucia Bank, and has 146.6 nm^2 of overlap with a HAPC (See Figure 8). The NOAA National Deep-Sea Coral and Sponge Database, 1842-Present identifies significant coral and sponge observations throughout this Call Area. Comprehensive baseline characterization studies will be required to document the habitats and ecological communities present.

Generally, areas located around marine banks such as Santa Lucia Bank have complex circulation patterns and are hotspots of diversity and productivity.[166] The potential for significant impacts to established benthic communities are likely higher in the Diablo Call Area than in the Humboldt and Morro Bay Call Areas. The grid connection for the Diablo Call Area would likely pass through the Point Buchon State Marine Reserve (SMR) and Conservation Area. Current state regulations do not allow development within a SMR and state policy requires state marine protected areas to be managed to promote areas of minimal human disturbance.[167]

BOEM should conduct comprehensive surveys of Santa Lucia Bank, and should avoid designating WEAs that overlap with the HAPC within the Diablo Call Area. There is an approximately a 108 nm^2 section that does not overlap with the HAPC within the Call Area (See Figure 8). Locating development in this inshore section of the Diablo Call Area outside of the HAPC may significantly reduce benthic impacts and could be explored for potential development, while also considering of other potential impacts to species of concern such as marine mammals, forage fish, and birds.

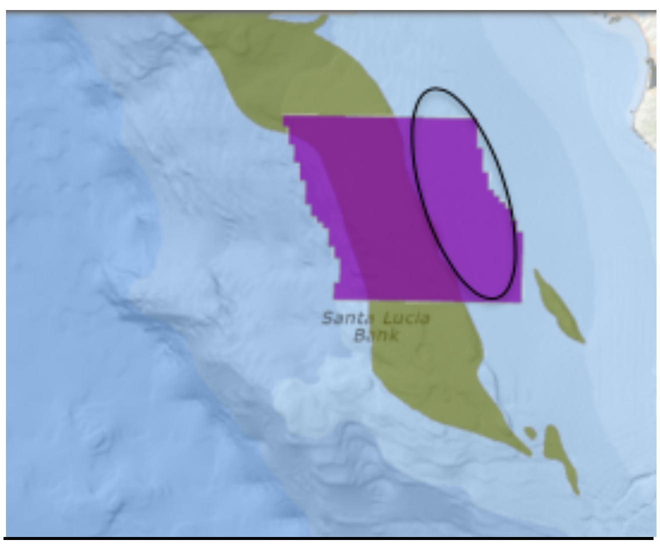


Figure 8. Bureau of Ocean Energy Management (BOEM) Diablo Call Area (purple) overlapping with Pacific Fisheries Management Council (PFMC) Habitat Areas of Particular Concern (HAPC, olive) for

[166] Yoklavich M, Wakefield W. 2015. Pacific Coast Region. In: Our living oceans: habitat: Status of the habitat of U.S. living marine resources [Internet], [cited 2019 Jan 9]; p. 189-221. NOAA Technical Memorandum NMFS-F/SPO-75. Available from: https://swfsc.noaa.gov/publications/CR/2015/2015Yoklavich.pdf

[167] Marine Life Protection Act. California Department of Fish and Wildlife [Internet]. [cited 2019 Jan 9]. Available from: https://www.wildlife.ca.gov/Conservation/Marine/MPAs/MLPA

Groundfish. Black circle indicates approximately 108 nm^2 located on the inshore area of the Call Area that should be explored as the priority location within this Call Area due to the likelihood it could reduce benthic impacts.

Species of concern

Seabirds

Both call areas are adjacent to and slightly overlapping with the Piedras Blancas IBA (Diablo Canyon Call Area) and the Point Sal 121W35N IBA (Morro Bay Call Area). The Piedras Blancas and Point Sal IBAs have been identified as essential habitat for wintering sooty shearwaters and breeding/wintering pink-footed shearwaters, respectively.[168]

Ashy Storm-Petrels: There should be a substantial effort to understand the seasonal and annual abundance and distribution of the Ashy Storm-Petrel (*Oceanodroma homochroa*) within the two Call Areas offshore southern California. The entire global population of Ashy Storm-Petrel is estimated at roughly 10,000 individuals, with breeding colonies occurring in a restricted area along the California coast from the Coronado Islands (32 °N) to Mendocino county (41 °N).[169] Notably, roughly half of the world's population is thought to occur in the Channel Islands, roughly 60 nm south of Morro Bay Call Area.[170] Further, Ashy Storm-Petrels have been caught via mist-nests on Vandenberg Air Force Base, which is located north of Point Conception[171] and ~ 14.6 nm southeast from the Morro Bay Call Area. The Ashy Storm-Petrel is listed as Endangered with a decreasing population trend by the IUCN, and are listed as a Species of Special Concern with both the California Department of Fish and United States Department of Fish and Wildlife Service. The at-sea range is thought to be restricted, and range dynamics of this species are not well-understood. The small physical size of Ashy Storm-Petrels (~ 40 g) is incompatible with most bio-logging instrumentation methods and their small size also contributes to the challenge of observing them at-sea. The limited observations of Ashy Storm-Petrels that do exist indicate the at-sea range is restricted to waters along the edge of the continental shelf from northern Baja California to central California.[172] Importantly, from a conservation perspective, they have been observed to aggregate at-sea in large flocks during the fall primary feather molt. Hotspots of Ashy Storm-Petrels have been documented in waters both south (33.5 °N) and north (38 °N) of the Morro Bay and Diablo Canyon Call Areas[173] and individuals have also been documented foraging on the continental slope off Point Conception[174] and 5.4-37.8 nm offshore between San Miguel Island (32 °N and Point Buchon 35.3 °N).[175]

The limited range of Ashy Storm-Petrels and at-sea aggregations make them particularly susceptible to local disasters such as oil spills or other impacts from human activities and offshore development.

