DOCKETED	
Docket Number:	17-MISC-01
Project Title:	California Offshore Renewable Energy
TN #:	238496
Document Title:	Ocean Conservation Research Comments - OCR Recommendations for biological baselining and acoustical monitioring of the Morro Bay offshore wind development
Description:	N/A
Filer:	System
Organization:	Ocean Conservation Research
Submitter Role:	Public
Submission Date:	6/25/2021 2:20:38 PM
Docketed Date:	6/25/2021

Comment Received From: Ocean Conservation Research
Submitted On: 6/25/2021
Docket Number: 17-MISC-01

OCR Recommendations for biological baselining and acoustical monitioring of the Morro Bay offshore wind development

Comments attached

Additional submitted attachment is included below.

OCEAN CONSERVATION RESEARCH

Science and technology serving the sea

6/24/2021

Commissioner Karen Douglas
California Energy Commission
1516 Ninth St.
Sacramento, CA 95814

Re: Docket #: 17-MISC-01: California Offshore Renewable Energy

Dear Commissioner Douglas,

We appreciate this opportunity to express our concerns, and provide comments and recommendations on the process of siting, deploying, and operating offshore wind power equipment. As an organization that has focused much of our legacy efforts on mitigating damages done by the fossil fuel industry, we could not be more pleased at how rapidly our state has pivoted to offshore wind energy. It was just four years ago that the previous federal administration was proposing offshore leasing for oil and gas extraction off our coast – an effort that now appears to be fading in our rear-view mirror.

But pivoting from one colossal energy source to another will not be as simple as removing the pipelines and replacing them with power cables; we are talking about transforming large swaths of our Outer Continental Shelf marine habitat with a technology that has many unanswered questions in terms of how marine life across all taxa will be impacted.

Our particular focus is on marine bioacoustics, and how marine life is impacted by anthropogenic noise sources, so our comments will orbit around that. And given that the ocean is as much an acoustic environment as our terrestrial habitat is visual, there will be much to comment on.

All activities associated with offshore wind, from siting, to installation, to operation will be accompanied by noise. So the launch of the first survey vessel will initiate a cascading effect on the natural soundscape of the subject area. For this reason, it would be wise to immediately begin monitoring the area soundscapes. This would give us a temporal/spatial understanding of the density and activity of marine life in the area across all sound-making taxa – from marine arthropods, to fish, to marine mammals.

These passive acoustical surveys need to be broad-band, recording between 4 Hz to 100kHz to capture all acoustical niches anticipated in the area – from blue whales to harbor porpoises. They will also capture anthropogenic noise sources including vessel traffic and surveying equipment; from impulse signals used for geological characterization, to scanning sonars used for seafloor profiling. Additionally, they will provide acoustical data that would reveal interactions between marine life and the anthropogenic noise sources to which they are being they are subjected.

While there is already considerable anthropogenic noise in the sea due to shipping traffic,[1] robust baselining of the proposed windfarm areas would reveal the acoustical changes to the habitat as a consequence of the development, deployment, and operation of the turbines, and the associated ongoing support and maintenance of the equipment.

These soundscape recordings should also accompany health and fitness monitoring of area animals across all taxa. These studies will, out of necessity, involve reviewing what historical data that exists. Unfortunately, given all of the anthropogenic stressors – from climate catastrophe, industrial and agricultural chemicals, noise, over-harvesting, etc. there are so many other covariates that are causing or influencing ongoing environmental compromise, such as the current kelp die-off all along the California coast,[2] and the "Unusual Mortality Event" (UME) of Eastern Pacific gray whales,[3] the "baseline" is already cluttered with ambiguities.

The rationale behind examining health and fitness across all taxa is that there is so much interdependence of life in these large areas, that only an ecosystem-based approach will give us some clarity on the impacts of transforming so much of it. For example, it is well known in the bioacoustics field that chronic shipping noise elevates stress in mysticetes,[4] it is less known that chronic noise is also a stress factor for bivalves[5] and arthropods[6]. In a study by Solan et. al (2016),[7] it was found that chronic shipping and construction noise disrupted the burrowing and bioirrigation activities of the North Sea Langoustine.[8] (Bioirrigation is how much the organism moves water in and out of the sediment by its actions). This is alarming because the langoustine "fluffs up" the sediment of the North

---

[1] Ross, D. 1976. Mechanics of underwater noise (Pergamon Press, New York). Ross predicted that noise from global shipping would increase 2dB per decade, starting in 1964. By the late 1990's his model was confirmed, and named "The Ross prediction." Using that prediction, noise density in the ocean is 12dB – or 20 times louder in 2021 than in 1964. This does not account for regional differences such as the shipping lanes that run adjacent to the Morro Bay call area.

