High definition video technique – an advanced approach to offshore surveying of marine mammals

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Increasing human activities at sea require robust data on marine mammal distribution and abundance aimed at balancing economic activities with conservation demands. In order to obtain unbiased survey data, a video technique has been developed offering the possibility to cover large areas by high definition imaging. A flight altitude of 1800 feet (549m) allows surveying of areas containing offshore wind farms which will be closed for conventional survey flights for safety reasons. In Germany and the UK digital survey techniques now serve as standard method for marine mammal surveys in relation to offshore wind farm planning. However, surveying marine mammals by digital imaging is often discussed as being a challenge due to the fact that animals spend most of their time under the sea surface.

Two digital video surveys were flown by HiDef along a series of transects off the north coast of Germany around the alpha ventus wind farm (Figure 1). Four bespoke video cameras were rigged to sample a total strip width of 500m, with a ground sample distance (GSD) of 2cm. The aircraft was flown at a height of 1800ft (549m).
Videos were manually reviewed and 20% of the footage was independently checked for 90% agreement in detected objects . All objects detected during review were identified by experienced field observers and classified to species group, and where possible to species with confidence levels of 'possible', 'probable' and 'definite.' A 'blind' audit of 20% randomly selected objects required at least 90% conformance in the identification.
Densities were calculated by correcting the total number with the average time porpoises spent underneath 2m from the sea surface (availability bias; Teilmann et al. 2013).

Visual aerial surveys were carried out between 2008 and 2013 by BioConsult SH flying at an altitude of 250ft (76m; bird surveys including marine mammals) and at an altitude of 600ft (183m; dedicated marine mammal surveys). Two observers watched from each side of the aircraft. A third observer on the rear seat switched at the beginning of each transect to the side with best sighting conditions. All sightings of marine mammals were measured using an inclinometer to calculate perpendicular distances from the trackline. Densities were calculated using line transect analysis (Buckland et al. 2001). g(0) was corrected following Grünkorn et al. (2005) for detection bias by the number of missed animals by the third observer and for availability bias by the average time porpoises stay submerged 2m below the sea surface (Teilmann et al. 2013).

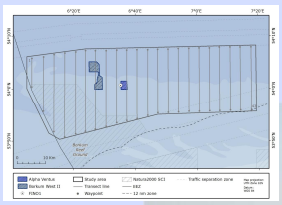


Figure 1: Location of survey transects for digital video and conventional surveys around German offshore wind farms.

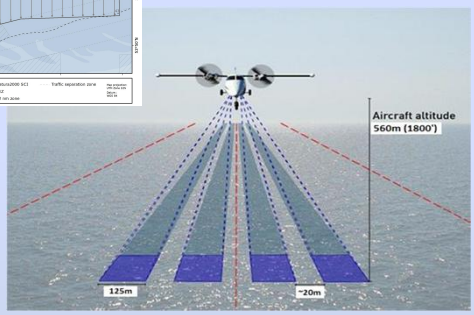


Figure 2: Configuration and orientation of the four video cameras for digital aerial surveys.

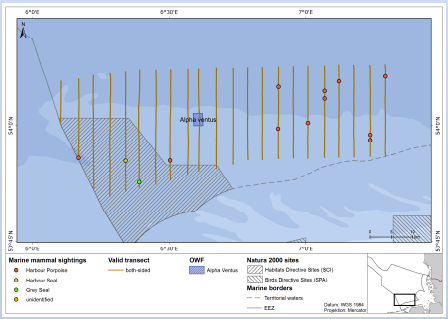


Figure 4: Distribution of porpoise sightings during the visual aerial survey on 13th February 2013.

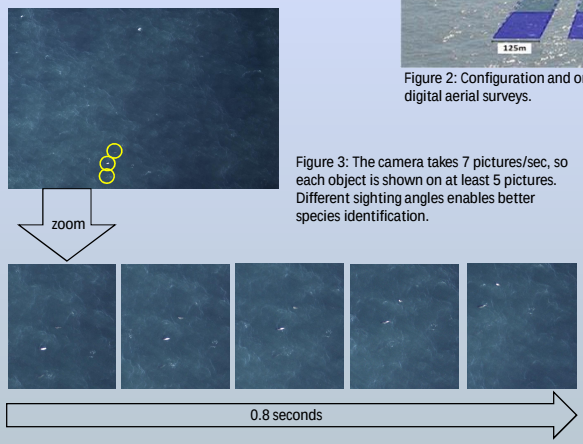


Figure 3: The camera takes 7 pictures/sec, so each object is shown on at least 5 pictures. Different sighting angles enables better species identification.

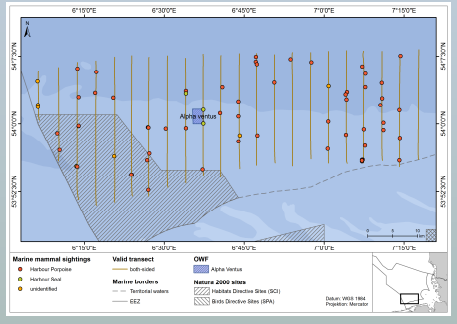


Figure 5: Distribution of porpoise sightings during the digital aerial survey on 20th April 2013 provided higher sighting rates than visual surveys.

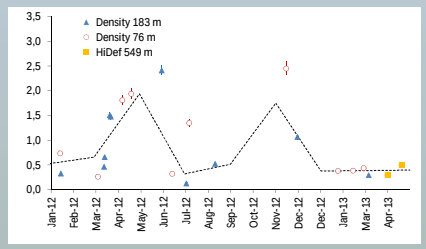
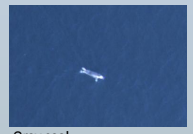
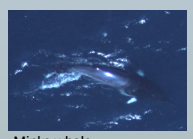


Figure 6: Density estimates using the average surface time of tagged porpoises show very similar density estimates to conventional (visual) aerial surveys.

Harbour porpoise



Grey seal



Minke whale

Figure 7: Different species detected by digital video surveys.

High-definition video surveys offer excellent opportunities to census marine mammals over large areas:

- Even coverage of area equalizes detection bias – no DISTANCE correction needed.
- High repetition rate of video images facilitates detection even of submerged marine mammals.
- Species do not have to be identified within a few seconds.
- All data are reproducible: Possibility to double-check for species detection and species identification greatly improves data quality.
- Different approaches are possible to correct for availability bias (e. g. double platform) .

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Grünkorn, T, Diederichs, A & Nehls G 2005. Aerial surveys in the German Bight - estimating g(0) for harbour porpoises by employing independent double counts. In: Thomsen, F, Ugarte, F & Evans, PGH 2005. Proceedings of the workshop on estimation of g(0) in line transect surveys of cetaceans. ECS Newsletter 44 - Special Issue. 46pp
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