Aerial high definition video surveys – an advanced method to monitor marine mammals

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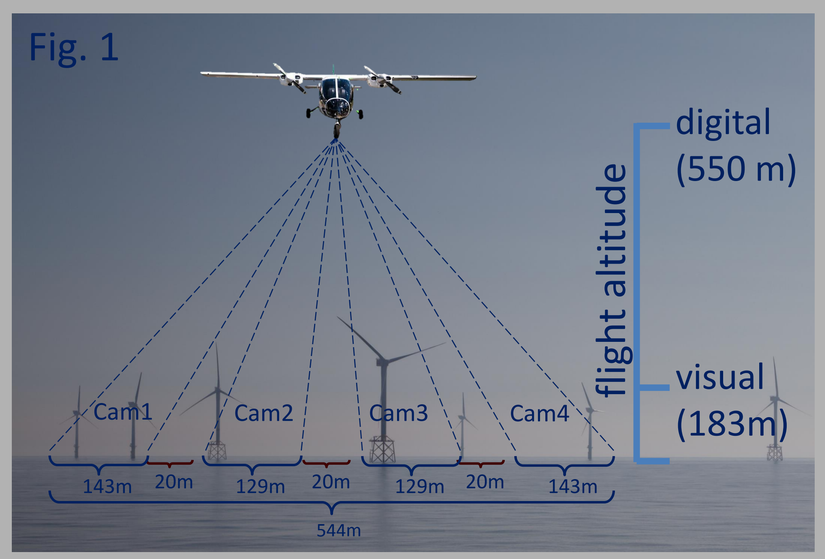
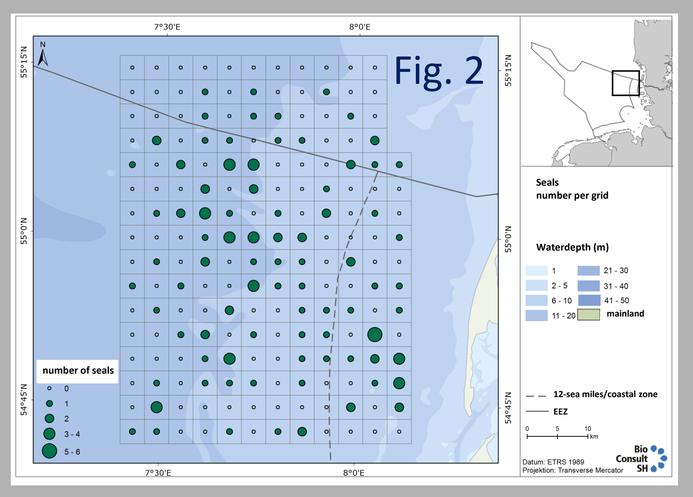
INTRODUCTION:

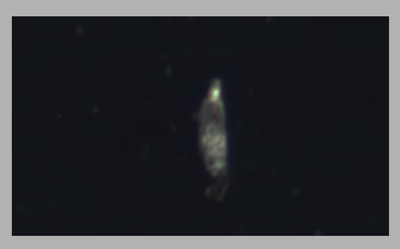


Monitoring the abundance and distribution of marine mammals has traditionally been conducted by visual observer-based flights. Since 2014, these are now replaced by an automated high definition survey technique (Fig.1) which enables to video-survey at a resolution of 2 cm ground sample distance. 4 cameras are mounted to a Partenavia P68 and cover a strip width of 544m. 9 images per sec are consecutively taken at a speed of 220km/h enabling to cover large areas of about 120km^2/h.

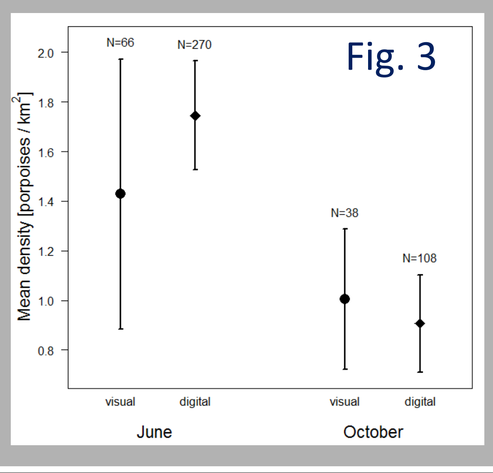
METHODS AND RESULTS:

We applied digital aerial video techniques as developed by HiDef in several monitoring studies of harbour porpoises (*Phocoena phocoena*) and harbour seals (*Phoca vitulina*) during investigations of offshore wind farms in the German North Sea. The videos provided high sighting rates of both surfacing and submerged animals. Information on behavior and the animals' size and length offers additional data. Seals can now be counted in offshore waters (Fig.2) unrestricted by molting and pupping seasons. However, a correction factor for an availability bias still has to be evaluated.