Other seabird species of conservation concern occur in the California Current at the same latitudes as the Morro Bay and Diablo Canyon Call Areas. These include IUCN-listed Vulnerable Leach's Storm-Petrel (common), Pink-footed Shearwater (common), Black-legged Kittiwake (common), Scripps Murrelet (uncommon), and Short-tailed Albatross (uncommon), as well as the Endangered Hawaiian Petrel and Guadalupe Murrelet (both uncommon). Short-tailed albatrosses are designated as a federally listed endangered species through the Endangered Species Act as well as a State endangered species of Alaska.

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168 https://netapp.audubon.org/iba/Reports/4687; https://netapp.audubon.org/iba/Reports/4692
169 Ainley, et al (1995). "Variations in Marine Bird Communities of the California Current, 1986-1994"; Carter et al. (2008). "Organochlorine Contaminants in Ashy Storm-Petrel Eggs from Santa Cruz Island, California, in 1992–2008: Preliminary Findings."
170 Carter et al. (2016), "Range-Wide Conservation and Science of the Ashy Storm-Petrel Oceanodroma Homochroa."
171 Brown et al. (2003), "A Potential New Colony of Ashy Storm-Petrels on the Mainland Coast of California, USA."
172 Ainley and Boekelheide (1990), "Seabirds of the Farallon Islands."
173 Carter et al. (2016), "Range-Wide Conservation and Science of the Ashy Storm-Petrel Oceanodroma Homochroa."
174 Adams and Takekawa (2008), "At-Sea Distribution of Radio-Marked Ashy Storm-Petrels Oceanodroma Homochroa Captured on the California Channel Islands."
175 Mason et al. (2007), "At-Sea Distribution and Abundance of Seabirds Off Southern California : A 20-Year Comparison".

While uncommon in the Call Areas, the loss of even a few individual Short-tailed albatrosses can result in population-level impacts. Particular effort should be made to model flight heights of Short-tailed albatross in the wind regimes experienced in the Call Areas and response actions should be established for mitigating loss of birds, including the temporary cessation of turbines if Short-tailed albatross are in the area. Populations of vulnerable pink-footed shearwaters are declining, and they occur in high numbers in the California Current offshore southern California. Their presence triggered the Audubon Society's establishment of Point Sal Important Bird Area, which was intended to highlight the important wintering grounds of this species. The boundary of the Morro Bay Call Area is adjacent to, and slightly overlapping with, the Point Sal IBA in the sites southeast corner (See Figure 9). Given the proximity to this important bird habitat, an action committee should be established to minimize habitat loss and bird mortality of pink-footed shearwaters from OWEI.

Sooty shearwaters: While sooty shearwaters are abundant and not yet a species of concern on federal or state listings, their populations are declining. The Diablo Canyon and Morro Bay Call Areas are in regions that experience high numbers of wintering sooty shearwaters, and both Call Areas are adjacent to the Piedras Blancas IBA that was established to highlight important habitat for wintering sooty shearwaters. Given the proximity of both Call Areas to this important bird habitat, an action committee should be established to minimize habitat loss and bird mortality of sooty shearwaters from OWEI.

Marbled Murrelets: Marbled Murrelets are listed as Threatened under the federal Endangered Species Act and as Endangered by the state of California. They breed in coniferous forests in California from the Oregon border to Santa Cruz County and also occur in waters off San Luis Obispo county, primarily in fall.[176] Concentrations in San Luis Obispo County occur around San Simeon Cove (35.6 N), directly east of Diablo Canyon Call Area.[177] Marbled Murrelets are a nearshore species, so are not at a high collision or displacement risk from OWEI development.

Marine Mammals and Sea Turtles - Morro Bay

Blue whales: Overlap of the Morro Bay Call Area with blue whale habitat appears to vary depending on the data source; however, the Call Area does not overlap with blue whale BIAs. Tracking data show that the Morro Bay Call Area overlaps with the core and overall home ranges of a low number of blue whales (overall home range: 10-28 of 171 tagged individuals; core home range: 1-9 individuals).[178] It should be noted that one of the primary tagging sites was near the Channel Islands just to the south, thereby potentially biasing home range results to areas near to the tagging location. As previously described, WhaleWatch predicts some of the highest densities of blue whales (approximately three individuals per cell) in the Call Areas will overlap with all three Call Areas during the summer months,[179] though Becker *et al*.[180] predict lower densities for the Morro Bay call area.

Grey whales: The Call Areas do not overlap with grey whale feeding BIAs, as all occur on the continental shelf and in coastal nearshore waters, and further north of the Call Areas, primarily in Washington and Oregon. Similarly, migration corridors and BIAs occur close to shore (within 5.4 nm). It is important to note that in defining BIAs, a 25.4 nm buffer was included. The buffer represents the potential path of some individuals that move further offshore during annual grey whale migrations. The southbound

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[176] Henkel (2014), "At-Sea Distribution of Marbled Murrelets in San Luis Obispo County , California At-Sea Distribution of Marbled Murrelets in San Luis Obispo County , California FINAL REPORT Submitted to the Oiled Wildlife Care Network Watsonville , CA 95076."
[177] Henkel (2014), "At-Sea Distribution of Marbled Murrelets in San Luis Obispo County , California At-Sea Distribution of Marbled Murrelets in San Luis Obispo County , California FINAL REPORT Submitted to the Oiled Wildlife Care Network Watsonville , CA 95076."
[178] Irvine, L.M., Mate, B.R., Winsor, M.H., Palacios, D.M., Bograd, S.J., Costa, D.P., et al. (2014). Spatial and temporal occurrence of blue whales off the US West Coast, with implications for management. *PLoS One* 9(7)**,** e102959.
[179] Hazen et al. 2016.
[180] Becker et al. 2016

migration occurs from October through March (peak December through March) and the northbound migration occurs from January through July (peak April through July).[181]

Humpback whales: Humpback whale feeding BIAs occur within 32.4 nm of shore and are located approximately 13.5 nm further inshore than the Call Areas. The SWFSC density models predict the Morro Bay Call Area to overlap with regions of high or moderate density for humpback whales,[182] and humpbacks were sighted during three of the six survey years.[183]

Fin whales: Fin whales occur in both pelagic and coastal waters, and where they feed primarily on krill and fish. Current research suggests that only some fin whales undergo long distance migrations, with some individuals even remaining resident in warmer waters of Southern California.[184] The variability in movements make BIAs difficult to define and thus were not designated. However, the SWFSC density models suggest high fin whale density may occur in the Morro Bay Call Area.[185] Additionally, concentrations of sightings were found in the Saint Lucia Bank region. Satellite tagging-based habitat suitability models also suggest the Morro Bay Call Area is in high suitability habitat areas, particularly during the summer and fall (June through November[186]). The average depth of four satellite-tagged individuals in 2010 was over 700 m and 38.9 nm from shore.[187]

Minke whale: Minke whales in California are usually sighted on the continental shelf. Populations in inland California waters are thought to be resident populations and establish home ranges, although individuals in Alaska migrate to warmer waters for breeding.[188] The population size and status are unknown, and little is known about individual movements, making impacts and potential overlap with Call Areas difficult to assess.

