To Whom It May Concern,

I am writing as a bat researcher to comment in the open hearing on the topic of land allocation, licensing process and applications for offshore wind energy, and proposals for amendments to the Marine Energy Act and the Marine Energy Act regulations. I urge the Norwegian Ministry of Petroleum and Energy to incorporate bat monitoring and conservation guidelines into the established and future development of offshore wind energy infrastructure. Here, I will focus my comments on the necessity of including bat monitoring and conservation plans in the pre- and post-construction stages of offshore wind energy development. Mitigative strategies are briefly discussed.

In Norway, bats are legally protected as native wildlife (Viltloven 1981). Bats are also afforded further protection through the EUROBATS Agreement (Agreement on the Conservation of Populations of European Bats; https://www.eurobats.org/), which was acceded by Norway in 1993. The EUROBATS Agreement was established under the Convention on the Conservation of Migratory Species of Wild Animals (CMS), otherwise known as the Bonn Convention (https://www.cms.int/). EUROBATS aims to facilitate coordination and direction for the conservation, protection, and research of European bat populations across their range, with a special emphasis on migratory species. Countries, such as Norway, contracted to the EUROBATS Agreement are committed to uphold a minimal standard of bat monitoring and conservation, suited to the unique conditions with each country: 'each Party shall take […] additional action as it considers necessary to safeguard populations of bats which it identifies as being subject to threat and shall report under Article VI on the action taken' (Article III, Fundamental Obligations, point 6, Hutson et al. 2019).

Wind turbines, onshore as well as offshore, are a documented threat to bat populations in Northern Europe (Rydell et al. 2010, Rydell et al. 2017, Gaultier et al. 2020, Lagerveld et al. 2020). EUROBATS has published guidelines for assessing potential impacts of wind turbines on bats and for planning, construction, and operation of wind turbines in accordance with the ecological needs of bat populations (Rodrigues et al. 2015). Res. 8.4 Wind Turbines and Bat Populations and additional resolutions (Hutson et al. 2019) provide updated expectations for how to monitor and assess impacts of wind energy infrastructure on bat populations in Europe. These guidelines include recommendations for how to conduct bat monitoring, assess threats to bat populations and incorporate mitigative measures to those threats in relation to onshore as well as offshore wind turbines.

Migrant bat species are of special concern with relation to wind energy development in Europe (Voigt et al. 2013, Voigt et al. 2015, Gaultier et al. 2020). Ahlen et al. 2009 identified *Nyctalus noctula*, *Pipistrellus nathusii* and *Vespertilio murinus* as being especially high risk to offshore wind turbines in the Baltic Sea. These species are all currently red-listed on the Norwegian National Red List. Leopold et al. 2015 developed a species-specific risk index for bats found in the southern North Sea, which provides further support for the vulnerability of these three species to onshore as well as offshore wind turbines. Lagerveld et al. 2020 emphasized that these species are perhaps the most vulnerable to offshore wind turbines in the North Sea.

Notably, *P. nathusii* may be especially vulnerable to offshore wind turbines situated off the Norwegian coast in the North Sea. This species is almost exclusively observed in Norway along the southern coast in autumn and is a long-distance migrant, with the record for the longest traveled migratory distance of any bat (Alcalde et al. 2021). it is of special interest with regards to offshore and coastal wind facilities due to its well documented propensity to fly over open water and use coastal areas for migration, especially in the North Seas. Losing large numbers of migratory bats such as this has far reaching impacts on bat populations across the range and may have cumulative effects (Arnett et al. 2013, 2016, Voigt et al. 2012, Lehnert et al. 2014).

EUROBATS guidelines on this topic, like many international guidelines, are mostly focused on onshore turbines as it is considerably more challenging to monitor bat activity and fatalities at offshore wind turbines. However, there is a growing consensus that further evidence needs to be collected on best practices for monitoring bats at these sites and to provide more rigorous standards of conducting environmental assessments for bats at offshore wind turbines. These should include pre- as well as post- construction bat monitoring strategies.

I suggest that pre-construction surveys utilize bat acoustic monitoring surveys that may be conducted at sea or on the coast. The objective of such surveys should be to assess what bat species assemblages are using the areas where turbines are intended to be built and to determine if there are bat migratory behavior occurring in these areas during critical periods in the year. These surveys should be situated at geographical features that may serve as migratory landmarks, or headlands, where bats will congregate during stages of migration (Ahlen et al. 2009, Rydell et al. 2014).

Furthermore, pre-construction surveys when followed by post-construction surveys make it possible to assess what impact the site-specific turbines have on the bat community composition in those areas and will inform future developments. Pre-construction acoustic surveys should take place during the spring and autumn, between April and mid-June, then August and mid-October, respectively. Offshore acoustic detectors should be deployed at heights within the rotor sweep zone of wind turbines on existing infrastructure offshore such as on oil rigs or platforms. Coastal surveys, within approximately 30 km of proposed turbine locations, may include ground level bat acoustic detectors or similarly “at height” acoustic detectors deployed on existing infrastructure such as weather masts or meteorological towers. Acoustic detectors may also be deployed on boats, such as at ferries that make regular crosses, to survey transects along the coast.

Offshore post-construction surveys should take place during the same periods of the year, at spring and autumn. Acoustic detectors should be deployed within the rotor sweep zone, on wind turbines directly. Ideally, two microphones oriented in opposite directions should be deployed at each turbine being monitored. Ahlen et al. 2007, Ahlen et al. 2009, Lagerveld et al. 2014, Leopold et al. 2015, Rodrigues et al. 2015, Diffendorfer et al. 2017, Lagerveld et al. 2017, Platteeuw et al. 2017, Lagerveld et al. 2020 all provide examples of different strategies for monitoring bats at active offshore wind turbines. The use of sensor systems used to monitor turbines and detect when injured or dead bats or birds may be falling from colliding with the turbine directly or because of barotrauma are another method that is being explored and refined. The effectiveness of the sensor systems currently being used for monitor bird and bat fatalities at wind turbines are explored and discussed within Lagerveld et al. 2020. Furthermore, Lagerveld et al. 2020 recommends that bat and bird fatality monitoring systems at offshore turbines include a combination of radar, thermal cameras, and acoustic detectors to monitor wildlife interactions at offshore turbines. These tools will likely need special modifications to make them suitable to offshore environmental conditions.

Weather monitoring must be included in pre- as well as post- construction surveys to model how atmospheric conditions relate to bat activity in within specific sites during different periods of the year (Smith and McWilliams 2016).

While there is not a set standard for how to conduct pre- and post-construction bat monitoring at offshore wind turbines, there is a wealth of knowledge available which makes it clear these efforts are worth pursuing, and a legal framework that obligates Norwegian government agencies to uphold bat monitoring and conservation agreements.

Monitoring the threats that turbines have to biodiversity is one part of taking appropriate action to limit unnecessary damage to ecosystem health and productivity, while allowing for necessary energy development. Implementing mitigation measures to compensate unavoidable damages to protected wildlife are also an important part of responsible energy development. I strongly suggest that the building of MOTUS towers (https://motus.org/) along the coast be implemented within the regions where wind turbines are built, especially at offshore facilities, as a mitigative strategy to compensate for bat and bird fatalities at these turbines. These towers can be used to monitor bird as well as bat migration at local and large scales and thus benefit a wide-reaching community of wildlife conservation stake holders.

I appreciate the time and consideration set aside to consider my appeal to include bat conservation in future offshore wind energy development plans in Norway.

Sincerely,

April McKay

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