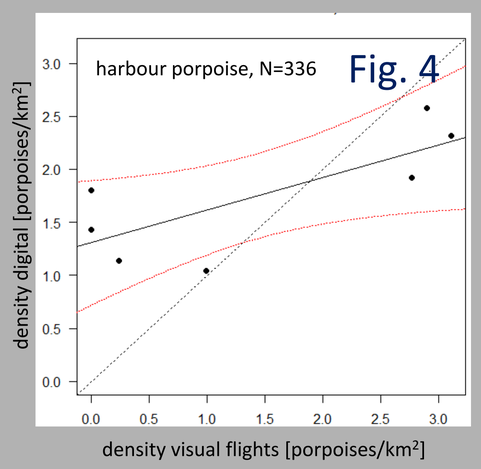


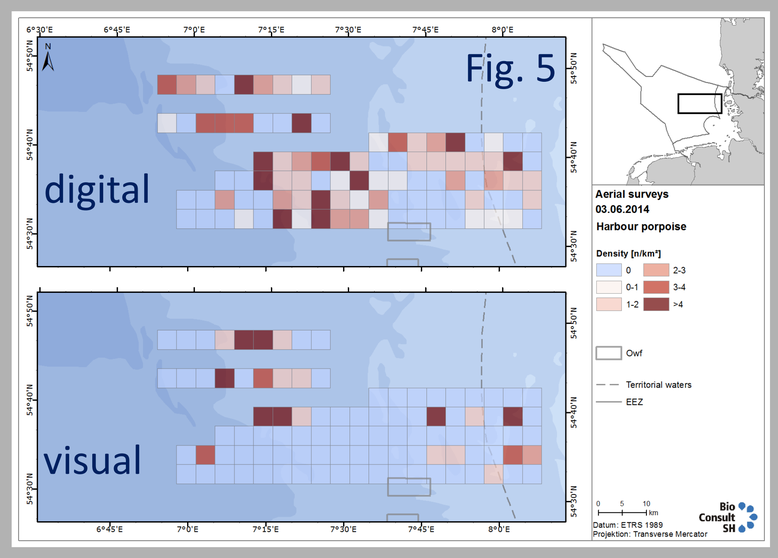
Flight date	#of porpoises		factor
	visual	digital	
June	66	270	4.1
October	38	108	2.8



For a methodological comparison, two simultaneous digital and visual flights were conducted with a time delay of two hours. Digital surveys cover an area 2-4 times greater than that of visual flights. The comparison of densities for the total study area (Fig. 3) revealed a higher density for digital surveys in June ($t = -0.79$; $p = 0.46$) and a lower density for digital surveys ($t = 0.26$; $p = 0.80$) in October. Both methods are comparable.

June:

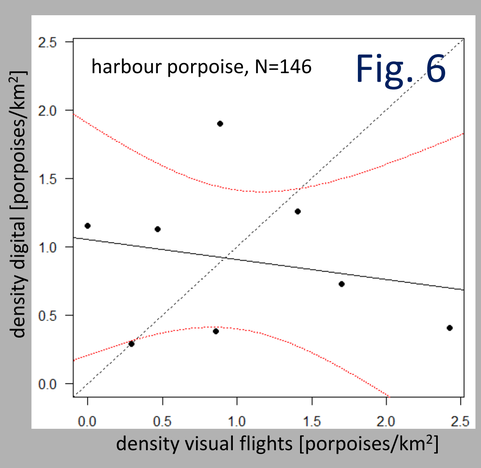


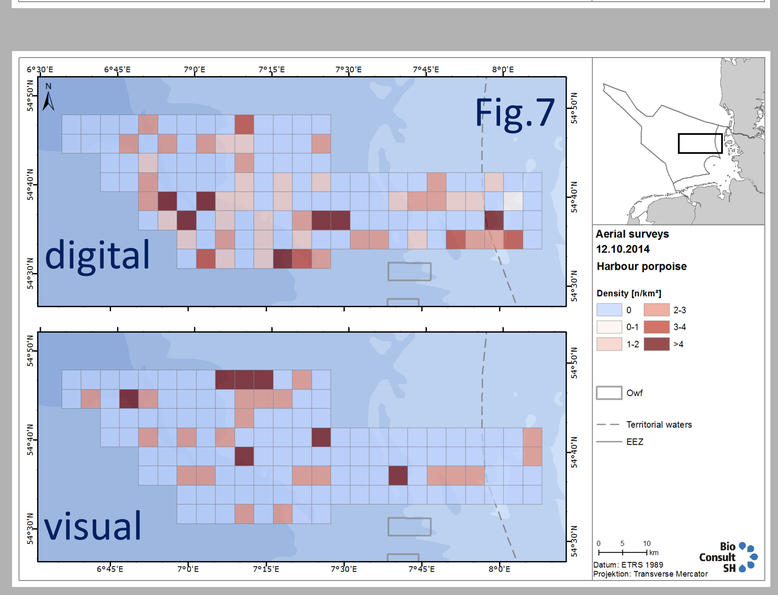


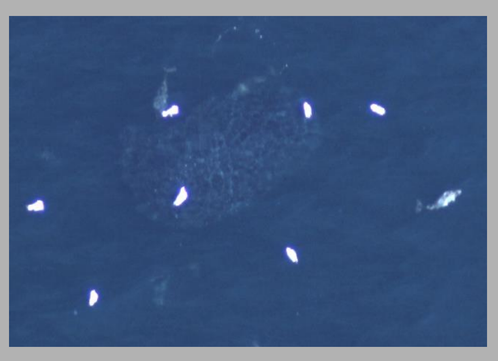
On the basis of transect lines, porpoise sightings were compared via linear regression. Transect densities of visual and digital methods were positively correlated in June (Fig.4: R^2 0.58; $t = 2.62$; $p = 0.05$, Intercept signif.: $t = 5.7$; $p=0.002$) whereas no significant correlation could be found (Fig.6: $R^2 = 0.05$; $t = -0.53$; $p=0.6$, Intercept signif.: $t = 3.0$; $p = 0.02$) in October.

Digital surveys resulted in more grid cells with porpoise presence and less grid cells with densities above 4 Ind. / km^2 (Fig.5 and Fig.7). This is due to greater spatial coverage and no necessity for distance correction resulting in lower variability of density estimates. Thus, digital surveys may be more reliable.

October:







CONCLUSION:

Density estimation by both methods are comparable. Detection probability decreases with distance from the transect line for visual surveys whereas digital surveying provide an equal detection probability over the entire strip width. Survey data can be validated at all times. Digital surveys yield a better spatial resolution and additional information such as behavior, size measurements and association to other animals. It also enables to estimate seal density offshore.

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