North Pacific right whale: As previously discussed, potential overlap of North Pacific right whale habitat with the Call Areas is unknown. Since 1950, there have been at least four sightings of North Pacific right whales from the eastern population from Washington (one of which occurred since 1990) and twelve in California waters. There were two sightings offshore La Jolla, three in the Channel Islands, one each off Piedras Blancas, Big Sur, Half Moon Bay, and four in the San Francisco vicinity,), including two potentially in the Morro Bay or Diablo Canyon Call areas in the 1990s (Piedras Blancas and Big Sur Coast sightings).[189] Habitat preference models have also indicated that southern California is a potential calving area, based on environmental conditions.[190]

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[181] Id.
[182] Becker et al. (2012).
[183] Id.; Becker et al. (2016).
[184] Calambokidis et al. (2015).
[185] Becker et al. (2012).
[186] Scales et al. (2017).
[187] Schorr, G.S., Falcone, E.A., Calambokidis, J., and Andrews, R.D. (2010). "Satellite tagging of fin whales off California and Washington in 2010 to identify movement patterns, habitat use, and possible stock boundaries". CASCADIA RESEARCH COLLECTIVE OLYMPIA WA).
[188] https://www.fisheries.noaa.gov/species/minke-whale
[189] National Marine Fisheries Service. 2013. Recovery plan for the North Pacific right whale (*Eubaleana japonica*). National Marine Fisheries Service, Office of Protected Resources, Silver Spring, MD; Brownell Jr, R.L., and Clapham, P.J. (2001). Conservation status of North Pacific right whales. *Journal of Cetacean Research and Management* (2), 269-286.
[190] Id.

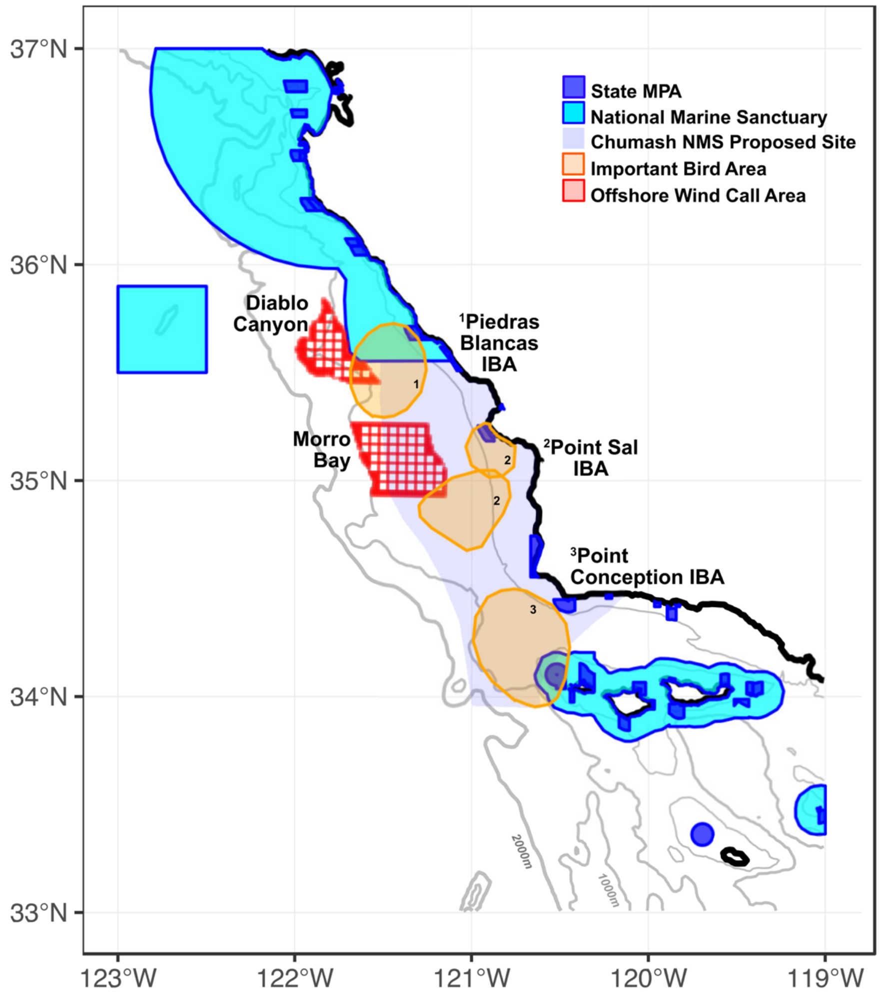

Figure 9. The Morro Bay and Diablo Call Areas are positioned adjacent to, but with minimal overlap with, a network of National Marine Sanctuaries (NMSs) (Designated and Proposed), State marine protected areas (MPAs), and Important Bird Areas (IBAs). Additional IBAs exist along the coastline from the two Call Areas but were removed from map for simplicity since they are not in close proximity to OWEI call areas.

<u>*Morro Bay Small Resident Population Harbor Porpoise*</u>: Of the harbor porpoises in the northeastern Pacific, the Morro Bay Small Resident Population is distributed from Point Conception to Point Sur, with particularly high densities from Point Estero and Point Arguello.[191] Northeastern harbor porpoises are segregated into smaller groups and are most abundant from shore to the 50 m isobath.[192] The Morro Bay Small Resident Population is especially vulnerable to anthropogenic impacts because of the small core size of its range.[193] The Morro Bay harbor porpoise BIA extends from Point Conception to Point Sur and follows the 200m isobath.[194] Although out of range of where floating turbines would be located, transmission cable construction and vessel traffic for O&M would occur within the Morro Bay harbor porpoise BIA.

