

**Supplementary material**

## Appendix 1

**Table A1.** Comparison of methods used to monitor ecological dynamics of bird nests and colonies. Methodological performance is categorized using three levels (low, medium, high) according to the methods capability of: collecting spatial data (spatial accuracy), collecting ecological and behavioural data (data quality), avoiding disturbance to monitored species or habitats (disturbance), covering large sampling areas (range), reducing economic daily costs (Economic cost) and enhancing to the safety level for field workers conducting monitoring (safety level). Key references are shown for each method. Note that the distribution of the colonies on artificial structures built by humans are conditioned by the building itself (\*) and that economic cost may vary (\*\*). Kite performance to collect spatial data will depend on wind conditions and distance from the colony (\*\*\*)

Method	Spatial accuracy	Data quality	Disturbance	Range	Economic cost	Safety level	Example References
Indirect observation on the ground	Low	Low	High	Low	Low	High	Stewart 1973, Sutherland 2006
Direct observation on the ground	High	High	High	Low	Low	High	Carney and Sydeman 1999
Direct observation from elevated hide	Low	Medium	Low	Low	Low	High	Sobey and Kenworthy 1979
Artificial structures	*	High	Low	Low	**	High	Wendeln and Becker 1996
Piloted aircraft	Medium	Medium	Low	High	High	Medium	Rodgers et al. 2005, Sasse 203, Conroy et al. 2008
Kite	***	Medium	Low	Low	Low	High	Delord et al. 2015
Remote Piloted Aircraft System (UAS):							
Small Rotary-winged	High	Medium	Low	Medium	Low	High	Anderson and Gaston 2013, Junda et al. 2015, Vas et al. 2015
Small Airplane	High	Medium	Low	High	Low	High	Sardà-Palomerat et al. 2012, Anderson

							and Gaston 2013
Ultra-High Resolution Imagery from satellite	Low	Low	None	High	High	High	Fretwell et al. 2012

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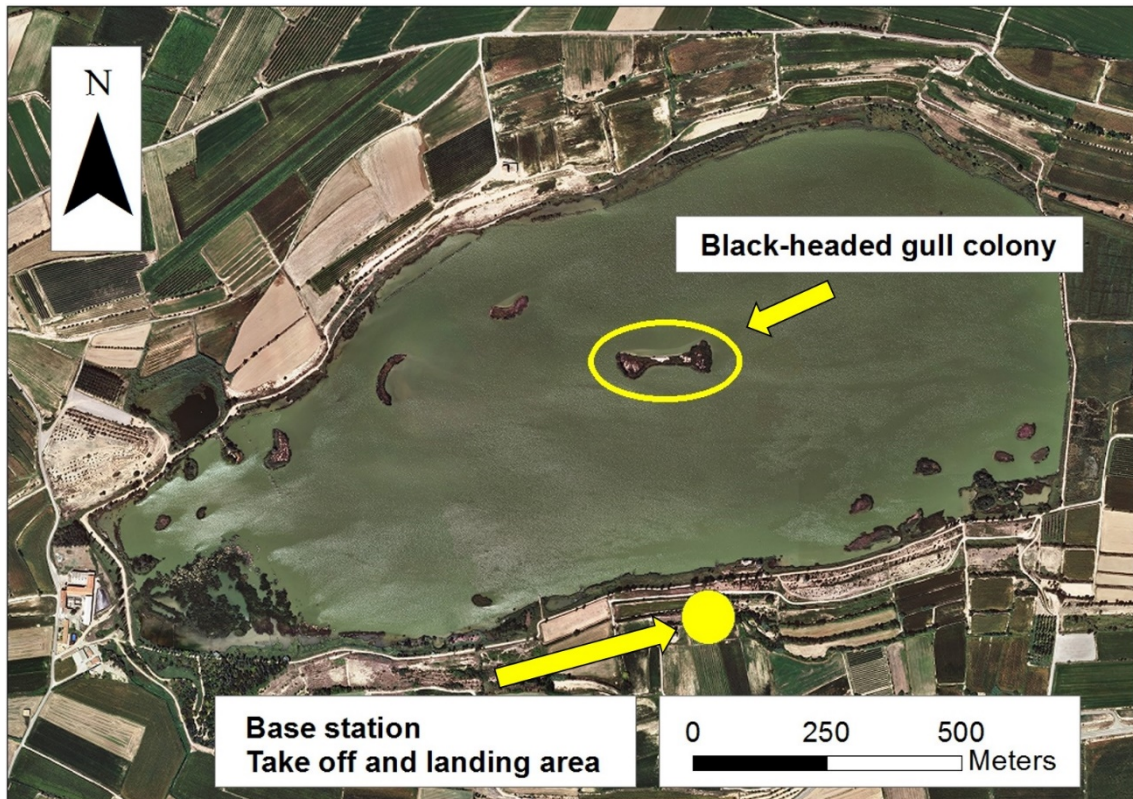
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**Table A2** Summary of the supported ( $\Delta AIC_c < 2$ ) and best non-supported ( $\Delta AIC_c > 2$ ) models for the different response variables. The  $AIC_c$  weight indicates the support for each model.  $\Delta AIC_c$  refers to the differences in AIC between the model and the best candidate model with the smallest  $AIC_c$ . Log Likelihood and Pseudo- $R^2$  (calculated from residual and null deviance) are also reported for each model.

<b>Supported and best non-supported models</b>	<b>Log Likelihood</b>	<b>Pseudo-<math>R^2</math></b>	<b><math>\Delta AIC_c</math></b>	<b><math>AIC_c</math> Weight</b>
Week   Distance CB  Distance NN   Week * Distance NN  Distance CB * Distance NN	-168.57	0.21	0.00	0.438
Week   Distance CB  Distance NN   Week * Distance CB   Week * Distance NN  Distance CB * Distance NN	-168.33	0.21	1.61	0.196
Week   Distance CB  Distance NN   Distance CB * Distance NN	-170.79	0.20	2.35	0.135

## Appendix 2

**Figure A1** Aerial image of “Estany d'Ivars i Vila-Sana” indicating the location of the Black-headed gull colony and the base station.



**Figure A2** Unmanned Aerial System (UAS) Skywalker 1680 V2, used to monitor the Black-headed gull colony in “Estany d’Ivars i Vila-Sana”.