[2] University of California - Santa Cruz. "The collapse of Northern California kelp forests will be hard to reverse." ScienceDaily. ScienceDaily, 5 March 2021.

[3] NOAA Fisheries 2019-2021 Gray Whale Unusual Mortality Event along the West Coast and Alaska. https://www.fisheries.noaa.gov/national/marine-life-distress/2019-2021-gray-whale-unusual-mortality-event-along-west-coast-and

[4] 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

[5] Charifi M, Sow M, Ciret P, Benomar S, Massabuau J-C (2017) The sense of hearing in the Pacific oyster, *Magallana gigas*. PLoS ONE 12(10): e0185353. https://doi.org/10.1371/journal.pone.0185353

[6] Pine MK, Jeffs AG, Radford CA (2012) Turbine Sound May Influence the Metamorphosis Behavior of Estuarine Crab *Megalopae*. PLoS ONE 7(12):
e51790. doi:10.1371/journal.pone.0051790

[7] Solan, M., Hauton, C., Godbold, J. et al. Anthropogenic sources of underwater sound can modify how sediment-dwelling invertebrates mediate ecosystem properties. Sci Rep 6, 20540 (2016). https://doi.org/10.1038/srep20540

[8] University of Southampton News, (5 February 2016) Man -made underwater sound may have wider ecosystem effects than previously thought.. https://www.southampton.ac.uk/news/2016/01/underwater-sound-biodiversity-study.page

Sea, providing habitat for burrowing worms, amphipods, crabs, and other marine invertebrates – the foundation of the area's trophic pyramid. Compromising the habitability of this will affect all marine life dependent upon it. Decrease in bioirrigation would also decrease carbon sequestration and nutrient recycling, with the potential consequence of the sediment becoming anoxic.

So in addition to robust acoustical baselining, biological transects of the seafloor should be made to map the various habitats of the area. This would inform site selection in ways that might, for example, steer away from areas where the Eastern Pacific grey whale might feed on amphipods, or where there are large aggregations of demersal fish.

We are fortunate that our deep-water installations will avoid the pile-driving that accompanies shallow water turbine monopile mast installation, which is known to be disruptive and requires expensive installation noise mitigation. So the majority of the noise will be in siting and installation, and then (hopefully to a lesser degree) maintenance. But there will also be chronic operational noise.

Norway's Hywind Tampen floating wind farm is all we have to go on in terms of measuring noise propagation from floating platforms into the sea. The two likely chronic noise sources would be gearbox noise from the turbines, and noises from the propeller blades, which include continuous noise from air turbulence induced by the blades, the pressure pulse as the blades pass the mast, and the roar of the tip vortices. Multiplying this by hundreds of turbines will significantly increase the acoustic energy in the environment.

The gearbox noise can be mitigated by way of acoustical decoupling of the turbine from the mast or platform, or installing direct drive turbines, which are quieter. The propeller noises may be another problem. While there is an approximately 65dB attenuation factor in the transmission of sound into the water across the human auditory band, the low frequency pressure oscillations from the propeller passing the mast would couple better across the air/water boundary, but I have not found any modeling or measurement of this in the literature.

If there is a good air/water coupling in these low frequency pressure oscillations, the question arises as to whether inadvertent synchronization of blade passages would create odd low frequency pulsing in the ocean that may spook or disorient rorquals which communicate or chorus in pulses.[9]

Even while the infrasonic frequencies are below what humans identify as "sound" (by definition), large pressure fluctuations in the realm of 0.2 Hz to 1Hz wind farms has been

[9] Manuel Castellote, Christopher W. Clark, Marc O. Lammers 2012 "Acoustic and behavioral changes by fin whales (*Balaenoptera physalus*) in response to shipping and airgun noise." Biological Conservation 147 (2012) 115–122

attributed to sleep disturbance,[10] induce nausea,[11] depression, anxiety, and headaches in some humans.[12] We do not know what effects this noise might have on various marine animals (which bolsters the argument for robust biological baselines).

Different turbine models and deployment methods will produce different noise profiles. Underwater noise measurements from three different monopile-mounted turbines in Denmark and Sweden confirm this; all had peaks around 20Hz, and between 150Hz and 400Hz which exceeded 120dB re:1µPa,[13] the NMFS regulatory threshold for continuous noise exposure. Unfortunately in these cases the operating bandwidth of the equipment used in this case was 100Hz-100kHz, so the "120dB at 20Hz" measurements would be 18dB higher than expressed in the paper,[14] and the infrasound of the blade and mast would not have been represented in the data due to the low frequency high-pass filter.

