September 13, 2021

Ms. Jean Thurston-Keller
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: Commercial Leasing for Wind Power Development on the Outer Continental Shelf (OCS) Offshore Morro Bay, California, East and West Extensions— Call for Information and Nominations (Call or Notice) [***Docket No. BOEM-2021-0044***]

Dear Ms. Thurston-Keller:

On behalf of the Environmental Defense Center (EDC), Defenders of Wildlife (Defenders), Monterey Bay Aquarium, Morro Coast Audubon Society, National Audubon Society (Audubon), Natural Resources Defense Council (NRDC), Ocean Conservation Research, Sierra Club California, Surfrider Foundation, Whale and Dolphin Conservation, and our millions of members and supporters, we submit these comments on the Bureau of Ocean Energy Management's (BOEM's) Call for Information and Nominations (Call or Notice) for Commercial Leasing for Wind Power Development on the Outer Continental Shelf (OCS) Offshore Morro Bay, California, East and West Extensions (Morro Bay 399). Our organizations are united in support of responsibly developed offshore wind energy as a critically needed climate change solution and we continue to advocate for policies and actions needed to bring it to scale in an environmentally protective manner.

The continued extraction and consumption 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 ocean, climate change is already bleaching coral, displacing species, increasing incidents of harmful algal blooms, causing marine heat waves, and acidifying the water, making it harder for shell-building organisms like oysters to grow shells and survive. California is already experiencing these global changes. Already marine heatwaves, like the "Blob" have caused massive seabird die offs, declines in forage fish, starving marine mammals, and harmful algae blooms that shut down California fisheries.[1] We must embrace clean energy industries, such as offshore wind, while prioritizing protections that will help defend already stressed marine life.

We commend the Biden Administration's leadership to direct the United States to urgently transition to clean energy sources. We are supportive of President Biden's goal to bring 30 gigawatts (GW) of offshore wind energy online by 2030. Paired with major reductions in fossil fuel use, offshore wind energy has the exciting potential to improve air quality in fenceline communities, create tens of thousands of clean energy jobs, and provide a consistent and powerful source of carbon-free electricity that complements solar renewable energy.

Our organizations enthusiastically support California's landmark legislation to achieve 100 percent zero-carbon and renewable energy by 2045. We commend the work of the California/BOEM Renewable Energy Task Force to enhance federal and state coordination in developing offshore wind energy inclusively and responsibly, and appreciate Representative Salud Carbajal and the Biden Administration's leadership to resolve use conflicts between Department of Defense (DoD) military preparedness activities and potential renewable energy OCS leasing activities.

Advancing offshore wind to generate carbon-free electricity 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 with the strongest level of protections in place for vulnerable coastal and marine habitats and wildlife. Many of our organizations have long advocated for a science-driven landscape-level planning process to identify "least conflict" sites for offshore wind energy development. We urge BOEM to adopt an approach that engages stakeholders early and often in discussions to develop offshore wind in a manner that avoids, minimizes, and mitigates any potential impacts to California's marine resources. We firmly believe that this approach will both protect the local environment and support this important new industry.

It is well documented that there are two primary environmental crises that threaten our survival: climate change and biodiversity loss. As BOEM advances offshore wind, the agency must bear in mind that preserving ecosystem function is also crucial to ocean health. Over the past decade, as many of our groups have worked in support of renewable energy, we have operated with the position that protecting biodiversity and rapidly transitioning to clean energy need not be in conflict–we can and need to do both.

In the Call, BOEM is requesting specific and detailed comments on: geological, geophysical, and biological conditions in the Morro Bay 399 Extensions; relevant biological and environmental information; and any other relevant information BOEM should consider during its planning and decision making process for the purpose of issuing leases in the Morro Bay 399 Extensions. In this letter, we address several central issues: 1) we make recommendations for how BOEM should work in partnership with the state of California and other key stakeholders (Section I); 2) we respond to BOEM's request for relevant biological and environmental information on the full Morro Bay 399 Call Area, including the East and West Extensions, sharing our initial review of relevant data for benthic habitat, fish, marine mammals, sea turtles, and birds (Section II); 3) we discuss potential impacts of floating offshore wind development on the Central Coast (Section III); and 4) we summarize data needs and potential mitigation measures that could be used to help advance offshore wind (Section IV and Appendix A). Finally, we offer our recommendations for BOEM's next steps for Morro Bay 399 (Section V). While the Call for comments is focused on the extensions, in a public outreach meeting, BOEM expressed interest in

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[1] 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.

information on the extensions as well as the original Call Area, as appropriate. Therefore, we discuss both the original Call Area and the extensions in this letter (collectively referred to as Morro Bay 399).

I. PROCESS RECOMMENDATIONS TO ADVANCE WIND DEVELOPMENT OFFSHORE CALIFORNIA

Offshore wind energy should advance in a responsible manner that minimizes conflicts and safeguards vulnerable ocean habitats and wildlife. The process must engage all stakeholders at all stages of offshore wind development (siting, site characterization, construction, operations and decommissioning) at the start and select lower, or "least," conflict sites, carefully monitor and mitigate impacts, and practice adaptive management to ensure new information is applied. Responsible development of offshore wind energy: (i) avoids, minimizes, mitigates, and monitors adverse impacts on marine and coastal habitats and the wildlife that rely on them, (ii) reduces negative impacts on other ocean uses, (iii) includes robust consultation with Native American tribes and communities, (iv) meaningfully engages state and local governments and stakeholders from the outset, (v) includes comprehensive efforts to avoid impacts to environmental justice communities, and (vi) uses the best available scientific and technological data to ensure science-based and stakeholder-informed decision making. Undertaking offshore wind in this way will foster a foundation of trust for this new industry.

Many of our organizations have been deeply engaged in advancing California's mandate to achieve 100 percent zero-carbon energy by 2045. This work has included establishing siting criteria on land to direct renewable energy planning and development to environmentally appropriate locations. Offshore wind development offers California an opportunity to tap into a 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.[2] For the past six years, many of our organizations have worked collaboratively with the California Energy Commission (CEC) and other state and local agencies to advocate for siting offshore wind energy that reflects the lessons learned from these onshore siting and development efforts.

Several decades of offshore wind development in Europe suggest that this carbon-free source of electricity can be developed responsibly, provided that 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 all important and necessary steps for responsible offshore wind energy development.[3]

While we can learn from Europe, it is important to acknowledge that, in the U.S., offshore wind largely remains a new industry with different considerations for species and habitat interactions. Moreover, floating wind technology is in its infancy, with only a select few projects worldwide, none of which are operational in the U.S.[4] Various potential impacts, including those noted in Section III, may be associated with offshore wind construction and operations on the U.S. West Coast and could have direct, indirect, and cumulative impacts on 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,

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[2] https://www.energy.ca.gov/news/2021-03/california-releases-report-charting-path-100-percent-clean-electricity

[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.

[4] The Business Network for Offshore Wind (2021). "Offshore Wind Policy Brief: The U.S. Opportunity in Floating Offshore Wind" at 10. Available at https://online.flippingbook.com/view/857405651/2/

construction, and operation plans of specific projects. We encourage BOEM to implement the following recommendations to identify areas for offshore wind development.

BOEM should work with the State of California to conduct a "least conflict" siting process

Many of our organizations have asserted repeatedly that a state and/or federal planning process that reflects environmental and other concerns will have the dual benefit of protecting biodiversity in wind energy development areas and mitigating the concerns of stakeholders in affected coastal communities. We believe that BOEM, working in partnership with the state, should facilitate an inclusive and transparent planning process in their consultations with Native American tribes and communities and with ocean users and coastal stakeholders to identify lower conflict lease areas.[5] Identifying viable development sites within the context of the entire waters offshore California, rather than on an ad hoc basis, will enable government agencies to evaluate offshore wind projects more efficiently. Such a process also elevates the likelihood of an offshore wind development advancing in a timely manner through the permitting process. The San Joaquin Valley Least Conflict Solar Analysis[6] is an example of a collaborative and orderly planning process that identified renewable energy development areas that were both close to existing transmission and were lower conflict. This six-month process continues to lead to more environmentally sound permitting of and transmission planning for solar photovoltaic projects in the Central Valley of California.

The State of California has already emphasized the value of utilizing a landscape-level planning process to advance offshore wind. The 2021 Senate Bill 100 Joint Agency Report states:

> The benefits of using landscape-level approaches for renewable energy and transmission planning include early identification and resolution of large issues or barriers to development, coordinated agency permitting processes, increased transparency in decision making, increased collaboration, avoidance of impacts, and more rapid development of environmentally responsible renewable energy projects.[7]

BOEM should prioritize siting and leasing that avoids areas that have the highest potential for adverse environmental impacts

Like any large-scale energy project, new offshore energy development will have some impact on the environment. It is crucial to California's renewables future, as well as to the future of the fledgling floating wind energy industry in the U.S., that care be taken upfront to avoid the most environmentally sensitive areas and adopt mitigation measures that will ensure the first projects minimize harm to the local environment as we learn about the impacts of floating offshore wind technology. BOEM should prioritize siting and leasing decisions that avoid areas that have the highest potential for harmful environmental impacts. Recognizing that even the most conservation-oriented siting and operating decisions are unlikely to eliminate all wildlife and habitat impacts, monitoring before, during, and after construction will be essential to ensuring the necessary data is collected to enable improved, adaptive management. In this letter we offer some preliminary monitoring and mitigation recommendations in Appendix A. The recommendations in Appendix A are not exhaustive and we anticipate the need for additional mitigation measures that are tailored to the location, scale, and other project specifics.

[5] Our organizations would welcome semi-regular informal meetings with BOEM to share information and discuss our priorities for responsible offshore wind energy development.

[6] https://sjvp.databasin.org/pages/least-conflict/

[7] https://efiling.energy.ca.gov/GetDocument.aspx?tn=237167&DocumentContentId=70349 at pg. 112

The Department of Defense should not be the de facto siting agency for offshore wind development in California

Our organizations commend the 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 OCS offshore California intensively and extensively for military testing, training, and operations. These activities occur in the airspace, on the water, and throughout the water column.[8] The use of the California OCS for military purposes is so extensive that it has threatened the very potential of developing offshore wind on the Central Coast. The 2018 Call stated that DoD reviewed "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" were compatible with offshore wind energy analysis."[9] By engaging in these private negotiations with offshore wind developers to discover areas of potential compatibility with offshore wind development on the Central Coast, BOEM, DoD, and industry have 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. This process has led to BOEM identifying just three potential areas for wind energy development consideration within the entire California OCS environment to date, one of which was subsequently eliminated from consideration due to DoD conflicts.

When one stakeholder entity is engaged in private negotiations with BOEM and developers, environmental or other stakeholder considerations may become secondary considerations. As stated previously, we urge BOEM to work with the CEC, the Ocean Protection Council, and the California Coastal Commission to conduct a comprehensive, stakeholder-driven process that identifies least conflict areas for wind energy development using siting criteria based on environmental considerations, sensitivity to human activity, cultural significance, and other stakeholder values.

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

Morro Bay 399 is 399 mi^2 and includes a 258 mi^2 section of the original 2018 Morro Bay Call Area plus the West (118 mi^2) and East (23 mi^2) Extensions, adding 141 mi^2 to the original Morro Bay Call Area (Figure 1a). Demersal/benthic habitat within Morro Bay 399 largely consists of soft sediment and muddy sea bottom with occasional rocky outcrops. The areas are situated in the California Current Ecoystem (CCE) and located adjacent to the coastal (200 m) Davidson Current which carries warmer, more saline water from the south into the cooler, fresher water travelling from the north in the CCE. The mixing of these different water masses makes the California Central Coast one of the rarest bioregions in the world, supporting high levels of biodiversity along the mainland United States. The overlap of "[o]ceanographic processes in the region foster 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."[10]

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

[9] 83 FR 53096 at 53100 (10/19/2018).

[10] *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.

The California Current Ecosystem's (CCE's) ecological value is underscored by its numerous protected areas. The coast of California is home to four national marine sanctuaries (NMS): Cordell Banks, Greater Farallones, Monterey Bay, and Channel Islands. Morro Bay 399 lies adjacent to the Monterey Bay NMS and falls within the nominated Chumash Heritage NMS. The Davidson Seamount is located approximately 30 km (49 mi) west of Morro Bay 399 and is part of the Monterey Bay NMS and designated as a Habitat Area of Particular Concern (HAPC). The east side of the Call Area abuts the southwest and southern boundary of the Monterey Bay NMS, home to a highly diverse array of species and habitats. Directly south of Morro Bay 399 is Santa Lucia Bank, which rises to 400 m from the surface and is part of a persistent upwelling cell.[11] California's state waters host the landmark network of 124 marine protected areas (MPAs). Critically, the effectiveness of California's MPA network relies not only on the protections that individual MPAs afford but on the connectivity of the entire MPA network.[12]

Benthic habitat

Benthic habitat is primarily classified based on physical substrate and depth.[13] In California, the geological shelf has a steep change in slope from the shoreline to the shelf break, which occurs at 130 m offshore in northern and central California and ranges from 80 to 145 m offshore in southern California.[2] Morro Bay 399 is located well offshore of the continental shelf 200 m isobath on the lower continental slope and ranges in depth from approximately 850 m on the East Extension to 1,300 m along the West Extension. 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 different types of mud.[14]

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.[15] The microbial ecology of the continental slope oxidizes methane and sequesters carbon into marine sediments, helping to mitigate climate change caused by these greenhouse gases.[16] Scientists are just beginning to understand these microbial communities and their 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, which converts critical nutrients like

[11] 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; Proposed Chumash Sanctuary: Area 2 [Internet]. Northern Chumash Tribal Council [cited 2019 Jan 9]. Available from: https://chumashsanctuary.com/area/area-2/

[12] 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.

[13] 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. Berkeley, CA; [cited 2019 Jan 9]; p. 167-202. Available from: ftp://ftp.sccwrp.org/pub/download/DOCUMENTS/JournalArticles/488_continental_shelf.pdf

[14] 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.

[15] 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.

[16] 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; 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/

nitrogen and phosphorus into biologically usable forms that support the growth and reproduction of marine organisms,[17] is also an important component of these benthic communities.

The slope ecosystem also supports habitat-forming macro-invertebrates, such as sponges and corals, in areas that generally have minimal rugosity and other features. Living organisms such as sponges, sea pens, gorgonians, and other types of coral provide three-dimensional "biogenic" structures that support fish and other marine life. These biogenic shelters are important for commercial species like deep-living rockfishes and thornyhead, as they protect against predators and currents and provide firm substratum and increased food supply. They are especially important for juvenile fishes that use this biogenic habitat as shelter from predators. As a result, these areas also are generally associated with high densities and diversity of fishes.[18] These resources have slow growth rates and are long-lived species. As an example, black coral (Order Antipatharia) are extremely slow growing 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 1,000 years old.[19]

The Deep Sea Corals Research and Technology Program National Database records mapped locations of a single sponge or coral, called "points" (Figure 1b).[20] The camera used for this mapping has a narrow field of vision and so it should not be assumed that there is only a single individual in the surrounding area of the surveys. Morro Bay 399 has direct overlap with 29 common name category points, which indicate the location of a coral or sponge individual from the National Oceanic and Atmospheric Administration Deep Sea Corals Research and Technology Program National Database that overlap with Morro Bay 399. It is common for this type of biogenic habitat to be clustered closely together, interspersed within vast areas of fairly featureless soft substrate.

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[17] 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

[18] 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

[19] 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

[20] National Oceanic and Atmospheric Administration, "Deep Sea Corals Research and Technology Program National Database", accessed August 9, 2021, https://deepseacoraldata.noaa.gov/.

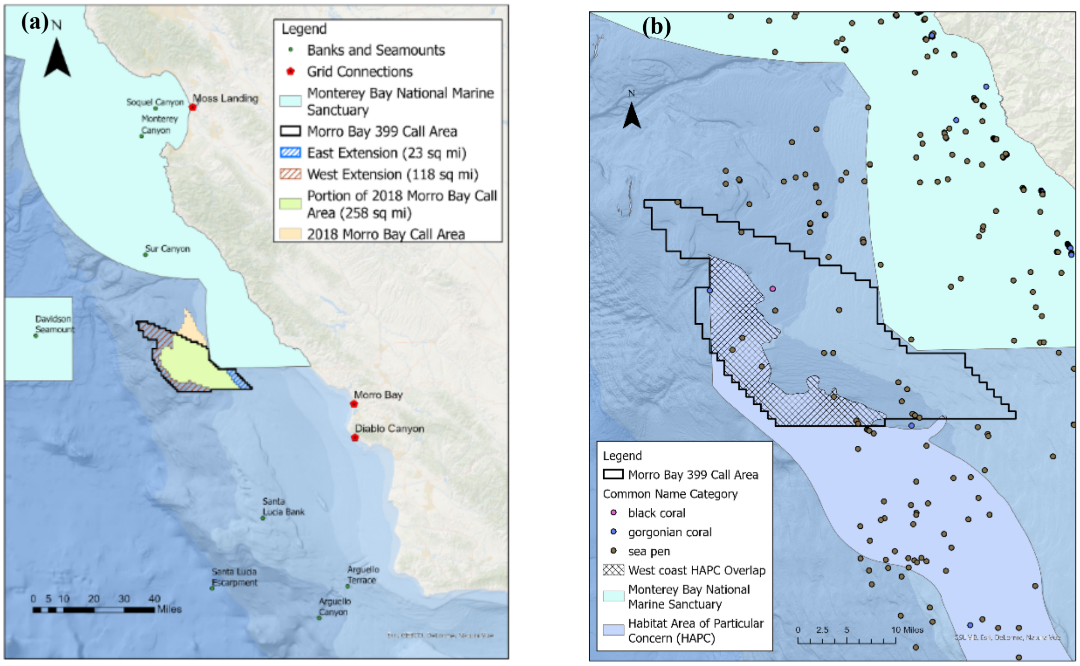

Figure 1. (a) Morro Bay 399 vicinity map showing the East and West Extensions as well as the original 2018 Morro Bay Call Area. (b) Morro Bay 399 Area showing overlap with HAPC and points in the Deep Sea Corals Research and Technology Program National Database. Note that the points are stacked on top of each other due to the scale of the map.

A recent report from Kuhnz et al. (2021)[21] for BOEM provides additional information and detail on the benthic habitat and faunal assemblages in the original Morro Bay Call Area (excluding the East and West Extensions). The Expanding Pacific Research and Exploration of Submerged Systems campaign[22] (EXPRESS) was formed in 2017 to support data collection offshore of Washington, Oregon, and California. This area was selected due to large gaps in mapping using modern techniques and due to the active federal/state joint process to develop offshore floating wind projects in this area.[23] This focused project effort on the seafloor offshore central California is called the California Deepwater Investigations

[21] Linda A. Kuhnz et al., "California Deepwater Investigations and Groundtruthing (Cal DIG) I, Volume 1: Biological Site Characterization Offshore Morro Bay", Camarillo (CA): US Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2021-037, 2021: 72 p., https://espis.boem.gov/final%20reports/BOEM_2021-037.pdf

[22] United States Geological Survey, "Expanding Pacific Research and Exploration of Submerged Systems (EXPRESS)", accessed August 4, 2021, https://www.usgs.gov/centers/pcmsc/science/express-expanding-pacific-research-and-exploration-submerged-systems?qt-science_center_objects=0#qt-science_center_objects

[23] EXPRESS is a collaboration coordinating assets and people across federal, state, and private groups to address seafloor and ocean related science needs more effectively. As members of EXPRESS, BOEM, the U.S. Geological Survey, the National Oceanic and Atmospheric Administration (NOAA), and the Monterey Bay Aquarium Research Institute focused on biological and geological characterizations of the area offshore Morro Bay in central California.

and Groundtruthing I (Cal DIG I). The results from the cruise are aggregated for all analyses and reported results are summarized below (Figures 2 and 3).[24]

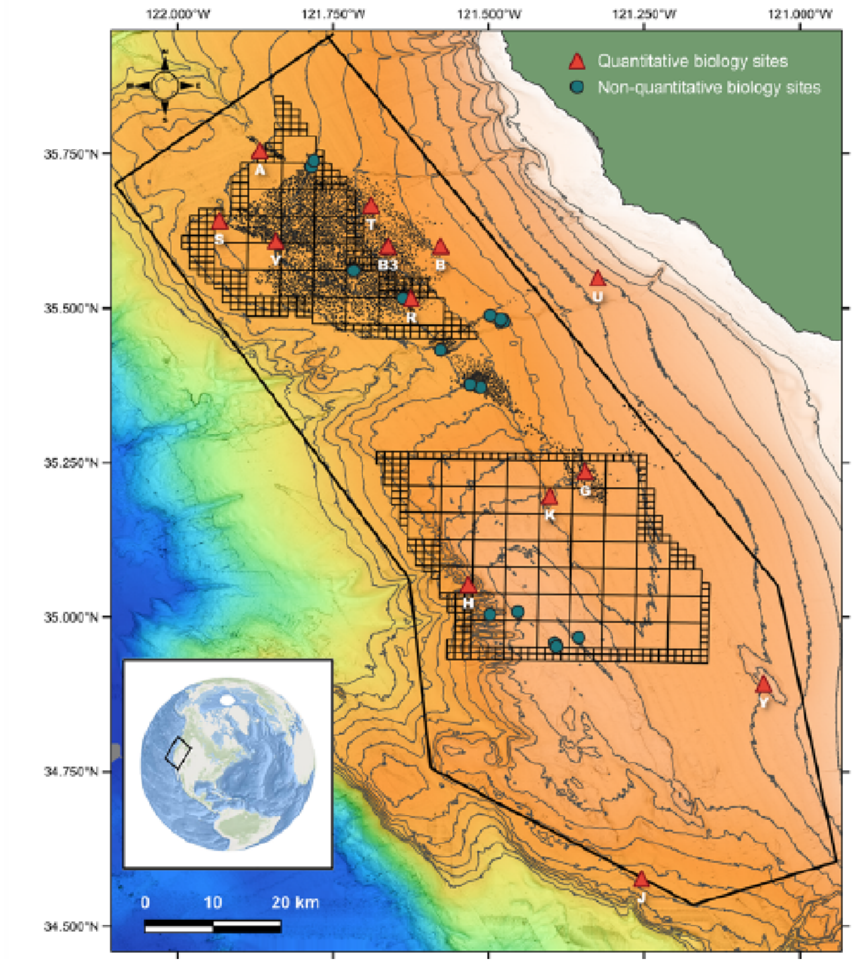

Figure 2. From Kuhnz et al. (2021) showing the region of study offshore of Morro Bay, central California from approximately 400 to 1,200 m depth. The Cal DIG I study area is defined with the large black polygon. Symbols show 13 lettered sites with red triangles, which indicate quantitative biological survey sites, and green circles showing additional observation sites. Small fields of black dots illustrate the extent

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[24] Video was collected from multiple (replicate) transects at 13 sites across four depth zones and three major substratum categories (soft, mixed/hard, and pockmark fields). Depth Zone 1 was 300-500m, Zone 2 was 500-700m, Zone 3 was 700-900m, and Zone 4 was 900-1,000m. Note that no pockmark fields occur between 300-500 m depth and that they were limited at 500-700 m. More than 7,600 observations regarding the surficial geological habitat character were made. The primary substrate in areas surveyed was soft substrate (80%). Hummocky mud occurred in 37.9% of the region and was present at all depth zones, all oxygen levels, and all temperatures. Greenish-black muddy coarse sand covered 17.5% of the surveyed area. Accumulations of dead sponge were present on slopes in the southern portion of the region, and at Site S to the north (Figure 3). The extent of these accumulations is not clear since the field of view with the remotely operated vehicle (ROV) is limited to a width of about 4 m. Dead *Farrea spp.* and *Heterochone calyx* were most common. These may be important biogenic habitats that uniquely support a high diversity of other fauna that are too small to be observed with video. Most of the seabed within the study area is only mildly sloped and non-rugose (78% 0-5 degree slopes, 71% non-rugose). Rugose (hard substrate-dominated) areas were generally on 5-30+ degree slopes and were observed in the southern portion of the region and at Site S in the north. Very steep slopes (60-90 degrees) occur at Sites K and S and were bedrock representing 3.2% of the area surveyed. (It is noteworthy that steep slopes are likely technically infeasible for offshore wind energy development at this time.)

of pockmark fields (Lundsten et al. 2019[25]). Two areas identified for potential future wind energy leases are overlaid as a grid representing a partial lease block (BOEM 2018[1]). The upper gridded area is the 2018 Morro Bay Call Area and the lower gridded area is the 2018 Diablo Canyon Call Area. The results for the cruise were aggregated across all remotely operated vehicle dives and quantitative transects.

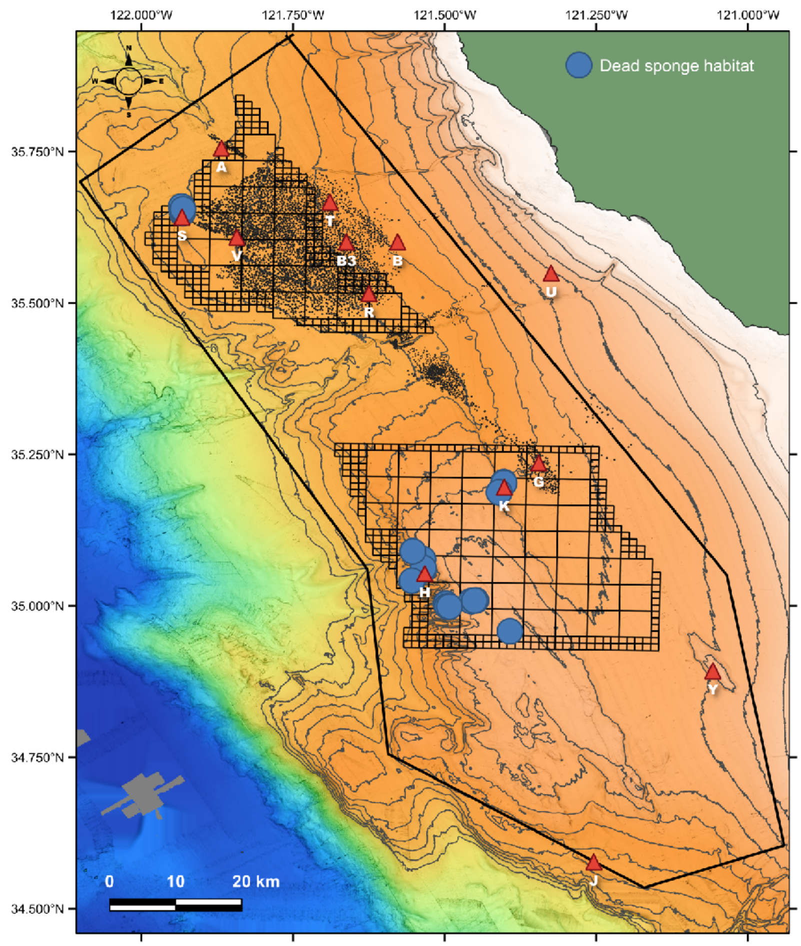

Figure 3. From Kuhnz et al. (2021) general areas where dead sponge skeletons were observed indicated by blue circles. Dead skeletons may provide unique habitat for dense numbers of organisms too small to be seen on video.

The EXPRESS cruises conducted 40 ROV dives over three separate cruises and covered 46.8 km of seafloor at an average of 4 m field view. The existing data shows significant coverage within the 2018 Morro Bay Call Area footprint.[26] These results indicate there is significant biodiversity across species taxa.

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[25] Eve M. Lundsten et al., "Commingled seafloor pockmarks and micro depressions offshore Big Sur, California", AGU Fall 2019 meeting, talk EP11B-02 (Monday, Dec. 9, 8:20 a.m. Moscone West, Room 3009), https://www.mbari.org/holes-in-seafloor/

[26] The transects were taken inside both the 2018 Morro Bay and Diablo Canyon Call Areas with a few transects completed outside of the 2018 Call Areas for comparison. The results are reported in aggregate, thus underscoring the need for more detailed mapping.

Over 101,000 megafaunal organisms from among at least 220 presumptive taxa were observed in observational and quantitative video. Echinoderms (e.g., sea cucumbers, sea stars, brittle stars, urchins, and crinoids) were the most abundant phylum-level group and comprised 46 different taxa. Vertebrate chordates (e.g., bony fishes and elasmobranchs) were also abundant and represented the most speciose group (54 taxa). The most abundant benthic organisms were mobile (71.8%; sessile = 28.2%). Sessile animals were associated with hard substratum, but present in high numbers in muddy areas as well in the form of sea pens and anemones. Evaluation of trophic levels for megafauna revealed 35% predator/scavengers, 34% surface deposit feeders, and 30% suspension/filter feeders.

