Article title should be less than 15 words, no acronyms

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Put your abstract here. Abstracts are limited to 100 words and should be in a single paragraph. Please avoid the use of personal pronouns or the words “new” and/or “novel” in the abstract.

1. Introduction and first-level headings

Understanding and reporting ambient noise levels is a crucial part of all passive acoustic studies. Ambient noise levels can influence local marine life, sometimes adversely, and introduce bias into density, abundance, or occupancy estimates. Within the context of BOEMs wind energy areas (WEA), there is a concerted effort to understand whether and how ambient noise levels change between the baseline, construction, and operational phases of offshore wind farms and how this may affect different species present in the region. These baseline data are critical to monitor changes in sound levels from anthropogenic sources in space and time as activities related to offshore wind development increase in the WEAs.

Sound pressure levels vary as a function of three-dimensional location as well as time. Vertical placement of sensors will lead to different propagation conditions due to the temperature profile and thermocline, through surface and bottom reflections, and proximity to noise sources. Understanding the spatial extent of noise is a particularly challenging question for PAM studies that rely on a single sensor or sparse array of sensors to monitor large habitat regions. Some of the principal questions needing to be addressed include, are the noise levels measured at a given hydrophone representative of those experienced by the species monitored? How do assumptions about frequency bands and integration periods (e.g. minutes vs. hours) vary over space?

The ADRIFT project uses clusters of drifting buoys to produce snapshots of ambient noise levels and animal presence in wind energy areas that compliment existing longitudinal studies from nearby seafloor hydrophones. With these buoys, we can begin to document spatial variability in soundscapes, validate propagation models, and better understand how well single sensors represent sound within the greater region. The following work highlights some of the preliminary findings of noise representation from the ADRIFT project.

1. Methods
   1. Data Collection

The ADRIFT project seeks to characterize soundscapes and habitat use around a wind lease area approximately 40km offshore of Morro Bay, California, USA. Audio data were collected using custom drifting recording buoys (henceforth drifter). Each drifter includes a pole buoy with an attached GPS, a surface float, subsurface float, depth sensors, a SoundTrap ST640 (Ocean Acoustics, Auckland, New Zealand), a pair HTI hydrophones and an anchor. The recorder and hydrophones were attached to a 100m line below the surface float and terminated at depth with a 30lb anchor to maintain vertical orientation in the water. All drifters also had a dampener plate and a ½” elastic bungee in line with the 100m nylon line to reduce the effect of vertical movement on recording quality.

The SoundTraps were set to record continuously at 384kHz. The drifters were deployed at eight predetermined locations within the wind energy area, in two horizontal lines of 4 with a 5km spacing. Drifters were then retrieved approximately seven days later. Only seven drifters were used for this study.

* 1. Audio Processing

Audio data were downloaded and decompressed after recovery. End-to-end calibration value was estimated as the sum of the soundtrap calibration value and the HTI hydrophone calibration values, both provided by the manufacturer(???).

Soundscape metrics were calculated using Triton Software (Wiggins et al., 2010), audio data were first decimated to 48 kHz and then long-term spectral averages (LTSAs) were calculated with 1 sec and 1 Hz resolution. From these LTSAs, several metrics including broadband and third octave band calculations were made. For the purpose of this analysis, median third octave levels per two-minute bin were used. Only levels from the lowest and highest third octave bands (cetner frequencies, XXX and YYY) were included to show contrast between the two frequency bands.

Polynomial interpolation was used to estimate the GPS receiver position for each 2-minute periods between subsequent pings. In doing so each noise level record was associated with a location

* 1. Spatial and Temporal Cohesion

As a preliminary analysis, spatial cohesion of ambient noise levels were investigated across the 7 drifter array. Here we used correlograms to measure similarity in trend in ambient noise levels. A correlograms show the relationship between each pair of numeric variables of a dataset. Highly correlated noise levels are expected with closely spaced receivers (e.g. recording noise levels in similar areas) and with low frequencies, where the transmission loss is low and soundscape is dominated by distant shipping and or storms.

* 1. Spatial and Temporal Autocorrelation

Noise levels recorded by the drifters are naturally correlated in space and time so care must be taken in the analysis in order to conflate the spatial and temporal effects. This can be achieved in a variety of ways including XXXXXXX. In this case several storms moved through the area during the deployment which resulted in a uniform increase in third octave levels on the scale of hours. This is meaningful in and of itself, but in this study we sought to understand variation in soundscape across the survey area. Thus, the effects of the storm were addressed simply by subtracting the median hourly noise levels from each two-minute observation.