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[191] Calambokidis, et al. 2015.
[192] Id.
[193] Id.
[194] Id.

Leatherback Sea Turtles: Both the Morro Bay and Diablo Canyon call areas fall entirely within with Critical Habitat for leatherback sea turtles designated under the Endangered Species Act.[195] All three Call Areas may overlap with high density areas identified from habitat modeling approaches.[196]

Marine Mammals and Sea Turtles - Diablo Canyon
Blue whales: Tracking data show that the Diablo Canyon Call Area overlaps with the core and overall home ranges of a low number of blue whales (overall home range: 10-28 of 171 tagged individuals; core home range: 1-5 individuals).[197] It should be noted that one of the primary tagging sites was near the Channel Islands just to the south, thereby potentially biasing home range results to areas near the tagging location. Using habitat modeling approaches, WhaleWatch predicts some of the highest densities of blue whales (approximately three individuals per cell) in the area will overlap with all three Call Areas during the summer and early fall months (July through October);[198] Becker *et al.*[199] predicts the same for the Diablo Canyon Call Area.

Grey whales: Same information as Morro Bay Call Area.

Humpback whales: Same information as Morro Bay Call Area.

Fin whales: SWFSC density models suggest high density fin whale areas may likely occur in the Diablo Canyon Call Area during at least two of their six survey years, with sightings occurring in the region during all but one year.[200] Habitat models based on satellite data also suggest the Diablo Canyon Call Area is in high suitability habitat areas, particularly during the summer and fall (June through November).[201]

Minke whales: Same information as Morro Bay Call Area.

North Pacific right whale: Same information as Morro Bay Call Area.

Leatherback Sea Turtle: Same information as Morro Bay Call Area.

VI. RECOMMENDED AREAS TO AVOID WITHIN THE CALL AREAS

It is clear that any offshore wind development in California, if it is to proceed, will occur within an incredibly rich and biologically-important marine ecosystem. Given that the impacts of floating offshore wind development in the California Current specifically are not yet known, we strongly recommend that BOEM take action to prioritize work to fill the key research needs described in this letter. Our analysis of the biological data forms the basis of following recommendations with respect to the Call Areas.

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195 https://www.westcoast.fisheries.noaa.gov/maps_data/endangered_species_act_critical_habitat.html
196 Eguchi, T., Benson, S.R., Foley, D.G., and Forney, K.A. (2017). Predicting overlap between drift gillnet fishing and leatherback turtle habitat in the California Current Ecosystem. *Fisheries Oceanography* 26(1), 17-33.
197 Irvine, L.M., Mate, B.R., Winsor, M.H., Palacios, D.M., Bograd, S.J., Costa, D.P., et al. (2014). Spatial and temporal occurrence of blue whales off the US West Coast, with implications for management. *PLoS One* 9(7), e102959.
198 Hazen et al. (2016).
199 Becker et al. (2016).
200 Becker et al. (2012).
201 Scales et al. (2017).

Additional research to support decision making could help BOEM to evaluate the suitability of HAPC, EFH Conservation Areas, IBAs, and BIAs for inclusion in WEAs.

1.) **BOEM should exclude HAPC from WEAs.** The Magnuson-Stevens Fishery Conservation and Management Act enables the regional fisheries management councils to identify and designate this specific subset of EFH. On the West Coast, the PFMC has identified HAPC – fisheries habitat that fulfills important ecological functions and/or is especially vulnerable to degradation.[202] NOAA and the PFMC have designated these areas in order to denote that they are a high priority for conservation. To preserve the ecosystem function that sustains the West Coast's valuable commercial fisheries, BOEM should remove the portions of the Humboldt, Morro Bay, and Diablo Call Areas that overlap with HAPC. As previously noted, there is considerable overlap of HAPC and the Diablo Canyon Call Area.

2.) **BOEM should exclude EFH Conservation Areas from WEAs.** The PFMC has identified EFH Conservation Areas "to minimize, to the extent practicable, the adverse effects of fishing on groundfish EFH."[203] To protect the sensitive features of the habitat that warrant protection, EFH Conservation Areas are closed to specific types of fishing. As is evident from Figure 3, there is substantial overlap of EFH Conservation Areas and the Morro Bay and Diablo Canyon Call Areas. Conducting additional benthic surveys in the Morro Bay and Diablo Canyon Call Areas would better equip BOEM and other stakeholders to assess the potential for offshore wind developments to harm or destroy the features the EFH Conservation Area protects.

3.) **BOEM should give IBAs a higher priority of avoidance over other parts of the Call Areas.** The IBA program, administered by the National Audubon Society in the United States, is part of an international effort by BirdLife International to designate and support conservation efforts at sites that provide significant breeding, wintering, or migratory habitats for specific species or concentrations of birds. Sites are designated based on specific and standardized criteria and supporting data. It is important to note that these areas may shift due to climate change, food source, or other factors over the duration of any offshore wind project. IBAs signal the need for a significantly higher level of pre- and post-construction and ongoing data collection, review, adaptive management procedures, and technologies than other areas. If the level of investment or technology needed for that higher level of pre- and post-construction and ongoing data collection, review, and adaptive management procedures and technologies are not financially or technologically feasible, then those areas and appropriate buffers for shifting influences such as climate and food source should be avoided entirely or removed from the Call Areas.

4.) **BOEM should carefully consider BIAs when making siting decisions.** NOAA has identified BIAs for marine mammals because of their particular importance for feeding, reproduction, and migration. Fifty percent of each of the Call Areas overlap with the BIA buffer zone for grey whales. Until there is a better understanding of the use of this BIA buffer, our organizations recommend BOEM prioritize avoiding the grey whale BIA. As important, transit routes for all offshore wind-associated vessels to and from the port to the WEA should be sited outside of BIAs. If this is not possible, BOEM should require stringent vessel speed restrictions and monitoring measures to avoid and reduce the severity of vessel collisions.