Fish

Hundreds of fish species inhabit the CCE, including: striped marlin, albacore tuna, Pacific sardine, thresher sharks, shortfin mako, blue shark, the California skate, black cod, halibut, scorpionfish, cowcod, over 100 species of rockfish, and more than 90 species of groundfish. Many of these fish have decreasing population levels and have been identified as near threatened, vulnerable, or endangered by the International Union for Conservation of Nature (IUCN).[27]

Coastal Pelagic Species and Highly Migratory Species Habitat

Along the California coastline, habitat conditions (temperature, productivity, etc.) vary greatly between seasons and years. These conditions, which may be strongly impacted by El Niño/La Niña cycles and the Pacific Decadal Oscillation, drive primary productivity (i.e., phytoplankton growth), determining prey abundance for coastal pelagic species (CPS) and highly migratory species (HMS). Sea surface temperature is an important determinant of primary productivity, which in turn is closely linked to zooplankton production,[28] a primary food source of many CPS.[29] The distribution of key CPS habitat is therefore largely based upon a thermal range bordered within the geographic area where a CPS is present at any life stage – i.e., where the CPS has occurred historically during periods of similar environmental conditions. Habitat for these species is therefore derived from distributional data, oceanographic data (e.g., sea surface temperatures), and relationships between oceanographic variables.[30]

Table 1. CPS present off the California coast. Data based on relative, approximate extractions from Pacific Fishery Management Council stock assessment reports.[31]

Species name		**General distribution**	**Presence in call area (2016*)**	**Important forage species**	**Notes**
Common	**Scientific**		**Morro Bay**		
Pacific sardine[32]	*Sardinops sagax*	Mexico to Alaska	Med.	Yes	Appear seasonally in north

[27] Near threatened species include albacore tuna, blue shark, yellowfin tuna, and striped marlin; vulnerable species include common thresher, bigeye thresher, bigeye tuna, and northern bluefin tuna; the pelagic thresher is endangered; IUCN Redlist; Knowledge of the status of California's fish populations is compromised by considerable data deficiencies that impair our ability to assess a species' overall health and population trend. This common problem underscores the need for BOEM to gather robust baseline monitoring of Morro Bay 399 as soon as possible.

[28] Hays et al. Climate change and marine plankton. TREE. 2005.

[29] Ware and Thomson, Bottom-up ecosystem trophic dynamics determine fish production in the Northeast Pacific, Science, 2005.

[30] https://www.westcoast.fisheries.noaa.gov/publications/habitat/essential_fish_habitat/coastal_pelagic_appendix_d.pdf; It is important to note 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).

[31] https://www.pcouncil.org/coastal-pelagic-species/background-information/

[32] http://www.pcouncil.org/wp-content/uploads/2017/05/Appendix-C-2017-sardine-assessment-NOAA-TM-NMFS-SWFSC-576.pdf

Pacific (chub) mackerel[33]	*Scomber japonicus*	Mexico to Alaska	High	Yes	Most abundant south of Point Conception
Northern anchovy[34]	*Engraulis mordax*	Mexico to British Columbia	High	Yes	N, central & S subpopulations
Jack mackerel[35]	*Trachurus symmetricus*	Mexico to Alaska	High	Yes (but only smaller Y1-Y2 individuals)	Most abundant S California. Offshore late spring to early fall
Market Squid[15]	*Doryteuthis opalescens*	Mexico to Alaska	Med.	Yes	Most abundant between Baja and Monterey Bay

The distributions of all the CPS noted above (Table 1) overlap with Morro Bay 399. However, the predicted abundances of each vary both in time and space (Table 2).

Table 2. Summary of relative abundance estimates within Morro Bay 399 of the four CPS fish species for which data are available. 1= low. 5 = high predicted abundance.

Species	Relative abundance per species* per year quarter (Average 1998-2016)			
	Q1	Q2	Q3	Q4
Albacore	4	2	1	2
Sardine	5	5	2	5
Anchovy	1	1	2	2
Clubhook Squid	4	5	3	4

***"Per species" means that a medium estimate for Albacore is not the same as a medium estimate for Sardine etc.**

Given the wide annual variability of the CCE, it is difficult to predict the times of highest CPS abundance in Morro Bay 399.

Albacore, sardine, and clubhook squid show the highest abundance in and around Morro Bay 399 in the first two quarters of the year. Anchovy shows the highest predicted abundance in the third quarter of the year. Because of the annual variation in the predicted average abundances of each CPS and the fact that their distributions are highly dynamic due to variations in water temperature and planktonic productivity, it is not entirely reliable to label certain quarters as high versus low abundance, particularly as the predictability of species distributions deteriorates under changing, and novel, environmental conditions in the CCE.[36] This is particularly so given that recent sea surface temperature anomalies have had significant impacts on the distribution of CPS and are predicted to become more frequent with climate change (Figure 4).[37] With these large-scale changes in the global oceanography (and in the CCE), it is also likely that the distribution of CPS will shift in response.

33 http://www.pcouncil.org/wp-content/uploads/2017/05/Appendix-B-2017-Pacific-Mackerel-Projection-Estimate.pdf

34 https://www.pcouncil.org/coastal-pelagic-species/fishery-management-plan-and-amendments/northern-anchovy-fmp/

35 https://www.pcouncil.org/coastal-pelagic-species/current-season-management/#monitored

36 Muhling et al. (2020) particularly as the predictability of species distributions deteriorates under changing / novel environmental conditions in the California Current System

37 Miyama, et al. (2021) Marine heatwave of sea surface temperature of the Oyashio Region in Summer in 2010-2016; Oliver et al. (2018) Longer and more frequent marine heatwaves over the past century. Cavole, et al. (2016) Biological impacts of the 2013-2015 warm-water anomaly in the NE Pacific: Winners, Losers, and the Future.

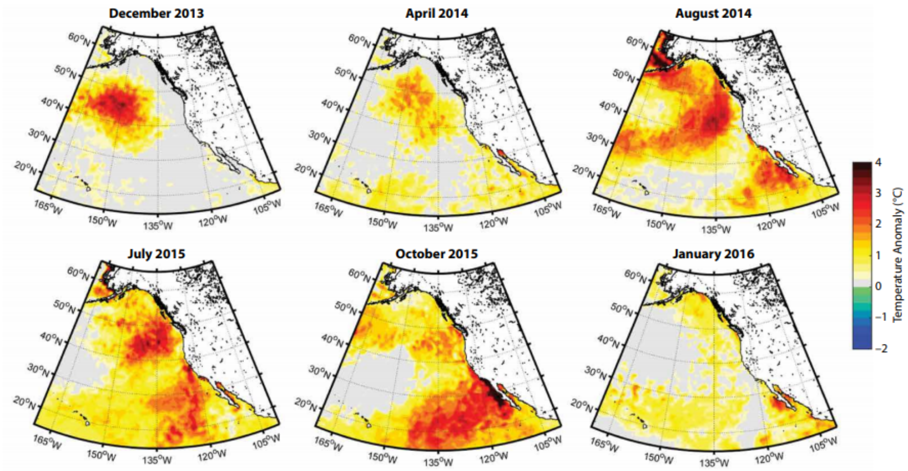

Figure 4. Sea surface temperature (SST) anomalies showing progression of the warm water anomaly from December 2013 through January 2016 in the northeastern Pacific Ocean. Temperature data were obtained from NOAA (Taken from Cavole et al. 2016[12]).

CPS are often a prey source for HMS.[38] Of the HMS of commercial interest in the CCE (Table 3), distributional prediction data is available for swordfish, common thresher sharks, shortfin mako sharks, albacore, yellowfin, bluefin, and blue sharks (see Appendix B).[39]

Table 3. Commercially caught, HMS present off the California coast.[40] *Others may also include opah (*Lampris guttatus*), basking (*Cetorhinus maximus*), megamouth (*Megachasma pelagios*), and great white (*Carcharadon carcharias*) sharks.

Group	Species name		US 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
	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

[38] Preti (2020) Trophic ecology of nine top predators in the California Current.
[39] Hazen EL, Jorgensen S, Rykaczewski RR, Bograd SJ, Foley DG, Jonsen ID, Shaffer SA, Dunne JP, Costa DP, Crowder LB, Block BA. Predicted habitat shifts of Pacific top predators in a changing climate. Nature Climate Change. 2013 Mar;3(3):234-8.
[40] https://www.westcoast.fisheries.noaa.gov/publications/habitat/essential_fish_habitat/highly_migratory_species_appendix_f.pdf.

	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

The distributions of all the HMS noted above (Table 3) overlap with Morro Bay 399. However, the predicted abundances of each vary both in time and space (Table 4).

Table 4. Summary of relative habitat suitability estimates within Morro Bay 399 of the 4 HMS fish species for which data is available. 1= low. 5 = high predicted abundance.

Species	**Relative habitat suitability per species* per month (Average 1998-2016)**				
	September	**October**	**November**	**December**	**January**
Swordfish	3	3	2	1	1
Common Thresher Shark	1	1	2	2	2
Shortfin Mako Shark	2	2	2	1	1
Blue Shark	5	4	3	2	1

*This means that (for example) a medium estimate for Swordfish is not the same as a medium estimate for Blue Shark etc.

For the Morro Bay area, swordfish, shortfin mako, and blue shark show the highest abundance in and around Morro Bay 399 in September (see Appendix B). The common thresher shark shows the highest predicted abundance between November to January. Again, as with the CPS, the variation in habitat suitability, no defined benthic habitat affinity, and dynamic distributions determined by water temperature mean that making firm conclusions from the HMS data displayed must be undertaken with some degree of caution, particularly when making future predictions.

Groundfish (benthic and demersal species)

In contrast to CPS and HMS, benthic and demersal species (i.e., the groundfish species) are more closely tied to fixed habitat structures and generally experience lower levels of abiotic habitat variability 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.

Much of the California Coast has been designated as Essential Fish Habitat (EFH) for sheepshead, sturgeon, and skate. To minimize to the extent practicable adverse effects from fishing, EFH on the U.S. West Coast prohibits fishing with various gear types within EFH designated areas (Figure 5).

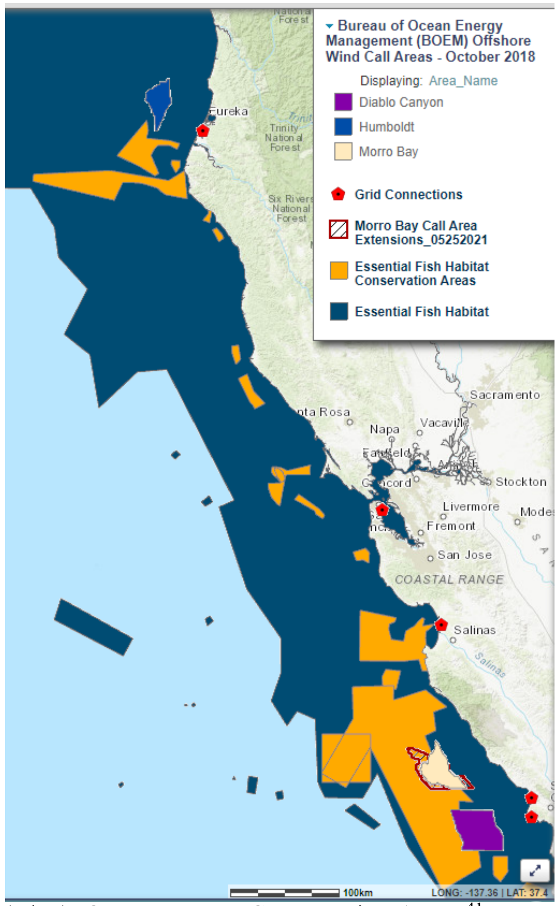

Figure 5. EFH boundaries (Blue). Orange = EFH Conservation Areas.[41]

The Pacific Fisheries Management Council (PFMC) has designated several Habitat Areas of Particular Concern (HAPC), subsets of EFH that have a particularly important ecological role in fish life cycles or are especially sensitive, rare, or vulnerable.[12] The original Morro Bay Call Area overlapped with 156 mi^2 of Pacific coast groundfish HAPC (Figure 6); Morro Bay 399 has an increase in HAPC overlap by 112 mi^2. As is evident in Figure 6, the bulk of the overlap occurs in the West Extension of Morro Bay 399.

[41] The Pacific Fisheries Management Council (PFMC) has designated several EFH Conservation Areas, which are subsets of EFH.

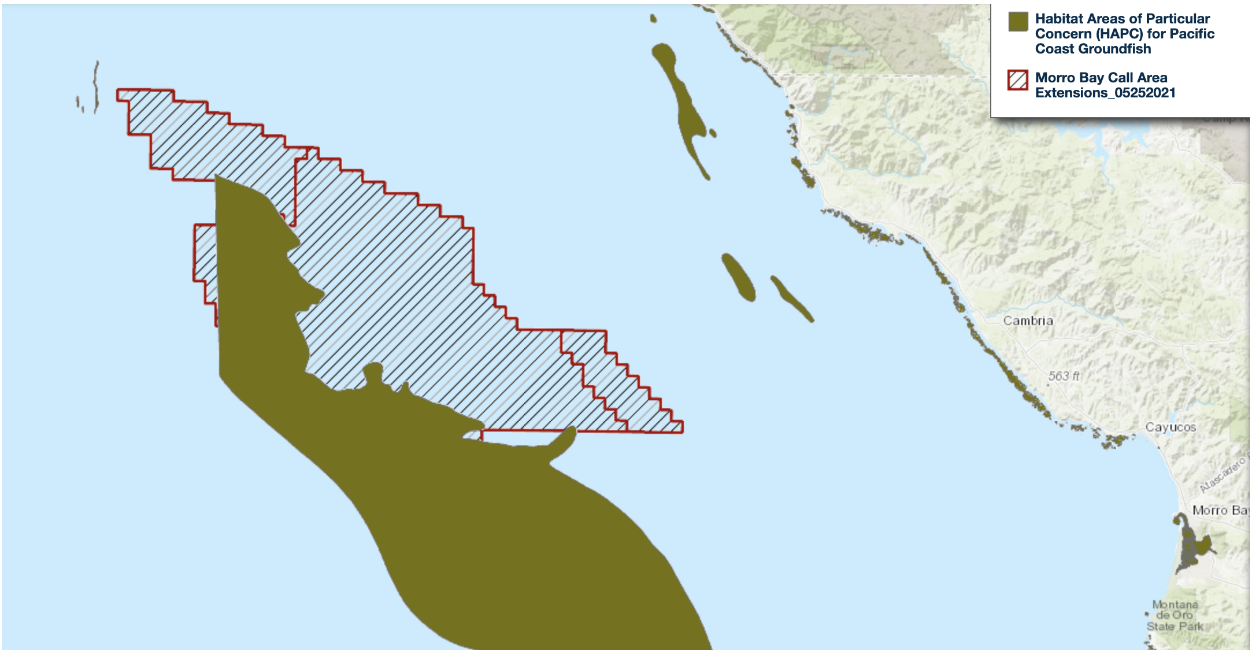

Figure 6. Morro Bay 399 with HAPC overlay. DataBasin

The current classifications of HAPC types: estuaries, canopy kelp, seagrass, rocky reefs, and "areas of interest" do not include a specific pelagic classification.[42] There is little specific documentation specifying the importance of HAPC "areas of interest" for California's CPS and HMS.[43] However, as BOEM attempts to demarcate areas of special interest for California's CPS and HMS relative to Morro Bay 399, the agency should carefully consider the important connection between banks, canyons, seamounts, and oceanic productivity. Further, as BOEM works with state agencies to permit the infrastructure to bring offshore wind power to shore, BOEM and state agencies should avoid fragile coastal habitat, such as the HAPC classification types listed above.[44] Morro Bay itself is designated as HAPC.

Marine mammals

Critical Considerations for Cetaceans

The overlap of Morro Bay 399 with specific cetacean habitat is described below, yet there are several important environmental considerations that apply to cetaceans broadly. As BOEM proceeds toward an intended 2022 lease sale, the agency should consider the following: (1) there are limitations of NOAA's Biologically Important Areas (BIAs) as a primary data source for cetacean habitat; (2) offshore wind energy developments are likely to overlap with critical prey resources, particularly krill; (3) there is a need to understand how climate change will influence dynamic marine habitat and how other stressors on cetaceans will change as a result.

BIAs and their current limitations

There are a variety of BIA designations, comprising reproductive areas, feeding areas, migratory corridors, and areas in which small and resident populations are concentrated. NOAA identifies BIAs through an expert consultation process with scientists, using available data sources, including boat-based

42 This includes submarine features such as banks, seamounts, and canyons

43 https://www.westcoast.fisheries.noaa.gov/publications/habitat/essential_fish_habitat/coastal_pelagic_appendix_d.pdf.

44 https://inport.nmfs.noaa.gov/inport/item/39359; https://catalog.data.gov/dataset/seagrass-distribution-off-california.

and aerial survey data, tracking data, and expert opinion.[45] BIAs offer a necessary complement to habitat-based density models (e.g., NOAA CetMap); in addition to high density areas, BIAs may capture areas of critical importance to the survival of a species or stock where density of individuals may be low. However, while BIAs articulate key areas of importance, BIA designations are not comprehensive and are intended to be periodically reviewed and updated to reflect the best available scientific information.[46] In fact, West Coast BIAs are currently undergoing review, a process that may yield new or revised BIAs for a number of species, including humpback, gray, fin, and blue whales. The process is expected to be complete in December 2021.[47] We caution that BOEM and other agencies should not rely on BIAs as the sole indicator of habitat importance for species; rather, determinations about the importance of habitat should factor in multiple data sources, many of which are outlined herein.

For each cetacean species, we discuss currently designated BIAs and highlight other relevant data sources that provide insight into additional habitats and movements that should be factored into responsible offshore wind development off the West Coast.

Overlap with prey resources

The CCE includes vitally important foraging habitat for cetaceans. For many CCE cetaceans, particularly large baleen whales, including blue, humpback, and fin whales, krill is a particularly important resource.[48] It is therefore critical to understand the distribution of both cetacean prey (i.e., krill) and cetaceans when evaluating the potential impacts of offshore wind energy developments. Several studies suggest that Morro Bay 399 falls in a relatively high krill abundance area[49] (Figure 7). These studies used a relatively straightforward measure to predict changes in forage species distributions and this same method can be used to determine when forage species are likely to be present in Morro Bay 399 -- thereby potentially attracting whales. The variation in krill distribution and the ability to predict these distributions suggests that offshore wind development and operations activities could be tailored to minimize disruptions to feeding whales during periods of high krill density (e.g., via seasonal restrictions on certain activities).

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[45] Calambokidis, John, et al. "4. Biologically Important Areas for Selected Cetaceans within US Waters-West Coast Region." *Aquatic Mammals* 41, no. 1 (2015): 39.

[46] Van Parijs, S. M. (2015). Letter of Introduction to the Biologically Important Areas issue. In S. M. Van Parijs, C. Curtice, & M. C. Ferguson (Eds.), Biologically Important Areas for cetaceans within U.S. waters (p. 1). Aquatic Mammals (Special Issue), 41(1). 128 pp.

[47] See https://oceannoise.noaa.gov/biologically-important-areas.

[48] See, e.g., Irvine, Ladd M., et al. "Spatial and Temporal Occurrence of Blue Whales off the U.S. West Coast, with Implications for Management." Edited by Andreas Fahlman. PLoS ONE 9, no. 7 (July 23, 2014): e102959. https://doi.org/10.1371/journal.pone.0102959.

[49] Cimino, Megan A., et al. "Essential Krill Species Habitat Resolved by Seasonal Upwelling and Ocean Circulation Models within the Large Marine Ecosystem of the California Current System." *Ecography* 43, no. 10 (October 2020): 1536–49. https://doi.org/10.1111/ecog.05204.; Santora, Jarrod A., Nathan J. Mantua, Isaac D. Schroeder, John C. Field, Elliott L. Hazen, Steven J. Bograd, William J. Sydeman, et al. "Habitat Compression and Ecosystem Shifts as Potential Links between Marine Heatwave and Record Whale Entanglements." *Nature Communications* 11, no. 1 (December 2020): 536. https://doi.org/10.1038/s41467-019-14215-w.

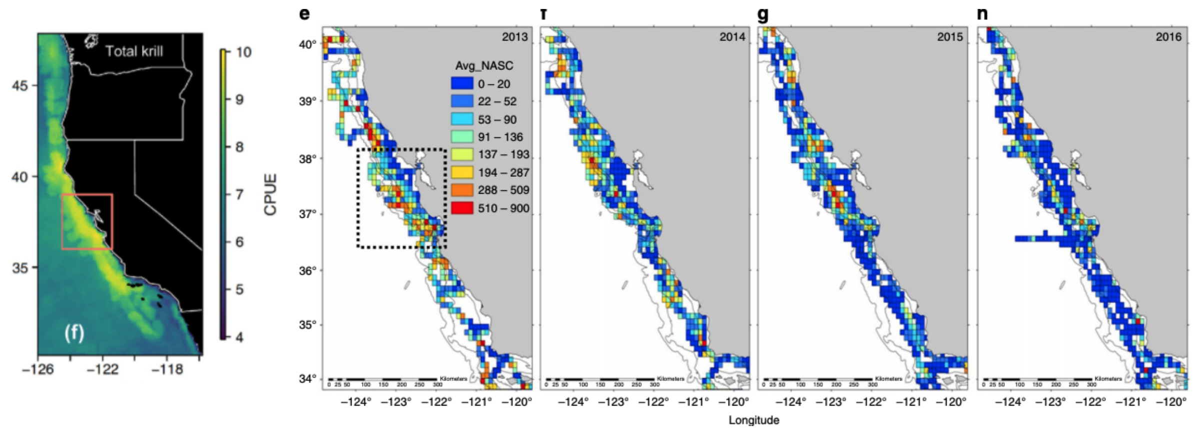

Figure 7. Krill abundance. Left map: Modeled predicted average krill catch per unit effort from 2002 to 2018 along the US west coast;[50] Right four maps: Acoustically determined (NASC; m^2 nmi^{-2}) krill distribution and abundance from 2013 to 2016, averaged onto a 25 km^2 grid.[51]

Climate change impacts

Climate change impacts, such as marine heat waves, may cause temporary or permanent shifts in habitat for cetaceans and possibly increase their presence in Morro Bay 399. Blue, fin, and humpback whale densities remained high in Morro Bay 399 during an anomalously warm year when the spatial extent of habitat was reduced. In fact, for fin and humpback whales, densities were predicted to be slightly higher in Morro Bay 399 during this warmer period (Figures 8, and 10-11).[52] This implies that climate change impacts, including increased ocean temperatures, may increase the relative density of cetaceans in this region or use of Morro Bay 399. This underscores the importance of consulting climate change models to ensure responsible siting, mitigation, and monitoring in Morro Bay 399.

In addition to climate change being a critical factor in considering timing of site assessment and construction activities, it may also cause the intensification of other stressors on whale populations, contributing to cumulative impacts. For example, a 2021 study on blue and humpback whales in the Gulf of the Farallones area found that the whales have been arriving earlier to the area, resulting in greater overlap with fisheries and increased entanglements beginning in 2014.[53] These overlaps were especially intensified in 2016 during the 2014-2016 heat wave due in part to delayed opening of the Dungeness crab fishery, concurrent with a shift in habitat use closer to shore by blue and humpback whales, resulting in a record high number of humpback whale entanglements in 2016.[54] The habitat compression caused by this

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[50] Cimino, Megan A., et al. "Essential Krill Species Habitat Resolved by Seasonal Upwelling and Ocean Circulation Models within the Large Marine Ecosystem of the California Current System." *Ecography* 43, no. 10 (October 2020): 1536–49. https://doi.org/10.1111/ecog.05204.

[51] Santora, Jarrod A., Nathan J. Mantua, Isaac D. Schroeder, John C. Field, Elliott L. Hazen, Steven J. Bograd, William J. Sydeman, et al. "Habitat Compression and Ecosystem Shifts as Potential Links between Marine Heatwave and Record Whale Entanglements." *Nature Communications* 11, no. 1 (December 2020): 536. https://doi.org/10.1038/s41467-019-14215-w

[52] Becker, Elizabeth A., et al. "Predicting Cetacean Abundance and Distribution in a Changing Climate." Edited by Maria Beger. *Diversity and Distributions* 25, no. 4 (April 2019): 626–43. https://doi.org/10.1111/ddi.12867.

[53] Ingman, Kaytlin, et al. "Modeling Changes in Baleen Whale Seasonal Abundance, Timing of Migration, and Environmental Variables to Explain the Sudden Rise in Entanglements in California." Edited by Songhai Li. *PLOS ONE* 16, no. 4 (April 15, 2021): e0248557. https://doi.org/10.1371/journal.pone.0248557.

[54] Santora, Jarrod A., et al. "Habitat Compression and Ecosystem Shifts as Potential Links between Marine Heatwave and Record Whale Entanglements." *Nature Communications* 11, no. 1 (December 2020): 536. https://doi.org/10.1038/s41467-019-14215-w.

marine heatwave increased whale presence closer to shore in 2015 and 2016, likely in response to the more available forage fish prey.[55]

Prey-switching by humpback whales in response to variations in ocean conditions is important to consider in offshore wind development, as whales may vary their distribution and foraging behavior between years, requiring adaptability in mitigation measures. These insights will be critical to understanding the appropriate timing for both construction and monitoring of offshore wind developments, particularly during anomalous years with marine heat waves and other climate driven changes that may affect the distribution of both marine mammals and human activities. Below, species-specific climate impacts are discussed, based on best available scientific information.

Species-Specific Impacts and Overlap with Morro Bay 399

Blue whales

Blue whales are endangered and protected under the Endangered Species Act (ESA). There are an estimated 5,000–15,000 individuals remaining globally.[56] Data through 2018 for the Eastern North Pacific (ENP) population models its abundance as 1,767 individuals, with numbers largely stable since the 1990s with a possible slight increase, although there is a sampling bias.[57] The total annual potential biological removal (PBR) from all human-caused mortality in the United States for this stock is only 1.23 whales annually;[58] a fatality rate of greater than 1.23 whales per year would impact population levels. Human-caused mortality already exceeds this crucial PBR level, with 1.44 whales lost per year due to entanglement in fishing gear, and 0.4 whales per year due to vessel strike, based on observed mortalities.[59] The probability of detection of both entanglements and vessel strikes is low, however, meaning the actual number of deaths is likely much higher. For instance, research using encounter models between blue whales and vessels estimated 18 ship strike deaths per year, nearly 1% of the population.[60]

Morro Bay 399 does not overlap with current blue whale BIAs (although, as noted previously, BIAs are currently under review) and overlap of Morro Bay 399 with blue whale habitat appears to vary depending on the data source. For example, a study by Becker and colleagues found that the East Extension area overlaps with high density regions and the West overlaps with moderate density regions in the summer and fall.[61] WhaleWatch predictions for both 2016 and 2017 show the opposite pattern: the West Extension region overlaps with higher density regions than the East Extension in most of the summer months when

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[55] *Id.* and Fleming, A. H., Clark, C. T., Calambokidis, J. & Barlow, J. Humpback whale diets respond to variance in ocean climate and ecosystem conditions in the California Current. Glob. Chang. Biol. 22, 1214–1224 (2016).

[56] Cooke, J.G. 2018. *Balaenoptera musculus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2018: e.T2477A156923585. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T2477A156923585.en. Downloaded on 29 August 2021.

[57] Calambokidis, J., and J. Barlow. 2020. Updated abundance estimates for blue and humpback whales along the U.S. West Coast using data through 2018. U.S. Department of Commerce, NOAA Technical Memorandum, NMFS-SWFSC-634. 20 pp.

[58] Carretta, James, et al. "U.S. Pacific Marine Mammal Stock Assessments: 2019, U.S. Department of Commerce", NOAA Technical Memorandum NMFS-SWFSC-629 (2020). https://media.fisheries.noaa.gov/dam-migration/2019_sars_bluewhale_enp.pdf.

[59] James V. Carretta, Erin M. Oleson, Karin. A. Forney, Marcia M. Muto, David W. Weller, Aimee R. Lang, Jason Baker, Brad Hanson, Anthony J. Orr, Jay Barlow, Jeffrey E. Moore, and Robert L. Brownell Jr. 2021. U.S. Pacific Marine Mammal Stock Assessments: 2020, Blue whale: Eastern North Pacific Stock. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SWFSC-646.

[60] *Id.* and Rockwood RC, Calambokidis J, Jahncke J (2018) Correction: High mortality of blue, humpback and fin whales from modeling of vessel collisions on the U.S. West Coast suggests population impacts and insufficient protection. PLOS ONE 13(7): e0201080. https://doi.org/10.1371/journal.pone.0201080

[61] Becker, Elizabeth A., et al. "Moving towards Dynamic Ocean Management: How Well Do Modeled Ocean Products Predict Species Distributions?" *Remote Sensing* 8, no. 2 (2016): 149.

the density of blue whales is highest.[62] Home range analyses show a similar pattern: of 171 whales tagged (representing about 10% of the ENP population), the West Extension overlapped with between six and nine blue whales' core areas, and the East Extension overlapped with between one and five whales' core areas.[63] While the percentage of tagged animals in these areas may seem low, as discussed above, impacts to even one blue whale from offshore wind energy development has the potential to result in population-level consequences.

