Harbor Porpoises and Offshore Wind Energy

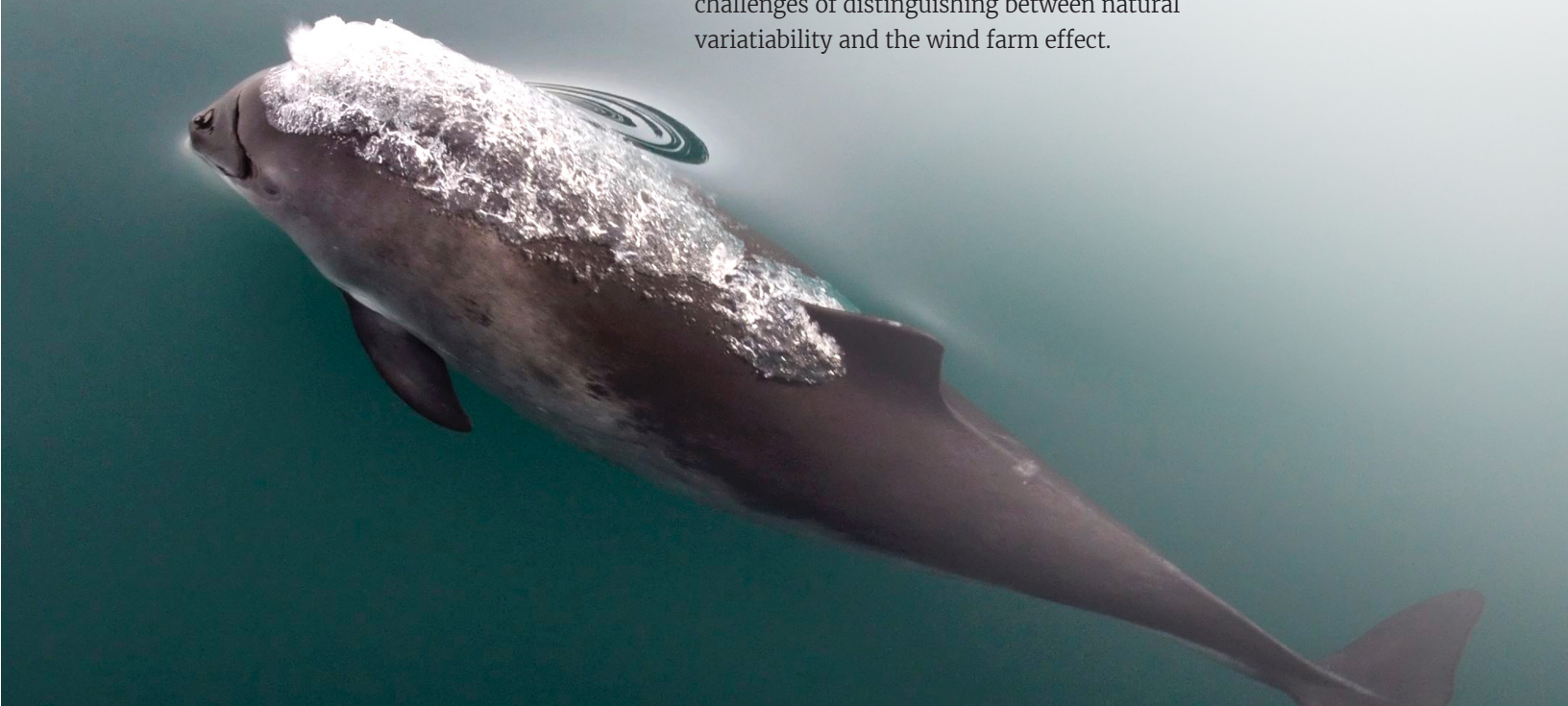
The science associated with understanding and managing the effects of offshore wind energy on Harbor porpoise populations is introduced below.

THE SPECIES

Harbor porpoises (*Phocoena phocoena*) are a small and abundant cetacean species. Found throughout the temperate and subarctic waters of the northern hemisphere, they prefer shallow, coastal waters, and feed near the bottom on small fish, squid, and crustaceans. The population status worldwide is not of concern. Repeat surveys during the last two decades of the relatively coastal North Sea population off Western Europe suggest that this local population is healthy. The status of populations on the east and west coasts of Canada and the United States are largely unknown.

