



Figure S1. Example images of the high-resolution aerial photography captured in 2012 showing live grey seal pups, adults and a pup carcass (circled).

Table S1. Data sources used to compile the GIS database and catalogue grey seal pup carcasses.

Survey type	Data format	Source	Date
Aerial survey	Digital images	Sea Mammal research Unit (SMRU), University of St Andrews	28/11/12
			18/11/12
			05/11/12
			24/10/12
			14/10/12
Walked visual census	GPS spatial point data	MMQ* and SMRU	30/11/12
			01/12/12
			02/12/12
Aerial survey	Microfiche	Sea Mammal research Unit (SMRU), University of St Andrews	19/11/08
			10/11/08
			27/10/08
			18/10/08
			30/11/08
Walked visual census	GPS spatial point data	Sea Mammal research Unit (SMRU), University of St Andrews	01/12/08

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Table S2. Backwards stepwise model selection process summary for the GLMM used to predict the probability of grey seal pup carcasses being washed away as a function of the variables proximity to shore (vector distance from Admiralty Chart Datum (ACD)) and breeding colony location.

Model	Model variables	Deviance	Log-likelihood	AIC	Δ AIC
1	location + proximity to shore + location: proximity to shore + (random intercept = year)	161.0	-80.5	174.99	
2	location + proximity to shore + (random intercept = year)	216.4	-108.2	226.38	-51.39

Table S3. Backwards stepwise model selection process summary for the GLMM used to predict the duration grey seal pup carcasses remained ashore before being washed away as a function of the variables tide strata and breeding colony location.

Model	Model variables	Deviance	Log-likelihood	AIC	ΔAIC
1	location + tide strata + location:tide strata + (random intercept = year)	647.8	-323.9	673.81	
2	location + tide strata + (random intercept = year)	655.9	-327.9	671.87	1.94
3a	location + (random intercept = year)	664.6	-332.3	674.64	2.77
3b	tide strata + (random intercept = year)	658.0	-329.0	670.04	1.83*
Null	1 + (random intercept = year)	666.1	-333.0	672.07	-2.03

*AIC compared to model 2

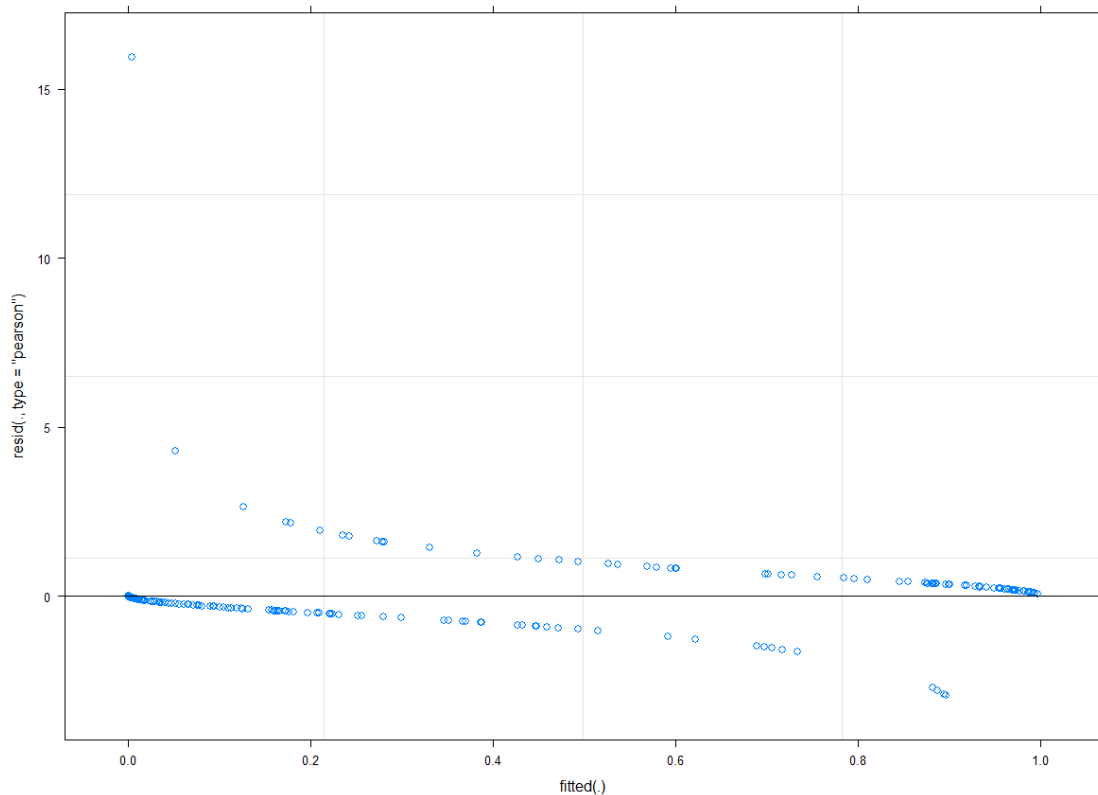


Figure S2. Residual vs fitted values for the GLMM used to predict probability of grey seal pup carcasses being washed away as a function of the variables distance from Admiralty Chart Datum (ACD) and breeding colony location.