A recent study by Abrahms and colleagues showed that, of 104 blue whales tracked from 1994 to 2008, historical patterns in primary productivity were more important drivers of seasonal-scale movements than contemporaneous productivity.[64] This suggests that blue whales not only have strong foraging site fidelity, but that their memory of where resources have been in the past is a major driver for where they will search for food in future years. If wind leases are sited in known foraging areas for blue whales, blue whales are likely to return to those same areas and thereby experience increased potential for impacts. Similarly, a study using an overlapping dataset by Palacios et al. (2019) appears to show high probability of blue whale foraging in Morro Bay 399, regardless of oceanographic conditions, another indication of strong site fidelity.[65] As mentioned above, a study by Becker et al. (2019) also showed that blue, fin, and humpback densities remained high in Morro Bay 399, even during an anomalously warm year (2014 - see Figure 8).

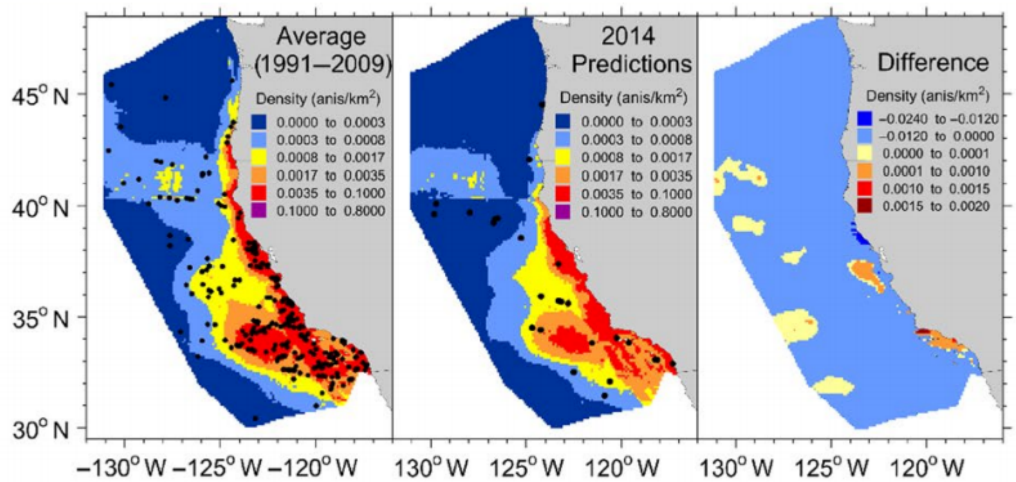

Figure 8. Blue whale density. Predicted blue whale density average from 1991-2009; predictions for 2014, and the difference between the average and 2014.[66]

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62 Hazen, Elliott L., et al. "WhaleWatch: A Dynamic Management Tool for Predicting Blue Whale Density in the California Current," 2016.

63 Maxwell, Sara, et al. "Cumulative Human Impacts on Marine Predators." *Nature Communications* 4 (2013): 2688. https://doi.org/10.1038/ncomms3688; Irvine, Ladd M., Bruce R. Mate, Martha H. Winsor, Daniel M. Palacios, Steven J. Bograd, Daniel P. Costa, and Helen Bailey. "Spatial and Temporal Occurrence of Blue Whales off the U.S. West Coast, with Implications for Management." Edited by Andreas Fahlman. *PLoS ONE* 9, no. 7 (July 23, 2014): e102959. https://doi.org/10.1371/journal.pone.0102959. 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.

64 Abrahms, Briana, et al. "Memory and Resource Tracking Drive Blue Whale Migrations." *Proceedings of the National Academy of Sciences* 116, no. 12 (March 19, 2019): 5582–87. https://doi.org/10.1073/pnas.1819031116.

65 Palacios, Daniel M., et al. "Ecological Correlates of Blue Whale Movement Behavior and Its Predictability in the California Current Ecosystem during the Summer-Fall Feeding Season." *Movement Ecology* 7, no. 1 (December 2019): 26. https://doi.org/10.1186/s40462-019-0164-6.

66 Becker, Elizabeth A., et al. "Predicting Cetacean Abundance and Distribution in a Changing Climate." Edited by Maria Beger. *Diversity and Distributions* 25, no. 4 (April 2019): 626–43. https://doi.org/10.1111/ddi.12867.

The timing of blue whale arrival to Morro Bay 399 region may also be important to consider. A 2020 study suggested that colder sea surface temperature anomalies from the previous season were correlated with greater krill biomass the following year and earlier arrival by blue whales; additionally, the study suggests that blue whales have been spending more time in Southern California as a result of the climate change-driven decadal increase in temperatures.[67] Similarly, as discussed above, a study in the Gulf of the Farallones found that blue and humpback whales were arriving earlier to the area, resulting in more overlap with fisheries and increased entanglements,[68] and this pattern may extend into the Morro Bay 399 region as well.

Gray whales

Pacific gray whales are currently experiencing an ongoing Unusual Mortality Event (UME) due to undetermined causes, though poor body condition likely resulting from starvation has been observed over the course of the UME.[69] The ENP population of gray whales, while not listed under the ESA, has declined by an estimated 24% since 2016, currently numbering approximately 20,580 individuals.[70] The Western North Pacific (WNP) population is listed as endangered, and individuals have been documented along the migration route of the ENP population.[71] The Morro Bay 399 extensions do not overlap with current gray whale feeding BIAs, which occur on the continental shelf and in coastal nearshore waters, and further north of Morro Bay 399, primarily in Washington and Oregon. Similarly, migration corridors and BIAs occur close to shore (within 5.4 nm). However, when defining BIAs, scientists included a 25.4 nm "Potential Presence" buffer.[72] The buffer represents the potential path of some individuals that move further offshore during annual gray whale migrations. The East Extension is entirely encompassed in the Potential Presence area, and a small area is encompassed in the West Extension (Figure 9). Additionally, development activities, such as site assessment, cable laying, and vessel transits, will occur within migration corridors.[73] Vessel strikes are responsible for a portion of gray whale deaths observed during the UME.

[67] Szesciorka, Angela R., et al. "Timing Is Everything: Drivers of Interannual Variability in Blue Whale Migration." *Scientific Reports* 10, no. 1 (December 2020): 7710. https://doi.org/10.1038/s41598-020-64855-y.

[68] Ingman, Kaytlin, et al. "Modeling Changes in Baleen Whale Seasonal Abundance, Timing of Migration, and Environmental Variables to Explain the Sudden Rise in Entanglements in California." Edited by Songhai Li. *PLOS ONE* 16, no. 4 (April 15, 2021): e0248557. https://doi.org/10.1371/journal.pone.0248557.

[69] Christiansen F, Rodríguez-González F, Martínez-Aguilar S, Urbán J and others. 2021. Poor body condition associated with an unusual mortality event in gray whales. Mar Ecol Prog Ser 658:237-252

[70] Stewart, JR and DW Weller. 2021. Abundance of eastern North Pacific gray whales 2019/2020. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SWFSC-639.https://doi.org/10.25923/bmam-pe91.

[71] Mate, BR et al. 2015. Critically endangered western gray whales migrate to the eastern North Pacific. Bio. Lett. 11(4):20150071, doi: 10.1098/rsbl.2015.0071

[72] Calambokidis et al. 2015. Biologically Important Areas for Selected Cetaceans Within U.S. Waters – West Coast Region. Aquatic Mammals 2015, 41(1), 39-53, DOI 10.1578/AM.41.1.2015.39

[73] Becker, Elizabeth A., et al. "Moving towards Dynamic Ocean Management: How Well Do Modeled Ocean Products Predict Species Distributions?" *Remote Sensing* 8, no. 2 (2016): 149.

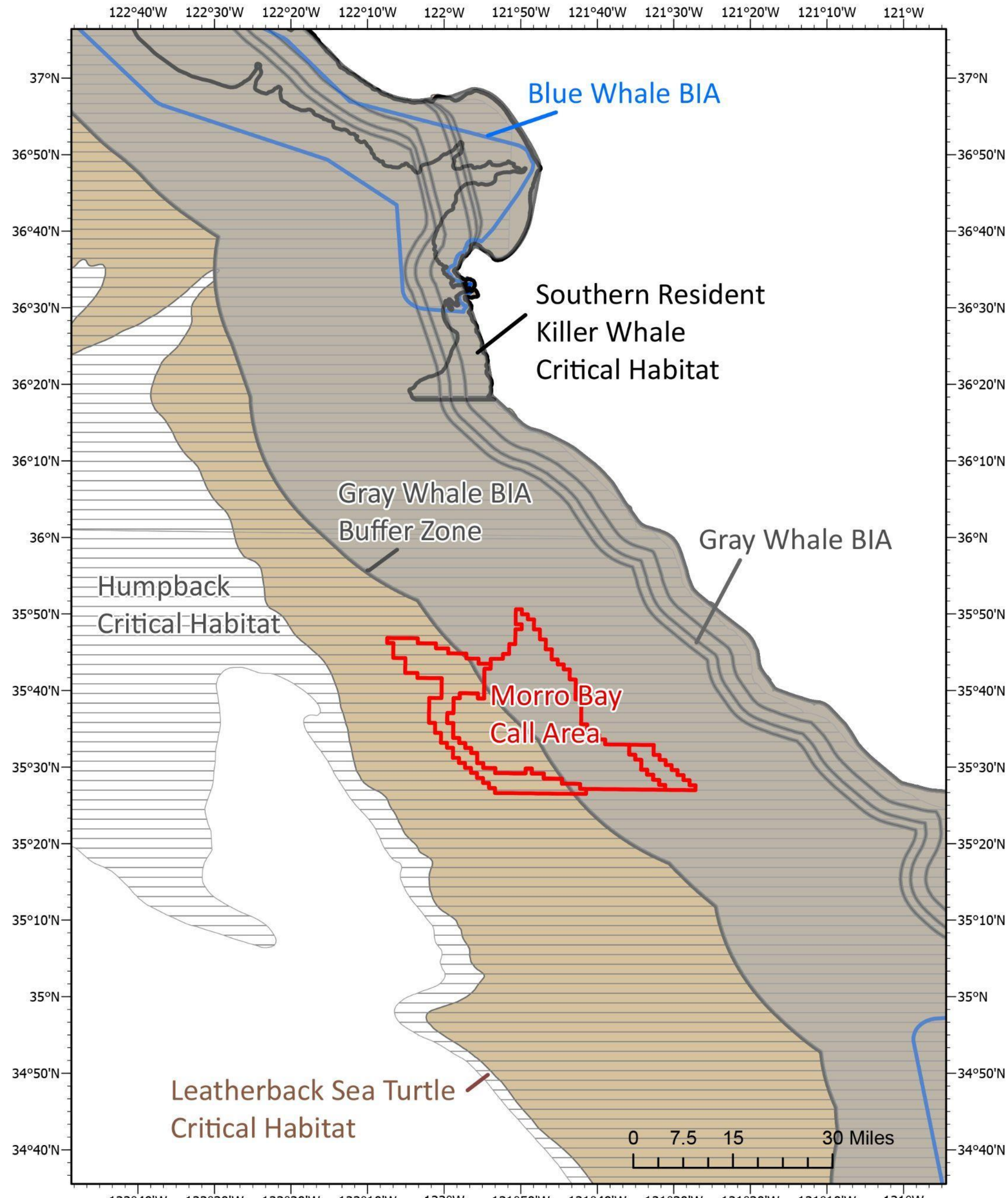

Figure 9. Morro Bay 399 with gray whale BIA and buffer, blue whale BIA, and humpback whale, leatherback sea turtle, and Southern Resident killer whale Critical Habitat.

Humpback whales

The CCE is an important foraging area for ESA-listed humpback whale populations that spend significant amounts of time off the California Coast in the spring through fall. The Central America Distinct Population Segment (DPS) of humpback whales is designated as endangered under the ESA and the Mexico DPS as threatened. Together, the populations are considered the “CA/OR/WA stock” under the

MMPA and have an estimated abundance of 4,973 individuals.[74] NMFS has also identified the Central America DPS as a demographically independent population ("DIP") under the MMPA, distinguishing it further from the CA/OR/WA stock.[75] Critical Habitat for these populations was designated in 2021. Critical Habitat is defined under the ESA (16 U.S.C. 1532 (5)) Section 3(5)(A) as an area with "physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection." All of Morro Bay 399 falls within this Critical Habitat (Figure 9). Further, a portion of Critical Habitat with a Very High Conservation Rating for the Central America DPS and a Moderate Conservation Rating for the Mexico DPS falls within Morro Bay 399.[76] NOAA's Office of Protected Resources states that "habitat units receiving a higher conservation value rating by Critical Habitat Review Team (CHRT) members are ones considered to be used by a relatively larger percentage of the DPS and contain higher quality feeding habitat;" of these ratings, "Very High" is the highest conservation value rating, indicating that these habitats are "very important to the conservation of the DPS."[77]

Humpback whale feeding BIAs occur further inshore than Morro Bay 399, with approximately 10 nm between the East Extension and the westernmost boundary of the closest BIA. The Southwest Fisheries Science Center (SWFSC) density models predict that Morro Bay 399 overlaps with regions of high or moderate density for humpback whales in the summer and fall; there appears to be greater overlap with high density areas in the East Extension area than the West.[78] Tracking studies support this distinction and suggest moderate use by humpback whales in the West Extension and low use in the East though sample sizes are relatively low (n = 13).[79] As noted earlier, a study by Becker et al. (2019) also showed that blue, fin, and humpback densities remained high throughout all of Morro Bay 399, even during 2014, a year that was anomalously warm (Figure 10). In fact, for fin and humpback whales, densities were predicted and observed to be slightly higher in the Morro Bay 399 region in 2014, possibly due to a shift in foraging patterns and habitat compression due to the unusual ocean conditions.

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[74] John Calambokidis and Jay Barlow. 2020. Updated abundance estimates for blue and humpback whales along the U.S. West Coast using data through 2018, U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SWFSC-634.

[75] Martien, K. et al. 2019. "The DIP Delineation Handbook: A Guide to Using Multiple Lines of Evidence to Delineate Demographically Independent Populations of Marine Mammals." U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SWFSC-622 at 33-34.

[76] NOAA Office of Protected Species. "ESA Section 4(b)(2) Report In Support of the Final Designation of Critical Habitat for the Mexico, Central America, and Western North Pacific Distinct Population Segments of Humpback Whales (*Megaptera novaeangliae*)." (2020) https://media.fisheries.noaa.gov/2021-04/Humpback%204b2%20Report_101520_final%20clean_040821_508.pdf?null=

[77] *Id.*

The CHRT determined these areas after review of available scientific data.

[78] Becker, Elizabeth A., et al. "Moving towards Dynamic Ocean Management: How Well Do Modeled Ocean Products Predict Species Distributions?" *Remote Sensing* 8, no. 2 (2016): 149.

[79] Maxwell, Sara, et al. "Cumulative Human Impacts on Marine Predators." *Nature Communications* 4 (2013): 2688. https://doi.org/10.1038/ncomms3688;

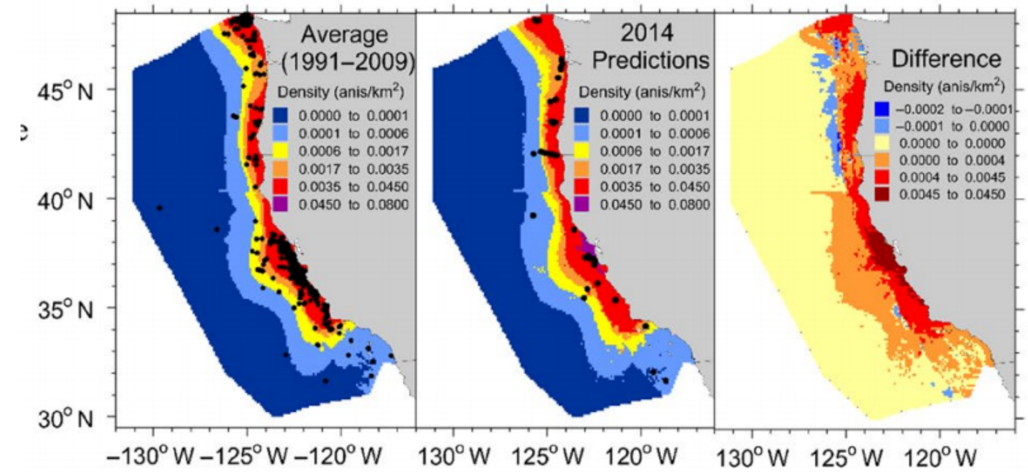

Figure 10. Humpback whale density. Predicted humpback whale density average from 1991-2009; predictions for 2014, and the difference between the average and 2014.[80]

Fin whales

Fin whales are listed under ESA and occur in both pelagic and coastal waters, where they feed on krill and fish. Current research suggests that only some fin whales undergo long distance migrations while some individuals remain residents in warmer waters of Southern California.[81] The variability in movements make BIAs difficult to define and thus they were not designated, although BIAs are currently being considered as a result of new research. The SWFSC density models suggest high fin whale density may occur in both the East and West Extensions.[82] There was also a concentration of sightings in the Santa Lucia Bank region. Satellite tagging-based habitat suitability models also suggest that both Extension Areas are in high suitability habitat areas based on model predictions, particularly during the summer and fall (June through November).[83] As stated above, a Becker et al. (2019) study showed that blue, fin, and humpback densities were high in Morro Bay 399, even during 2014 (Figure 11).[84] In fact, for fin and humpback whales, densities were predicted to be slightly higher in the Morro Bay 399 region, possibly due to a shift in foraging patterns and habitat compression due to the unusual ocean conditions.

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[80] Becker, Elizabeth A., et al. "Predicting Cetacean Abundance and Distribution in a Changing Climate." Edited by Maria Beger. *Diversity and Distributions* 25, no. 4 (April 2019): 626–43. https://doi.org/10.1111/ddi.12867.

[81] Calambokidis J., Steiger G., Curtice C., Harrison J., Ferguson M., Becker E., DeAngelis M., Van Parijs S., "Biologically Important Areas for Selected Cetaceans Within U.S. Waters—West Coast Region," Aquatic Mammals 2015, 4l(1), 39-53.

[82] Becker, Elizabeth. A., et al. "Predictive Modeling of Cetacean Densitites in the California Current Ecosystem Based on Summer/Fall Ship Surveys in 1991-2008." La Jolla CA: NOAA, 2012; Becker, Elizabeth A., Karin A. Forney, Paul C. Fiedler, Jay Barlow, Susan J. Chivers, Christopher A. Edwards, Andrew M. Moore, and Jessica V. Redfern. "Moving towards Dynamic Ocean Management: How Well Do Modeled Ocean Products Predict Species Distributions?" *Remote Sensing* 8, no. 2 (2016): 149.

[83] Scales, Kylie L., et al. "Should I Stay or Should I Go? Modelling Year-round Habitat Suitability and Drivers of Residency for Fin Whales in the California Current." Edited by Jeremy VanDerWal. *Diversity and Distributions* 23, no. 10 (October 2017): 1204–15. https://doi.org/10.1111/ddi.12611.

[84] Becker, Elizabeth A., et al. "Predicting Cetacean Abundance and Distribution in a Changing Climate." Edited by Maria Beger. *Diversity and Distributions* 25, no. 4 (April 2019): 626–43. https://doi.org/10.1111/ddi.12867.

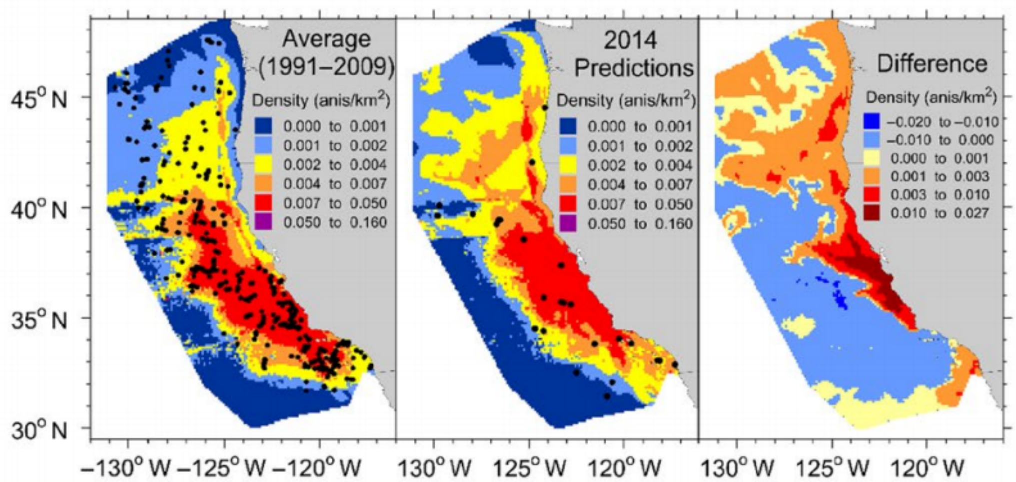

Figure 11. Fin whale density. Predicted fin whale density average from 1991-2009; predictions for 2014, and the difference between the average and 2014.[85]

Harbor porpoise

The Morro Bay Small Resident Population is distributed from Point Conception to Point Sur, with particularly high densities from Point Estero and Point Arguello.[86] The minimum population size is estimated at 2,737 animals;[87] however, the Morro Bay Small Resident Population is especially vulnerable to anthropogenic impacts because of the small core size of its range.[88] The Morro Bay harbor porpoise BIA extends from Point Conception to Point Sur and follows the 200 m isobath.[89] Although out of range of where floating turbines would be located, site assessment and characterization activities potentially involving high resolution geophysical surveys, transmission cable construction, and vessel traffic for operations and maintenance would occur within the Morro Bay harbor porpoise BIA. Both captive and wild animal studies show harbor porpoises abandoning habitat in response to various types of pulsed sounds at well below 120 dB (re 1 uPa (RMS))[90] and, in fact, evidence of the acoustic sensitivity of the harbor porpoise has led scientists to call for a revision to the NMFS acoustic exposure criteria for behavioral response.[91] Impacts to the Morro Bay harbor porpoise population must, therefore, be minimized and mitigated to the full extent practicable.

Minke whale

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[85] *Id.*
[86] Calambokidis, et al. 2015.
[87] NMFS 2019 Stock Assessment Report. https://media.fisheries.noaa.gov/dam-migration/2019_sars_harborporpoise_morrobaystock.pdf
[88] *Id.*; Forney, K.A., Southall, B.L., Slooten, E., Dawson, S., Read, A.J., Baird, R.W. and Brownell Jr, R.L., 2017. Nowhere to go: noise impact assessments for marine mammal populations with high site fidelity. *Endangered species research*, *32*, pp.391-413.
[89] *Id.*
[90] *See,* e.g., Bain, D.E., and Williams, R., "*Long-range effects of airgun noise on marine mammals: responses as a function of received sound level and distance"* Report by Sea Mammal Research Unity (SMRU), 2006.; Kastelein, R.A., Verboom, W.C., Jennings, N., de Haan, D., "Behavioral avoidance threshold level of a harbor porpoise (*Phocoena phocoena*) for a continuous 50 kHz pure tone." *Journal of the Acoustical Society of America*, vol. 123 (2008): 1858-1861.; Kastelein, R.A., Verboom, W.C., Muijsers, M., Jennings, N.V., van der Heul, S., "The influence of acoustic emissions for underwater data transmission on the behavior of harbour porpoises (*Phocoena phocoena*) in a floating pen." *Mar. Enviro. Res.* Vol. 59 (2005): 287-307; Olesiuk, P.F., Nichol, L.M., Sowden, M.J., and Ford, J.K.B., "Effect of the sound generated by an acoustic harassment device on the relative abundance and distribution of harbor porpoises (*Phocoena phocoena*) in Retreat Passage, British Columbia." *Marine Mammal Science,* vol. 18 (2002): 843-862.
[91] Tougaard, J., Wright, A. J., and Madsen, P.T., "Cetacean noise criteria revisited in the light of proposed exposure limits for harbor porpoises," *Marine Pollution Bulletin.* vol. 90 (2015): 196-208.

Minke whales in California are usually sighted on the continental shelf. Populations in inland California waters are thought to be resident populations with established home ranges, although individuals in Alaska migrate to warmer waters for breeding.[92] The population size and status are unknown, and little is known about individual movements, making impacts and potential overlap with Morro Bay 399 difficult to assess.

North Pacific right whale

Potential overlap of endangered North Pacific right whale habitat with Morro Bay 399 is unknown. This highly endangered whale is one of the rarest marine mammal species, with fewer than 500 remaining in the North Pacific and likely around 30 individuals in the Eastern North Pacific population.[93] Very little is known about their distribution and habitat use, but since 1950, there have been at least four sightings of North Pacific right whales from the eastern population that occurred in Washington (one of which occurred since 1990), twelve in California waters, two off British Columbia in 2013, and several recent sightings in Alaska.[94] 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 potential sightings in Morro Bay 399 in the 1990s (Piedras Blancas and Big Sur Coast sightings).[95] Habitat preference models based on environmental conditions have indicated that Southern California is a potential calving area.[96]

Sperm whales

The SWFSC density models suggest that the density of sperm whales is low in the East Extension and moderate in the West Extension.[97] Sperm whales are a deep diving species, and rarely seen during ship-based surveys, so much of the density estimates follow bathymetric contours as they are usually sighted in deeper waters. Sperm whales worldwide are listed as endangered under the ESA, and the minimum abundance for the CA/OR/WA stock is estimated at 1,270 whales.[98]

Small beaked whales

The SWFSC density models suggest that the density of small beaked whales (i.e., *Mesoplodon* spp., Cuvier's beaked whales) is potentially low in both of the Extension Areas.[99] Considerable uncertainty exists around density estimates of beaked whales as there is little research on the species and what drives their habitat use. However, evidence is emerging that beaked whales may occupy relatively restricted

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92 NMFS, "Minke Whale," NMFS, Accessed August 21, 2021, https://www.fisheries.noaa.gov/species/minke-whale.

93 Wright DL, Castellote M, Berchok CL, Ponirakis D, Crance JL, Clapham PJ (2018) Acoustic detection of North Pacific right whales in a high-traffic Aleutian Pass, 2009-2015. Endang Species Res 37:77-90. https://doi.org/10.3354/esr00915

94 Ford, J.K.B., Pilkington, J.F., Gisborne, B. et al. Recent observations of critically endangered North Pacific right whales (Eubalaena japonica) off the west coast of Canada. Mar Biodivers Rec 9, 50 (2016). https://doi.org/10.1186/s41200-016-0036-3; https://www.fisheries.noaa.gov/feature-story/four-endangered-north-pacific-right-whales-spotted-gulf-alaska

95 National Marine Fisheries Service. "Recovery plan for the North Pacific right whale (*Eubalaena japonica*)." (2013) National Marine Fisheries Service, Office of Protected Resources, Silver Spring, MD.

96 *Id.*

97 Becker, Elizabeth A., et al. "Moving towards Dynamic Ocean Management: How Well Do Modeled Ocean Products Predict Species Distributions?" Remote Sensing 8, no. 2 (2016): 149.

98 James V. Carretta, Erin M. Oleson, Karin. A. Forney, Marcia M. Muto, David W. Weller, Aimee R. Lang, Jason Baker, Brad Hanson, Anthony J. Orr, Jay Barlow, Jeffrey E. Moore, and Robert L. Brownell Jr. 2021. U.S. Pacific Marine Mammal Stock Assessments: 2020, Sperm whale: California/Oregon/Washington stock. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SWFSC-646.

99 *Id.*

ranges (for example, offshore North Carolina[100]), meaning that they may be particularly vulnerable to any impacts associated with offshore wind energy development located in their ranges.[101]

Baird's beaked whales

The SWFSC density models suggest density in the East Extension is likely to be low to moderate; in the West Extension it is likely to be moderate to high.[102] Again, significant uncertainty exists around density estimates of beaked whales in the area, including Baird's beaked whales.

Additional species

In addition to the species listed above, many other marine mammals utilize the deep waters around the continental shelf off California and are likely to overlap with Morro Bay 399 or be impacted by site assessment, cable-laying, and vessel activities. Other ESA-listed marine mammals found in this area include sei whales and Guadalupe fur seals.

Very little is known about sei whales, including a worldwide population estimate. They are typically observed in deeper waters and have an unpredictable distribution.[103] Sei whales can often be confused with blue and fin whales and they face similar threats including vessel strikes, entanglement, noise, and shifts in prey distribution.

