SUPPORTING INFORMATION for

Temporary mate removal during incubation leads to variable compensation in a biparental shorebird

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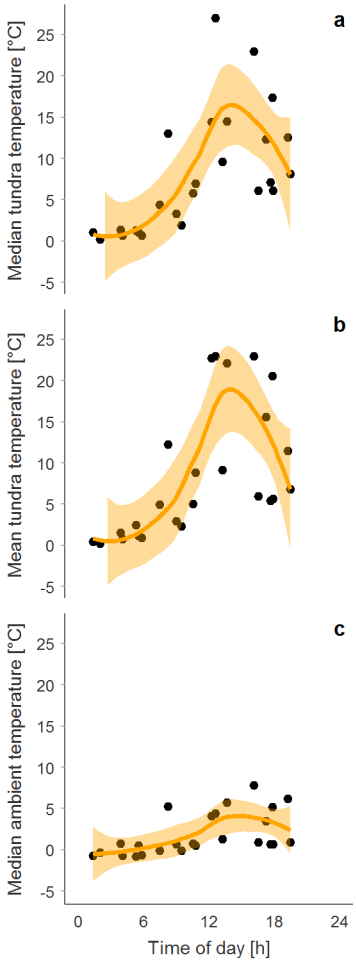

Figure S1| Change in tundra and ambient temperatures during treated bouts with time of day. a-c, Median (**a**) and mean (**b**) tundra temperature during the treated bout measure next to the nest and median ambient temperature at the study site measure 2 m above the ground (**c**; NOAA Earth System Research Laboratory; http://www.esrl.noaa.gov/). Points represent experimental bouts, lines represent loess smoothing and shaded area its confidence intervals generated by 'ggplot2' R package (Wickham 2009).

Figure S2 | Enclosure for nest-protection, boxes and shed for removed parents. a, Enclosure that protected the nest against avian predators (approximate size 0.8 × 0.7 × 0.5 m) was a modification of an earlier design (Bulla *et al.* 2015) and was made by cutting and bending a chicken wire (mesh size 5 × 5 cm and 5 × 10 cm where the cage touched the ground; wire ø 1.9 mm). The sharp parts sticking out into the air prohibit avian predators to land on the enclosure. The enclosure allowed incubating parents to fly off the nest, which was not the case for the earlier design (Bulla *et al.* 2015) – where some birds had difficulties escaping upon approach of avian predator (we recorded one case where a parent was caught by the avian predator). **b**, Removed parents were brought to the shed where they were kept in cardboard boxes (21 cm × 30 cm × 25cm; with holes on the sides). **c**, Each box was lined with tundra and contained water and feeding tray, both attached with Velcro to the bottom of the box.

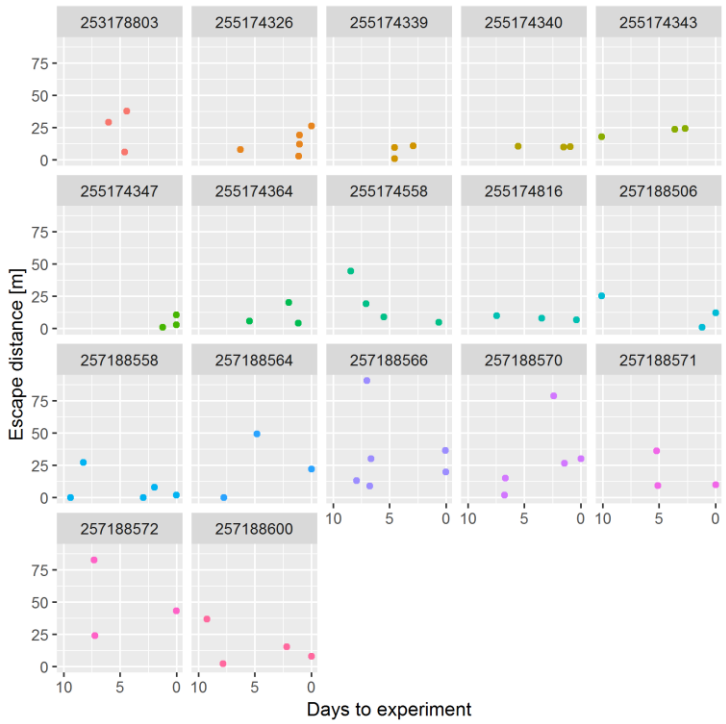

Figure S3 | Temporal change in escape distances of focal parents during pre-experimental period. Escaped distance in relation to number of days before the experiment started (indicated by zero). Each panel represents one of 25 focal parents. Dots indicate nest visits when escape distance was estimated. Note that also overall escape distance changed little over time during the pre-experimental period (estimate = -0.8 m per day, 95%CI: -1.9 – 0.23 m per day; based on mixed-effect model with random intercept of bird identity nested within nest identity; *N* = 110 escape distance observations of 49 individuals – focal and removed - from 25 nests).

