

Table S1. Model selection based on Akaike's Information Criterion corrected for small sample sizes (AICc) to explain heart rate excess variability in response to acute stressors in breeding king penguin.

N°	Model terms	Covariates	df	Loglikelihood d	AICc	ΔAICc	wi
1	Breeding shift + Stressor type	Colony area, stressor order	8	-476.825	970.3	0.00	0.496
2	Breeding shift + Stressor type + Sex	Colony area, stressor order	9	-476.818	972.4	2.14	0.170
3	Breeding shift + Stressor type + Breeding shift*Stressor type	Colony area, stressor order	10	-476.259	973.5	3.20	0.100
4	Breeding shift + Stressor type + Sex + Sex*Stressor type	Colony area, stressor order	11	-475.350	973.8	3.57	0.083
5	Breeding shift + Stressor type + Sex + Sex*Breeding shift	Colony area, stressor order	10	-476.814	974.6	4.31	0.058
6	Breeding shift + Stressor type + Sex + Breeding shift*Stressor type	Colony area, stressor order	11	-476.258	975.6	5.39	0.034
7	Breeding shift + Stressor type + Sex + Sex*Breeding shift + Sex*Stressor type	Colony area, stressor order	12	-475.341	976.0	5.76	0.028
8	Breeding shift + Stressor type + Sex + Sex*Stressor type + Breeding shift*Stressor type	Colony area, stressor order	13	-474.911	977.4	7.13	0.014
9	Breeding shift + Stressor type + Sex + Sex*Breeding shift + Breeding shift*Stressor type	Colony area, stressor order	12	-476.252	977.8	7.59	0.011
10	Breeding shift + Stressor type + Sex + Sex*Breeding shift + Sex*Stressor type + Breeding shift*Stressor type	Colony area, stressor order	14	-473.902	980.4	9.35	0.005

The 10 best models retained by AICc selection are presented. Independent variables include stressor type (sounds, 10-m approaches and captures), breeding shift number, sex, and interactions between those variables. Colony area and stressor order were entered as a covariates in all models to control for area related differences in stress responses (see Viblanc et al. 2012) and potential habituation/sensitization effects. Bird ID was included as a random factor in all models to account for repeated measures on individual birds. ΔAICc is the difference in AIC compared to the best model (given in bold). The AIC weight is given by wi and represents the probability that a given model is the best among the models presented. When 2 models had ΔAICc < 2, the model with the highest wi was selected.

Table S2. Model selection based on Akaike's Information Criterion corrected for small sample sizes (AICc) to explain heart rate excess variability in response to acute stressors in breeding king penguin

N°	Model terms	Covariates	df	Loglikelihood d	AICc	ΔAICc	wi
1	Breeding stage + Stressor type	Colony area, stressor order	8	-472.566	961.7	0.00	0.292
2	Breeding stage + Stressor type + Breeding stage*Stressor type	Colony area, stressor order	10	-470.464	961.9	0.13	0.274
3	Breeding stage + Stressor type + Sex	Colony area, stressor order	9	-472.313	963.4	1.65	0.128
4	Breeding stage + Stressor type + Sex + Breeding stage*Stressor type	Colony area, stressor order	11	-470.328	963.8	2.05	0.105
5	Breeding stage + Stressor type + Sex + Sex*Stressor type	Colony area, stressor order	11	-470.884	964.9	3.16	0.060
6	Breeding stage + Stressor type + Sex + Sex *Breeding stage	Colony area, stressor order	10	-472.280	965.5	3.76	0.045
7	Breeding stage + Stressor type + Sex + Sex*Breeding stage + Breeding stage *Stressor type	Colony area, stressor order	12	-470.299	965.9	4.20	0.036
8	Breeding stage + Stressor type + Sex + Sex*Stressor type + Breeding stage *Stressor type	Colony area, stressor order	13	-469.328	966.3	4.59	0.029
9	Breeding stage + Stressor type + Sex + Sex*Stressor type + Sex*Breeding stage	Colony area, stressor order	12	-470.832	967.0	5.27	0.021
10	Breeding stage + Stressor type + Sex + Sex*Breeding stage + Sex*Stressor type + Breeding stage *Stressor type	Colony area, stressor order	14	-469.327	968.5	6.73	0.010

The 10 best models retained by AICc selection are presented. Independent variables include stressor type (sounds, 10-m approaches and captures), breeding shift number, sex, and interactions between those variables. Colony area and stressor order were entered as a covariates in all models to control for area related differences in stress responses (see Viblanc et al. 2012) and potential habituation/sensitization effects. Bird ID was included as a random factor in all models to account for repeated measures on individual birds. ΔAICc is the difference in AIC compared to the best model (given in bold). The AIC weight is given by wi and represents the probability that a given model is the best among the models presented. The best model is selected based on lowest AICc. When 2 models had ΔAICc < 2, the model with the highest wi was selected.