Guadalupe fur seals are listed as threatened and juveniles travel long distances from the species' breeding ground on Guadalupe Island off the coast of Mexico, and regularly strand on coasts from Northern California to Washington State.[104] A UME was declared for Guadalupe fur seals in 2015 and is still ongoing.[105]

Small cetaceans in the CCE may be present year-round, including two additional types of orcas (Transient and Offshore), bottlenose dolphins, common dolphins, Dall's porpoises, Risso's dolphins, Pacific white-sided dolphins, short-finned pilot whales, and northern right whale dolphins.[106] Other species of pinnipeds likely to overlap with Morro Bay 399 include northern elephant seals and northern fur seals, both of which seasonally travel through and forage in deeper waters.[107] Further, as BOEM works with state agencies to permit the infrastructure to bring offshore wind power to shore, they should evaluate the importance of fragile coastal habitat to other marine mammal species. Morro Bay, for example, is an important estuarine habitat for the southern sea otter, a species listed as threatened under the ESA.[108]

Table 5. Summary Overview for Marine Mammals and Sea Turtles

[100] Foley, H.J., Pacifici, K., Baird, R.W., Webster, D.L., Swaim, Z.T. and Read, A.J., 2021. Residency and movement patterns of Cuvier's beaked whales Ziphius cavirostris off Cape Hatteras, North Carolina, USA. Marine Ecology Progress Series, 660, pp.203-216.
[101] Forney, K.A., Southall, B.L., Slooten, E., Dawson, S., Read, A.J., Baird, R.W. and Brownell Jr, R.L., 2017. Nowhere to go: noise impact assessments for marine mammal populations with high site fidelity. *Endangered species research*, *32*, pp.391-413.
[102] *Id.*
[103] *See* NOAA Fisheries species directory: Sei whale. https://www.fisheries.noaa.gov/species/sei-whale
[104] NOAA Fisheries species directory: Guadalupe fur seal. https://www.fisheries.noaa.gov/species/guadalupe-fur-seal
[105] NOAA Fisheries 2015–2021 Guadalupe Fur Seal Unusual Mortality Event in California, Oregon and Washington: https://www.fisheries.noaa.gov/national/marine-life-distress/2015-2021-guadalupe-fur-seal-unusual-mortality-event-california
[106] NOAA Fisheries species directory, marine mammals: https://www.fisheries.noaa.gov/species-directory/marine-mammals
[107] *Id.*
[108] Hatfield, B. B., J. L. Yee, M. C. Kenner, and J. A. Tomoleoni. 2019. California sea otter (*Enhydra lutris nereis*) census results, spring 2019. U.S. Geological Survey Data Series 1118, Reston, Virginia, USA. https://doi.org/10.3133/ds1118.

Species *US ESA Status*	**Primary Threats**	**Overlap Descriptor**	**East Extension**	**West Extension**	**Source**
Blue whales *Endangered*	Entanglement, ocean noise, vessel strikes, climate change	BIAs	No current BIA overlap or adjacency	No current BIA overlap or adjacency	NOAA
		Satellite tracking, ship-based survey	**Moderate to high** density area overlap	**Moderate to high** density area overlap	Becker et al 2016; Hazen et al 2016; Becker et al 2018
Gray whales *WNP: Endangered* *ENP: not listed*	Climate change, vessel and noise disturbance, entanglement, habitat impacts, vessel strikes	BIAs	Overlaps with **'Potential Presence'** BIA; adjacent to coastal migratory BIAs	Overlaps minimally with **'Potential Presence'** BIA; adjacent to coastal migratory BIAs	NOAA
Humpback whales *Central America DPS:Endangered* *Mexico DPS: Threatened*	Entanglement, vessel strikes, vessel-based harassment, ocean noise	Critical Habitat	Overlaps with Critical Habitat; **'Very High' Conservation Value** for Central American DPS, **'Moderate' Conservation Value** for Mexico DPS	Overlaps with Critical Habitat; **'Very High' Conservation Value** for Central American DPS, **'Moderate' Conservation Value** for Mexico DPS	NOAA Office of Protected Resources 2020
		BIAs	No current BIA overlap but near to coastal BIA	No current BIA overlap but near to coastal BIA	NOAA
		Ship-based survey	**High** density area overlap; densities predicted to be **higher during warm years**	**Moderate to high** density area overlap; densities predicted to be **higher during warm years**	Becker et al 2016, 2018
Fin whales *Endangered*	Climate change, entanglement, prey	BIAs	*BIAs not yet determined*	*BIAs not yet determined*	

	depletion, ocean noise, vessel strikes	Satellite tracking, ship-based survey	**High** density and habitat suitability area overlap; densities predicted to be **higher during warm years**	**High** density and habitat suitability area overlap; densities predicted to be **higher during warm years**	Becker et al 2016, 2018; Scales et al 2017
Southern resident killer whale DPS *Endangered*	Chemical contaminants, physical and acoustic disturbance, entanglement, prey depletion, oil spills	Critical Habitat	No overlap with Critical Habitat, or known distribution	No overlap with Critical Habitat, BIAs or known distribution	NOAA 2021
Sperm whales Endangered	Climate change, entanglement, marine debris, ocean noise, oil spills and contaminants, vessel strikes	Ship-based survey	**Low** density area overlap	**Moderate** density area overlap	Becker et al 2016
Baird's beaked whales *No status*	Commercial whaling, Entanglement, Marine debris, Ocean noise	Ship-based survey	**Low to moderate** density area overlap	**Moderate to high** density area overlap	Becker et al 2016
Small beaked whales **(Mesoplodon spp. & Cuvier's Beaked Whale)** *No status*	Entanglement, Ingestion of marine debris, Ocean noise, Vessel strikes	Ship-based survey	**Low** density area overlap	**Low** density area overlap	Becker et al 2016
Leatherback sea turtles Endangered	Bycatch in fishing gear, Climate change, Direct harvest of turtles and eggs, Loss and degradation of nesting and foraging habitat, Ocean pollution/marine debris, Vessel strikes	Critical Habitat	**Overlaps with Critical Habitat**	**Overlaps with Critical Habitat**	NOAA
		Satellite tracking	Overlaps with **moderate habitat suitability**	Overlaps with **moderate habitat suitability**	Hazen et al 2018

Loggerhead sea turtles Endangered	Bycatch in fishing gear, loss and degradation of nesting habitat, vessel strikes, direct harvest of turtles and eggs, ocean pollution/marine debris, climate change	Aerial surveys	No overlap recently observed. Presence may increase in the future.	No overlap recently observed. Presence may increase in the future.	Eguchi et al. 2018

Color key (Please note that color coding is solely for data visualization purposes):

High density area overlap/Very high conservation value/Critical Habitat
Moderate to high density area overlap
Moderate density/habitat suitability
Low to moderate density area overlap/potential presence

Sea turtles

All sea turtles are protected under the ESA, and of the four species found off the Central Coast, leatherback sea turtles (endangered throughout its range) and loggerhead sea turtles (the North Pacific DPS is endangered) are of particular concern for potential interactions with future offshore wind development in Morro 399. An overview of concerns for sea turtles can be found above in Table 5.

Leatherback sea turtles

Both the Morro Bay extensions fall entirely within Critical Habitat for leatherback sea turtles designated under the ESA (Figure 9).[109] All of Morro Bay 399 overlaps with high density areas identified from habitat modeling approaches.[110]

Loggerhead sea turtles

Loggerhead sea turtles have not been regularly observed in Morro Bay 399, however, there have been increased sightings in the Southern California Bight to the south, especially during periods of warm sea surface temperatures (Figure 12).[111] It is possible that with increased warming, loggerheads will be seen in Morro Bay 399 more regularly.

[109] NMFS, "Critical Habitat - Leatherback Sea Turtle (Pacific Ocean)," NMFS, Accessed August 21, 2021, https://www.fisheries.noaa.gov/resource/map/critical-habitat-leatherback-sea-turtle-pacific-ocean.

[110] Eguchi, Tomoharu, et al. "Predicting Overlap between Drift Gillnet Fishing and Leatherback Turtle Habitat in the California Current Ecosystem." *Fisheries Oceanography* 26, no. 1 (2017): 17–33.

[111] Eguchi, Tomoharu, et al. "Loggerhead Turtles (Caretta Caretta) in the California Current: Abundance, Distribution, and Anomalous Warming of the North Pacific." *Frontiers in Marine Science* 5 (December 6, 2018): 452. https://doi.org/10.3389/fmars.2018.00452.

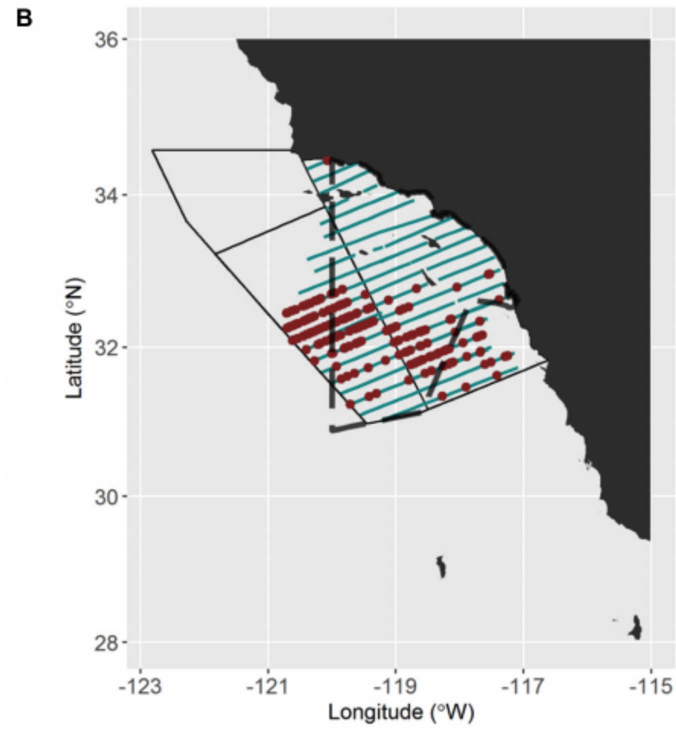

Figure 12. Loggerhead sea turtle sightings in 2014. Aerial survey loggerhead sea turtle sightings shown as red dots, survey lines in green. Dashed line is the Loggerhead Turtle Management Area that is enacted during warm years.[112]

Bats

Little data exist on bats and offshore wind energy, although research has shown that bat fatalities are common at land-based wind facilities[113] with the potential for cumulative impacts to cause population-level declines.[114] How bats use the offshore environment is not well understood, although a report prepared by Peterson et al. (2016)[115] for the Department of Energy on bat use in the Atlantic and Gulf of Maine found that bats were present at all surveyed locations offshore, with bats detected up to 130 km (70.2 nm) from the mainland. Cave bats (*Myotis* species) were detected at 89% of sites surveyed and migratory tree bats were even more widespread, with eastern red bats (closely related to California's

[112] *Id.*

[113] Arnett, Edward B., and Erin F. Baerwald. 2013. "Impacts of Wind Energy Development on Bats: Implications for Conservation." In Bat Evolution, Ecology, and Conservation, 435–56. New York, NY: Springer New York. https://doi.org/10.1007/978-1-4614-7397-8_21.

[114] Frick, W. F., E. F. Baerwald, J. F. Pollock, R. M. R. Barclay, J. A. Szymanski, T. J. Weller, A. L. Russell, S. C. Loeb, R. A. Medellin, and L. P. Mcguire. 2017. "Fatalities at Wind Turbines May Threaten Population Viability of a Migratory Bat." Biological Conservation 209: 172–77. https://doi.org/10.1016/j.biocon.2017.02.023; Population-Level Risk to Hoary Bats Amid Continued Wind Energy Development: Assessing Fatality Reduction Targets Under Broad Uncertainty. EPRI, Palo Alto, CA: 2020. 3002017671.

[115] Peterson, Trevor S, Steven K Pelletier, and Matt Giovanni. 2016. "Long-Term Bat Monitoring on Islands, Offshore Structures, and Coastal Sites in the Gulf of Maine, Mid-Atlantic, and Great Lakes—Final Report." Topsham, ME, USA. Prepared for the U.S. Department of Energy.

western red bats), hoary bats, and silver-haired bats (both present in California) detected at 97%, 95%, and 89% of all sites surveyed, respectively.[116]

Migratory bat presence offshore is of particular note because silver-haired, eastern red, and hoary bats are the bat species most highly impacted by land-based wind energy development, representing almost 80% of all bats killed at wind facilities in North America.[117] Migratory tree bat species are believed to be attracted to land-based wind turbines[118] and have been recorded altering flight paths to approach turbines.[119] Although no scientific consensus exists on why bats are attracted to onshore wind facilities, this behavior puts bats at increased risk for collision. Whether such behavior could occur at offshore wind turbines merits careful consideration.

Demographic modeling for hoary bats, the bat species most frequently killed by land-based wind turbines in North America, shows that the 2014 land-based wind energy buildout is sufficient to cause a 90% decline in hoary bat populations over the next 50 years.[120] Hoary bats are present in California and the coastal forest in northern California provides important habitat for the species, which may use the area year-round.[121] Although there are no data tracking hoary bat movements offshore in the Pacific, hoary bats are frequent visitors to Southeast Farallon Island,[122] more than 30 km off the California coast, and have colonized the Hawaiian Islands,[123] likely from California.[124] Given the presence of hoary bats in coastal California and their ability to make long-distance flights over water, it is possible that hoary bats are present in Morro Bay 399 and therefore have the potential to interact with future wind energy development.

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116 *Id.*

117 Hoary bats, eastern red bats, and silver-haired bats represent 38%, 22%, and 18% of all bat fatalities at wind turbines in the United States and Canada, respectively. Arnett, Edward B., and Erin F. Baerwald. 2013. "Impacts of Wind Energy Development on Bats: Implications for Conservation." In *Bat Evolution, Ecology, and Conservation*, 435–56. New York, NY: Springer New York. https://doi.org/10.1007/978-1-4614-7397-8_21.

118 Cryan, Paul M., P. Marcos Gorresen, Cris D. Hein, Michael R. Schirmacher, Robert H. Diehl, Manuela M. Huso, David T. S. Hayman, et al. 2014. "Behavior of Bats at Wind Turbines." *Proceedings of the National Academy of Sciences of the United States of America*. National Academy of Sciences. https://doi.org/10.2307/43189889; Cryan, P. M., & Barclay, R. M. R. (2009). Causes of Bat Fatalities at Wind Turbines: Hypotheses and Predictions. *Journal of Mammalogy*, *90*(6), 1330–1340. http://www.jstor.org/stable/27755139; Arnett et al. 2008; Horn, J. W., Arnett, E. B., & Kunz, T. H. (2008). Behavioral Responses of Bats to Operating Wind Turbines. Source: The Journal of Wildlife Management, 72(1), 123–132. https://doi.org/10.2193/2006-465; Kunz, T. H., Arnett, E. B., Erickson, W. P., Hoar, A. R., Johnson, G. D., Larkin, R. P., Strickland, M. D., Thresher, R. W., & Tuttle, M. D. (2007). Ecological Impacts of Wind Energy Development on Bats: Questions, Research Needs, and Hypotheses. In Ecology and the Environment (Vol. 5, Issue 6).; Ahlén, I. (2003). Wind turbines and bats-a pilot study.

119 Cryan et al. 2014.

120 Although this research focused on hoary bats, the study authors caution that other migratory tree bats, such as eastern red bats and silver-haired bats which also experience high levels of fatalities at land-based wind facilities, might also experience population-level declines; Frick et al. 2017.

121 Weller, T.J., Castle, K.T., Liechti, F., Hein, C.D, Schirmacher, M.R., Cryan, P.M.. First Direct Evidence of Long-distance Seasonal Movements and Hibernation in a Migratory Bat. Sci Rep 6, 34585 (2016). https://doi.org/10.1038/srep34585; Salganek, S. (2019) Autumn Roost Selection by Male Hoary Bats (*Lasiurus Cinereus*) In Northern California. A Thesis Presented to The Faculty of Humboldt State University In Partial Fulfillment of the Requirements for the Degree Master of Science in Biology.

122 Cryan, P. M., & Brown, A. C. (2007). Migration of bats past a remote island offers clues toward the problem of bat fatalities at wind turbines. *Biological Conservation*, *139*(1–2), 1–11. https://doi.org/10.1016/j.biocon.2007.05.019.

123 Hoary bats have colonized the Hawaiian Islands from the mainland multiple times; Russell, A. L., Pinzari, C. A., Vonhof, M. J., Olival, K. J., & Bonaccorso, F. J. (2015). Two Tickets to Paradise: Multiple Dispersal Events in the Founding of Hoary Bat Populations in Hawai'i. PLOS ONE, 10(6), e0127912. https://doi.org/10.1371/journal.pone.0127912.

124 Bonaccorso F.J., McGuire L.P. (2013) Modeling the Colonization of Hawaii by Hoary Bats (*Lasiurus cinereus*). In: Adams R., Pedersen S. (eds) Bat Evolution, Ecology, and Conservation. Springer, New York, NY. https://doi-org.stanford.idm.oclc.org/10.1007/978-1-4614-7397-8_10

There is insufficient research on bats and offshore wind to accurately assess potential risk to bats from offshore wind development in Morro Bay 399. Because of this knowledge gap, we recommend BOEM and its partner agencies support research to better understand bat use of the Pacific OCS and that BOEM require offshore wind facilities to commit to pre- and post-construction monitoring which integrates novel technology as it becomes available.

Birds

National Audubon Society's climate science identifies 389 species of birds likely to become extinct under a warming scenario of 3 degrees Celsius above pre-industrial levels.[125] Audubon's analysis found 78% of waterbirds vulnerable to extinction under more severe warming scenarios.[126] While climate mitigation will reduce risks to birds from range loss, a majority of species are facing multiple pressures on their populations, which are compounded by a changing climate.[127] Seabirds offshore California experience population-level impacts from overfishing and habitat loss, factors which are exacerbated by warming temperatures, ocean acidification, and rising sea-levels. Cassin's auklet, as an example, experienced a massive mortality event following a severe heat wave resulting in trophic collapse.[128] Brown pelicans, like many seabirds, face several challenging factors in addition to climate change, including loss of breeding habitat, invasive predators, diminished forage fish availability, pesticides, and bycatch.[129] In light of the number of compounding threats to avian conservation, it will be crucial to reduce additional pressure to these vulnerable populations.

Seabirds, in general, tend to be long-lived, breed infrequently, and produce few chicks annually, meaning that population trajectories are highly sensitive to changes in adult survival. Laysan and black-footed albatross, on the more extreme end of this life history strategy, do not begin reproducing until seven years after hatching, frequently skip years for breeding, lay only a single egg in a season,[130] and are known to survive 70 years.[131] 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.[132] 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.[133] 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,

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125 Wilsey, C, B Bateman, L Taylor, JX Wu, G LeBaron, R Shepherd, C Koseff, S Friedman, R Stone. Survival by Degrees: 389 Bird Species on the Brink. National Audubon Society: New York (2019), https://www.audubon.org/sites/default/files/climatereport-2019-english-lowres.pdf.

126 Bateman BL, Wilsey C, Taylor L, Wu J, LeBaron GS, Langham G. 2020. North American birds require mitigation and adaptation to reduce vulnerability to climate change. Conservation Science and Practice 2:e242.

127 Bateman BL, Taylor L, Wilsey C, Wu J, LeBaron GS, Langham G. 2020. Risk to North American birds from climate change-related threats. Conservation Science and Practice 2:e243.

128 Jones T et al. 2018. Massive Mortality of a Planktivorous Seabird in Response to a Marine Heatwave. Geophysical Research Letters 45:3193–3202.

129 Bateman BL, Taylor L, Wilsey C, Wu J, LeBaron GS, Langham G. 2020. Risk to North American birds from climate change-related threats. Conservation Science and Practice 2:e243.

130 Rice DW, Kenyon KW. 1962. Breeding Cycles and Behavior of Laysan and Black-Footed Albatrosses. The Auk 79:517–567.

131 https://medium.com/usfwspacificislands/worlds-oldest-known-banded-wild-bird-hatches-chick-at-midway-atoll-2708a0b3f2c0

132 IUCN (2019)

133 Paleczny et al. (2015), "Population Trend of the World's Monitored Seabirds, 1950-2010."

and climate change.[134]

The CCE is unique for the diversity of pelagic avian species that it attracts. The steep shelf that defines the geography offshore California creates upwellings that deliver an abundance of fish to the surface. The pelagic seabirds attracted to these abundant foraging grounds include ESA-listed species like short-tailed albatross. Shorebirds breeding along Alaska's arctic tundra take migratory pathways which cross over the CCE during their southbound migration in the fall.[135] As arctic nesters are experiencing extreme pressure on their breeding grounds, extra care should be taken to limit additional external pressure to their populations. Alcids, gulls, terns, pelicans, and cormorants, which breed along California's coastal beaches and islands, also forage offshore along the shelf break to provision themselves and their chicks. This includes the ESA-listed marbled murrelet and California least tern, as well as Scripp's murrelet, which are under listing consideration.

Over 75 species of seabirds frequent the CCE, including year-round residents, seasonal residents, and long-distance migrators en route to breeding or wintering grounds and hotspots of seabird activity occur along the CCE.[136] While many species exploit waters close to shore, others prefer to forage in offshore waters at or beyond the continental shelf,[137] following concentrations of prey that can often occur far offshore in the CCE.[138] Previously named Xantus's murrelet species, which include the candidate species Scripp's Murrelet, occur in relatively high abundance in and around Morro Bay 399.[139] Sooty shearwater, an abundant yet declining species, winters in such high numbers in Morro Bay, hence the designation of the globally recognized Piedras Blancas Important Bird Area (IBA), which overlaps the East Extension of Morro Bay 399 and the southeastern portion of the Morro Bay Call Area (Figure 13).

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134 McCauley et al. (2015), "Marine Defaunation: Animal Loss in the Global Ocean."

135 While trans-oceanic migrating shorebirds and songbirds typically fly above the rotor swept zones of turbines, they are more likely to encounter the turbines during periods of inclement weather.

136 Nur et al. (2011), "Where the Wild Things Are: Predicting Hotspots of Seabird Aggregations in the California Current System"

137 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.

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

139 Karnovsky NJ et al. 2005. At-sea distribution, abundance and habitat affinities of Xantus's Murrelets:16.

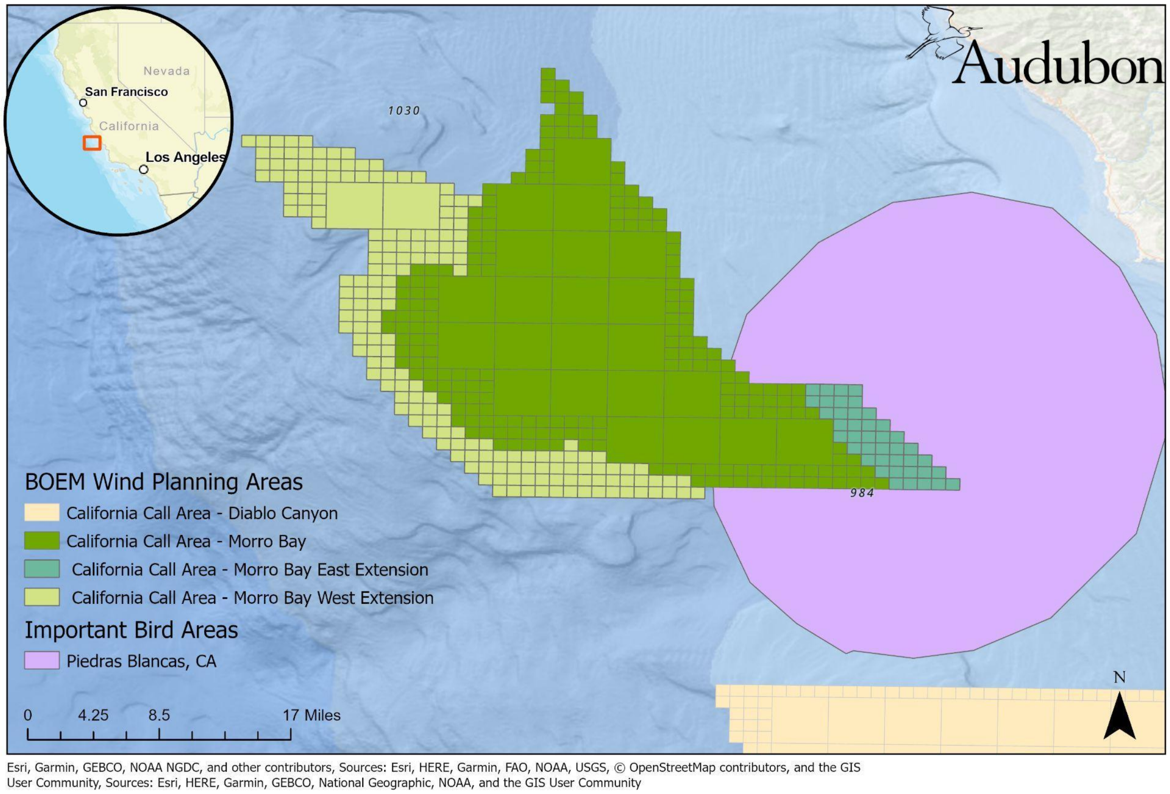

Figure 13. Piedras Blancas Important Bird Area, designated as important habitat for Sooty Shearwater, overlapping with eastern portion of Morro Bay 399.

The IBAs 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. IBAs signal the need for a significantly higher level of offshore wind pre- and post-construction monitoring as well as ongoing data collection, review, adaptive management procedures, and technologies. Additionally, these areas may shift due to climate change, food source, or other factors over the duration of an offshore wind project.

The East Extension has higher densities of common murres, brown pelicans, and cassin auklets than the other parts of Morro Bay 399 (Figure 14), in addition to overlapping entirely with the Piedras Blancas IBA. The southeastern part of the Morro Bay Call Area also has relatively high densities of sooty shearwaters and red-necked phalarope and overlaps with the IBA (Figure 14).

Species of concern and conservation obligation

BOEM must consider of the full range of potential impacts on all bird species known to forage or rest in or near Morro Bay 399, or migrate through the area, including those species protected under the Migratory Bird Treaty Act (MBTA) and the ESA, as well as species of birds covered under obligations for conservation of birds under the Fish and Wildlife Conservation Act as amended in 1988,[140] Executive Order 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds*,[141] the North American

[140] 16 U.S.C. 2901-2911 (1988).

[141] Exec. Order No. 13,186, *Responsibilities of Federal Agencies to Protect Migratory Birds* (Jan. 10, 2001).

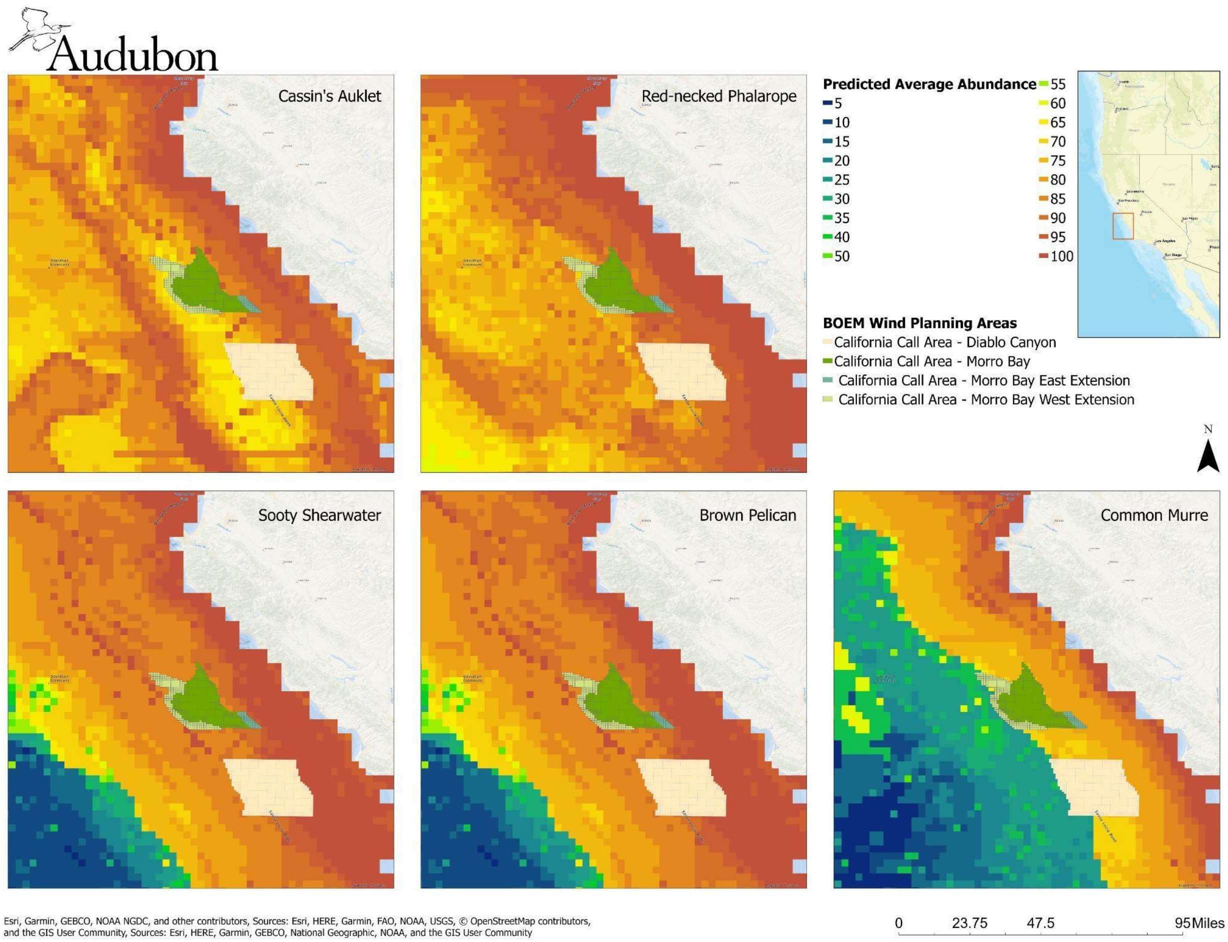

Figure 14. Predicted average abundance of select marine birds vulnerable to offshore wind development in the vicinity of Morro Bay 399 Call Area, from Nur et al. 2011.