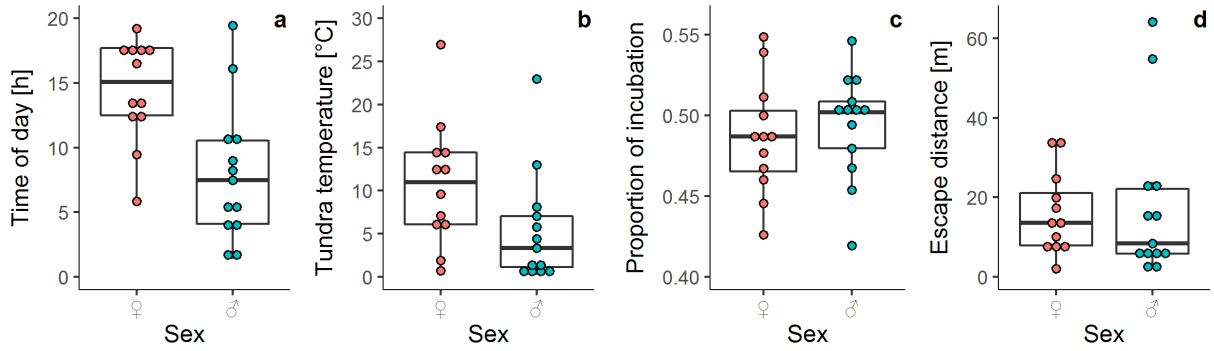

Figure S4 | Predictors of compensation according to sex of the focal parent. a-d, Relationship between sex of the focal parent and the mid-time of the treated period (**a**), the median tundra temperature at the nest during the treated period (**b**), the focal parent's share of incubation during the before-experimental period (**c**) and its median escape distance from the nest prior to the experiment (**d**). Points indicate individuals (female = red, male = blue). Box plots defined in Figure S4. *N* = 25 individuals.

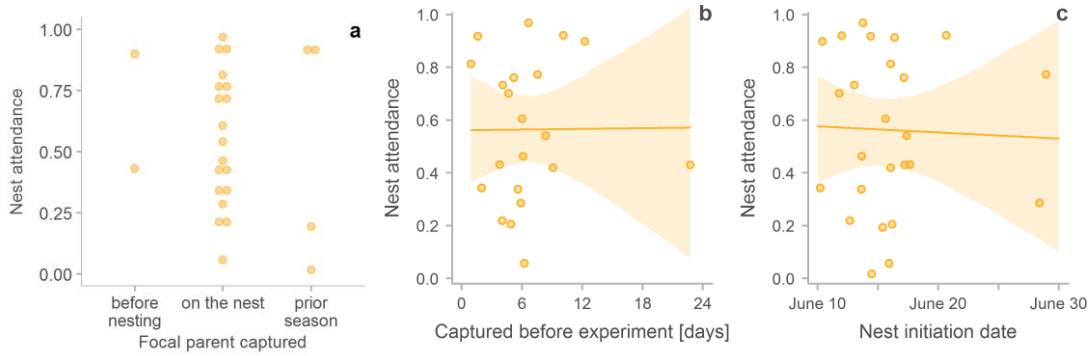

Figure S5 | Possible confounds of compensation response. a-c, Nest attendance during treated period (compensation) in relationship to when the focal parent was trapped (**a**; before nest initiation, while incubating or in previous seasons), in relationship to how many days prior to experiment was the focal parent captured (**b**), and in relationship to when the nest was initiated (**c**). Points indicate individuals ($N_{a,c}$ = 25, N_b = 21 individuals). Yellow lines with yellow-shaded areas indicate model predictions with 95%CI.

Table S1 | **Effects of treatment on nest attendance.**

Model	AIC	ΔAICc [a]	w_i [b]	ER [d]	Effect type	Effect	Estimate	95% CI Lower	95% CI Upper
Minimal	-5.64	0	0.624	1	Fixed	Intercept (control)	0.939	0.854	1.024
						Period (treated)	-0.384	-0.494	-0.266
					Random	Bird ID (intercept)	9%		
					(variance)	Residual	91%		
With period Length	-4.19	1.45	0.302	2.06	Fixed	Intercept (control)	0.915	0.823	1.011
						Period (treated)	-0.338	-0.484	-0.206
						Period length	0.035	-0.034	0.106
					Random	Bird ID (intercept)	9%		
					variance)	Residual	91%		
With sex	- 1.36	4.28	0.074	8.48	Fixed	Intercept (control, ♀)	0.942	0.811	1.063
						Period (treated)	-0.345	-0.517	-0.179
						Sex (♂)	-0.012	-0.183	0.156
						Period × Sex	-0.066	-0.304	0.165
					Random	Bird ID (intercept)	9%		
					(variance)	Residual	91%		

