Monitoring seabirds and marine mammals with high definition aerial surveying and image analysis – first results of digital versus visual surveys

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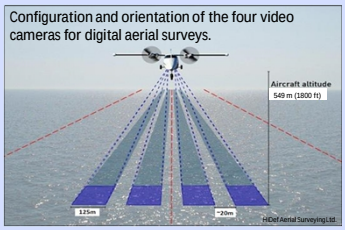
INTRODUCTION: Since 2014 conventional aerial surveys within EIA studies in German Waters are replaced by digital surveys due to safety reasons. BioConsult SH uses a high definition video technique for digital surveys, developed by HiDef Aerial Surveying Ltd. in the German EEZ. The system is operated at a survey altitude of 1800 ft (549 m, Fig. 1) with 2 cm resolution, which allows the identification of seabirds and marine mammals to the species level. The video technique enables validation of the survey data and accurate flock counts, has no need for distance correction and increases flight safety.

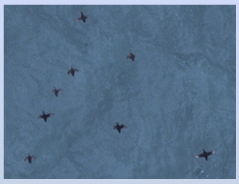
Configuration and orientation of the four video cameras for digital aerial surveys.



Increasing human activities at sea, including offshore wind farm constructions, require solid data on seabird and marine mammal distribution and abundance in order to balance economic activities with conservation demands. Since data for baseline studies were collected by conventional surveys, it is important to validate that digital surveys produce comparable results.

METHOD OF VISUAL OBSERVATIONS: Flight altitude: 76m (birds + marine mammals); 183m (marine mammals) . Observations: 3 experienced observers: One on each side + a third on the rear seat observing the side with best sighting conditions. All observers store their observations on digital tape recorders. Density calculation: Birds: Strip transect distance sampling (Buckland et al. 2001); harbour porpoise: Line transect distance sampling (Buckland et al. 2001). g(0) correction only for marine mammals by using two correction factors: a) perception bias using double sighting rates, b) availability bias using the average time porpoises spent in the upper 2 m of the water column (Teilmann et al. 2013).

METHOD OF DIGITAL OBSERVATIONS: Flight altitude: 549 m; Observation: Videos with 7 pictures/sec ; all pictures are manually reviewed; 20% of the footage are independently checked for 90% agreement in detected objects . All objects are identified by experienced observers. A 'blind' audit of 20% randomly selected objects requires at least 90% conformance in the identification. Density calculation: Birds: No correction needed; number of birds related to covered area; harbour porpoise: only one correction factor for availability bias using the average time porpoises spent spent in the upper 2 m of the water column (Teilmann et al. 2013).



Common scooter
(*Melanitta nigra*)

Do results differ between visual and digital surveys?

Harbour porpoise
(*Phocoena phocoena*)

RESULTS: We analyzed sighting rates and densities of three species (groups), Common scooter (*Melanitta nigra*), Divers (*Gaviidae* sp.) and Harbour porpoises (*Phoceana phoceana*), obtained during three comparison flights conducted with parallel visual (76 m) and digital surveys (549 m; Tab. 1 and 2).

Tab 1: Sighting rates (Ind./ 100km) and density estimates (Ind./km²) of Divers and Common scoters obtained during three comparison flights .

species/ species group	sighting rates digital survey / 100 km	sighting rates visual survey/ 100 km	digital survey [ind./km²]	visual survey [ind./km²]
Divers *(Gaviidae sp.)*				
Dec 2013	15 > 6.09		0.30 < 0.51	
June 2014	0.213 > 0.00		0.0043 > 0.00	
Oct 2014	1.12 > 0.29		0.02 = 0.02	
Common Scoter *(Melanitta nigra)*				
Dec 2013	6968.9 > 418.93		79.36 > 35.20	
June 2014	0.9 > 0.00		0.02 > 0.00	
Oct 2014	325.5 > 2.34		6.51 > 0.20	

Tab. 2: Sighting rates (Ind./ 100km) and density estimates (Ind./km²) of Harbour porpoises obtained during three comparison flights .

	sighting rates digital survey / 100 km	sighting rates visual survey/ 100 km	digital survey [ind./km²]	visual survey [ind./km²]
Harbour porpoise *(Phocoena phocoena)*				
Dec 2013	7.76 > 0.76		0.31 > 0.19	
June 2014	43.63 > 7.10		1.58 > 1.56	
Oct 2014	16.08 > 3.70		0.71 < 1.00	

DISCUSSION AND CONCLUSION:

- Digital surveys cover a larger area. Therefore for all three species sighting rates (Ind./ 100km) with digital observations were much higher than with visual observations.
- Distance sampling approach and g(0) correction factors are not needed for digital survey data.
- Common scoter densities were much higher due to no disturbance of birds by digital surveys. Digital surveys are more appropriate for species, which react to low flying platforms (e.g. Common Scoters).
- Diver densities (Ind./km²) did not differ between both survey methods.
  Ø Both methods are appropriate to calculate densities for divers.
- Harbour porpoise densities (Ind./km²) revealed almost comparable results with both methods.
  Ø Both methods are appropriate to calculate densities Harbour porpoise.

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Literature cited: Buckland, ST, Anderson, DR, Burnham, KP, Laake, JL, Borchers, DL and Thomas, L 2001. Introduction to Distance Sampling: Estimating Abundance of Biological Populations. Oxford University Press, Oxford, UK.
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Teilmann, J, Christiansen, CT, Kjellerup, S, Dietz, R & Nachman, G 2013. Geographic, seasonal, and diurnal surface behavior of harbor porpoises. Marine Mammal Science 29(2): E60-E7. doi: 10.1111/j.1748-7692.2012.00597.x6.