Waterbird Conservation Plan[142] the U.S. Shorebird Conservation Plan,[143] the Memorandum of Understanding (MOU) between the U.S. Minerals Management Service and the U.S. Fish and Wildlife Service (USFWS) regarding implementation of Executive Order 13186,[144] the United Nations Convention on the Conservation of Migratory Species of Wild Animals (CMS)[145] and BOEM, the Department of Interior (DOI), USFWS, and NOAA's membership in the IUCN[146] (hereinafter collectively referred to as the "conservation obligations").

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[142] Kushlan et al. 2002. Waterbird Conservation for the Americas: The North American Waterbird Conservation Plan, Version 1. Waterbird Conservation for the Americas, Washington, DC. Available at https://www.fws.gov/migratorybirds/pdf/management/northamericawaterbirdconservationplan.pdf.

[143] Brown et al., eds. 2001. The U.S. Shorebird Conservation Plan, 2nd ed. Manomet Center for Conservation Sciences, Manomet, MA. Available at https://www.shorebirdplan.org/wp-content/uploads/2013/01/USShorebirdPlan2Ed.pdf.

[144] Memorandum of Understanding Between the Department of the Interior U.S. Minerals Management Service and the Department of the Interior U.S. Fish and Wildlife Service Regarding Implementation of Executive Order 13186, "Responsibilities of Federal Agencies to Protect Migratory Birds" (June 4, 2009), https://www.boem.gov/sites/default/files/renewable-energy-program/MMS-FWS MBTA MOU 6-4-09.pdf [hereinafter "DOI MOU"].

[145] Convention on the Conservation of Migratory Species of Wild Animals, Convention Text (June 23, 1979), https://www.cms.int/en/convention-text.

[146] IUCN, IUCN Members (last visited July 25, 2021), https://www.iucn.org/about/members/iucn-members.

As we have commented to BOEM before, we are aware that the DOI and the USFWS are now relying on a new rule[147] which codifies an illegal interpretation of the MBTA and limits its scope to the purposeful take of birds[148] (discussed further below). Our organizations strongly oppose this rule as contrary to the plain language and intent of the law, and we urge BOEM to continue to implement its MBTA responsibilities as previous administrations have done in the past, with explicit recognition that incidental take is prohibited. This would also be consistent with the MOU that BOEM signed with USFWS in 2009 to protect migratory bird populations.[149] If DOI's new interpretation changes BOEM's analysis and associated requirements for impacts to migratory birds in any way, a detailed description and explanation of such changes must be included in subsequent NEPA documents. We note that several signatories of these comments, together with many other organizations and states, successfully challenged DOI's unlawful reinterpretation of the MBTA in court[150] and we expect BOEM and USFWS to respect the court's ruling.

The MBTA states that, "[u]nless and except as permitted by regulations…it shall be unlawful at any time, by any means or in any manner, to pursue, hunt, take, capture, kill, attempt to take, capture, or kill…any migratory bird."[151] For decades, the DOI has interpreted the MBTA to encompass "incidental takes" of migratory birds, including from wind turbines. It was not until the 2017 Jorjani Opinion M-37050 that the DOI limited the MBTA's legal scope to only include actions that purposely take migratory birds.[152] However, on August 11, 2020, the U.S. District Court for the Southern District of New York found that "the Jorjani Opinion's interpretation runs counter to the purpose of the MBTA to protect migratory bird populations."[153] The Court found that the statute's unambiguous text makes clear that killing a migratory bird "by any means or in any manner," regardless of how, is covered by the statute.[154] As such, the District Court struck down the Jorjani Opinion as unlawful, restoring the MBTA's protections for migratory birds from incidental takes.[155] The unlawful reinterpretation does not relieve BOEM or USFWS from their obligations for conservation of birds under the aforementioned federal laws, Executive Order and MOU, as well as the MBTA.

At a minimum, to fulfill its conservation obligations, BOEM should carefully consider impacts to the following priority species which are likely to use Morro Bay 399:

- Marbled murrelet, short-tailed albatross, and California least tern are protected under the ESA.
- Scripp's murrelet were petitioned for listing under the ESA in 2002.
- Ashy storm-petrel classified by IUCN as Endangered.
- Ashy storm-petrel, marbled murrelet, brant, Brandt's cormorant, black skimmer, black tern, Caspian tern, gull-billed tern, least tern, red-throated loon, western grebe, black-footed albatross, Laysan albatross, and Cassin's auklet are all marine birds occurring in the Pacific

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147 50 C.F.R. § 10 (2021).

148 Memorandum M-37050: The Migratory Bird Treaty Act Does Not Prohibit Incidental Take, U.S. DEP'T OF INTERIOR (DOI) (Dec. 22, 2017), https://www.doi.gov/sites/doi.gov/files/uploads/m-37050.pdf [hereinafter "2017 MBTA Interpretation"]. While USFWS has proposed to revoke the illegal rule, until that revocation has been effected we are concerned that the agencies may rely on it to exclude key protections for migratory birds.

149 See DOI MOU.

150 Nat'l Audubon Soc'y v. U.S. DOI, No. 18-cv-08084 (S.D.N.Y 2019).

151 16 U.S.C. § 703 (1918).

152 2017 MBTA Interpretation.

153 NRDC v. U.S. DOI, 2020 WL 4605235, at *6 (S.D.N.Y. Aug. 11, 2020).

154 *Id.* at 28.

155 *Id.* at 42-44.

OCS listed as USFWS Birds of Conservation Concern under the Fish & Wildlife Conservation Act, 1988 amendment.[156]

- Whimbrel is a trans-Pacific migrating shorebird and USFWS Birds of Conservation Concern[157] with documented migratory paths through the Pacific OCS,[158] and should therefore be prioritized for studies concerning risks to land bird migrants.
- Black-legged kittiwake, short-tailed albatross, Scripp's murrelet, and Leach's storm-petrel are classified by the IUCN as Vulnerable.
- Sooty shearwater, black-footed albatross, Laysan albatross, and Cassin's auklet are classified by IUCN as Near Threatened.

Many of the species that may migrate through Morro Bay 399 are also protected under California state regulations, in addition to the federal ESA and the MBTA. BOEM should consider impacts to species protected under California's endangered species laws, as well as the species of greatest conservation need designated under California's State Wildlife Action Plan.

BOEM must additionally consider species prioritized for conservation by avian expert partners, including the Pacific Flyway Shorebird Initiative, Partners in Flight, and the North American Waterbird Plan. Along with ESA-listing and IUCN Red List status, the species included on these initiative priority lists are of high national and international conservation concern. Their priority status by these entities highlights their vulnerability and is further indicative of the need for enhanced mitigation and conservation measures to ensure their survival.

We provide additional information regarding some species of particular concern within Morro Bay 399 below.

Sooty Shearwaters

IUCN classifies sooty shearwaters as near threatened due to declining population trajectories. Morro Bay 399 generally, and the East Extension especially, experience high numbers of wintering sooty shearwaters. The Piedras Blancas IBA --established to highlight important habitat for wintering sooty shearwaters-- overlaps with the East Extension. Given the proximity of this area to this important bird habitat, an action committee should be established to minimize habitat loss and bird mortality of sooty shearwaters from offshore wind energy infrastructure (OWEI).

Marbled Murrelets:

Marbled murrelets are listed as Threatened under the federal ESA and as Endangered by the state of California under CESA. 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. Marbled murrelets are considered vulnerable to displacement from OWEI, so BOEM must carefully consider impacts to this species from construction activities and vessel traffic, especially nearshore.

Ashy Storm-Petrels:

There should be a substantial effort to understand the seasonal and annual abundance and distribution of the ashy storm-petrel within Morro Bay 399. The entire global population of Ashy storm-petrel is

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[156] U.S. Fish and Wildlife Service. 2021. Birds of Conservation Concern 2021. United States Department of the Interior, U.S. Fish and Wildlife Service, Migratory Birds, Falls Church, Virginia. Available at https://www.fws.gov/migratorybirds/pdf/management/birds-of-conservation-concern-2021.pdf.

[157] *Id.*

[158] Frank A. La Sorte & Daniel Fink, Projected changes in prevailing winds for transatlantic migratory birds under global warming, J. ANIMAL ECOLOGY (Dec. 14, 2016).

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).[159] Notably, roughly half of the world's population is thought to occur in the Channel Islands, roughly 60 nm south of Morro Bay 399.[160] Further, ashy storm-petrels have been caught via mist-nests on Vandenberg Air Force Base. The ashy storm-petrel is listed as Endangered with a decreasing population trend by the IUCN and they are listed as a Species of Special Concern by California Department of Fish and Wildlife. 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) precludes use of 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.[161] 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 Morro Bay 399.[162]

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 industrial offshore development. It is likely that part of the reproductive declines in Ashy Storm-Petrels is due to organochloroform contamination causing eggshell thinning and subsequently poorer reproductive success,[163] so it is critical that contamination from OWEI does not contribute to further population declines in this highly vulnerable species.

Pacific Black Brant:

California's Department of Fish and Wildlife lists brant as a species of special concern within their wildlife action plan. The species is also considered a bird of conservation concern of global importance by the USFWS for its position on the Partners in Flight Watch List and its consistently declining population status.[164] The Pacific brant actually refers to two disjunct breeding populations, black brant and western high arctic brant, sharing common staging and wintering grounds.[165] Morro Bay serves as a critical over-wintering site and stopover site for brant during their spring migration.[166] While the number of birds using Morro Bay varies annually, over-winter counts by Audubon California showed hundreds of thousands of bird use-days annually between 1999 and 2007.[167] The numbers have fallen significantly

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159 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.

160 Carter et al. (2016), "Range-Wide Conservation and Science of the Ashy Storm-Petrel Oceanodroma Homochroa."

161 Ainley and Boekelheide (1990), "Seabirds of the Farallon Islands."

162 Carter et al. (2016), "Range-Wide Conservation and Science of the Ashy Storm-Petrel Oceanodroma Homochroa."

163 *Id.*

164 U.S. Fish and Wildlife Service. 2021. Birds of Conservation Concern 2021. United States Department of the Interior, U.S. Fish and Wildlife Service, Migratory Birds, Falls Church, Virginia. https://www.fws.gov/migratorybirds/pdf/management/birds-of-conservation-concern-2021.pdf managed-species/birds-of-conservation-concern.php

165 Lewis, T. L., D. H. Ward, J. S. Sedinger, A. Reed, and D. V. Derksen. 2013. Brant (Branta bernicla), version 2.0. In Rodewald, P. G., ed. Birds of North America. Cornell Lab of Ornithology, Ithaca, NY, USA. DOI: 10.2173/bna.337

166 Moore JE, Colwell MA, Mathis RL, Black JM. 2004. Staging of Pacific flyway brant in relation to eelgrass abundance and site isolation, with special consideration of Humboldt Bay, California. Biological Conservation 115:475–486.

167 Roser, J. 2021. Brant Counts for Morro Bay, California: 2020 - 2021 Season. Unpublished report, 309 Binscarth Rd., Los Osos, California 93402.

since 2007, however Morro Bay likely supports the same proportion of the brant population, where more than 600 brant can be observed foraging within the bay through wintering and spring migration. While brant are drawn to Morro Bay to forage on eelgrass, the species is known to congregate offshore from their foraging grounds with flocks of up to 100 individuals occurring up to 90 km from shore.[168] Given the reliance of this species on the region, special care must be taken to mitigate impacts to this species from development of Morro Bay 399.

III. POTENTIAL ENVIRONMENTAL RISKS ASSOCIATED WITH FLOATING OFFSHORE WIND TECHNOLOGY

Deployment of commercial-scale floating turbines is a recent development–the largest floating offshore wind development is a 30-megawatt (MW) project located in waters offshore Scotland. Given that the industry is in early stages, the near- and long-term environmental impacts of floating offshore wind developments are largely unknown. Floating turbines may have deleterious impacts on marine wildlife through habitat loss; collisions with cables and mooring lines by lunge-feeding mysticetes; collisions with wildlife by project-associated vessels; secondary entanglement with derelict fishing gear that snags on wind farm equipment; stress impacts from noise associated with site assessment activities and operations; collision with turbine blades; and electromagnetic field (EMF) impacts on elasmobranchs, turtles, and potentially migratory pelagic fishes.

Floating wind turbines are the only practical offshore wind technology for commercial-scale wind farms in California's offshore waters. While there are likely risks associated with floating turbines, the technology avoids some of the significant environmental impacts associated with 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.[169] Floating platforms and associated cables, and most anchor types, can be fully removed from the environment during decommissioning.[170]

Immediately below we describe potential environmental impacts to benthic habitat, fish, marine mammals, and birds from offshore wind development within the CCE due to potential habitat loss, collision and entanglement, noise, and EMF.

Habitat loss and barrier effects

The ways in which the presence of floating platforms with extensive underwater network of mooring lines and dynamic inter-array power cables will impact animal habitat is unclear. Impact studies at offshore wind farms in Europe reveal that offshore wind developments can cause significant changes to wildlife distributions. Some marine birds, fish, sea turtles, and marine mammals may avoid offshore wind farms due to noise, electromagnetic fields, vessel traffic, or other disruptions. Responses will likely be species dependent and vary over different scales, ranging from avoidance on a macro-scale, where species may avoid the entire floating wind energy area altogether, to micro-avoidance, where species avoid turbines in very close range.[171] If offshore wind turbines are placed in important habitats over a large area, this

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168 Briggs KT, Tyler WB, Lewis DB, Carlson DR. 1987. Bird Communities at Sea Off California: 1975 to 1983. The Cooper Ornithological Society.

169 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.

170 *Id.*

171 Cook, A. S. C. P., Humphreys, E. M., Bennet, F., Masden, E. A., & Burton, N. H. K. (2018). Quantifying avian avoidance of offshore wind turbines: Current evidence and key knowledge gaps. *Marine Environmental Research*, *140*, 278–288. https://doi.org/10.1016/j.marenvres.2018.06.017.

avoidance behavior could have serious consequences. For example, when displaced from foraging grounds, animals must expend additional energy to find food elsewhere, which can compromise their survival. Displacing wildlife from foraging grounds can lead to population-level impacts if it results in significant decreases in survival and fecundity.[172]

Benthic habitat

Anchors and anchor rode will have direct impacts to infaunal and epifaunal communities through direct physical contact (i.e., dropping an anchor onto sensitive habitat and interactions between the anchor rode and sea floor) and indirect impacts to the physical environment through changes to water movement, sediment dynamics, and nutrient and carbon cycling. The data that are currently available indicate effects will be highly dependent on siting, the specific anchor array, and may be localized. Our comments assume, based on the depths of Morro Bay 399, 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.[173] It will be important to consider that impacts to benthic habitat will likely vary depending on the type of platform, moorings, and anchoring system selected for projects. A taut-leg mooring system coupled with suction pile anchors would have the smallest benthic footprint and should be assessed to determine if this combination is appropriate for the conditions in Morro Bay 399. Additional benthic surveys should be conducted when specific anchor and anchor rode locations are chosen to help minimize the impacts to sensitive substrate, biogenic habitat, and faunal communities.

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.[174] Studies of pile-driven offshore wind farms areas in Europe indicate that development does cause shifts in the macrobenthic community,[175] suggesting that this may also be a concern for floating technologies.

Research shows that mooring lines and anchors do 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 6 m waves, more than 60 mi^2 of benthic habitat were affected.[176] At offshore wind farms, the interaction between turbine

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[172] Onderz. Form. D., WIAS, Onderz. Form. I., Onderz. Form. B., van Kooten T, Soudijn F, Tulp I, Chen C, Benden D, Leopold M. 2019. The consequences of seabird habitat loss from offshore wind turbines, version 2 : Displacement and population level effects in 5 selected species. Wageningen Marine Research, IJmuiden. Available from https://research.wur.nl/en/publications/d794211c-8541-4a22-b317-e3bd8be35896 (accessed July 16, 2021)

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[175] 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.

[176] 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.

foundations and local hydrodynamics affect sediment characteristics by reducing flow and preventing the re-suspension of finer sediments and sand around a device.[177] In addition, alteration of the natural hydrodynamics near turbine foundations can result in bottom scour.[178] The nautical charts of the area indicate that the bottom is mud and/or clay, yet fine-scale data on Morro Bay 399's bottom profile and habitat composition are sparse, as noted in the discussion of benthic habitat in Section II.[179]

Fish

Increased sedimentation during construction and regular operations and maintenance from seabed disturbance may have an impact on demersal/benthic fish species.[180] The impacts on pelagic species may be minimal[181] unless certain life stages of CPS or HMS use benthic habitat (e.g., spawning, egg-laying).

Changes in behavior around wind farm structures are difficult to predict and will likely be dependent on the specific species in question. Any significant changes in the behavior of fish may cause alterations to aggregations, spawning events and migration patterns.[182] Reduced CPS abundance in Morro Bay 399 could therefore have a dramatic impact on marine mammal and bird populations, many of which prey heavily on forage fish species.[183]

Marine mammals

While there are 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 floating offshore wind development, it is possible 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.

Birds

Offshore wind projects have the potential to harm birds through disturbance and habitat loss or degradation.[184] Disturbance to birds can occur during site characterization and continue through wind farm construction and operation. These disturbances may lead directly to expulsion and thus loss of territory for certain species of birds. Murrelets, known to rely heavily on waters offshore the Central Coast and within the Morro Bay 399 East Extension, are predicted to be particularly vulnerable to

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doi:10.1016/j.ecolmodel.2012.02.025, http://tethys.pnnl. gov/publications/disruption-benthic-habitats-moorings-wave-energy-installations-modelling-case-study.

[177] 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.

[178]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;et al..

[179] NOAA Nautical Chart 18700, Point Conception to Point Sur and NOAA Nautical Chart 18620 Point Arena to Trinidad Head.

[180]van Berkel, Joshua, et al. "The Effects of Offshore Wind Farms on Hydrodynamics and Implications for Fishes." *Oceanography*, vol. 33, no. 4, Oceanography Society, 2020, pp. 108–17, https://www.jstor.org/stable/26965754.

[181] D.H. Wilber, D.A. Carey, M. Griffin, Flatfish habitat use near North America's first offshore wind farm, Journal of Sea Research,Volume 139, 2018, Pages 24-32, ISSN 1385-1101, https://doi.org/10.1016/j.seares.2018.06.004.

[182] Bornatowski et al. Ecological importance of sharks and rays in a structural foodweb analysis in southern Brazil. ICES J. of Mar. Science. 2014.

[183] https://oceana.org/sites/default/files/reports/Forage_Fish_OCEANA_2011_final.pdf; Cury et al, Global Seabird Response to Forage Fish Depletion- One-third for the birds, Science, 23 Dec 2011; Smith et al, Impacts of Fishing Low-Trophic Level Species on Marine Ecosystems, Science, 26 Aug 2011; Lenfest Forage Fish Task Force, Little Fish Big Impact, 2013.

[184] 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.

displacement effects.[185] Research at Horns Rev wind project offshore Denmark found significant changes in the distributions of divers, common scoter, and common guillemot/razorbills following construction, and these species avoided not only the wind farm but also the two (2) km and four (4) km zones around the wind farm.[186] At other offshore wind facilities, alcids, kittiwake,[187] and loons[188] avoided areas up to 16 and eight (8) km away, respectively, from offshore turbine arrays during operation and construction.

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[189] and result in a functional loss of habitat.[190] This is likely especially true for offshore wind developments built within primary foraging areas or along the migration and commuting routes.

Displacement impacts to birds are not limited to the area around the turbine array. Loons,[191] alcids, and some sea ducks, all of which occur within the CCE, are particularly vulnerable to impacts from vessel traffic.[192] These impacts are especially pronounced from traffic outside of designated shipping lanes, which has often been the case for site characterization activities for Atlantic offshore wind.[193] Increased vessel traffic can ultimately result in a loss of habitat for affected marine birds if they are regularly disturbed from important foraging grounds.[194]

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185 Kelsey EC, Felis JJ, Czapanskiy M, Pereksta DM, Adams J. 2018. Collision and displacement vulnerability to offshore wind energy infrastructure among marine birds of the Pacific Outer Continental Shelf. Journal of Environmental Management 227:229–247.

186 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.

187 Peschko V, Mendel B, Müller S, Markones N, Mercker M, Garthe S. 2020. Effects of offshore windfarms on seabird abundance: Strong effects in spring and in the breeding season. Marine Environmental Research:105157.

188 Mendel B, Schwemmer P, Peschko V, Müller S, Schwemmer H, Mercker M, Garthe S. 2019. Operational offshore wind farms and associated ship traffic cause profound changes in distribution patterns of Loons (Gavia spp.). Journal of Environmental Management 231:429–438.

189 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."

190 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."

191 Mendel B, Schwemmer P, Peschko V, Müller S, Schwemmer H, Mercker M, Garthe S. 2019. Operational offshore wind farms and associated ship traffic cause profound changes in distribution patterns of Loons (Gavia spp.). Journal of Environmental Management 231:429–438.

192 Fliessbach KL, Borkenhagen K, Guse N, Markones N, Schwemmer P, Garthe S. 2019. A Ship Traffic Disturbance Vulnerability Index for Northwest European Seabirds as a Tool for Marine Spatial Planning. Frontiers in Marine Science 6:192.

193 Schwemmer P, Mendel B, Sonntag N, Dierschke V, Garthe S. 2011. Effects of ship traffic on seabirds in offshore waters: implications for marine conservation and spatial planning. Ecological Applications 21:1851–1860.

194 Regular disturbance from vessel traffic can decrease energy reserves for birds. Species with the shortest flight initiation distances (i.e., most responsive to vessel traffic like loons, alcids, and sea ducks) also tend to be those species with the largest wing loadings compared to other marine birds (Greenwalt. 1962), meaning the birds that are more likely to expend extra energy in response to vessels also waste more energy with each take off relative to birds with lower wing loadings (Fliessbach et al. 2019). Furthermore, terns and other pelagic seabirds occurring within the CCE are attracted to wakes and turbulence created from objects like vessels and turbine platforms in the marine environment (Lieber et al. 2021). Diverting from fruitful foraging grounds to investigate artificially created marine turbulence, creates an ecological trap for these individuals by which they expend critical energy. Crawford H. Greenwalt. 1962. Dimensional relationships for flying animals. Smithsonian

Collision

Marine mammals

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[195] (although the petrochemical industry platforms are typically much larger and are situated in an industrial noise field which certain species may avoid). Floating wind turbines of this scale have not yet been developed in important habitats for large baleen whales and so the potential impacts to naïve animals are unknown. While fixed submerged structures are likely to pose little collision risk, cables, chains, power lines, and components that move freely on the surface or in the water column (i.e., the mooring lines and cables of floating turbines) may pose a higher risk of collision.[196] It is possible that feeding whales could collide with mooring lines and cables, resulting in damaged baleen and permanent impairment of the animal's ability to feed.[197] Collision risk would likely be greater with rorquals and humpbacks that lunge feed on aggregations of small fish and invertebrates down to 300 m. Lunge feeding involves their acceleration up to 6 m sec^{-1} (~20 kph or ~13 mph), opening their jaws up to 90 degrees from their body,[198] capturing their body-weight in food-laden water, closing their jaws, and expelling the water through their baleen.[199] Executing this maneuver in a habitat modified with floating substructures and a network of cables and mooring lines poses a number of potential threats. Additionally, midwater structures serve as fish aggregating devices for pelagic forage fish preferred by these lunge-feeders.[200]

Collisions with ships are currently a leading cause of baleen whale mortality on the West Coast.[201] 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 greater than 10 knots.[202] BOEM should adopt regulatory measures to limit the vessel speeds of offshore wind project-associated vessels to 10 knots or less within any eventual Wind Energy Areas (WEAs) and along primary transit routes.

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miscellaneous collections 144; Fliessbach KL, Borkenhagen K, Guse N, Markones N, Schwemmer P, Garthe S. 2019. A Ship Traffic Disturbance Vulnerability Index for Northwest European Seabirds as a Tool for Marine Spatial Planning. Frontiers in Marine Science 6:192; Lieber L, Langrock R, Nimmo-Smith WAM. 2021. A bird's-eye view on turbulence: seabird foraging associations with evolving surface flow features. Proceedings of the Royal Society B: Biological Sciences 288:rspb.2021.0592, 20210592.

195 Andrea E. Copping, Luke Hanna, Jonathan Whiting, Nichole Sather. (2016) What do we know about environmental effects of marine renewable energy devices? the state of the science in 2016 White paper/lit review. https://tethys.pnnl.gov/sites/default/files/publications/Copping-et-al-2016-METS.pdf et al.

196 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.

197 *Id.*

198 Goldbogen, J. A.; Calambokidis, J.; Shadwick, R. E.; Oleson, E. M.; McDonald, M. A.; Hildebrand, J. A. (2006). "Kinematics of foraging dives and lunge-feeding in fin whales". Journal of Experimental Biology. 209 (7): 1231–1244

199 Fossette, S.; Abrahms, B.; Hazen, E. L.; Bograd, S. J.; Zilliacus, K. M.; Calambokidis, J.; Burrows, J. A.; Goldbogen, J. A.; Harvey, J. T.; Marinovic, B.; Tershy, B.; Croll, D. A. (2017). "Resource partitioning facilitates coexistence in sympatric cetaceans in the California Current". Ecology and Evolution. 7 (1): 9085–9097. doi:10.1002/ece3.3409

200 Workman, Ian K.; Landry, Jr., André M.; Watson, Jr., John W.; Blackwell, John W.A Midwater Fish Attraction Device Study Conducted from Hydrolab. University of Miami - Rosenstiel School of Marine and Atmospheric Science. Bulletin of Marine Science, Volume 37, Number 1, July 1985, pp. 377-386(10)

201 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.

202 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.

Birds

Collision is one of the primary concerns for direct impacts to birds from wind turbines. Loss et al. (2013) estimates that the average annual mortality rate for birds from turbines onshore is 3.58 birds/MW (95% C.I.=3.05-4.68).[203] Recent research by Huso et al. (2021) confirmed that the rate of collision is not expected to decrease with increased turbine size.[204] While these impacts can be estimated at onshore wind facilities through carcass surveys, there are no reliable methods for measuring rates of collision in the offshore environment. 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.[205] BOEM's own research on collision vulnerability[206] is a great first step to evaluate which avian populations may be at greatest risk of collision impacts from eventual development within Morro Bay 399, and which areas should be avoided for development. However, many of the species that occur along the CCE are unique to the region and have never been observed around operating wind developments. Additionally, floating technology poses new challenges, including variable height that occurs from pitch and yaw of the turbines, which may interact with avian behavior to affect collision risk. Preliminary recommendations on monitoring and mitigation for avian impacts can be found in Appendix A.

Collision Risk for Seabirds

In reviewing Morro Bay 399, BOEM must adequately assess collision risk to seabirds. This must include an analysis, using the most current available science, of flight heights (averages and ranges), avoidance rates, and other relevant avian flight behavior at the very least. BOEM must also consider the range of turbine specifications that could influence collision risk, including air gap, total rotor swept zone, and turbine height. We know from studies around oil and gas platforms that gulls, shearwater, storm-petrel, and peregrine falcons are attracted to platforms in the marine environment, which further heightens their potential collision risk with turbines.[207] Nocturnal migrants and foraging seabirds alike are attracted to lights associated with offshore infrastructure, which has led to an estimated 200,000 collision-induced mortalities per year in the Gulf of Mexico where offshore infrastructure is prevalent.[208]

Avian species may experience impacts to their populations via three main mechanisms: 1) displacement or loss of habitat; 2) barrier effects which can have energetic costs if birds reroute daily movements to foraging grounds or seasonal migratory movements; and, 3) direct mortality, such as through collision.; true seabirds, terns, gulls, pelicans, and cormorants are more sensitive to collision; and nocturnal migrants and shorebird migrants are sensitive to barrier impacts and collision. Diving birds, like alcids and loons, are also sensitive to potential impacts from secondary entanglement and underwater noise from construction and operations activities. Furthermore, seabirds that use upwellings and ocean turbulence as

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203 Scott R. Loss et al., *Estimates of bird collision mortality at wind facilities in the contiguous United States*, BIOLOGICAL CONSERVATION (Dec. 2013).