5.) **BOEM should prohibit energy leasing within Outer Continental Shelf Lands Act (OCSLA) prohibited areas.** Under OCSLA, BOEM is prohibited from leasing within the boundaries of the National Park Service, National Wildlife Refuge System, National Marine Sanctuary System, and any National Monument. We support BOEM's decision to remove National Marine Sanctuaries from

[202] 50 C.F.R. 600.815(a)(8), NOAA, Essential Fish Habitat, Habitat Areas of Particular Concern: https://www.westcoast.fisheries.noaa.gov/habitat/fish_habitat/hpac.html.
[203] Id.

consideration. Preserving these areas of significant environmental value to secure the health of the larger marine ecosystem and will allow sites with the greatest potential for environmentally responsible development to advance.

VII. RECOMMENDATIONS ON ESSENTIAL SCIENCE FOR BOEM TO ADVANCE OFFSHORE WIND DEVELOPMENT

Our organizations appreciate and recognize BOEM's extensive outreach, the resources the agency has provided, and the approachability and accessibility of the Pacific Region BOEM staff. We encourage BOEM to seize this unprecedented opportunity to set a high environmental bar for the growth of the offshore wind industry in California, a standard that is particularly prudent given the importance of the state's ocean economy and leadership role in ocean conservation.

While we understand the keen interest in initiating the multi-year offshore wind leasing process, it is imperative to have a well-informed understanding of avian, marine mammal, fish, and structural benthic habitat distributions throughout the North and Central Coast prior to making leasing decisions. Proactive measures that prioritize marine resource protection will not only provide the marine protections expected and required of the state and federal government—they will ultimately help the industry succeed and ensure that the lengthy permitting process is smooth. Siting should be based on the best available science, and developments should advance only when they incorporate research and monitoring for potential individual and cumulative impacts.

a) Prioritize funding for a third-party analysis of data layers included in the California Offshore Wind Data Basin Gateway to identify low environmental risk areas

The Call states that BOEM conducted environmental sensitivity analysis for marine mammal and avian species.[204] While we acknowledge BOEM's efforts to incorporate these crucial environmental considerations into the site designation process, our organizations would be very appreciative of greater transparency about the environmental analysis that has informed siting decisions thus far. We are concerned that key governmental and non-governmental stakeholders such as the Ocean Protection Council, the California Coastal Commission, non-federally recognized tribes, fishermen, and environmental organizations lack the environmental data analysis needed to make informed decisions on appropriate locations for WEAs. One way to enable these stakeholders to more fully participate in siting decisions is to leverage the Data Basin's ample resources.

We are supportive of the Data Basin Gateway (Gateway) effort and appreciate the CEC and BOEM's work to make it an inclusive and collaborative federal, state, and stakeholder collaboration. The Gateway now contains over 700 data sets that are intended to guide siting decisions by providing the ecological lens through which decisions should be made. We believe more time and resources are needed to fully analyze and process the data currently in the Gateway and are concerned there are insufficient resources and staff time to fully harmonize and synthesize the enormous volume of studies the site contains.

There is an outstanding need for BOEM to be able to analyze multiple layers simultaneously and provide fine scale detail in certain areas of interest. At present, the low resolution of and gaps inherent in some of the data preclude such careful analysis. Maps that overlay BIAs, krill hot spots, species-specific

[204] "BOEM…endeavored to exclude from Call Areas those places where preliminary analysis indicated the presence of high concentrations of marine mammal and avian species potentially impacted by offshore wind development."

seasonality and sensitivity data, boundaries of protected areas, bathymetry, and areas of developer interest for wind development are still needed.

Decision-support tools should also be developed that assist the user in navigating, overlaying, and interpreting these multiple data layers. The process for creating these maps and tools should be publicly available and guide CEC and BOEM in identifying areas of high environmental importance and/or sensitivity that minimize the risks of offshore wind development to the marine environment.

b) Conduct research to address key data gaps and specify a plan to incorporate ongoing and future scientific studies into project siting

In making this recommendation, we commend BOEM for its completed and planned research that will inform analysis and decision-making of offshore wind development. For instance, BOEM is currently undertaking two studies on seabird and marine mammal abundances in the Central Coast that have the potential to fill some critically-important data gaps.

The offshore wind industry is in nascent stages in California—even the most ambitious projections for a first offshore wind project do not anticipate an initial deployment until 2024. With this amount of time, it is entirely feasible to incorporate these baseline studies and data analysis that are needed to minimize risks to the marine environment into the OCS leasing process, and in so doing, advance the industry in an expeditious manner that reduces risk for businesses. The data gaps presented here fall into two major categories: location-specific biological or ecological data; and environmental impacts associated with floating offshore wind technology.

For each resource category, there is a consistent theme – in order to site offshore wind developments there is an outstanding need to collect biological data at appropriate spatial and temporal scales.[205] For many of the species with known distributions, the data are not of high enough resolution to make localized decisions. If not already in process, sufficient resources and time should be allocated to carry out this analysis at a resolution capable of informing marine planning decisions. Our analyses of the fishes and marine mammals present in the three Call Areas shows the great extent to which key biological events occur seasonally. For instance, groundfish spawning events occur annually in the fall, and there is greater predicted blue and fin whale density within the Call Areas during the summer and early fall months.

As BOEM undertakes research to support offshore wind leasing decisions and development in California, the agency's studies should include at least three years of baseline research on affected species and habitats. These surveys should be conducted at a spatial and temporal scale appropriate to the size of the prospective lease area and include the temporal variability of the species and habitats of concern. From both the standpoint of basic statistical assumptions, and also the inter-annual biological variability of the region, anything less than three years of marine mammal data would be an inadequate baseline from which to assess potential environmental impacts.

BOEM should undertake research to fill key data gaps on species and habitats and to resolve questions about wildlife interactions with utility-scale, floating wind development. In prioritizing research funding, BOEM should include research that aids in evaluating the cumulative impacts of multiple offshore wind developments on Pacific wildlife species and populations. We recommend that CEC, BOEM, and other relevant agencies also analyze and model the potential synergistic and cumulative impacts of initial projects. This modeling should consider present and future ocean conditions.

