Appendix S3c. Detection histories (French Wolf Network observers).

Here, let ψ_t be the probability a unit is occupied in season t, and $p_{t,j}$ be the probability of detecting the species in the j_{th} survey of a unit during season t (given the species was present at the unit in season t). Consider the three season detection history h_i = 110 000 010 were the unit I was occupied all three seasons and the species detected by FWN observers in the firth and second survey of the first season; the species being not detected in the second season and being detected in the second survey but not first and third surveys of the third season. The probability of observing the entire detection history would be:

$$\Pr(h_i = 110\ 000\ 010 \mid \psi, p) = \psi_1 p_{1,1} p_{1,2} (1-p_{1,3}) \times [\psi_2 (1-p_{2,1}) (1-p_{2,2}) (1-p_{2,3}) + (1-\psi_2)] \times \psi_3 (1-p_{3,1}) p_{3,2} (1-p_{3,3}).$$

In each sampled unit i the wolf presence was previously confirmed by camera trapping, thus we can set $\psi_1 = \psi_2 = \psi_3 = 1$. In these conditions, the probability of observing the entire detection history would be as a single season with multiple surveys:

$$\Pr(hi = 110\ 000\ 010 \mid \psi, p) = p_{1,1} p_{1,2} (1-p_{1,3}) \times [(1-p_{2,1}) (1-p_{2,2}) (1-p_{2,3}) + (1-\psi_2)] \times (1-p_{3,1}) p_{3,2} (1-p_{3,3}).$$

Detection histories (French Wolf Network observers)

Data WP

h[,1]	h[,2]	h[,3]	h[,4]	h[,5]	h[,6]	h[,7]	h[,8]	h[,9]	h[,10]	h[,11]	h[,12]	h[,13]
	h[,14]	h[,15]	h[,16]	h[,17]	h[,18]	h[,19]	h[,20]	h[,21]	h[,22]	h[,23]	h[,24]	
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
0	1	0	0	0	0	0	0	0	0	0	0	NA
	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
0	1	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	NA	NA	0	0	0	0	0	
0	1	NA	0	0	0	0	0	0	0	0	0	0
	1	0	0	0	0	0	1	0	0	0	0	
0	0	0	0	0	0	0	0	0	0	0	0	1
	0	0	0	0	0	0	0	1	0	0	0	
0	0	0	NA	0	0	0	0	0	0	0	0	0
	0	NA	0	0	0	0	0	0	NA	NA	0	
0	0	0	0	0	0	0	0	0	0	0	0	0
	0	1	0	0	1	0	0	0	0	NA	0	

END

Data No-WP

h[,1]	h[,2]	h[,3]	h[,4]	h[,5]	h[,6]	h[,7]	h[,8]	h[,9]	h[,10]	h[,11]	h[,12]	h[,13]
	h[,14]	h[,15]	h[,16]	h[,17]	h[,18]	h[,19]	h[,20]	h[,21]	h[,22]	h[,23]	h[,24]	
0	0	0	0	0	0	0	1	0	0	1	0	0
	0	0	0	0	0	0	0	0	0	0	0	
0	0	0	0	0	NA	0	0	0	0	0	0	1
	0	0	0	0	1	1	0	0	0	0	0	

0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 1 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0
END