

OW_03

離岸風力發電水下打樁噪音對中華白海豚棲地的影響 Noise Impact on Indo-Pacific Humpback Dolphin in the Habitat of the East Taiwan Strait during the Pile Driving Activity of Demonstration Offshore Wind Farm

胡惟鈞^{1,2}、陳琪芳^{1,2*}、周蓮香^{3*}、吳誌豪²、Shane Guan⁴

魏瑞昌⁵、陳乃菖¹、王煒傑²、李沛沂³、楊瑋誠⁶

¹ 國立臺灣大學工學院海洋技術研究中心

² 國立臺灣大學工程科學及海洋工程學系

³ 國立臺灣大學生態學和演化生物學研究所

⁴ 美國天主教大學機械工程系

⁵ 國立中山大學海下科技研究所

⁶ 國立嘉義大學獸醫學系

Wei-Chun Hu^{1,2}, Chi-Fang Chen^{1,2*}, Lien-Siang Chou^{3*}, Chih-Hao Wu², Shane Guan⁴

Ruey-Chang Wei⁵, Nai-Chang Chen¹, Wei-Chieh Wang², Pey-Yi Lee³, Wei-Cheng Yang⁶

¹ Ocean Technology Research Center, College of Engineering, National Taiwan University

² Department of Engineering Science and Ocean Engineering, National Taiwan University

³ Institute of Ecology and Evolutionary Biology, National Taiwan University

⁴ Department of Mechanical Engineering, The Catholic University of America

⁵ Institute of Undersea Technology, National Sun Yat-sen University

⁶ Department of Veterinary Medicine, National Chiayi University

*chifang@ntu.edu.tw, *chouls@ntu.edu.tw

摘要

我國正極力推動綠能低碳資源之開發，「千架海陸風力機」計畫在 2016 年已有二座離岸風力示範風機在苗栗外海進行打樁施工，但在臺灣中西部，臺灣海峽東邊，近苗栗縣後龍溪龍鳳漁港離岸三至五公里水域處有一個極度瀕危的中華白海豚(*Sousa chinensis*)族群棲息，因族群量很小，且面臨許多人類開發衝擊，離岸風機建置時打樁所發出的強烈衝擊噪音已被證明在近距離下有可能造成海洋哺乳動物聽力損傷(PTS)，聽力閾值暫時性上升(TTS)，故在施工期間我們在現場蒐集噪音數據，發現距離打樁 750m 之聲壓位準(SPLrms)不超過 180dB re 1 μ Pa，而其聲壓峰值(Lpk,flat) 低於 190 dB re 1 μ Pa，另外我們也對中華白海豚可能受到的潛在影響進行初步評估。本文建議對施工期間噪音監測與中華白海豚觀測作業為 1. 劃出「噪音禁區」，訂為距噪音源 750 公尺處聲壓峰值(Lpk,flat)必須低於 190~220 dB re 1 μ Pa，同時在禁區邊界四個方位以水下聽音器即時監測(可以不同燈號表示其是否超出最大噪音量容忍值，並發出警告)；2. 在噪音禁區外圍標定「監測區」(距噪音源 1500 公尺內)，本區需請鯨豚觀測人員日間監看，同時以被動聲學監測(日夜不間斷)，俾使海豚不誤闖禁區，並保證無母子對(mother and calf)出現在監測區內。

關鍵詞：離岸風場、水下噪音、中華白海豚、環境影響評估、禁區、監測區。

Abstract

Government of Taiwan is actively promoting the development of low-carbon emission energy resources. Under the “Thousand Wind Turbines Project,” foundation piles of the first two wind turbines were conducted off the coast of Miaoli in 2016. However, the nearshore water off west coast of Taiwan is also the habitat of the critically endangered Eastern Taiwan Strait (ETS) population of Indo-Pacific humpback dolphin (*Sousa chinensis*). The range of the ETS Indo-Pacific humpback dolphin is limited to within 3~5 km from shore in waters of depth less than 15 m. Intense noise from impact pile driving could cause hearing damage (PTS) or temporary hearing threshold shift (TTS) to

dolphins and other marine mammals at close range. In this study, we collected underwater noise data during the construction of wind turbines and found that the sound pressure level (SPLrms) from 750m distance of the piling was less than 180dB re 1μPa and the peak value of sound pressure (Lpk, flat) was less than 190 dB re 1μPa. After a preliminary assessment on the potential impacts on mid-frequency cetacean such as the ETS Indo-Pacific humpback dolphin, we presented recommendation of noise monitoring and marine mammal observation during pile driving activities. It includes (1) an exclusion zone of radius 750m from the piling location and the peak sound pressure (Lpk, flat) is not to exceed 190~220 dB re 1μPa at 750 m distance, (2) an observation zone of outer circle at 1500 m radius where both marine mammal observers and passive acoustic monitoring are posted. The goal is to minimize the potential impact on Indo-Pacific humpback dolphin during the establishment of offshore wind farms.

Keywords: Offshore wind farm, Underwater noise, Indo-Pacific humpback dolphin, Environmental impact assessment, exclusion zone, observation zone, peak sound pressure.