[205] Furness, Wade, and Masden (2013), "Assessing Vulnerability of Marine Bird Populations to Offshore Wind Farms."

Here we highlight some of top research priorities for benthic habitat, fish, seabirds, and marine mammals. These categories are a representative sample of some, but not all, elements of the marine ecosystem upon which offshore wind development may have an impact.

Benthic habitat:
Although there are some data available that generally describe the type of habitats in each of the Call Areas, there is a need for: (1) detailed ground truthing of current mapping; (2) mapping in areas where there are data gaps on substrate composition and biological communities; and (3) updated biological surveys of areas that were previously surveyed to ensure potential offshore wind sites minimize impact to benthic communities and avoid HAPC and EFH Conservation Areas. New technologies such as rapid deploy landers and autonomous underwater vehicles and improvements to towed camera sleds make this work both highly feasible and affordable.

Fish:
BOEM has acknowledged that there are deficiencies regarding current fishing data and data gaps related to commercial fishing. Although fish landings data will provide the most comprehensive view of estimated fish presence around each of the Call Areas, it must be noted that this will not accurately elucidate where fish are caught as catch records are only recorded at ports. It would therefore be beneficial to combine logbook data, catch records, and Automatic Identification System and Vessel Monitoring System data to give spatially explicit estimates of fish abundance and exact presence in the Call Areas. If this is not possible due to data privacy issues, a more thorough review of catch records is still worthwhile given that it is in the economic interest of fishers to land fish near where it is caught in order to minimize travel costs.[206]

The impacts of warming sea surface temperatures and changes in upwelling intensity along the California coast underscores the importance of considering the future impacts of climate change on CPS and HMS populations.[207] For example, changes in the reproductive performance of marine birds in the Southern California Current System[208] reiterate the importance of the link between changes in oceanographic conditions and the performance of resident animal populations. Understanding resultant changes in the productivity of California's marine fisheries will also be an important consideration under future climate change scenarios.[209]

It will be important to verify the migratory periods and any persistent or seasonally-occurring oceanic habitat features associated with fish species of commercial interest and/or ecological importance that may occur within the Call Areas. Information about timing and location of these habitat features may be used to mitigate potential impacts to fisheries. For example, by adopting temporal closures to windfarm vessel traffic and/or cessations in windfarm activity during important fish-related events such as spawning, migration, and aggregation, developers can minimize impacts of offshore wind development to commercial fisheries. NOAA has established BIAs for cetaceans and HAPC for groundfish – establishing a similar concept for CPS and HMS would be useful to help guide wind farm siting decisions. New and

[206] BOEM has also noted the need for a more thorough review of catch records, "*BOEM is continuing with its outreach efforts to the fishing industry and requesting additional information regarding recreational and commercial fisheries that operate within the Call Areas, particularly related to fishing gear types, seasonal use of areas and general recommendations for reducing conflicts. BOEM will consider new information at the Area Identification stage of its planning process as a result of essential fish habitat consultations under the Magnuson Stevens fishery Conservation and Management Act.*"
[207] Snyder et al. Future climate change and upwelling in the California Current System, Geophysical Research Letters, 2003.
[208] Sydeman et al. Climate change, reproductive performance and diet composition of marine birds in the southern California Current System 1969-1997. Progress in Oceanography, 2001.
[209] Sumaila et al. climate change impacts on the biophysics and economics of world fisheries. Nature Climate Change 2011.

better methods of population estimation and stock assessments will be invaluable and should be targeted at species of importance in Call Areas.[210]

Any future field surveys must be conducted at spatial and temporal scales relevant to the Call Areas and the species and habitats of interest. The community turnover rates that account for local biological variability should also be studied to help ensure statistical robustness of conclusions drawn from such studies.[211]

Acoustic and EMF effects and thresholds for fish species of interest and particular concern need to be established. These noise levels should then be compared to the levels of each that will occur when the windfarms are being built and when they become operational. These studies can occur as laboratory-based experiments and should be completed before offshore windfarms are established.[212]

Seabirds

There are abundant vessel-based survey data on seabird occurrences from many sources. Much of the data are widely available, and provide extensive information on seabird occurrence, abundance, and community structure in the California Current at large spatial scales. Yet, there remain significant data gaps of seabird distributions in the three Call Areas at the spatial and temporal resolution needed to design efficient and effective development and mitigation plans to minimize negative impacts on seabirds in the Call Areas. Baseline data at the appropriate spatial and temporal resolutions on all relevant seabird species is a critical data need. The information generated from the *Seabird and Marine Mammal Surveys Near Potential Renewable Energy Sites Offshore Central* study and the *Southern California* and *Pacific Marine Assessment Partnership for Protected Species* (PACMAPPS) study should influence siting decisions.[213]

Further, the transition of the CCE from a subarctic system toward a subtropical system is influencing shifts in species ranges and at-sea distributions, seabird community compositions, and species distributions.[214] It will therefore be important to consider not just current overlap in species ranges with OWEI areas, but also predicted overlap in different climatic scenarios.

As a first approach to evaluating species-specific risk to OWEI, planners and managers should familiarize themselves with the work of Kelsey *et al*. (2018) and Adams *et al*. (2016) which uses a generalized framework to rank seabird species of the CCE based on population vulnerabilities as well as vulnerabilities to wind-turbine collision and displacement.[215] It is then critical that subsequent studies model precise species-specific risks to bird-turbine collision risk using empirical data collected at each site,[216] incorporating wind and wave conditions, seabird behavioral state and detailed flight characteristics, and turbine features. Measurements of flight behavior at sites should also occur in each season, since seasonality will influence behavior and wind and wave conditions, and, accordingly flight

