

SC/68D/E/08Rev

Sub-committees/working group name: E

Unusual mortality event of harbour porpoises in the Netherlands

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**INTERNATIONAL
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Summary: Unusual mortality event of harbour porpoises in the Netherlands

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In August 2021, nearly 200 dead harbour porpoises (*Phocoena phocoena*) washed ashore on the Dutch Wadden Sea Islands within just ten days. This is a remarkably high number, considering the annual average of about 600 stranded porpoises on the entire Dutch coastline. The stranded animals all appeared in a similar state of advanced decomposition. This indicated that they died some days to weeks before the stranding event, but likely all around the same time. A drift-model from Rijkswaterstaat, the executive agency of the Dutch Ministry of Infrastructure and Water Management, normally used to locate adrift persons, was amended and indicated a location northwest of the Frisian Front and east of the Cleaver Bank as the most likely point of origin of the porpoise carcasses of approximately 10 by 10 km² (Fig. 1). There was a predominant Northern wind in the period prior to the stranding event, which is uncommon for this time a year and could have contributed in the abnormal high stranding number.

An investigation into the possible cause of death of these animals was initiated, aiming at excluding possible hypotheses. Twenty-two stranded harbour porpoises were collected for post-mortem investigation. Necropsies were conducted following international standardized procedures, but limited by carcass decomposition. Among the 22 cases, there were 16 adult females, four adult- and two juvenile males. Among the adult females, it was noticeable that in general these animals were in good nutritional condition (sufficient blubber, mostly visceral fat present), there were mild to moderate parasitic loads in the organs and they were reproductively active (where it could be judged, porpoises were just pregnant or lactating). This indicates an overall fair to good health status. Despite their relatively good nutritional state, no prey remains were found in the stomachs of eleven porpoises. The others only had small amounts of food in their stomachs. These findings pointed towards a subacute cause of death.

The Ministry was able to exclude detonation events of old munition in the period prior to the stranding event. Also, there were no records of sonar or other military activities in Dutch waters or other human activities which could have caused such an event. Contact with neighbouring countries revealed that in the UK, dead and dying crabs and lobsters were washed ashore in unusually large numbers, along parts of the North East coast, between October and December 2021. Crabs and lobsters were the only species that appear to have been affected by the incident. Dying crabs and lobsters displayed characteristic 'twitching' and lethargic behaviour. An extensive range of testing was undertaken over several months by Defra group agencies. Evidence suggests that a naturally occurring harmful algal bloom was the most likely cause of this incident.

Ancillary testing of collected carcasses was focused on potential 'biological' causes of mass mortality in (small) cetaceans: harmful algae blooms (HABs), viral outbreaks or other infectious agents. Fluids collected from the stomachs and liver tissues of necropsied porpoises were tested for the presence of domoic acid, saxitoxins (STX), tetrodotoxin and lipophilic marine toxins. There was STX found in one liver sample, but at a low concentration (15 µg STX/kg). Targeted PCRs for Influenzavirus, Morbillivirus and SARS-CoV-2 were negative. One harbour porpoise tested positive for *Phocoena phocoena alpha herpesvirus* in the brain, but all others were negative. Due to the low number of positive cases, herpesvirus and STX likely did not explain the mortality event at large. Liver samples of 21 necropsied porpoises were submitted for bacteriological assessment, which resulted in dominant cultures of *Erysipelothrix rhusiopathiae* in 16 of these (76%). The same bacteria was also cultured from organs with macroscopic changes of three of these porpoises, including lung and mammary gland. This bacteria has not been cultured from harbour porpoises investigated in the Netherlands before.

Erysipelothrix rhusiopathiae occurs in almost all animal species and can cause Erysipeloid: an infection frequently seen in livestock such as pigs and turkeys. The disease can also occur in reptiles, fish and humans. There are no reports in literature of cetacean mass mortality as a result of *Erysipelothrix* infection, only individual captive or free-ranging cetaceans, mostly suffering from sepsis. In our harbour porpoises, the bacteria was present in liver, as well as in other organs tested, which suggests septicaemia. If and how this resulted in an unusual mortality event of harbour porpoises is still unclear. The point of entry is still unknown.

This might have been via infected water, infected fish, or mutual transmission. Currently, sequencing of the cultured *E. rhusiopathiae* is ongoing. Additionally, metagenomic sequencing to detect presence of novel viruses is still conducted. Finally, sprat samples (important prey for porpoises in the North Sea) caught in August south of the Frisian Front are submitted for microbiological assessment.

This research is a collaboration between Utrecht University (Faculty of Veterinary Medicine), Wageningen University (Marine Research and BioVeterinary Research), Erasmus Medical Centre and Rijkswaterstaat, conducted under the auspices of the Dutch Government of Agriculture, Nature and Food Quality.

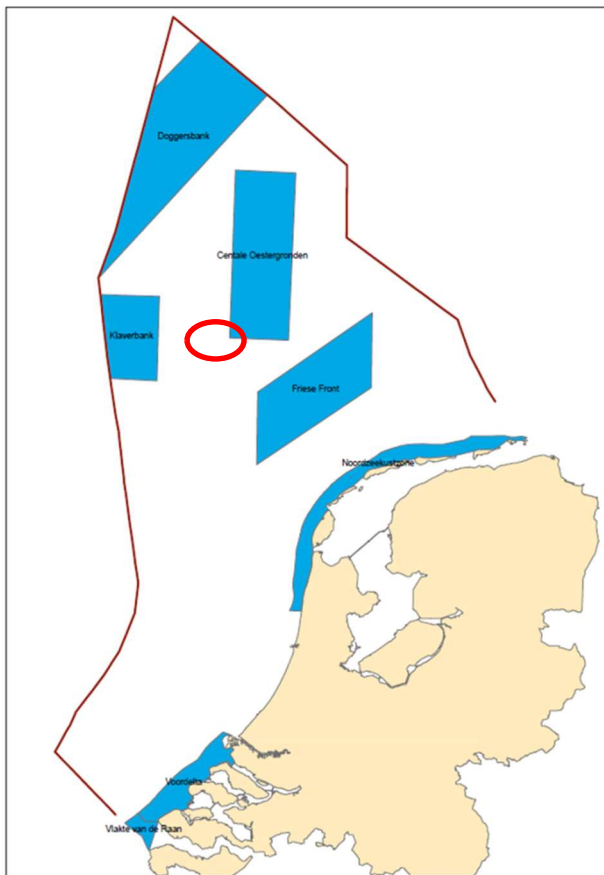


Figure 1: Map of MPAs in the Dutch part of the North Sea and approximate location of the mortality event in red.