* 1. Spatializing Fields

Following normalization, the fields package in r (cite xxxx) was used to investigate spatial variation in noise levels.

1. Results
   1. Spatial Cohesion

Figure 1 shows the 2-minute median noise level in two third octave bins during an 8-day drift in the Morro Bay WEA. Considerable variation in noise levels were observed in the first few days across both third octave bins with more variation, as expected, in the 20 kHz bin. Interestingly, storms moving through the area during the second half of the deployment raised the baseline noise levels nearly uniformly.

* 1. Second-level heading

1. Discussion

* Shown an approach for spatializing noise
* When used alone, can provide insights into
  + Propagation conditons
  + Spatial soundscape
* Can be combined with other analyses
  + Validate propagation models
  + Combine with windspeed to discriminate between environmental and anthropogenic inputs to the soundscape
  + Include spatialized noise levels in a predictor for habitat use for acoustically sentitive species

1. Tables, figures, and multimedia

This section will cover incorporating tables, figures, and multimedia.

* 1. Tables

Tables should be included within the main document file, where they are initially called out. Number tables using Arabic numerals (1, 2, 3, etc.). Please limit number of tables to three or fewer.

Table 1. A descriptive caption (not a title) should be used above each table.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Column 1 | Column 2 | Column 3 | Column 4 |
| Row 1 | 867 | 5309 | 777 | 9311 |
| Row 2 | 42a | 877 | 376b | 6016 |

a Example first footnote to Table 1.

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When including multimedia to be published inline within the article, the text should refer to these files using the designations Mm. 1, Mm. 2, etc.; this is similar to the convention of referring to figures as Fig. 1, Fig. 2, etc. Captions for each multimedia file are required and should be placed following the first paragraph in which the file is mentioned. The multimedia caption should resemble the following example:

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Equations need to be editable, so if you are using Microsoft Word, we suggest creating them using the built-in Microsoft Equation Editor. If you will be inserting equations into Word from the MathType program, please be sure to check for compatibility: https://docs.wiris.com/en/mathtype/faq.

Display equations should be on separate lines distinct from the text. Equations are numbered consecutively in the text in the order in which they appear; the number designation is in parentheses and on the right side of the page. Equations should be referenced from within the main text as Eq. (1), Eq. (2), Eq. (3), etc., with Equation spelled out in full at the beginning of a sentence. The numbering of the equations is independent of the section in which they appear for the main body of the text.

(1)

(2)

For long equations, the equation number may appear on the next line. For very long equations, the right side of the equation should be broken into approximately equal parts and aligned to the right of the equal sign. The equation number should appear only at the right-hand margin of the last line of the equation.

1. Conclusion

And in conclusion…

Supplementary Material

If authors have supplementary material for publication that would be of interest to the readers of the article, then this can be published with the article. Appropriate items include multimedia, figures, data tables, and text (e.g., appendixes) that are too lengthy or of too limited interest for inclusion in the article.

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The whale watch crew

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Conflict of Interest

A conflict of interest statement is required. If there are no conflicts to report, the authors must state that they have no conflicts to disclose.

Ethics Approval

Any research article containing experiments using animal subjects and/or human participants must adhere to the ASA Ethical Principles (<https://acousticalsociety.org/ethical-principles>) and include a statement that the authors obtained ethics approval. Ethics approval statements must include the institutional and/or licensing committee(s) approving the experiments. For research using human participants, the statement must indicate that informed consent was obtained from all participants or why this was not necessary. For more, see JASA Express Letters Information for Contributors: <https://pubs.aip.org/asa/jel/pages/manuscript>.

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References and Links (NUMERICAL STYLE)

1 A. N. Norris, “Finite-amplitude wave in solids,” in *Nonlinear Acoustics*, edited by M. F. Hamilton and D. T. Blackstock (Academic, San Diego, 1998), Chap. 9.

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5 Any footnotes to text material will be included in the reference list, numbered according to where it is mentioned in the text.

6 P. Luizard, and X. Pelorson, “Threshold of oscillation of a vocal fold replica with unilateral surface growths,” J. Acoust. Soc. Am (published online 2017).

7 E. Fernandez-Grande, “Four decades of near-field acoustic holography,” J. Acoust. Soc. Am., in press (2022).

8 P. Riety, “Retour sur la theorie du thermophone a feuilles d'or” (“Look back on thermo-phone theory”), Cahiers d'Acoustique **70**, 169-201 (1955).

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