204 Huso M, Conkling T, Dalthorp D, Davis M, Smith H, Fesnock A, Katzner T. 2021. Relative energy production determines effect of repowering on wildlife mortality at wind energy facilities. Journal of Applied Ecology:1365-2664.13853.

205 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."

206 *Id.*

207 Ronconi RA, Allard KA, Taylor PD. 2015. Bird interactions with offshore oil and gas platforms: Review of impacts and monitoring techniques. Journal of Environmental Management 147:34–45.

208 Russell, R.W. 2005. Interactions between migrating birds and offshore oil and gas platforms in the northern Gulf of Mexico: Final Report. U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study MMS 2005-009. 348 pp.

ecological cues to locate important foraging areas offshore can be attracted to the wakes created by offshore infrastructure. Turbine platforms can mimic the cues birds rely on, even when foraging fish are not present, creating an ecological trap by which these birds both expend energy foraging in an unfruitful environment and potentially expose individuals to higher collision risk.[209]

BOEM should start with its own analysis of the vulnerability of over 80 species of birds that could come into contact with the wind turbine generators in the cumulative OCS wind development areas within the CCE in the foreseeable future and incorporate this analysis into its decision making regarding the designation of WEAs and lease areas.[210] BOEM must be transparent in presenting the high level of uncertainty in the results, including high and low estimates for population-level cumulative impacts. Much of the high uncertainty in these models is a result of highly variable concentrations of seabirds throughout the year. BOEM should be explicit about these seasonally higher risks and not rely on annual averages. Many tubenoses, for example, congregate outside the breeding season near upwellings and other locations of high productivity. Such concentrated flocks, if occurring within the turbine array, could produce significantly large collision events, even if such events are relatively rare. BOEM should consider this variability of large concentrations of birds even in short periods of time in its analysis of seasonal abundance when calculating risk to birds.

Collision Risk for Land Bird Migrants

Marine birds are not the only avian group at risk of collision from offshore wind energy development in the CCE. Many species of land birds breeding in Alaska cross over the shelf break offshore before stopping over on the coast of California. whimbrel, designated by USFWS as a bird of conservation concern,[211] may fly nonstop more than 8,000 km over the Pacific Ocean before making landfall.[212] Unlike the migratory altitudes estimated for many land birds based on radar studies, whimbrel are known to regularly fly within the rotor-swept zone for oversea flights (median=133 m above sea level).[213]

BOEM must sufficiently consider collision risks to land bird migrants. Migration events are relatively infrequent, and therefore, survey efforts like the Pacific Continental Shelf Environmental Assessment (PaCSEA)[214] and *Pacific Marine Assessment Partnership for Protected Species* (PacMAPPS)[215] are not appropriate for characterizing collision risk to land bird migrants. In general, understanding collision risk will require a combination of radar, telemetry, survey, and acoustic monitoring, and should not be based on a single technology alone.

Collision Risk Models

209 Lieber L, Langrock R, Nimmo-Smith WAM. 2021. A bird's-eye view on turbulence: seabird foraging associations with evolving surface flow features. Proceedings of the Royal Society B: Biological Sciences 288:rspb.2021.0592, 20210592.

210 Adams et al. (2016), "Collision and Displacement Vulnerability among Marine Birds of the California Current System Associated with Offshore Wind Energy Infrastructure."

211 U.S. Fish and Wildlife Service. 2021. Birds of Conservation Concern 2021. United States Department of the Interior, U.S. Fish and Wildlife Service, Migratory Birds, Falls Church, Virginia. http://www.fws.gov/birds/management/ managed-species/birds-of-conservation-concern.php

212 Shiloh Schulte, personal communication, August 14, 2021; Ruthrauff DR, Harwood CM, Tibbitts TL, Warnock N, Gill RE. 2021. Diverse patterns of migratory timing, site use, and site fidelity by Alaska-breeding Whimbrels. Journal of Field Ornithology 92:156–172.

213 Galtbalt B, Lilleyman A, Coleman JT, Cheng C, Ma Z, Rogers DI, Woodworth BK, Fuller RA, Garnett ST, Klaassen M. 2021. Far eastern curlew and whimbrel prefer flying low - wind support and good visibility appear only secondary factors in determining migratory flight altitude. Movement Ecology 9:32.

214 https://pubs.er.usgs.gov/publication/70100431

215 https://www.fisheries.noaa.gov/west-coast/science-data/pacmapps-pacific-marine-assessment-program-protected-species

We expect that BOEM will apply collision risk models (CRMs) to evaluate potential avian impacts from developing Morro Bay 399 and use this information to determine the areas within Morro Bay 399 to offer for leasing. While limited, CRMs are one of the only tools available to hypothesize potential impacts to birds from collision in the offshore environment. See Appendix A for further discussion on CRMs and monitoring and mitigation recommendations.

Primary and secondary entanglement

Wildlife entanglement risk associated with mooring lines and dynamic array cables is one of the key potential risk differences between fixed foundations and floating offshore wind technology. Floating offshore wind farms will have an extensive network of mooring lines and inter-array cables that interconnect turbines to one another and ultimately the floating substation. The inter-array power cables connecting turbines are likely to have curvature and will sit roughly 100 m below the surface.

Entanglement risk may take two forms: "primary entanglement" where wildlife becomes entangled directly in the mooring lines and cables; and "secondary entanglement" where abandoned, lost, or discarded fishing gear or other marine debris becomes caught on mooring lines and subsequently entangles species.

Entanglement and entrapment may cause death by drowning, serious injuries, starvation, and sub-lethal impacts where an animal's health and ability to reproduce is impaired by the stress of a current or previous entanglement event. Entrapment can be defined as physically trapping an animal or causing confusion in or around a set of mooring lines.[216] In planning for commercial-scale offshore wind energy development in federal waters offshore California, it is important to note that several marine mammal populations off the West Coast, including blue whales and humpback whales, are at increased risk from human activities, including entanglement,[217] and cannot withstand additional entanglement risk. Entanglement is also a primary driver of sea turtle and seabird mortality.

Primary entanglement

It is possible that marine mammal species may be able to detect the large diameter mooring lines, either visually, 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.[218] Scientists also suggest that the risk of primary entanglement is low given that the cables and mooring lines are relatively taut and likely to be of a diameter large enough to preclude entanglement of even a large whale.[219] Additionally, the mooring lines for floating offshore wind developments will have less curvature and are made of more rigid material than fishing lines, resulting in little to no risk of loop creation and

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

217 Saez, L., D. Lawson, and M. DeAngelis. 2021. Large whale entanglements off the U.S. West Coast, from 1982-2017. NOAA Tech. Memo. NMFS-OPR-63A, 50 p.; NMFS (2020) 2019 Blue Whale (*Balaenoptera musculus musculus*): Eastern North Pacific Stock (https://media.fisheries.noaa.gov/dam-migration/2019_sars_bluewhale_enp.pdf);NMFS (2020) 2019 Humpback Whale (*Megaptera novaeangliae*): California/Oregon/Washington Stock (https://media.fisheries.noaa.gov/dam-migration/2019_sars_humpbackwhale_cawaor.pdf)

218 Benjamins et al. 2014.

219 Bailey, H., Brookes, K. L., & Thompson, P. M. (2014). Assessing environmental impacts of offshore wind farms: Lessons learned and recommendations for the future. Aquatic Biosystems, 10, 8; Benjamins, S., Harnois, V., Smith, H. C. M., Johanning, L., Greenhill, L., Carter, C., & Wilson, B. (2014). Understanding the potential for marine megafauna entanglement risk from renewable marine energy developments. Scottish Natural Heritage Commissioned Report No. 791. Available at https://tethys.pnnl.gov/sites/default/files/publications/SNH-2014-Report791.pdf.

subsequent entanglement.[220] However, large whales, including baleen whales and sperm whales, have been entangled in undersea cables,[221] so mooring lines from floating turbines may present some risk.

Catenary moorings are the most slack and thus pose the greatest potential risk of primary entanglement, but entanglements have not been reported for oil platforms with similar configurations.[222] No primary entanglement in mooring lines, cables, or related gear has been reported for floating turbines in Scotland since operation began in October 2017. Killer whales, long-finned pilot whales, sperm whales, fin whales, and minke whales, as well as pinnipeds occur in Scottish waters, so potential for entanglement exists.[223] However, large migratory populations of baleen whales are not present in the North Sea, so results cannot be generalized to other regions where baleen whales occur in high densities, such as the U.S. West Coast. Further, surveys of inter-array and mooring lines have only occurred annually and biennially, so there is incomplete information about the frequency of entanglement or gear ensnarement.

While unlikely, there is currently no information available to entirely discount primary entanglement as a threat. It is possible that baleen whales may be at the greatest risk of primary entanglement because of their large body size and open-mouth foraging behavior.[224]

Secondary entanglement

Entanglement in abandoned, lost, or discarded fishing gear and other marine debris is a well-established threat to many species of marine wildlife that often causes serious injury or death. In the case that these materials become ensnared in floating offshore wind mooring lines and cables, secondary entanglement could pose a significant risk and have population-level impacts, particularly if endangered species are routinely present in the areas around floating offshore wind projects.

Marine mammals, diving seabirds, sea turtles, elasmobranchs, and fishes are vulnerable to secondary entanglement if the underwater infrastructure accumulates derelict fishing gear, such as nets and hooks or lines, or plastic pollution.[225] In turn, fish and other animals caught in the abandoned gear can serve as a bait for other, larger predators thus placing these predators at risk of secondary entanglement. The high densities of large baleen whales in Morro Bay 399, as well as the presence of endangered and threatened sea turtles, seabirds, sharks, and large pelagic fish, indicate that this may be a concern.

In addition, large whales already entangled in fishing gear often drag long ropes and heavy traps in their wake that could, in turn, become caught around the mooring lines and cables associated with floating offshore wind energy developments. This alternative form of secondary entanglement may represent a significant risk to species that are already experiencing a high number of entanglements and occupy areas planned for floating wind development.

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220 Benjamins et al., *id*.

221 M. P. Wood and L. Carter, "Whale Entanglements with Submarine Telecommunication Cables," in IEEE Journal of Oceanic Engineering, vol. 33, no. 4, pp. 445-450, Oct. 2008, doi: 10.1109/JOE.2008.2001638;

222 Harnois, V., Smith, H. C. M., Benjamins, S., & Johanning, L. (2015). Assessment of entanglement risk to marine megafauna due to offshore renewable energy mooring systems. *International Journal of Marine Energy*, *11*, 27–49. https://doi.org/10.1016/j.ijome.2015.04.001

223 Gillham, K., & Baxter, J. (2009). Whales, Dolphins & Porpoises: Naturally Scottish (p. 58). Scottish Natural Heritage. https://www.nature.scot/sites/default/files/2017-07/Naturally%20Scottish%20-%20Whales%2C%20Dolphins%20and%20Porpoises.pdf

224 *Id.*

225 Hardesty, B.D., Good, T.P. and Wilcox, C., 2015. Novel methods, new results and science-based solutions to tackle marine debris impacts on wildlife. *Ocean & Coastal Management*, *115*, pp.4-9; Benjamins et al. (2014), "Understanding the Potential for Marine Megafauna Entanglement Risk from Marine Renewable Energy Developments." Scottish Natural Heritage Commissioned Report No. 791

Fishing gear is the number one cause of underwater entanglement for birds, with diving birds like sea ducks, loons, grebes, pelicans, and alcids at greatest risk.[226] Citizen science surveys off California's Central Coast revealed sooty shearwater and western gull regularly fall victim to entanglement with ghost gear, which is of particular note as these species are also predicted to be highly vulnerable to collision with turbines.[227]

When 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 can 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.[228] Such changes could modify existing entanglement risks to marine megafauna.[229]

It will be important for scientists to evaluate "snagging risk" of derelict fishing gear on cables within proposed mooring systems for floating turbines. Recommendations outlined in Benjamins et al. (2014) could be used to conduct a qualitative risk assessment that would facilitate risk management. However, as the potential impacts to species are so severe, BOEM should act early to require mitigation strategies to eliminate the risk of primary and secondary entanglement as the standard for the U.S. floating offshore wind industry.[230]

Noise

Detrimental impacts from noise on marine wildlife are of significant concern when considering offshore wind energy development, 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, pre-construction site assessment and characterization activities employing high resolution geophysical surveys will likely be necessary and, after an offshore wind farm becomes operational, active turbines will produce low levels of underwater noise. Associated maintenance activities will also last over the lifetime of the wind farm, including noise from increased traffic of service vessels transiting between ports and the wind farm areas and operating within the wind farm area.

High resolution geophysical surveys are used in the initial stages of offshore wind development for engineering and siting decisions and during construction to inform micro-siting of turbines. The resulting maps help offshore wind developers determine available options for cable routes, pile driving locations, mooring conditions, foundation type, and turbine layout. Some of the sound waves used in geophysical surveys overlap with the same frequencies that marine mammal hearing. While not as loud as the seismic airgun surveys used for oil and gas exploration, exposure to noise from geophysical surveys used for

226 Ryan PG. 2018. Entanglement of birds in plastics and other synthetic materials. Marine Pollution Bulletin 135:159–164; Good TP, June JA, Etnier MA, Broadhurst G. 2010. Derelict fishing nets in Puget Sound and the Northwest Straits: Patterns and threats to marine fauna. Marine Pollution Bulletin 60:39–50.

227 Donnelly-Greenan EL, Nevins HM, Harvey JT. 2019. Entangled seabird and marine mammal reports from citizen science surveys from coastal California (1997–2017). Marine Pollution Bulletin 149:110557.

228 *Id.*

229 *Id.*

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

offshore wind can damage the hearing and sensory abilities of some species, cause stress and negative health effects, disrupt vital behaviors, or displace marine mammals from habitat. For vulnerable species, displacement from preferred feeding and breeding areas or known migratory paths can be especially concerning. As multiple HRG surveys may occur concurrently or at the same time as other sources of noise, cumulative impacts of these activities are a serious concern. As with all increased vessel traffic, survey vessels also pose a risk of collision to marine mammals.

Sounds produced by floating offshore wind energy structures will be predominantly lower frequency sounds below ~1 kHz. Noise from operation will be largely dependent on wind speed, however measurement of noise from the floating turbine Hywind near Utsira Nord site is approximately 166 dB re 1μPa at 1 m from the sound source under local wind conditions,[231] which is 46 dB above NOAA exposure guidelines for "Level B" harassment guidelines for continuous noise exposure. This would mean that the "Level B" harassment threshold would be exceeded within 200 m of the noise source.[232]

As there is a correlation between turbine size and radiated noise, and whether the generator is direct or gear-box driven, the sizes and types of turbines will be important in determining occasional and cumulative impacts from the turbines. Other factors include how loud the operating noise is underwater, installation and service vessel noises, and low frequency pulses generated by the turbine blades passing by the mast. Understanding these noise factors will be critical to determining how various taxa would be impacted and by how much.[233] For example, species that are sensitive to lower frequencies might be able to detect turbines from several kilometers away if the ambient noise levels are below the radiated noise level from a given turbine. [234] Thus, it will be crucial to understand ambient noise across seasons before the installation of turbines to accurately understand and mitigate potential impacts,[235] and what mitigations will need to be employed in the design and installation of the turbines (such as direct drive or acoustically decoupling the turbine from the mast). Noise assessment must also be done in the context of a field of turbines, and the noise contribution of multiple turbines to the area's marine soundscape.

Perhaps the greatest concern regarding noise impacts on marine mammals from operational floating wind technology is the potential to mask sounds made by marine mammals for communication, locating prey, and navigation.[236] 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.[237] Importantly, as the scale of projects increases, the cumulative impacts of

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[231] Equinor (2019) "Noise Impact Assessment Hywind Tampen" https://www.equinor.com/content/dam/statoil/documents/impact-assessment/hywind-tampen/equinor-noise-impact-assessment-hywind-tampen.pdf

[232] $20\log_{10}(1/200)$=46dB for spherical propagation.

[233] Tougaard, Jakob, Line Hermannsen, and Peter T. Madsen. "How Loud Is the Underwater Noise from Operating Offshore Wind Turbines?" The Journal of the Acoustical Society of America 148, no. 5 (November 2020): 2885–93. https://doi.org/10.1121/10.0002453; Stöber, Uwe, and Frank Thomsen. "How Could Operational Underwater Sound from Future Offshore Wind Turbines Impact Marine Life?" The Journal of the Acoustical Society of America 149, no. 3 (March 2021): 1791–95. https://doi.org/10.1121/10.0003760; Serpetti, Natalia, Steven Benjamins, Stevie Brain, Maurizio Collu, Bethany J. Harvey, Johanna J. Heymans, Adam D. Hughes, et al. "Modeling Small Scale Impacts of Multi-Purpose Platforms: An Ecosystem Approach." Frontiers in Marine Science 8 (July 8, 2021): 694013. https://doi.org/10.3389/fmars.2021.694013.

[234] Serpetti, Natalia, et al. "Modeling Small Scale Impacts of Multi-Purpose Platforms: An Ecosystem Approach." Frontiers in Marine Science 8 (July 8, 2021): 694013. https://doi.org/10.3389/fmars.2021.694013.

[235] Bailey, H., K. L. Brookes, and P. M. Thompson. "Assessing Environmental Impacts of Offshore Wind Farms: Lessons Learned and Recommendations for the Future." Aquatic Biosystems 10 (2014): 8.

[236] 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.

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

underwater sound will likely increase and cause additional masking and other effects at greater distances from the source.[238] While low-level operational noise is considered to have a low impact on marine mammals due to the low-intensity of the noise,[239] low-level continuous noise is known to induce stress in mysticetes,[240] compromising fitness and breeding success. These low levels may also result in habitat displacement for some sensitive species.[241] For example, changes of behavior were observed for 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.[242] Thus the potential for habitat displacement over the long term remains an area of needed research.

Very little is known about sea turtle hearing and potential noise impacts. It has been determined that sea turtle hearing sensitivity overlaps with the frequencies and source levels produced by many anthropogenic sources; however, more research is needed to determine the potential physiological and behavioral impacts of these noise sources on sea turtles.[243]

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.[244] Impacts are likely to be greater on long-lived, slow reproducing species, such as sharks and rays.[245] Potential impacts

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[238] Copping et al. 2016.

[239] 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

[240] Rosalind M. Rolland, Susan E. Parks, Kathleen E. Hunt, Manuel Castellote, Peter J. Corkeron, Douglas P. Nowacek, Samuel K. Wasser and Scott D. Kraus (2012) “Evidence that ship noise increases stress in right whales” Proc. R. Soc. B doi:10.1098/rspb.2011.2429

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

[242] Snyder et al. 2009.

[243] Ridgway, S.H., E.G. Wever, J.G. McCormick, J. Palin, and J.H. Anderson. “Hearing in the giant sea turtle, *Chelonia mydas*.” *Proceedings of the National Academy of Sciences of the United States of America,* vol. 64, no. 3 (1969):884-890.; Bartol, S.M., J.A. Musick, and M.L. Lenhardt. “Auditory evoked potentials of the loggerhead sea turtle (*Caretta caretta*).” *Copeia,* vol. 3 (1999):836-840.; Dow Piniak, W.E., S.A. Eckert, C.A. Harms, and E.M. Stringer. 2012. *Underwater hearing sensitivity of the leatherback sea turtle (Dermochelys coriacea): Assessing the potential effect of anthropogenic noise*. OCS Study BOEM 2012- 01156. Herndon, VA: U.S. Department of the Interior, Bureau of Ocean Energy Management.; Martin, K.J., S.C. Alessi, J.C. Gaspard, A.D. Tucker, G.B. Bauer, and D.A. Mann. “Underwater hearing in the loggerhead turtle (*Caretta caretta*): A comparison of behavioral and auditory evoked potential audiograms.” *The Journal of Experimental Biology*, vol. 215, no. 17(2012):3001-3009.; Piniak, W.E.D., D.A. Mann, C.A. Harms, T.T. Jones, and S.A. Eckert. “Hearing in the juvenile green sea turtle (*Chelonia mydas*): A comparison of underwater and aerial hearing using auditory evoked potentials.” *PLoS ONE,* vol. 11, no. 10 (2016):e0159711.

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

[245] 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; 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; 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; Halvorsen, M., Casper, B., Woodley, C., Carlson, T., and Popper, A. 2012.

to commercial fisheries, including forage fishes, that provide critical resources to seabirds and shorebirds[246] must also be taken into consideration. To date, no studies have examined the acoustic impacts of floating turbine structures operations and maintenance on fish behavior or physiology. It is important to note that there is currently incomplete knowledge of background noise and acoustic turbine effects on fishes.[247]

While the impacts of underwater noise on diving seabirds have not been emphasized in the past, underwater noise from increased vessel traffic as well as turbine installation and operation also poses a potential threat to diving birds occurring within and around Morro Bay 399. As described above in the habitat loss section, loons[248] and alcids[249] have been known to avoid areas up to 16 and eight (8) km away, respectively, from offshore turbine arrays during operation and construction. Common Murre, which are predicted to be of high displacement vulnerability, and likely occur near Morro Bay 399, are sensitive to underwater noise.[250] It will be important for BOEM to consider this impact in its decision making and assess potential direct and indirect physiological impacts to diving birds from underwater noise associated with offshore wind construction and operation within the CCE moving forward.

Electromagnetic fields

The flow of electricity through a conductor produces both an electric and magnetic field around the conductor. The generation of EMFs is of concern for fish species in close proximity to wind farms, and studies have shown that some fish species are magneto-sensitive and use geomagnetic field information for orientation purposes.[251] EMF effects can alter the ability to detect or respond to natural magnetic signatures, potentially altering fish survival, reproductive success, or migratory patterns. Long-lived, slow reproducing elasmobranch species (sharks, rays, skates etc.) are of particular concern.[252] EMFs have been successfully used as deterrents in tests of depredation-mitigation devices in fisheries to reduce shark bycatch, which highlights the potential that EMF has to alter shark behavior.[253]

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246 Bailey et al. 2014.

247 Gill, Bartlett, Thompson, 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. 2012.

248 Mendel B, Schwemmer P, Peschko V, Müller S, Schwemmer H, Mercker M, Garthe S. 2019. Operational offshore wind farms and associated ship traffic cause profound changes in distribution patterns of Loons (Gavia spp.). Journal of Environmental Management 231:429–438.

249 Peschko V, Mendel B, Müller S, Markones N, Mercker M, Garthe S. 2020. Effects of offshore windfarms on seabird abundance: Strong effects in spring and in the breeding season. Marine Environmental Research:105157.

250 Anderson Hansen K, Hernandez A, Mooney TA, Rasmussen MH, Sørensen K, Wahlberg M. 2020. The common murre (Uria aalge), an auk seabird, reacts to underwater sound. The Journal of the Acoustical Society of America 147:4069–4074.

251 Öhman, Sigray, Westerberg, Offshore windmills and the effects of electromagnetic fields on fish. MABIO. 2007

252 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; 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; 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; 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.

253 Hutchison, Z.L., Sigray, P., Haibo He, A. B. Gill, King, J., Gibson, C., 2018. Electromagnetic Field (EMF) Impacts on Elasmobranch (shark, rays, and skates) and American Lobster Movement and Migration from Direct Current Cables. https://doi.org/10.13140/RG.2.2.10830.97602

Inter-array cables have the potential to affect magneto-sensitive 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.[254] The highest sensitivity taxa known are the elasmobranchs, the jawless fish (Agnatha), and sturgeons, paddlefish, and relatives (the chondrosteans),[255] but marine mammals, sea turtles, bony fish, crustacea (lobsters and prawns), and mollusca (snails, bivalves, cephalopods) are also sensitive.[256] 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.[257]

In general, however, little is known about the potential impacts of EMF on marine organisms.[258] If there are any consequences from exposure to EMF from OWEI on magneto-sensitive species, then they are most likely to be associated with multiple encounters with the EMF over a short timescale.[259] 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.[260] 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.[261] 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.[262]

In addition, while field studies have been conducted on the effects of EMF from cables buried in the seabed,[263] there is a limited understanding of the EMF impacts of cables suspended in the water column, as in floating wind dynamic power cables.[264] More work needs to be done to understand attraction or aversion effects of suspended, dynamic power cables, particularly on pelagic species.[265]

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254 Normandeau Associates et al. 2011.

255 Love, M., A. Bull & D. Schroeder. 2012. EMF and Marine Organisms. In: Boehlert, G., C. Braby, A. S. Bull, M. E. Helix, S. Henkel, P. Klarin, and D. Schroeder, eds. 2013. Oregon Marine Renewable Energy Environmental Science Conference Proceedings. U.S. Department of the Interior, Bureau of Ocean Energy Management, Cooperative Agreement with Oregon State University M12AC00012. OCS Report BOEM 2013-0113. 149 pp.

256 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.

257 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.

258 Copping et al. 2016.

259 Gill et al. 2012.

260 Masden et al. 2009

261 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.

262 Gill et al. 2012

263 E.g., Hutchison, et al., *supra*.

264 Gill, A., & Desender, M. (2020). *2020 State of the Science Report, Chapter 5: Risk to Animals from Electromagnetic Fields Emitted by Electric Cables and Marine Renewable Energy Devices* (PNNL--29976CHPT5, 1633088; p. PNNL--29976CHPT5, 1633088). https://doi.org/10.2172/1633088

265 Taormina, B., Bald, J., Want, A., Thouzeau, G., Lejart, M., Desroy, N., & Carlier, A. (2018). A review of potential impacts of submarine power cables on the marine environment: Knowledge gaps, recommendations and future directions. *Renewable and Sustainable Energy Reviews*, *96*, 380–391. https://doi.org/10.1016/j.rser.2018.07.026

Water quality impacts

The inter-array mooring cables and anchors used to secure the floating turbine platforms are likely to cause some benthic disturbance, particularly during the construction phase but also during standard operations and maintenance due to wave and current scouring action. This increased sedimentation may have an impact on fish populations associated with the sea bottom, but is unlikely to have an immediate impact on the adult life stages of pelagic species in the water column (up to 1,100 m above) unless a species relies on such benthic habitats for spawning purposes (e.g., Market squid). Increased sedimentation may also cause the release of seabed sediment contaminants which could impact benthic spawning habitat quality of some fish species, but at low levels this will not likely have a population-level impact on fish that live in the midwater. It is also possible that antifouling agents that will likely be used to hinder marine growth on the mooring structures could, over time, impact fish. These agents contain biocides which, by their very nature, are designed to prevent marine growth. The continual leaching and potential reapplication of these antifouling agents could pose a problem to pelagic fish, most likely impacting smaller, sensitive species such as anchovy and sardine (although to date no studies have looked at the effects of biocides on pelagic fish species).[266]

Hydrographic impacts

The design of an offshore wind farm, such as the location, number of turbines, and foundation types, may affect local and regional hydrodynamics.[267] As currents move past the offshore wind foundations, they generate a turbulent wake that will contribute to a mixing of the stratified water column.[268] The loss of stratification within the wake of a single offshore wind turbine has been observed in the German Bight, a relatively shallow area of the North Sea with typical water depths between 20 and 50 m.[269] A single monopile was found to be responsible for 7-10% additional mixing to that of the bottom mixed layer, whereby approximately 10% of the turbulent kinetic energy generated by the structure is used in mixing [270] Although the effect of a single turbine on stratification is relatively low, large-scale build-out of offshore wind energy (i.e., 100 sq miles) could significantly affect the vertical structure of a weakly stratified water column, and could modify the stratification regime and water column dynamics on a seasonal scale, depending on local conditions and turbine layout.[271] There is a lack of available data on the local-scale hydrodynamic effects of the platforms, mooring lines, and dynamic power cables associated with floating offshore wind turbines. BOEM should build off research already conducted in Europe, and the opportunity presented by the prospective Aqua Ventus research project in the Gulf of Maine, and study the hydrodynamic effects of individual floating offshore wind turbines. BOEM should then use that data to parameterize models to predict the cumulative effects of utility-scale offshore wind on oceanographic conditions, including stratification, and the resulting effects on habitat for fish and key prey species.

IV. RECOMMENDATIONS ON SCIENCE NEEDED FOR BOEM TO DETERMINE LEAST CONFLICT LOCATIONS FOR OFFSHORE WIND DEVELOPMENT

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[266] Amara et al. Antifouling processes and toxicity effects of antifouling paints on marine environment. A review. Env. Tox. Pharmacol. 2018.

[267] Segtnan OH, Christakos K. 2015. Effect of offshore wind farm design on the vertical motion of the ocean. Energy Procedia 80(2015): 213-222.