Table S3. Model selection based on Akaike’s Information Criterion corrected for small sample sizes (AICc) to explain variability in breeding king penguin detection distances (based on heart rate increase, see Methods) of an approaching experimenter during an acute capture stress.

N°	Model terms	Covariates	df	Loglikelihood	AICc	Δ AICc	wi
1	Breeding shift	Colony area, stressor order	6	-306.401	625.9	0.00	0.366
2	Intercept only	Colony area, stressor order	5	-307.686	626.2	0.24	0.324
2	Breeding shift + Sex	Colony area, stressor order	7	-306.401	628.3	2.39	0.111
3	Sex	Colony area, stressor order	6	-307.610	628.3	2.42	0.109
4	Breeding shift + Sex + Sex*Breeding shift	Colony area, stressor order	8	-305.394	628.7	2.83	0.089

Independent variables include bird sex, breeding shift number, and the interaction between those variables. Colony area and stressor order were entered as a covariates in all models to control for area related differences in stress responses (see Viblanc et al. 2012) and potential habituation/sensitization effects. Bird ID was included as a random factor in all models to account for repeated measures on individual birds. Δ AICc is the difference in AIC compared to the best model (given in bold). The AIC weight is given by wi and represents the probability that a given model is the best among the models presented. The best model is selected based on lowest AICc. When 2 models had Δ AICc < 2, the model with the highest wi was selected.

Table S4. Model selection based on Akaike's Information Criterion corrected for small sample sizes (AICc) to explain variability in breeding king penguin detection distances (based on heart rate increase, see Methods) of an approaching experimenter during an acute capture stress.

N°	Model terms	Covariates	df	Loglikelihood	AICc	Δ AICc	wi
1	Intercept only	Colony area, stressor order	5	-307.686	626.2	0.00	0.396
2	Breeding stage	Colony area, stressor order	6	-306.868	626.8	0.69	0.280
2	Sex	Colony area, stressor order	6	-307.610	628.3	2.17	0.133
3	Breeding stage + Sex + Sex*Breeding stage	Colony area, stressor order	8	-305.428	628.8	2.65	0.105
4	Breeding stage + Sex	Colony area, stressor order	7	-306.862	629.2	3.07	0.085

Independent variables include bird sex, breeding stage (incubation vs. chick brooding), and the interaction between those variables. Colony area and stressor order were entered as a covariates in all models to control for area related differences in stress responses (see Viblanc et al. 2012) and potential habituation/sensitization effects. Bird ID was included as a random factor in all models to account for repeated measures on individual birds. Δ AICc is the difference in AIC compared to the best model (given in bold). The AIC weight is given by wi and represents the probability that a given model is the best among the models presented. The best model is selected based on lowest AICc. When 2 models had Δ AICc < 2, the model with the highest wi was selected.

Table S5. Model selection based on Akaike's Information Criterion corrected for small sample sizes (AICc) to heart rate excess variability in response to acute stressors in breeding king penguin males during their first incubation shift either early or late in the season.

N°	Model terms	Covariate	df	Loglikelihood	AICc	ΔAICc	wi
1	Stressor type	Stressor order	5	-118.614	248.4	0.00	0.529
2	Stressor type + Breeding timing	Stressor order	6	-117.726	249.1	0.73	0.368
3	Stressor type + Breeding timing + Stressor type*Breeding timing	Stressor order	7	-117.697	251.7	3.27	0.103
4	Intercept only	Stressor order	4	-168.564	345.9	97.49	0.000
5	Breeding timing	Stressor order	5	-168.162	347.5	99.10	0.000

Independent variables include breeding timing (early vs. late in the season), stressor type, and the interaction between those variables. Stressor order was entered as a covariate in all models to control for potential habituation/sensitization effects. Early and late males were stressed in the same colony area. Bird ID was included as a random factor in all models to account for repeated measures on individual birds. ΔAICc is the difference in AIC compared to the best model (given in bold). The AIC weight is given by wi and represents the probability that a given model is the best among the models presented. The best model is selected based on lowest AICc. When 2 models had ΔAICc < 2, the model with the highest wi was selected.