[210] Ralston et al. Predicting market squid (*Doryteuthis opalescens*) landings from pre-recruit abundance. Digital Commons at the University of Nebraska – Lincoln 2018.
[211] Bailey et al. Assessing environmental impacts of offshore wind farms: lessons learned and recommendations for the future Aquatic Biosystems. 2014.
[212] If time and or budgets are limited, an effective approach to understand these impacts would be to group functionally and biologically similar species and test individuals from each group. For example, one small CPS (sardine or anchovy), on common shark species, one rockfish and one benthic species could be tested.
[213] The PACMAPPS study has the potential to last for three years, which would dramatically bolster statistical integrity of the data. Having at least three years of monthly ship and aerial pre-development baseline data on the presence and abundance of key species, including marine mammals and seabirds, is an especially important component of setting a high environmental bar.
[214] Wolf et al. Predicting Population Consequences of Ocean Climate Change for an Ecosystem Sentinel, the Seabird Cassin's Auklet. 2010.
[215] Kelsey et al. (2018), "Collision and Displacement Vulnerability to Offshore Wind Energy Infrastructure among Marine Birds of the Pacific Outer Continental Shelf"; Adams et al. (2016), "Collision and Displacement Vulnerability among Marine Birds of the California Current System Associated with Offshore Wind Energy Infrastructure."
[216] Ainley et al. (2015), "Seabird Flight Behavior and Height in Response to Altered Wind Strength and Direction."

characteristics.[217] The deployment of bio-logging devices (such as Global Positioning System (GPS) devices, altimeters, and accelerometers) on targeted seabird species combined with sophisticated statistical methods can increase the accuracy of modeled flight heights, such as the error-corrected altitude measurements from GPS devices using Bayesian state-space modeling to model flight heights of black-backed gulls.[218] Flight reconstructions from bio-logging technology, such as GPS devices, altimeters, and accelerometers, can also provide information on fine-scale flight differences and regional use between day and night.

Seabird species' behavioral responses of attraction or avoidance to windfarms need to be: 1) quantified; and 2) used in models to evaluate population effects of both habitat displacement (avoidance species) and increased collision risk (attracted species).

Marine mammals
There is a need for additional studies on marine mammal distribution on the Central and North Coasts, and on the potential impacts of floating offshore wind development. Given the nascence of floating offshore wind technology, there is a need for empirical assessments of the impacts of offshore floating wind turbines. Studies to assess potential impacts to marine mammals in Scotland should be implemented and made publicly available as soon as possible. These studies will provide valuable information, yet should not supplant the marine mammal studies for the CCE that are needed.

Data on basic biological data including distribution, critical habitat, and migration data are lacking for a number of large whale species including North Pacific right whales and minke whales; this lack of basic data makes it difficult to access potential impacts to marine mammals. BIAs have been defined for grey whales (feeding and migration), blue whales (feeding), and humpback whales (feeding), and were explored for fin whales but not designated.[219] BIAs have not yet been defined for a variety of additional species, and need to be explored for additional species including minke whale (*B. acutorostrata*), killer whale (*Orcinus orca*), beaked whales (Ziphiidae), and sperm whale (*Physeter macrocephalus*).

Baseline data on noise levels is needed in offshore Call Areas, with 'control' sites for future monitoring. It is critical to understand sound propagation at varying distances from lease sites to understand how sound moves in certain areas, and across different frequencies. Per the fish recommendations above, there is also a need to understand the impacts of noise on marine mammal prey species (i.e. krill and small schooling fish) – particularly the impact from operational use of turbines, for which data are severely lacking.

VIII. MONITORING AND MITIGATION RECOMMENDATIONS

We urge BOEM to prioritize siting and leasing decisions that <u>avoid</u> areas that have the highest potential for deleterious environmental impacts.

Any new offshore energy development may have impacts on the marine environment. Recognizing that even with the most conservation-oriented siting decisions there may still be wildlife and habitat impacts, we offer some preliminary mitigation and monitoring recommendations in the Appendix of this letter. Pre-construction monitoring and subsequent monitoring will be essential to ensuring that offshore wind

[217] Id.
[218] Ross-Smith et al. (2018), "Modelling Flight Heights of Lesser Black-Backed Gulls and Great Skuas from GPS: A Bayesian Approach."

development proceeds in a manner that maximizes benefits and reduces impacts. This preliminary list is not exhaustive, and we anticipate many other mitigation measures would be proposed that are tailored to the location, scale, and other project specifics.

VIII. CONCLUSION

Our organizations believe that offshore wind resources in California can and must be developed in an environmentally sound manner that reflects the vital importance of California's unique marine environment. Californians are acutely aware of the high price of climate change and our organizations believe that offshore wind along the Pacific Coast may be an important part of shifting away from dirty fossil fuels and fighting carbon pollution. The proposed Call Areas are key habitat for a host of marine resources including large baleen whales, fragile sponges and corals, commercially-valuable fish, and iconic albatrosses. While floating technology offers some advantages over fixed offshore wind projects with respect to potential ecosystem impacts, both the ecological importance of the proposed Call Areas and novelty of the technology require an abundance of caution as BOEM considers the Humboldt, Morro Bay, and Diablo Call Areas for WEA designation.

As BOEM evaluates these Call Areas for OCS leasing, we urge the agency to follow an inclusive, transparent, and science-based process, and to work quickly to identify areas of high environmental importance and/or sensitivity, as well as areas of potential conflict, so as not to delay the offshore wind planning progress. We believe that BOEM has sufficient time to incorporate the baseline studies and data analysis that we have described in this letter into the OCS leasing process, and in so doing, advance the industry in an expeditious manner while also minimizing risks to California's unique and valuable marine environment. Ensuring that leasing decisions in the proposed Call Areas are guided by comprehensive baseline research and full consideration of potential impacts to protected marine areas will lay the groundwork for the ultimate expansion of offshore wind energy.

We thank you for the opportunity to comment.

Respectfully submitted,

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Appendix – Preliminary Monitoring and Mitigation Recommendations

We recommend a precautionary approach to development, in a phased manner to allow for a robust assessment of impacts to both the immediate and surrounding areas. This preliminary list is not exhaustive, and we anticipate many other mitigation measures would be proposed to reflect the location, scale, and other project specifics of any new offshore wind development. Some recommendations for monitoring and mitigation follow.