[268] Schultze, L. K. P., L. M. Merckelbach, J. Horstmann, S. Raasch, and J. R. Carpenter. "Increased mixing and turbulence in the wake of offshore wind farm foundations." *Journal of Geophysical Research: Oceans* 125, no. 8 (2020): e2019JC015858

[269] *Id.*

[270] *Id.*

[271] *Id.*; Carpenter JR, Merckelbach L, Callies U, Clark S, Gaslikova L, Baschek B (2016) Potential Impacts of Offshore Wind Farms on North Sea Stratification. PLoS ONE 11(8): e0160830. https://doi.org/10.1371/journal.pone.0160830.

Our organizations appreciate and recognize BOEM's extensive outreach, the resources that the agency has dedicated to research in support of responsible offshore wind development, and the approachability and accessibility of the Pacific Region BOEM staff. To date, however, BOEM has not clearly demonstrated how it is incorporating local environmental considerations into its site identification, Call and WEA designations, and leasing decisions. Given the imperative of protecting biodiversity and advancing the offshore wind industry expeditiously, we encourage BOEM to seize this unprecedented opportunity to set a high environmental bar for the growth of the offshore wind industry in California. Our organizations urge BOEM to clearly articulate how it will use information about sensitive habitat and species to inform leasing decisions.

As wind development advances offshore California, greater data on avian, marine mammal, fish, and structural benthic habitat distributions throughout the Central Coast is needed. Siting must 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) BOEM should provide sustained funding to maintain the California Offshore Wind Data Basin Gateway and for third party analysis

We acknowledge BOEM's efforts to incorporate local environmental considerations into the site designation process. However, as noted in Section I, our organizations would appreciate 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 for analysis needed to make informed decisions on appropriate locations for future offshore wind developments. 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 initial work to make it an inclusive and collaborative federal, state, and stakeholder collaboration. Yet, attention and resources to sustain the Gateway have faltered, impairing its utility as a decision making support tool. Additional staff resources are needed to fully analyze and process the data currently in the Gateway and harmonize, synthesize, and maintain the enormous volume of studies the site contains.

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 must 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) BOEM should conduct research to address key data gaps and specify a plan to incorporate ongoing and future scientific studies into project leasing and permitting

In making this recommendation, we commend BOEM for its completed and planned research intended to inform analysis and decision making for offshore wind development. However, development of offshore wind is in nascent stages in California, and more research is required. Even the most ambitious projections for a first offshore wind project do not anticipate an initial deployment for several years, leaving open a unique window of opportunity to fill data gaps and establish a strong environmental baseline before construction. <u>With this amount of time, it is entirely feasible to undertake the baseline studies and data analysis that are needed to minimize risks to the marine environment and incorporate the results into the offshore wind leasing process, and, in so doing, advance the industry in an expeditious</u>

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.

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 the inter-annual biological variability of the region, anything less than three years of baseline data would be an inadequate baseline from which to assess potential environmental impacts.

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.

Here we highlight some of top research priorities for benthic habitat, fish, marine mammals, and birds. 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 Morro Bay 399, there is a need for: (1) detailed ground truthing of previously mapping areas; (2) targeted mapping of areas within Morro Bay 399 where there are data gaps on substrate composition and biological communities; and (3) thorough characterization of areas of likely high ecological importance to ensure potential offshore wind sites minimize impacts to sensitive benthic communities, such as HAPC. BOEM should incorporate the results of CalDig II into leasing decisions, and place additional focus on characterizing infaunal communities as part of the site characterization, baseline, and ongoing monitoring because previous efforts have been primarily focused on the epibenthic communities. New technologies such as rapid deploy landers, autonomous underwater vehicles, and improvements to towed camera sleds make this work more feasible.

Fish

The best available data for fish species presence in Morro Bay 399 come from commercial and recreational fisheries landings. These include California Department of Fish and Wildlife landings, logbooks, fisheries data, NOAA fisheries observer's data, and PFMC reports. BOEM and state officials, however, have already concluded that "no one dataset is able to describe all fisheries activities and the team in close collaboration with fishing communities achieves the most comprehensive fisheries data analysis possible."[272] Environmental data banks such as Scripps Oceanography's Coastal Data Information Program[273] are also useful for modelling the thermal habitats of CPS and/or HMS on a seasonal to annual basis. This idea of "Dynamic Ocean Management"[274] has considerable potential in the construction, maintenance, and decommissioning phases of offshore wind energy, as timings can be

272 BOEM California Intergovernmental Renewable Energy Task Force, Meeting Summary (September 2018).

273 http://cdip.ucsd.edu/m/about/.

274 Maxwell et al. Dynamic ocean management: Defining and conceptualizing real-time management of the ocean. Marine Policy, 2015.

adapted based on current or recent oceanographic activity to avoid ecologically important periods (HMS or CPS migration or spawning, for example).

BOEM and other parties have already acknowledged that there are deficiencies regarding current fish and fishing data. Although fish landings data will provide the most comprehensive view of estimated fish presence around Morro Bay 399, it must be noted that this will not accurately elucidate where fish are caught (catch records are recorded at ports only). It would therefore be beneficial, if possible (given data privacy issues), to combine logbook data, catch records and Automatic Identification System/Vessel Monitoring System data to give spatially explicit estimates of fish abundance and presence in Morro Bay 399, though at the least, a more thorough review of catch records is needed.[275]

It will be useful 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 Morro Bay 399. If significant impacts from wind energy development are found, then knowledge of the timing and location of these habitat features may be used to reduce certain impacts. (For example, by adopting temporal closures to vessel traffic and/or cessations in offshore wind development activity during important fish-related events (spawning, migration, aggregation etc.)). NOAA could apply a similar concept as a BIA to designate key habitat for CPS and HMS to help guide wind farm siting decisions, although the difficulty of defining habitat for pelagic species is noted above. New and better methods of stock assessments will be invaluable but should be targeted at species of importance related to the windfarm development.[276]

Acoustic and EMF effects and thresholds for fish species of interest/particular concern need to be established and compared to the levels of each that may occur when wind facilities are being built and when they are operational (and compared to background/ambient noise at Morro Bay 399). It would be best to conduct these studies by running laboratory-based experiments before the wind facility is established. If time and/or budgets are limited, an effective approach to understanding these impacts would be to group functionally/biologically similar species and test individuals from each group. (For example, one small CPS (sardine or anchovy), one common shark species, one rockfish and one benthic species.)

Marine mammals

There is a need for additional studies on marine mammal distribution on the Central and North Coasts through aerial or boat-based surveys and passive acoustic monitoring, and on the potential impacts of floating offshore wind development. Studies to assess potential impacts to marine mammals at other floating wind demonstration sites should be implemented and made publicly available as soon as possible. This information, however, must not supplant the baseline marine mammal studies for the CCE that are needed, as the community of marine mammals, and particularly cetaceans, is drastically different in the CCE versus other parts of the world.

Basic biological data including distribution, Critical Habitat, and migration patterns 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 assess potential impacts to marine mammals. It is difficult to understand the

[275] BOEM has noted this, "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".

[276] Ralston et al. Predicting market squid (*Doryteuthis opalescens*) landings from pre-recruit abundance. Digital Commons at the University of Nebraska – Lincoln 2018.

cumulative impact of offshore wind energy development on cetaceans given other impacts, such as the potential impact of additional vessel traffic on the likelihood of ship strikes,[277] entanglement risk from floating infrastructure, or displacement of whales, or possibly increasing overlap with fishing activities.[278] As noted in Section II, Critical Habitat has been identified for humpback whales and BIAs have been defined for gray whales (feeding and migration), blue whales (feeding), and humpback whales (feeding), and were explored for fin whales but not designated. BIAs have not yet been defined for a variety of additional species, including minke whale, killer whale, beaked whales (Ziphiidae, *Mesoplodon* spp.), and sperm whale. Revisions to existing BIAs and additional BIAs are being considered as part of the current update being undertaken by NOAA, expected to be completed in December 2021. While BIAs are specific areas used by marine mammals, they must not be the only source of information for identifying important habitat. For example, the California Department of Fish and Wildlife Risk Assessment Management Program (RAMP) conducts monthly assessments of entanglement risk for blue whales, humpback whales, and leatherback sea turtles. RAMP monitors marine life concentrations through aerial and vessel surveys and this information can help BOEM identify important habitat and add to baseline data for vulnerable marine species.[279] The agency must also consider potential shifts in distribution and habitat use driven by changes in ocean conditions, which may result in high concentrations of whales outside of identified BIAs. The development and verification of predictive models incorporating oceanographic data, habitat conditions, and marine mammal presence will be essential to identify current and potential areas of importance. The resulting information must be incorporated by BOEM into its offshore wind planning process.

Baseline data on noise levels is needed for Morro Bay 399, 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.[280] There is also a need to understand the impacts of noise on marine mammal prey species–krill, small schooling fish–particularly the noise from operational use of turbines, for which data are severely lacking.

Birds

There are abundant vessel-based survey data on seabirds 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 Morro Bay 399 at the spatial and temporal resolution needed to design efficient and effective development and mitigation plans to minimize negative impacts on seabirds. 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 PacMAPPS study should influence siting decisions.[281]

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277 Rockwood, R. Cotton, John Calambokidis, and Jaime Jahncke. “High Mortality of Blue, Humpback and Fin Whales from Modeling of Vessel Collisions on the U.S. West Coast Suggests Population Impacts and Insufficient Protection.” Edited by Songhai Li. *PLOS ONE* 12, no. 8 (August 21, 2017): e0183052. https://doi.org/10.1371/journal.pone.0183052.

278 Ingman, Kaytlin, et al. “Modeling Changes in Baleen Whale Seasonal Abundance, Timing of Migration, and Environmental Variables to Explain the Sudden Rise in Entanglements in California.” Edited by Songhai Li. *PLOS ONE* 16, no. 4 (April 15, 2021): e0248557. https://doi.org/10.1371/journal.pone.0248557.

279 *See* https://wildlife.ca.gov/Conservation/Marine/Whale-Safe-Fisheries

280 Bailey, H., K. L. Brookes, and P. M. Thompson. “Assessing Environmental Impacts of Offshore Wind Farms: Lessons Learned and Recommendations for the Future.” *Aquatic Biosystems* 10 (2014): 8.

281 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.

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.[282] It will therefore be important to consider not just current overlap in species ranges with Morro Bay 399, but also predicted overlap in different climatic scenarios.

As a first approach to evaluating species-specific risk from offshore wind energy development, 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.[283] It is then critical that subsequent studies model precise species-specific collision risks using empirical data collected at each site,[284] 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 characteristics.[285] 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.[286] 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 wind farms 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).

Bats

As discussed in Section II, there is insufficient research on bats and offshore wind to accurately assess potential risk to bats from offshore wind development in Morro Bay 399. Because of this knowledge gap, BOEM should support baseline data collection on bat activity in Morro Bay 399 and require future offshore wind projects to commit to pre- and post-construction monitoring and to integrate novel monitoring technology as it becomes available. A list of research needs for bats and offshore wind was compiled by a New York State Energy Research and Development Authority-led effort[287] -- we encourage BOEM to prioritize this research to better understand risk to bats offshore in the Pacific.

Although we now know that population-level impacts to bats are possible from land-based wind, it is important to note that these impacts to bats from onshore wind energy were unanticipated and were only

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[282] Wolf et al. Predicting Population Consequences of Ocean Climate Change for an Ecosystem Sentinel, the Seabird Cassin's Auklet. 2010.

[283] 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."

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

[285] *Id.*

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

[287] Hein, C., K. A. Williams, and E. Jenkins. 2021. Bat Workgroup Report for the State of the Science Workshop on Wildlife and Offshore Wind Energy 2020: Cumulative Impacts. Report to the New York State Energy Research and Development Authority (NYSERDA). Albany, NY. 21 pp. Available at https://a6481a0e-2fbd-460f-b1df-f8ca1504074a.filesusr.com/ugd/78f0c4_fe36c3c091724b14a884851859966ad1.pdf.

discovered because of monitoring for avian impacts.[288] BOEM and partner agencies should support coordinated and regional surveys of bat use of the Pacific OCS, with a focus on Morro Bay 399 and any other areas proposed for wind energy development. Should further monitoring and research efforts reveal that impacts to bats are non-negligible, BOEM and other agencies should support the development and deployment of minimization strategies and deterrent technologies.

BOEM and its partner agencies should:

- Support supplemental field surveys for bats on the OCS, using similar methodology as described in Peterson et al. (2016).[289]
- Require acoustic detectors to be placed at nacelle height on a subset of turbines constructed in Morro Bay 399 and require that the data collected be made publicly available.
- Support research to determine whether it is possible to improve acoustic monitoring to enable better species identifications.
- Support continued advances in radio telemetry equipment, nanotag transmitters, and GPS tags so that more bats can be tracked offshore (e.g., support the development of smaller GPS tags with longer battery lives).
- Support deploying Motus towers[290] and/or other nanotag receiving towers in the coastal and offshore environment, including on structures in Morro Bay 399.
- Support efforts to tag additional individual bats with nanotag transmitters and GPS tags.
- Support the development of bat monitoring technology for offshore wind turbines, such as strike detection technology and thermal video.
- Support research on and testing of bat deterrent devices for offshore wind turbines, such as ultraviolet lighting or ultrasonic noise emitters.
- Require offshore wind projects developed in Morro Bay 399 to support testing and deployment of best available monitoring and deterrent technologies, once they are developed.
- Require offshore wind projects developed in Morro Bay 399 to promptly report and make publicly available all monitoring and testing data.

Many of the above listed recommendations are aimed at filling knowledge gaps about bats' use of the offshore environment. These survey efforts will likely provide critical information about bats' use of Morro Bay 399 and will be necessary to assess potential risk to bats.

V. RECOMMENDATIONS FOR MORRO BAY 399

We offer the following recommendations as BOEM advances Morro Bay 399 to become a WEA. These recommendations are based on our analysis of the biological data discussed within these comments.

a.) BOEM should adopt a precautionary approach to floating offshore wind development in Morro Bay 399, taking care to adhere strictly to the mitigation hierarchy.

The environmental data we present in this letter describe the vibrant California Current ecosystem, rife with biological richness that includes marine mammals, seabirds, fish, invertebrates, sea turtles, and other

[288] Arnett et al. 2008.

[289] Peterson et al. 2016.

[290] Motus Wildlife Tracking System is an international network of researchers using coordinated automated radio-telemetry arrays to study small flying organisms' movements, including bats. Bird Studies Canada. 2018. "Motus Wildlife Tracking System." 2018. https://motus.org/.

important biota. Initial lease areas within the Morro Bay 399 Call Area should be those of relatively less environmental sensitivity.

BOEM should work with the state of California, tribal nations, and stakeholders to identify and select development sites that optimize offshore wind energy potential and minimize environmental impacts. Such an undertaking involves identification and mapping of any persistent hotspots of species abundance and/or areas of rare environmental significance. Significant areas relevant to Morro Bay 399 include, but are not limited to, the Morro Bay State Marine Reserve and Morro Bay State Marine Recreational Management Area, the Audubon Piedras Blancas IBA, Cetacean Density and Distribution Mapping BIAs, Critical Habitat for ESA-listed species, and HAPC. We note that leasing is prohibited in federal waters within the boundaries of the National Park System, National Wildlife Refuge System, and NMS System as per 30 C.F.R.§585.204, and that additional state laws and protections also apply.

Given that floating wind is a nascent technology and the industry is new to California, we urge great care in selecting sites, and strongly encourage a robust monitoring and mitigation effort. BOEM should ensure the necessary baseline data is collected and that a thorough monitoring effort continues throughout all stages of construction, operations, and decommissioning to allow for an understanding as to the potential adverse impacts on marine and coastal habitats. Collection of this data is essential to ensure future developments avoid and minimize harm to biologically rich local environments, and that further mitigation measures can be applied, as needed, to existing projects to reduce harm. We further suggest that BOEM consider phasing development of offshore wind projects in the Morro Bay area to allow us to learn as we build.

Should Assembly Bill 525 become law and go into effect on January 2022, BOEM should work closely with California state agencies to conduct the “least conflict” landscape-level planning that AB 525 mandates and is identified in Section I. Bringing key state and federal agencies, tribal nations, and stakeholders together at the start to ensure an open and transparent process will yield sound siting decisions that minimize impacts to the local environment and ultimately help the offshore wind industry proceed smoothly.

b.) BOEM’s offshore wind leasing decisions should be advised by several key studies and new data

BOEM and California have already committed resources to several studies that are underway now and designed to inform responsible offshore wind development; BOEM should factor research findings from these studies into any final Morro Bay WEA boundary determinations. In particular, it is critical to include the results of the Conservation Biology Institute geospatial analysis, the Data Synthesis and High-resolution Predictive Modeling of Marine Bird Spatial Distributions on the Pacific OCS,[291] Seabird and Marine Mammal Surveys Near Potential Renewable Energy Sites Offshore Central and Southern California,[292] and the new West Coast BIA identifications. Additionally, a CalPoly fishing analysis study will become available over the coming months and its results could be useful in determining how to minimize WEA overlap with fishing activity. These studies will provide critical information about areas of unique biodiversity and those of comparatively less biodiversity and will therefore be instructive in defining areas within Morro Call 399 that are most appropriate for development.

The state and BOEM's offshore wind planning timeline must align with the creation and release of these key data for agency/stakeholder/public access, rather than proceed when these data are not yet available. BOEM should articulate its plans to include the results of these upcoming analyses in its Morro Bay

291 https://opendata.boem.gov/BOEM-ESP-Ongoing-Study-Profiles-2021-FYQ2/BOEM-ESP-PC-15-01.pdf

292 https://www.boem.gov/sites/default/files/documents/environment/PC-17-01_0.pdf

decision-making. Although the offshore wind planning process provides flexibility in modifying the boundaries of lease parcels, given that these studies are expected soon, it would be prudent and most efficient to factor in this data upfront, before leasing decisions are made.

In particular, as noted below, BOEM should pause leasing decisions for the East Extension on Morro Bay 399 and the southeastern portion of the Morro Bay Call Area until the Conservation Biology Institute geospatial analysis, as well as BOEM's two ongoing studies to characterize avian distribution,[293] are complete and available.

We further recommend that BOEM prioritize collection of fine-scale benthic habitat mapping within HAPCs before leasing these areas. There is significant overlap of Morro Bay 399 with HAPC, particularly the Western Extension. HAPC fulfill important ecological functions and/or are especially vulnerable to degradation. HAPC designation by NOAA and the PFMC notes conservation priority status, and our organizations recommend that finer scale mapping be conducted prior to leasing HAPC areas, several of which overlap the West Extension, to ensure that the necessary data is on hand to advise decision-making.

c.) BOEM should avoid advancing leasing in the East Extension of Morro Bay 399 and the southeastern portion of the Morro Bay Call Area until the agency commits to intensive baseline studies, monitoring, and mitigation for the areas in advance of leasing

As discussed in Section II above, the eastern areas of Morro Bay 399 are critically important for seabirds. The vicinity of Morro Bay 399, and specifically the East Extension, to regions of significant biological importance to seabirds puts the seabird populations that rely on these habitats at an increased risk for negative impacts from offshore wind energy infrastructure, including possible collision, habitat displacement, barrier effects, secondary entanglement, and noise. As noted in the previous recommendation, we are awaiting results of two BOEM studies to help characterize marine bird distributions in and around Morro Bay 399.[294] Given the high biodiversity and abundance of avian species along the CCE, we strongly encourage BOEM to make leasing determinations on these areas only after the results of these pending studies are available, and to incorporate the results into its decision-making. If the level of investment or technology needed for BOEM to conduct a higher-level of scrutiny and mitigation (see Appendix A) are not financially or technologically feasible, then those areas and appropriate buffers for shifting influences (such as climate and food sources) should be avoided entirely and removed from areas under consideration for leasing.

VI. 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. We believe that offshore wind along the Pacific Coast can be an important part of shifting away from dirty fossil fuels and in fighting carbon pollution. At the same time, the Newsom and the Biden administrations are committed to stemming biodiversity loss, as it also imperils human existence and ecosystem resilience to climate change. Morro Bay 399 provides key habitat for a host of marine resources, including large baleen whales, fragile sponges and corals, commercially and ecologically valuable fish, and iconic bird species. Both the ecological importance of Morro Bay 399 and uncertainty about the impacts of floating

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[293] *Id*.

[294] NSL #PC-15-01; NSL #PC-17-01.

technology warrant a judicious approach to developing this important potential new resource for California and the nation.

As BOEM evaluates Morro Bay 399 for offshore wind leasing, we urge the agency to work quickly to identify areas of high environmental importance and/or sensitivity, as well as areas of potential conflict, so that offshore wind energy development can proceed responsibly and without delays stemming from high conflict siting. 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 offshore wind leasing process. Doing so will advance the industry in an expeditious manner while also minimizing risks to California's invaluable marine environment. Ensuring that leasing decisions in Morro Bay 399 are guided by comprehensive baseline research and full consideration of potential impacts to marine areas will lay the groundwork for a thoughtful and efficient expansion of offshore wind energy.

We thank you for the opportunity to comment.

Respectfully submitted,

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In addition to the signatories above, Andrew Johnson, PhD, MarFishEco Fisheries Consultants Inc, advised the fish section; Cyndi Dawson, Castalia Environmental, advised the benthic habitat section; and Sara Maxwell, PhD, University of Washington, advised the marine mammal section.

Appendix A – Preliminary Monitoring and Mitigation Recommendations

We urge BOEM to consider phasing development of offshore wind projects in the Morro Bay area to allow for learning as offshore wind is developed. Monitoring is essential to learning about the impacts of floating offshore wind development and to adaptive management and mitigation. This preliminary suite of recommendations is not exhaustive, and we anticipate proposing other mitigation measures to reflect the location, scale, and other project specifics of any new offshore wind development. In this Appendix, we offer some general recommendations and some taxa-specific recommendations. Our organizations are currently developing monitoring and mitigation recommendations for offshore wind development, including recommendations tailored to California, and will share that document with BOEM in late 2021.

Baseline surveys and ongoing monitoring

- Comprehensive pre-installation and ongoing monitoring in and around Morro Bay 399 should be implemented to assess individual species present and relevant biophysical processes. This monitoring should be of sufficient temporal and spatial scale and resolution to detect changes in processes and species distributions resulting from construction and operation.[295]
- Multi-location, broad-band[296] underwater soundscape monitoring should commence as soon as possible to derive robust acoustical habitat baselines before, during, and after equipment installation.
- Digital surveys should be conducted to: facilitate more robust and accurate wildlife monitoring methods through digital video aircraft surveys conducted in both manned[297] and unmanned aircraft;[298] enable higher flight altitudes; and decrease observer and distance biases and increase the number of identifiable bird, marine mammal and sea turtle sightings.[299]
- BOEM should consult and cooperate with NOAA NMFS and CDFW on the development and verification of predictive models for cetacean distribution and habitat use.
- Baseline hydrographic conditions should be established for Morro Bay 399 and a monitoring system capable of detecting deviations from that baseline should be designed and implemented.

Design and deployment considerations for floating offshore wind infrastructure

- 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). There are land-based avoidance and detection systems that can auto-detect species of special concern (e.g. eagles, condors) within terrestrial 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.
- Incorporate instrumentation into offshore wind turbine design (e.g., acoustic monitoring on turbine platforms and tracking instrumentation) to help reveal spatiotemporal dynamics of seabird, marine mammal, and other species' occurrence in or near Morro Bay 399, particularly for species of conservation concern and those that have higher collision and/or displacement risks.

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[295] 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.

[296] 4Hz to 20kHz should cover identification of most species found within Morro Bay 399 - from blue whales to harbor porpoises.

[297] Žydelis et al. (2019), "Comparison of Digital Video Surveys with Visual Aerial Surveys for Bird Monitoring at Sea."

[298] Gray et al. (2018), "A Convolutional Neural Network for Detecting Sea Turtles in Drone Imagery."

[299] Žydelis et al. (2019), "Comparison of Digital Video Surveys with Visual Aerial Surveys for Bird Monitoring at Sea."

- Place anchors and mooring cables in areas of relatively lower ecological importance and avoid setting anchors during important ecological events such as fish spawning.
- Site assessment and construction activities should occur during periods of relatively lower ecological importance.
- Use acoustic dampening devices/techniques on turbines and offshore wind support vessels to minimize noise.[300]
- 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-damping technologies to reduce turbine movement and subsequent sea bottom scour.
- Use ecologically "friendly" biocides for the antifouling of structures.
- Use lower risk mooring systems, such as tension-leg configurations, or catenary with chain and/or polyester configurations instead of nylon.[301] Consider the use of risk assessments similar to those described in Benjamins et al. (2014) 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 could be considered as a means of reducing entanglement. (For example, sea turtles respond to varying UV wavelengths.)

Operations

- Curtail operations during ecologically important times (e.g. migrations, foraging, etc.).
- Near real-time dynamic management tools such as Whale Alert,[302] WhaleWatch,[303] CDFW RAMP aerial surveys, and EcoCast,[304] or the development of other dynamic management tools,[305] can be used to determine when whales and turtles are or are likely to be present.
- All offshore wind-associated vessels should be required to travel at 10 knots or less at all times during all stages of project development.
- Conduct frequent and regular surveys of mooring lines and inter-array cables for derelict fishing gear or marine debris, noting that the potential for ensnarement of these materials around offshore wind structures will increase if biofouling increases over time. The frequency and type of monitoring, and how derelict gear would be removed should be included in all environmental assessments.
- Control and communications of any underwater autonomous and remotely controlled equipment shall be short-range UHF (>120kHz) acoustical signals, or light-activated modems to prevent noise pollution in the hearing range of odontocetes.
- Wireless tension monitors could be used to alert offshore wind project operators to the presence of a potentially entangled animal.[306] Wireless video could potentially be used in conjunction with tension monitoring to ground truth potential entanglements remotely. Divers, ROVs or wire-

[300] Robertis and Handegard, Fish avoidance of research vessels and the efficacy of noise-reduced vessels: a review, ICES J. of Mar. Sci. 2013.

[301] Benjamins et al. (2014).

[302] 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.

[303] Hazen et al. (2016).

[304] 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.

[305] 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.

[306] Personal communication, Caroline Carter, Scottish Natural Heritage

walker-type apparatus could subsequently be employed to remove any detected fishing gear or marine debris.

- A reporting structure should be in place to report entanglement of marine species in mooring lines and associated gears.

The following recommendations pertain to specific taxa and do not include the full range of taxa for which monitoring and mitigation requirements should apply.

MONITORING AND MITIGATION MEASURES: Fish and benthic habitat

Local scouring would be increased with certain anchor and mooring combinations that allow dragging of chain along the bottom. The benthic footprint and level of impact will depend entirely on the type of system selected and the exact location of deployment. There are a variety 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) that could be used.[307] The impacts during construction vary among platforms, moorings and anchoring. A taut-leg mooring system coupled with suction pile anchors would have the smallest benthic footprint and should be assessed to determine if this combination is appropriate for the conditions in Morro Bay 399.

For benthic habitat, it is critical that comprehensive pre-installation and ongoing-monitoring are implemented to assess the individual species present and the biophysical processes. (Biophysical processes encompass abiotic and biotic conditions which include the chemical, biological, physical, and ecological components present.) Traditional oceanographic sampling of the water column including instrumentation to sample water movement and chemical components (e.g. NO_2, NO_3, CO_2, P), coupled in space and time with benthic sampling, including biological sampling, will be needed to accurately assess ecosystem conditions pre- and post-installation.

Water column 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.

MONITORING AND MITIGATION MEASURES: Birds and bats

We expect BOEM to deploy two different types of tools to assess potential impacts from offshore wind development within Morro Bay 399: 1) those which predict risk to avian species from collision and displacement, and 2) those which measure realized impacts to birds from collision and displacement within Morro Bay 399 during construction and operation. We highlight here some of the key monitoring and mitigation needs, but also urge BOEM to:

1. Follow guidance previously provided to the agency (including by many of the groups signing this letter), all of which are relevant for leasing across U.S. marine environments, including guidance provided by the Atlantic Marine Bird Cooperative,[308] NYSERDA's E-TWG,[309] and a coalition of

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307 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.

308 Available at https://atlanticmarinebirds.org/recommendations-on-boem-avian-survey-guidelines-ambc-marine-spatial-planning-working-group/

309 Aonghais Cook, Kate Williams, Edward Jenkins, Julia Gulka, Jillian Liner. 2021. Bird Workgroup Report for State of the Science Workshop on Wildlife and Offshore Wind Energy 2020: Cumulative Impacts. Report to the New York State Energy Research and Development Authority (NYSERDA). Albany, NY. Available from https://www.nyetwg.com/2020-workgroups (accessed September 15, 2021).

environmental non-profits (avian considerations recommendations provided to BOEM on October 23, 2020).[310]

2. Engage experts, like the Pacific Seabird Group, in developing a monitoring and mitigation framework to adequately address potential impacts to seabirds along the CCE.