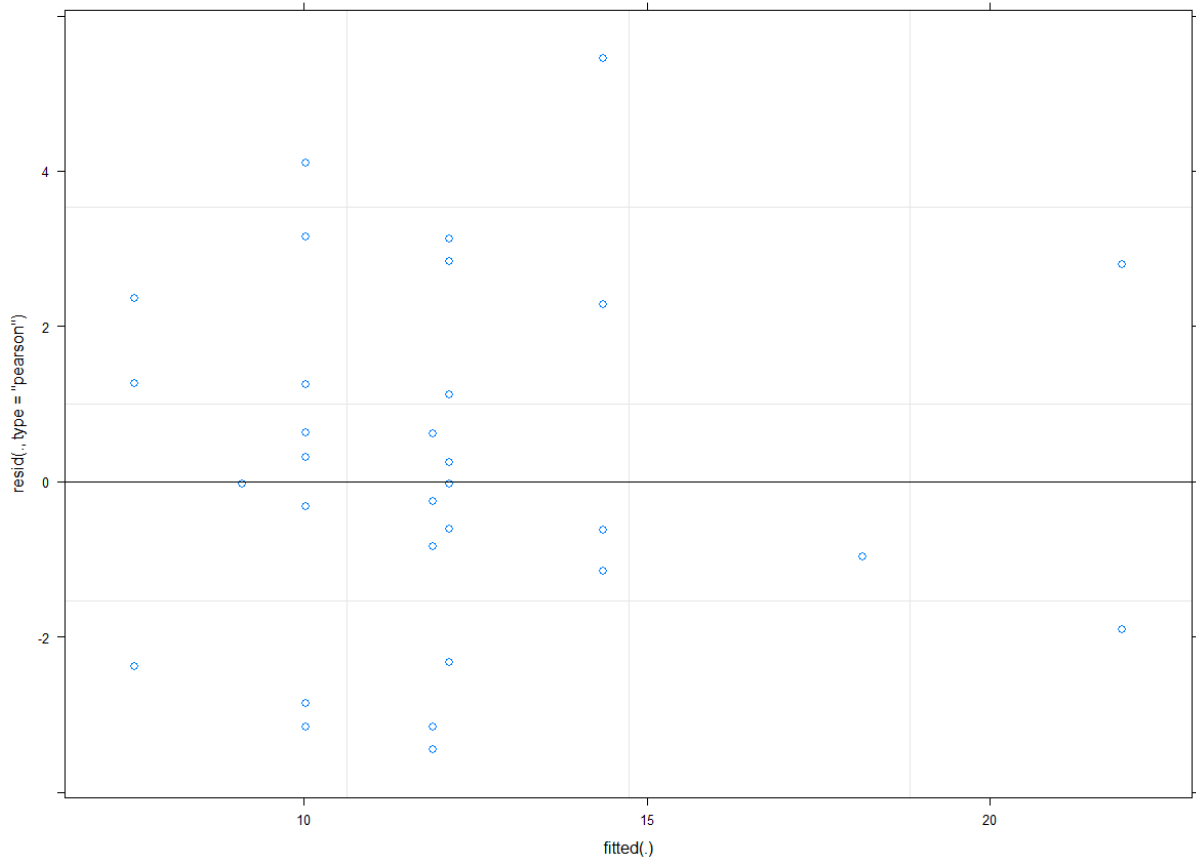


Figure S3. Residual vs fitted values for the GLMM used to predict the duration grey seal pup carcasses remained ashore before being washed away as a function of the variables tide strata and breeding colony location.

Equations. Equations used to calculate the maximum figure of grey seal pup body mass adapted from Kovacs & Lavigne (1986).

$$mm = 1.39a + 16.33 \quad \text{Eq1}$$

$$fm = 1.25a + 14.57 \quad \text{Eq2}$$

$$avm = \frac{mm+fm}{2} \quad \text{Eq3}$$

where, mm = male mass, fm = female mass and an assumed 1:1 ratio of male to female pups gives the average mass (avm).

Table S4. Parameter estimates from the optimal GLMM (model 1) used to predict the probability of grey seal pup carcasses being washed away as a function of the variables distance from Admiralty Chart Datum (ACD) and breeding colony location. The random intercept was “year”. The location variable contained three levels: The Loan, Pilgrim’s Haven and East Tarbet.

Fixed effect term	Estimate	S.E. of estimate	z	p-value
Intercept	3.950	1.419	2.783	<0.01
Location – Pilgrims Haven	2.563	1.605	1.597	0.110
Location – The Loan	1.297	1.311	0.990	0.322
distance from ACD	-0.021	0.003	-6.395	<0.001
Location – Pilgrims Haven: distance from ACD	-0.067	0.017	-3.806	<0.001
Location – The Loan: distance from ACD	-0.059	0.014	-4.211	<0.001

Table S5. Parameter estimates from the optimal GLMM (model 3b) used to predict the duration grey seal pup carcasses remained ashore before being washed away as a function of the variables tide strata and breeding colony location. The random intercept was “year”. The tide strata variable contained four levels: Dry – above High Water Spring, HWS-HWN – between High Water Spring and High Water Neap, HWN-LWN – between High Water Neap and Low Water Neap, LWN-LWS – between Low water Neap and Low water Spring.

Fixed effect term	Estimate	S.E. of estimate	z	p-value
Intercept	2.992	0.147	20.394	<0.001
Tide strata HWN_HWS	-0.424	0.143	-2.954	<0.01
Tide strata LWN_HWN	-0.593	0.132	-4.488	<0.001
Tide strata LWS_LWN	-0.880	0.173	-5.097	<0.001