Baseline surveys and ongoing monitoring

- Comprehensive pre-installation and ongoing monitoring should be implemented to assess individual species present and relevant biophysical processes.[220]
- Seasonal and inter-annual monitoring of site-specific seabird occurrence and abundance should occur.
- Conduct digital surveys to: facilitate more robust and accurate wildlife monitoring methods through digital video aircraft surveys conducted in both manned[221] and unmanned aircraft;[222] enable higher flight altitudes; and decrease observer and distance biases and increase the number of identifiable bird sightings.[223]
- OWEI design needs to include systems for continual monitoring of bird collisions with multi-sensor array and central on-board processing systems integrated into the turbines themselves.

Design considerations

- Design should include high-tech safeguards, such as deterrence systems, and/or detection systems (e.g. thermal cameras, radar, artificial intelligence software for identifying species). Already existing land-based avoidance and detection systems can auto-detect species of special concern (e.g. eagles, condors) in turbine areas and subsequently communicate a signal for temporary cessation of turbines; it is important that funding is available to support research and development to adapt this technology to offshore wind infrastructure.
- Evaluate "snagging risk" of derelict fishing gear on cables within the mooring system of floating turbines.
- Incorporate tracking data into site planning and to help reveal spatiotemporal dynamics of seabird occurrence in or near Call Areas, particularly for species of conservation concern and those that have higher collision and/or displacement risks.
- Place anchors and mooring cables in areas of relatively lower ecological importance and avoid setting anchors during important ecological events (i.e. fish spawning).
- Time construction and maintenance to occur during periods of relatively lower ecological importance (seasonality).
- Use acoustic dampening devices/techniques to minimize noise (and for vessels).[224]
- Calculate most efficient vessel use within areas to reduce vessel duration and noise within areas and vessel transits.
- Design/use electromagnetic shielding technologies and/or insulations on transmission cables and turbine platforms.
- Use wave dampening technologies to reduce turbine movement and subsequent sea bottom scour.

[220] Biophysical processes encompass abiotic and biotic conditions which include the chemical, biological, physical and ecological components present. This type of monitoring will allow for assessment of impacts from installation and operation including those associated with exclusion zones for fisheries that will be established around the platforms.
[221] Žydelis et al. (2019), "Comparison of Digital Video Surveys with Visual Aerial Surveys for Bird Monitoring at Sea."
[222] Gray et al. (2018), "A Convolutional Neural Network for Detecting Sea Turtles in Drone Imagery."
[223] Žydelis et al. (2019), "Comparison of Digital Video Surveys with Visual Aerial Surveys for Bird Monitoring at Sea."
[224] Robertis and Handegard, Fish avoidance of research vessels and the efficacy of noise-reduced vessels: a review, ICES J. of Mar. Sci. 2013

- Use ecologically "friendly" biocides for the antifouling of structures.
- Use wire-walker[225] cleaning devices for cables and manual cleaning of turbine bases.
- Use of lower risk mooring systems, such as taut configurations, or catenary with chain and/or polyester configurations instead of nylon.[226] Consider the use of risk assessments similar to those described in Benjamins *et al*. to assess entanglement risk of various turbine configurations, and with respect to the structure of oceanographic conditions in the region (e.g., currents).
- Use of color on mooring and other lines should be considered as a means of reducing entanglement. (For example, sea turtles respond to varying UV wavelengths.)

Operations

- Consider cessation of operations during ecologically important times (e.g. migrations, spawning etc.)
- Conduct regular and indefinite surveys of structures for lost/discarded gears (visually and/or acoustically) noting that the potential for net pollution will increase if biofouling increases over time. Derelict gears may snag on moorings presenting an increase in entanglement risk; autonomous underwater vessels could be used to regularly check for attached gear. The frequency and type of monitoring, and how derelict gear would be removed should be included in all environmental assessments; derelict gears could potentially be detected using tension monitors.
- Employ divers, ROVs or wire-walker-type apparatus to clear fouled gears.
- Consider the use of biodegradable or ropeless fishing gears in neighboring fishing grounds.
- Near real-time dynamic management tools such as Whale Alert,[227] WhaleWatch,[228] and EcoCast,[229] or the development of dynamic management tools,[230] can be used to determine when whales and turtles are or are likely to be present, allowing for either cessation or slowing of construction or maintenance vessel traffic.
- Monitor tension of lines to detect entanglement of large marine species; wireless tension monitors can be connected wirelessly to remotely alert to the presence of a potentially entangled species.[231] Similarly, wireless video can potentially also be used to monitor for potential entanglement at key parts of the turbines, such as the cables; video can be used in conjunction with tension monitoring to ground truth potential entanglements remotely.
- A reporting structure should be in place to report entanglement of marine species in mooring lines and associated gears, giving NOAA the ability to trigger emergency procedures similar to Biological Opinions that occur in other industries, such as fishing.
- Biological risk assessments similar to those described in Benjamins *et al*[232] could be conducted to determine what local species have the greatest probability of entanglement. Mitigation responses could be tailored to those species using suggested mitigation techniques herein or beyond.

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[225] e.g. http://delmarocean.com/wirewalker/ - but adapted for cleaning of cables
[226] Benjamins et al. (2014).
[227] Wiley, D., Hatch, L., Schwehr, K., Thompson, M., and MacDonald, C. (2013). Marine Sanctuaries and Marine Planning. *Proceedings of the Marine Safety & Security Council, the Coast Guard Journal of Safety at Sea* 70(3)**,** 10-15.
[228] Hazen et al. (2016).
[229] Hazen, E.L., Scales, K.L., Maxwell, S.M., Briscoe, D.K., Welch, H., Bograd, S.J., et al. (2018). A dynamic ocean management tool to reduce bycatch and support sustainable fisheries. *Science advances* 4(5)**,** eaar3001.
[230] Maxwell, S.M., Hazen, E.L., Lewison, R.L., Dunn, D.C., Bailey, H., Bograd, S.J., et al. (2015). Dynamic ocean management: Defining and conceptualizing real-time management of the ocean. *Marine Policy* 58**,** 42-50. doi: 10.1016/j.marpol.2015.03.014.
[231] Personal communication, Caroline Carter, Scottish Natural Heritage
[232] Benjamins et al. (2014).