As stated in the main body of this letter, BOEM is currently engaged in two studies which are meant to inform decision-making regarding leasing within the CCE. It is imperative that BOEM use the results of these studies, among others, in its decisions regarding Morro Bay 399 and any future developments in the CCE.

General

We suggest that BOEM clearly outline monitoring requirements and coordinate with other stakeholders, including future project developers, state agencies, and regional science entities, to support the development of a regional monitoring plan for birds and other wildlife.

Monitoring for adverse effects requires multiple modes of evaluation in a coordinated framework pre- and post-construction. Radar, vessel and aerial surveys, acoustic monitoring, and telemetry are all complimentary tools that provide data necessary for evaluating impacts, though none of these tools provides the full picture when used alone.

Scope

BOEM's collision and displacement risk analyses should include information of avian distribution and occurrence for all species that occur within a 20 km radius of the area under consideration for development and that trigger conservation obligations.[311]

Annual and seasonal variations in avian movement are also not well captured during a limited survey period. Surveys should be repeated frequently enough to cover within and between seasonal and annual variation in avian distribution, so that changes in distribution caused by offshore wind development can be discerned from other sources.

Migration events are relatively infrequent and therefore survey efforts like PacSEA[312] and PacMAPPS[313] are not appropriate for characterizing collision risk to land bird migrants. In general, understanding collision risk will require a combination of radar, telemetry, survey, and acoustic monitoring, and should not be based on a single technology alone. Studies to document and characterize land bird migration patterns should prioritize satellite telemetry, paired with altimeters/pressure sensors, for larger bodied birds, as this is the best method for gathering fine scale movement data and flight altitude.[314]

Monitoring - telemetry

BOEM must consider a full picture of migratory pathways for land birds and seabirds. This could be realized with the addition of satellite tracking information from Movebank and the National Aeronautics

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310 Available at https://drive.google.com/file/d/1qAY23mGxDLLKyEr9x6wJ_cSv6AOBiPQG/view?usp=sharing

311 See bird species of conservation concern in Section II.

312 https://pubs.er.usgs.gov/publication/70100431

313 https://www.fisheries.noaa.gov/west-coast/science-data/pacmapps-pacific-marine-assessment-program-protected-species

314 Péron G, Calabrese JM, Duriez O, Fleming CH, García-Jiménez R, Johnston A, Lambertucci SA, Safi K, Shepard ELC. 2020. The challenges of estimating the distribution of flight heights from telemetry or altimetry data. Animal Biotelemetry 8:5; Thaxter CB, Ross-Smith VH, Cook SCP. (n.d.). How high do birds fly? A review of current datasets and an appraisal of current methodologies for collecting flight height data: Literature review:66.

and Space Administration's Icarus project for larger bodied shorebirds, additional research and tagging of priority bird species using radio and satellite telemetry technology as appropriate, and an expansion of the radio telemetry receiver network in the offshore environment. BOEM should use the data currently available to calculate the risk to these migratory birds, especially in regard to modern turbine height, and provide for tracking focal species of these migratory birds during the life of projects within Morro Bay 399 and over all the cumulative projects in the Pacific OCS.

When incorporating radio telemetry methods, receiving stations need to be installed in the offshore environment in such a way that avian movement in and around the wind energy development areas can be adequately assessed prior to and following construction. BOEM must follow the monitoring protocols for automated radio telemetry that the agency is currently developing in partnership with USFWS and the Regional Wildlife Science Entity.[315] We applaud this interagency effort to develop robust, scientifically sound monitoring protocols and to test the feasibility of floating receiving stations. Metocean buoys, outfitted with telemetry, acoustic, and marine radar technology, should be deployed in wind energy areas prior to leasing, so that baseline data can be collected and paired with post-construction data to evaluate observed impacts from future projects' development and operation. BOEM needs to provide financial support for these efforts to further this technology, adopt these methods into regional monitoring protocols for offshore wind development, and ensure the success of this technology moving forward. It is important to note that the very-high frequency transmitters widely deployed along the coast have a limited lifespan. New solar-powered ultra-high frequency transmitters, which include on-board battery support for transmitting at night, should be the future focus for incorporating this technology.

It is important to note that acoustic monitoring is especially inappropriate on its own to characterize the community of land bird migrants within wind energy areas. Evidence indicates that Empidonax flycatchers and vireos, two of the most abundant nocturnal migrant groups, do not emit nocturnal flight calls and therefore would not be accounted for using acoustic monitoring. Additionally, acoustic monitoring does not adequately assess flux, a necessary value for assessing collision risk and estimating population-level impacts.

Collision - detection

BOEM should outline requirements for the implementation of collision detection and minimization measures during the operation of potential projects within Morro Bay 399 and other planning areas. Under the ESA and MBTA, developers are responsible for any take of migratory birds and ESA-listed species. However, without appropriate monitoring for collision detection, large collision events could have serious population-level impacts to migratory land birds and seabirds without recourse. This is not an acceptable outcome, and BOEM must have a plan to address this concern.

Post-construction fatality monitoring onshore is a key component of Tier 4 of the FWS Land-Based Wind Energy Guidelines.[316] Many wind projects onshore conduct post-construction monitoring, especially on public lands managed by the Department of Interior's Bureau of Land Management. Developers survey for carcasses around a radius from the turbines, under an a priori protocol, to determine avian mortality rates. The data are adjusted for searcher efficiency, carcass persistence, and other sources of bias.

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[315] Stakeholder Workshop: Scientific Research Framework to Understand the Effects of Offshore Wind Energy Development on Birds and Bats in the Eastern United States. (n.d.).:86.

[316] U.S. Fish and Wildlife Service. 2012. U.S. Fish and Wildlife Service land-based wind energy guidelines. OMB Control No, 10180148. U.S. Department of Interior, Fish and Wildlife Service, Hadley, MA. Available from https://www.fws.gov/ecologicalservices/es-library/pdfs/WEG_final.pdf.

This practice is entirely impractical at sea. However, that does not relieve BOEM from requiring post-construction fatality monitoring—an obligation that the onshore wind industry has committed to and is required to fulfill. In previous NEPA documents for Atlantic offshore wind development, BOEM has suggested that mortality monitoring rely on carcass monitoring around the base of the offshore wind turbines. This is contrary to the standard protocol for post-construction monitoring at onshore wind projects, where a radius from the turbine is prescribed as the search area and includes where birds may be propelled or thrown from the actual turbine structure and blades after collision. The offshore structures anticipated to be installed have very little available structure on which a dead or injured bird could land. Defining the structure as a search area, if it means the turbine base or nacelle (since no injured or dead birds could be found on the blades), is woefully inadequate. Only updated technology will detect bird strikes or mortalities in the appropriate range established by onshore post-construction mortality studies.

There is ongoing, rapid development of imaging and bird strike technologies used in the European Union and the United Kingdom, and technologies are also being developed in the United States.[317] DOE has recently funded development of collision detection technology from the Albertani Lab[318] at Oregon State University and WT Bird from WEST, Inc.[319] Similar technologies are being tested at Block Island Wind Project and other offshore locations in the European Union and United Kingdom and are making rapid gains in being effective, officially verified, commercially available, and affordable at scale in the near future, possibly prior to any construction and operation within Morro Bay 399.[320] However, these technologies must be fully integrated into turbine design before they can be deployed. DOE is currently evaluating the development status of these integrated systems based on their readiness for offshore wind deployment.[321] BOEM should support the development of these technologies and must drive turbine developers to integrate these systems into their turbine designs. BOEM must require this type of collision monitoring and work with the industry to support the development of these technologies to make deploying them a reality.

The incorporation of these new monitoring technologies, and hopefully a standardized technology, should be a required element in the post-construction monitoring plan for projects built within Morro Bay 399. BOEM should standardize the methodology for using these new technologies across all projects in the Pacific OCS to incorporate mortality data, and possibly displacement data, into ongoing cumulative effects analyses and adaptive management strategies, to validate collision risk models, and to measure impacts on ESA-listed species and other species of conservation obligation by augmenting tracking data with data from on-site detection technology.

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[317] Grant funding from the Department of Energy (DOE) Office of Energy Efficiency and Renewable Energy, state energy agencies, and others supports technical and economic advancement of offshore and onshore wind. The DOE Wind Energy Technologies Office invests in energy science research and development activities that enable the innovations needed to advance wind systems, reduce the cost of electricity, and accelerate the deployment of wind power.

[318] Clocker K, Hu C, Roadman J, Albertani R, Johnston ML. 2021. Autonomous Sensor System for Wind Turbine Blade Collision Detection. IEEE Sensors Journal:1–1.

[319] Verhoef JP, Eecen PJ, Nijdam RJ, Korterink H, Scholtens HH. 2003. WT-Bird A Low-Cost Solution for Detecting Bird Collisions:46.

[320] Dirksen S. 2017. Review of methods and techniques for field validation of collision rates and avoidance amongst birds and bats at offshore wind turbines. Sjoerd Dirksen Ecology.

[321] Brown-Saracino J. 2018. State of the Science: Technologies and Approaches for Monitoring Bird and Bat Collisions Offshore. Available at https://www.briloon.org/uploads/BRI_Documents/Wildlife_and_Renewable_Energy/NYSERDA_workshop_JocelynBrown-Saracino.pdf.

Collision - mitigation

We expect that offshore wind in California will incorporate a variety of technologies to minimize collision risks and measure collision impacts to birds, including aircraft detection lighting systems (ADLS), smart curtailment, deterrent technology, and collision detection.[322]

At a basic level, we expect BOEM to require that developers use Federal Aviation Administration-compliant ADLS on turbines to diminish attraction effects for nocturnal migrants in the marine environment. This technology is well developed and has been adopted across land-based wind facilities.[323] This has been a standard mitigation strategy identified in BOEM's environmental impact statements for offshore wind facilities in the Atlantic to date. We commend this step by BOEM, and look forward to seeing mitigation strategies grow and evolve as technology allows.

While we acknowledge that blanket seasonal curtailment strategies are likely untenable for an economically viable and successful offshore wind industry, reasonably tailored, smart curtailment strategies will likely be necessary for responsibly operated offshore wind in the CCE. Developments in radar science make it easier to predict migration timing and various research into the timing and environmental cues driving migration dynamics across the CCE make it possible to predict specific periods when collision risk might be highest. Developments in collision detection technology will also likely provide a mechanism for smart curtailment based on the proximity of individual birds to the turbines. This type of automated curtailment system has resulted in significant decreases in collision mortality events within land-based wind farms where it has been deployed.[324]

Collision risk models

While limited, CRMs are one of the only tools available to hypothesize potential impacts to birds from collision in the offshore environment. As such, CRMs provide a mechanism for testing outcomes (e.g., observed collision rates) against the model predictions (e.g., expected collision rates), and BOEM must ensure the necessary data is collected to test these hypotheses.

BOEM's permitting decisions should be based, in part, on a CRM-driven analysis for all species of conservation obligation which may occur within 20 km of the project footprints and for which a current CRM would be appropriate, even if the species has not been documented within the footprint of the Project. This should include a recent stochastic derivation of the Band model, such as the McGregor (2018) version.[325]

BOEM must be transparent in its CRM application. These models are extremely sensitive to the input parameters. A study by Cook et al. (2014) found that estimations of avoidance and collision risk from Band models were highly sensitive to the flux rate (total number of birds passing through the wind farm), corpse detection rate, rotor speed, and bird speed. Factors such as weather (i.e., wind speed and visibility) and habitat use would also affect the accuracy of these estimates, as such factors would greatly influence avian flight patterns and behavior.[326] BOEM's analysis must provide the inputs used in

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322 Cook ASCP et al. 2011. Identifying a range of options to prevent or reduce avian collision with offshore wind farms using a UK-based case study. BTO Research Report No. 580. British Trust for Ornithology, The Nunnery, Thetford, Norfolk.

323 https://detect-inc.com/aircraft-detection-lighting-systems/.

324 McClure CJW, Rolek BW, Dunn L, McCabe JD, Martinson L, Katzner T. 2021. Eagle fatalities are reduced by automated curtailment of wind turbines. Journal of Applied Ecology 58:446–452.

325 R.M. McGregor et al., A Stochastic Collision Risk Model for Seabirds in Flight, MARINE SCOTLAND (Apr. 6, 2018), https://tethys.pnnl.gov/sites/default/files/publications/McGregor-2018-Stochastic.pdf.

326 Aonghais S.C.P. Cook et al., The avoidance rates of collision between birds and offshore turbines, SCOTTISH MARINE & FRESHWATER SCI. (Jan. 2014).

order to best inform public comment and create a transparent decision process. Providing CRM results without transparency to the inputs and analytical process would never be acceptable from a scientific perspective and, therefore, would not be acceptable from BOEM. Providing inputs would show whether BOEM followed the guidance provided by Band in assessing collision risk. These details regarding inputs should include, but not be limited to, avoidance behavior, flight height, flight activity, flux rate, corpse detection rate, rotor speed, bird speed, and collision risk, as well as seasonal and daily conditions that might influence avian flight height.[327]

The current efforts underway at the Shatz Energy Research Center to develop a 3-D CRM for pelagic seabirds in the CCE could help inform these conditional flight heights.[328] This new derivation of the Band model should be applied, once available, in BOEM's assessments of avian impacts for future offshore wind developments, as they will be better able to incorporate variation in input parameters.

Moreover, CRMs provide a starting point, not an end point, from which to predict cumulative, population-level impacts across wind farms in the OCS. Collision risk models are not found to be reliable in predicting mortality:

> Siting and permitting decisions for many European offshore wind facilities are informed by collision risk models, which have been created to predict the number of avian collisions for offshore wind energy facilities. However, these models are highly sensitive to uncertainties in input data. The few empirical studies at land- based wind facilities that have compared model-estimated collision risk to actual mortality rates found only a weak relationship between the two, and due to logistical difficulties, the accuracy of these models has not been evaluated in the offshore environment.[329]

BOEM should pursue studies to not only verify CRM utility in the offshore environment, but must also move toward viable collision detection requirements for leases within Morro Bay 399 and any future offshore wind developments.

Compensatory mitigation

Given the importance of the CCE as a biodiversity hotspot and invaluable habitat for seabirds, BOEM should consider a mitigation framework which incorporates advanced conservation measures that appropriately compensate for the loss of adult seabirds. Given the life history of seabirds, as discussed above, these populations are highly sensitive to the loss of adults, and even non-breeding subadults. Supporting greater chick and egg survival will not necessarily compensate for decreases in adult survival.[330] Therefore, it is imperative that BOEM consult with experts like the Pacific Seabird Group to develop conservation strategies that will compensate for any potential population-level impacts to avian species within the CCE. Such strategies may include, but are not limited to, nesting colony restoration and management, removal of invasive species, forage fish restoration and management, marine debris mitigation, or other strategies which will soften potential population-level impacts from offshore wind.

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[327] Bill Band, Using a collision risk model to assess bird collision risks for offshore windfarms, STRATEGIC ORNITHOLOGICAL SUPPORT SERV. (Mar. 1, 2012).

[328] Shatz Energy Rsch. Ctr., Seabird Distribution in 3D: Assessing Risk from Offshore Wind Energy Generation, HUMBOLDT ST. UNIV. (Apr. 16, 2020), https://schatzcenter.org/2020/04/seabird3dstudy/.

[329] Taber D. Allison et al., Impacts to wildlife of wind energy siting and operation in the United States, ISSUES IN ECOLOGY (2019).

[330] Felton SK, Hostetter NJ, Pollock KH, Simons TR. 2017. Managing American Oystercatcher (Haematopus palliatus) population growth by targeting nesting season vital rates. Waterbirds 40:44–54.

Both direct and indirect impacts can have population-level consequences, as discussed above, and therefore should both be considered in developing compensatory conservation measures.

Until BOEM can effectively document the level of take from collision, displacement, barrier effects, and secondary entanglement, BOEM should take a conservative approach and require conservation strategies that compensate for highest estimates of loss.

Bats

Surveys of bat activity in Morro Bay 399 prior to turbine installation may not accurately predict bat fatalities from eventual turbine operation—at land-based wind facilities, pre-construction bat activity surveys are poorly correlated with post-construction fatalities.[331] Because of this discrepancy, the commitment to post-construction monitoring is critical to yielding a better understanding about how bats interact with offshore wind turbines. An important component to this will be tagging individual bats (at a programmatic level), such as through Motus, requiring receiving towers in future lease areas, and requiring installation of acoustic detectors, preferably at nacelle height.

Data on bat activity and calls within the rotor-swept zone of offshore wind turbines would allow better understanding of which bat species are at risk and during what environmental conditions, which could inform mitigation measures. Bat activity offshore in the Atlantic seems to be predominantly restricted to warm, slow wind speed nights during migration periods.[332] If the same holds true for bat activity in the Pacific and if monitoring efforts indicate that bat minimization measures are needed, minimization strategies, such as targeted curtailment (if shown to be effective in the offshore environment), could be restricted to these highest risk times.

In addition to operational curtailment, it is possible that deterrent technologies to prevent bats from approaching wind turbines could be useful in minimizing bat fatalities offshore. Deterrent technologies are being developed for land-based turbines, including turbine coatings (to counteract any attraction to smooth surfaces which might be perceived as water),[333] ultraviolet lighting (which many bat species can see),[334] and ultrasonic noise emitters (to possibly 'jam' bats' radars and make wind facilities unappealing to bats).[335] One of the ultrasonic deterrent technologies, NRG Systems, has been commercially deployed at land-based wind facilities.[336] None of these technologies have been assessed yet in the offshore

[331] Solick, D., Pham, D., Nasman, K., Bay, K. (2020). Bat Activity Rates do not Predict Bat Fatality Rates at Wind Energy Facilities. Acta Chiroptera, 22(1); Hein, C. D., Gruver, J., & Arnett, E. B. (2013). Relating pre-construction bat activity and post-construction bat fatality to predict risk at wind energy facilities: a synthesis. A report submitted to the National Renewable Energy Laboratory. https://tethys.pnnl.gov/sites/default/files/publications/Pre- Post-construction Synthesis_FINAL REPORT.pdf.

[332] Revolution Wind Construction and Operations Plan, Appendix AA, 2.3.1, p. 27; Peterson et al. (2016). In their study, the majority of bat activity in the Gulf of Maine and the Mid-Atlantic occurred below 10 m/s average nightly wind speed and above ~7°C.

[333] Texturizing Wind Turbine Towers to Reduce Bat Mortality DE-EE0007033, https://www.energy.gov/sites/prod/files/2019/05/f63/TCU%20-%20M17%20-%20Hale-Bennett.pdf (last visited Feb. 20, 2021).

[334] NREL Wind Research, Technology Development and Innovation Research Projects https://www.nrel.gov/wind/technology-development-innovation-projects.html (last visited Feb. 20, 2021)

[335] https://www.osti.gov/biblio/1484770; Weaver, S. P., Hein, C. D., Simpson, T. R., Evans, J. W., & Castro-Arellano, I. (2020). Ultrasonic acoustic deterrents significantly reduce bat fatalities at wind turbines. Global Ecology and Conservation, e01099. https://doi.org/10.1016/j.gecco.2020.e01099; Arnett, E. B., Hein, C. D., Schirmacher, M. R., Huso, M. M. P., & Szewczak, J. M. (2013). Evaluating the Effectiveness of an Ultrasonic Acoustic Deterrent for Reducing Bat Fatalities at Wind Turbines. PLoS ONE, 8(6), e65794. https://doi.org/10.1371/journal.pone.0065794.

[336] https://news.duke-energy.com/releases/duke-energy-renewables-to-use-new-technology-to-help-protect-bats-at-its-wind-sites

environment nor on turbines with such large swept areas, which may present a challenge for effective deterrent use offshore. Determining whether these technologies can be modified for use offshore and testing their efficacy at deterring bats in the offshore environment will be critical should monitoring data reveal that mitigation for bat impacts is necessary.

Appendix B – Distributional Prediction Data for HMS of Commercial Interest in the CCE

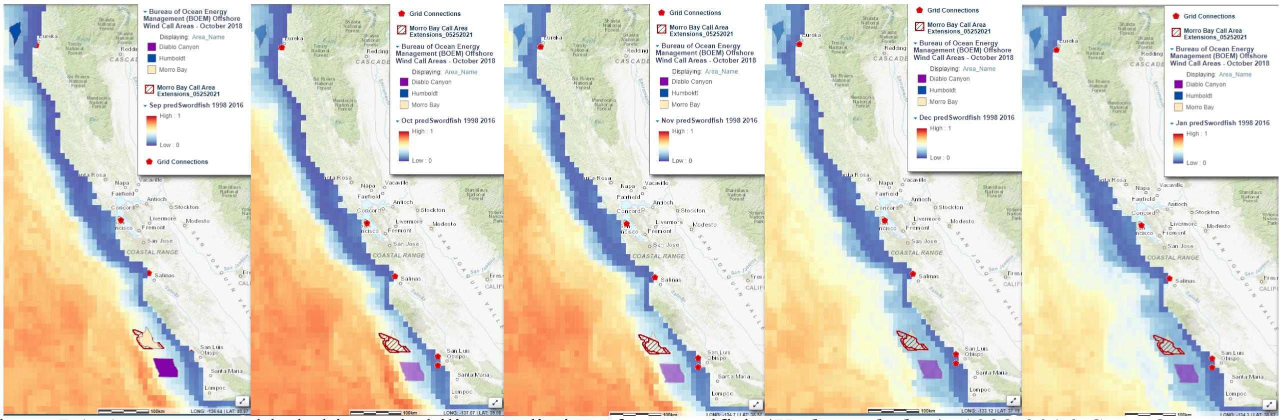

Figure B1. Average monthly habitat suitability predictions for swordfish (*Xiphias gladius*), 1998-2016. Sept, Oct, Nov, Dec, Jan. DataBasin.

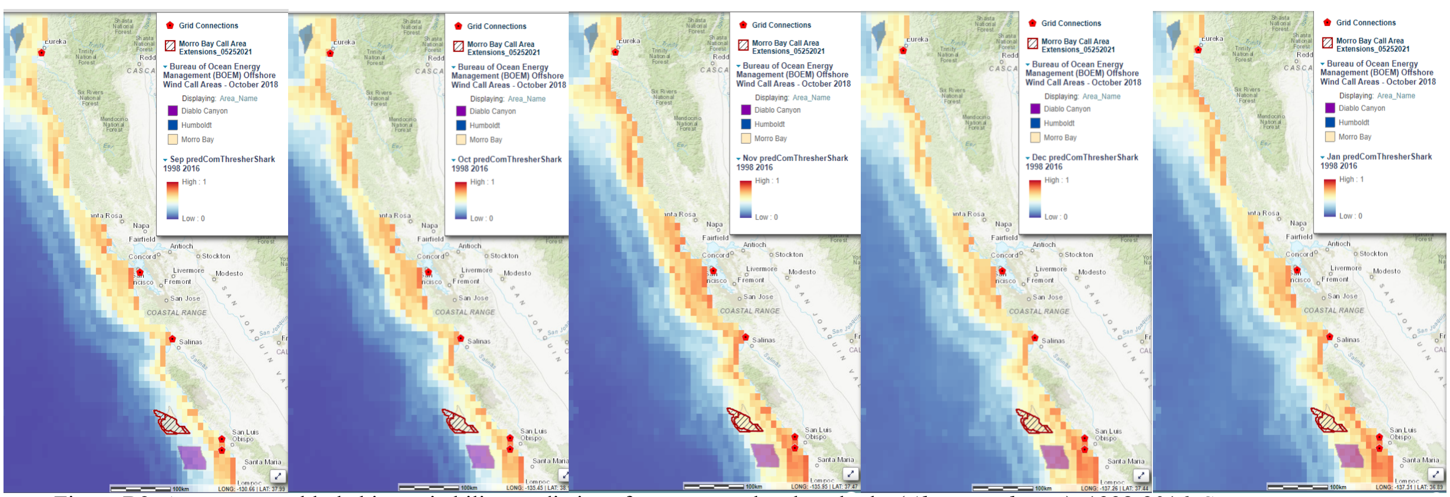

Figure B2. Average monthly habitat suitability predictions for common thresher sharks (*Alopias vulpinus*), 1998-2016. Sept, Oct, Nov, Dec, Jan. DataBasin.

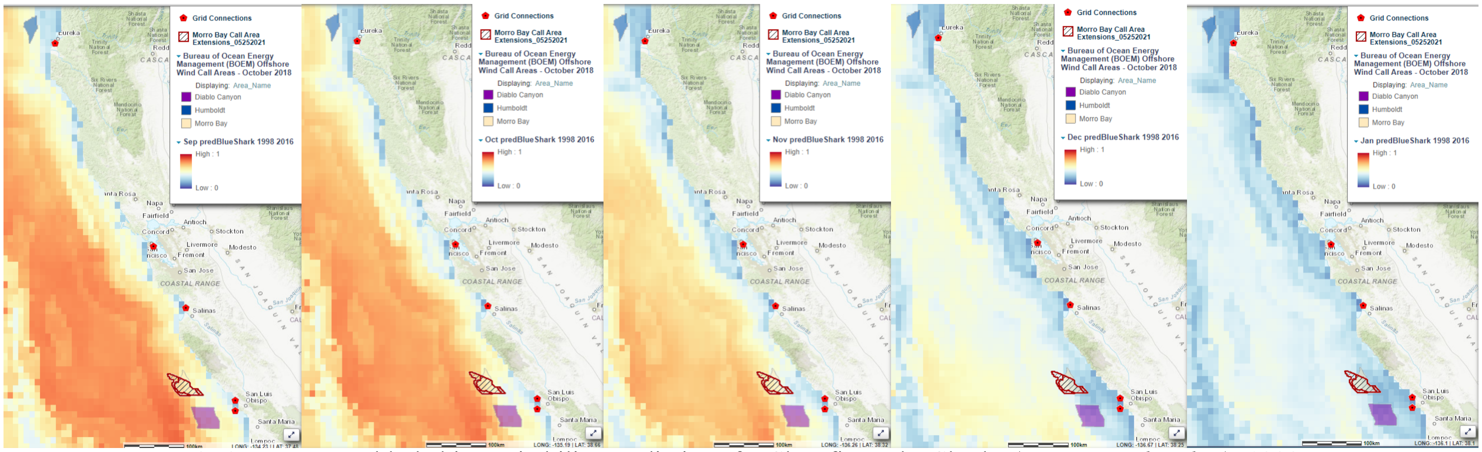

Figure B3. Average monthly habitat suitability predictions for Shortfin Mako Sharks (*Isurus oxyrhinchus*), 1998-2016. Sept, Oct, Nov, Dec, Jan. DataBasin.

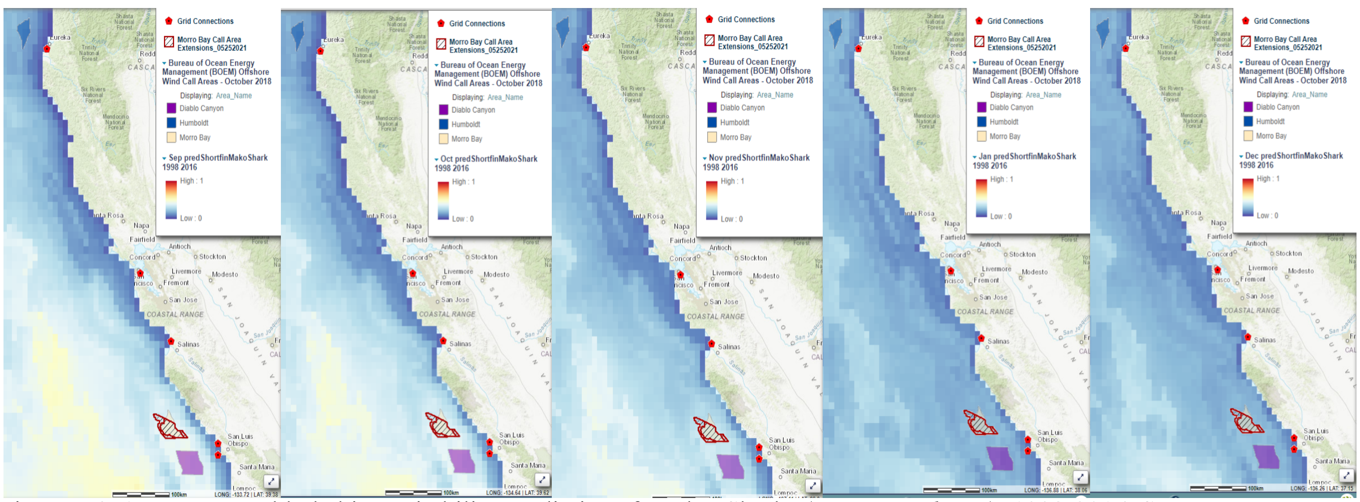

Figure B4. Average monthly habitat suitability predictions for Blue Sharks (*Prionace glauca*), 1998-2016. Sept, Oct, Nov, Dec, Jan. DataBasin.