THE MECHANISM OF SPECIES RISK FROM WIND ENERGY

Most concerns about offshore wind energy and Harbor porpoises are associated with construction activities, particularly if pile driving is required to install turbine foundations. These loud impulsive sounds may affect an individual's survival and reproduction with the significance of the effect likely to vary according to the importance of the area (for example, animals may respond differently in important feeding areas than in other areas). These effects on individuals could lead to impacts at the population level. Studies have demonstrated that species abundance typically returns to previous levels soon after pile driving ceases. Some studies have recorded either long-term reductions or increases in abundance once a wind farm has begun operations. However, confidence in all these results is often low owing to the challenges of distinguishing between natural variatiability and the wind farm effect.



Pre-installation surveys conducted for offshore wind development often include geotechnical and geophysical work that can also disturb Harbor porpoises because of the use of impulsive acoustics, but the effects are considered less harmful than pile driving. Noise associated with the operation of offshore wind farms and associated vessel traffic is not known to pose a major threat to Harbor porpoises, although they may be disturbed by vessel movement operations in the short term.

Offshore wind energy development may pose a lower risk to Harbor porpoises than other human activities, such as by-catch in commercial fisheries and shipping-related disturbance.

RISK MONITORING

The evidence used to assess the consequences of pile driving on Harbor porpoise populations comes from many sources, including lab-based controlled exposure experiments. However, most studies have focused on detecting changes in the local abundance and distribution between the periods of pre-construction, construction, and post-construction. Data are gathered using various technologies, including standardised boat-based monitoring, digital aerial surveys, and deployment of arrays of acoustic detection devices that measure abundance and distribution through the detection of Harbor porpoise echolocation clicks.

The noise from pile driving is often measured and compared to the biological hearing thresholds for Harbor porpoises that can cause injury and disturbance. A wide range of factors influence the levels of noise from pile driving, including pile diameter, energy of the piling hammer, water depth, sediment type, current flow, and hammer type. Less well understood are the precise mechanisms that drive the behavioral responses of individual animals to different levels and frequencies of noise. Differences are likely to be associated with environmental factors such as the importance of feeding areas, ambient noise levels, and the condition of the animals. These less well understood factors are considered likely to govern population level consequences.

RISK MANAGEMENT MEASURES

Engineering solutions that do not use pile driving avoid the need for mitigation of construction noise. These solutions include floating offshore wind turbines and gravity-based, or suction-bucket foundations in shallower waters.

Some jurisdictions require developers to reduce the noise levels produced to reduce disturbance. Mitigation of pile-driving noise may include the use of air barriers, special hammers, and other technologies. In other jurisdictions the objective is to reduce the risk of injury. Other measures are required, including the use of acoustic deterrents to move animals away, and soft starts to pile driving that give the animals time to leave the area without sustaining hearing damage. Similarly, the onset of work may be delayed if animals are detected in the vicinity prior to startup.

RESEARCH PRIORITIES

The greatest uncertainties are associated with potential long-term changes in Harbor porpoise populations from offshore wind development. Hypothesis-driven research is needed to quantify many of the parameters that will be modelled to determine population risk. Well-designed studies capable of linking acoustic exposure to effects on demographic parameters are needed. Ultimately, such studies are likely to provide more valuable information than studies focused on changes in distribution as the value of these studies is limited by the high levels of natural variability.

Optimum results for understanding potential offshore wind energy effects on the Harbor porpoise species will be informed by application of statistical models to analyse data, for example, using individual-based modelling approaches. Commitment to standardised long-term studies able to characterise the natural variability in populations and the magnitude of other stressors, including climate change and disease, may also provide useful information.

Written by: Dr. Kate Brookes, Dr. Ewan Edwards, and Finlay Bennet

For more information, go to *https://tethys.pnnl.gov/publications/wren-sss-harbor-porpoise*

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05/17