Another characterization study of a 3.5MW monopole increased the low frequency data down to 40Hz[15] that revealed significant energy in the low frequency band, appearing to rise as it approached cut-off frequency – suggesting that lower frequency noise might be even louder.

Unfortunately to date, infrasonic characterization of wind turbine noise has only involved terrestrial turbines as it pertains to disturbance of humans,[16] so characterization and measurement of low frequency wind turbine noise and propagation into the water would be an important investigation.

We also know that there will be several turbine deployment strategies – from floating masts to semi-submersible platforms, and that these will be tethered to the seafloor in a number of ways. The various noises of these deployments are also uncharacterized.

So from the above arguments, research is need in the following areas:

- Broadband baseline soundscape recordings across all four seasons.
- Continuous, ongoing broadband soundscape recordings.
- Health and fitness monitoring of marine life across all taxa.

---

[10] Micic, G., Zajamsek, B., Lack, L. *et al.* A Review of the Potential Impacts of Wind Farm Noise on Sleep. *Acoust Aust* **46,** 87–97 (2018). https://doi.org/10.1007/s40857-017-0120-9

[11] Paul D. Schomer, John Erdreich, Pranav K. Pamidighantam, and James H. Boyle (2015) A theory to explain some physiological effects of the infrasonic emissions at some wind farm sites. Journal of the Acoustical Society of America 137, 1356 (2015); doi: 10.1121/1.4913775

[12] Tesarz, M., Kjellberg, A., Landstr€om, U., and Holmberg, K. (1997)."Subjective response patterns related to low-frequency noise," J. Low-Freq. Sound Vib.6(2), 145–149

[13] Jakob Tougaard, Oluf Damsgaard Henriksen, and Lee A. Miller (2009) Underwater noise from three types of offshore wind turbines: Estimation of impact zones for harbor porpoises and harbor seals. J. Acoust. Soc. Am., Vol. 125, No. 6

[14] This is assuming that the low frequency, high-pass filter is 6dB/8va.

[15] Tanja Pangerc, Peter D. Theobald, Lian S. Wang, Stephen P. Robinson, and Paul A. Lepper (2016) Measurement and characterization of radiated underwater sound from a 3.6 MW monopile wind turbine Journal of the Acoustical Society of America 140, 2913 (2016); doi: 10.1121/1.4964824

[16] Seong-Chan Kim and Min Joo Choi (2021) Harmfulness of infrasound and wind turbine noise. Journal of the Acoustical Society of Korea Vol.40, No.1 (2021).

- Area benthic transects and sea bottom sampling identifying biological activity.
- Characterization and quantification of noise emitted from the turbines and propagated into the water from floating platforms.
- Characterization and quantification of underwater noise emitted of the floating turbine deployment systems.

Data and research management

Recently a number of us from the conservation community had a meeting with Doug Haas, Senior District Representative for Congressman Salud Carbajal from California's Central Coast. Representative Carbajal is on the Offshore Wind caucus as his district includes Morro Bay, where the Central Coast wind farms will eventually land their power cables.

Cal Poly San Luis Obispo is in Representative Carbajal's district and are thrilled, of course; as they have marine biology, engineering, and project management departments just ready to expand. But other universities like UCSB, UCSC, and UC Davis biology departments are also expected to put their shoulders behind the research and monitoring efforts. There will also be efforts funded and executed by BOEM, NOAA Fisheries, and the Marine Mammal Commission at the Federal level, as well as efforts funded by the California Ocean Protection Council, and I suspect various contract firms such as Cascadia Research, Marine Applied Research Engineering, and of course our shop.

Given the extent of the biological monitoring, mapping, research, and geophysical characterization, it would be wise to coordinate this with some clearing house for all of the studies to make sure that data gaps are exposed, and efforts aren't duplicated.

BOEM has a California Offshore Energy Gateway[17] to track their efforts. But a more comprehensive relational database actively managed by people who understand ecosystems-based management and can map out the long-term strategies needed to coordinate the research efforts would be more than useful.

All of the efforts and recommendations above will necessarily cost a lot of money and take a lot of work. But as I indicated above, we are migrating from one colossal energy source where conservation and environmental planning was eschewed, to another, where we have the opportunity to do it much better. The lack of environmental; planning in the former case has led us to a place where we are unsure of whether our planet will be inhabitable in 100 years. The rapid pivot to wind could be our "moonshot" to avoid the deepest catastrophes, or another blunder on our bumpy road to extinction.

Sincerely,

Michael Stocker

[17] https://caoffshorewind.databasin.org/