Shown are the posterior estimates (medians) of the effect sizes with the 95% credible intervals (CI) from a posterior distribution of 2,000 simulated values generated by the 'sim' function in R (Gelman & Su 2015). Variance components were estimated by the 'lmer' function in R (Bates *et al.* 2015). *N* = 25 individuals each with one control period, followed by one treated period (*N* = 50 periods). We used 50 as the number of independent observations for AICc computation.

Period length was z-transformed (mean-centred and divided by the standard deviation).

[a]The difference in AICc between the first-ranked model and the given model.

[b]Akaike weight – the weight of evidence that a given model is the best approximating model (i.e., probability of the model).

[d] Evidence ratio – model weight of the first-ranked model relative to that of the given model (i.e., how many times is the first-ranked model more likely than the given model).

Table S2 | **Predictors of nest attendance during the treated period.**

Model	AIC	ΔAICc [a]	w_i [b]	ER [d]	Effect	Estimate	95% CI Lower	95% CI Upper
Full	5.43	0	0.66	1	Intercept	0.556	0.457	0.651
					Tundra temperature (°C)	0.177	0.073	0.274
					Proportion of incubation	0.031	-0.069	0.136
					Escape distance (m)	0.139	0.04	0.237
Temperature	6.93	1.51	0.31	2	Intercept	0.557	0.445	0.674
					Tundra temperature (°C)	0.16	0.048	0.265
Time	15.71	10.28	0.00	171	Intercept	0.518	0.396	0.648
					sin (time)	-0.044	-0.203	0.114
					cos (time)	-0.174	-0.382	0.037
Proportion	16.74	11.32	0.00	287	Intercept	0.556	0.434	0.679
					Proportion of incubation	-0.015	-0.143	0.111
Escape	11.84	6.41	0.03	25	Intercept	0.556	0.446	0.672
					Escape distance (m)	0.129	0.019	0.246

Shown are the posterior estimates (medians) of the effect sizes with the 95% credible intervals (CI) from a posterior distribution of 2,000 simulated values generated by the 'sim' function in R (Gelman & Su 2015). *N* = 25 individuals. Temperature, proportion of incubation and escape distance were z-transformed.

[a]The difference in AICc between the first-ranked model and the given model.

[b]Akaike weight – the weight of evidence that a given model is the best approximating model (i.e., probability of the model).

[d]Evidence ratio – model weight of the first-ranked model relative to that of the given model (i.e., how many times is the first-ranked model more likely than the given model).

Table S3 | **Relationship between nest attendance and time-of-day during the control period and under natural conditions.**

				95% CI	
Model	Effect type	Effect	Estimate	Lower	Upper
Control period	Fixed	Intercept	0.929	0.911	0.947
		sin (time)	0.015	-0.005	0.035
		cos (time)	0.028	-0.003	0.058
Natural conditions 2011 data	Fixed	Intercept	0.929	0.918	0.939
		sin (time)	0.015	-0.011	0.007
		cos (time)	0.028	0.003	0.021
	Random (variance)	Bird ID (intercept)	22%		
		sin (time)	1%		
		cos (time)	1%		
		Residual	76%		

Shown are the posterior estimates (medians) of the effect sizes with the 95% credible intervals (CI) from a posterior distribution of 2,000 simulated values generated by the 'sim' function in R (Gelman & Su 2015). Variance components were estimated by the 'lmer' function in R (Bates *et al.* 2015).

$N_{Control}$ = 25 control periods (one per focal experimental parent); control period started with the arrival of the focal bird on the nest (after removal of its partner) and lasted for the length of median incubation bout, estimated from the three pre-experimental incubation bouts of the focal bird.

$N_{2011\ datal}$ = 832 incubation bouts from 47 nests (the data come from Bulla *et al.* 2013; Bulla *et al.* 2014)

Table S4 | Difference in nest attendance and bout length in the before- and after-experimental period.

Model	AIC	ΔAICc [a]	w_i [b]	ER [d]	Response variable	Effect type	Effect	Estimate	95% CI Lower	95% CI Upper
Day	-388.3	1.92	0.268	2.61	Incubation constancy (proportion)	Fixed	Intercept (before)	0.937	0.891	0.982
							Period (post)	-0.057	-0.128	0.011
							Day	-0.003	-0.023	0.016
							Period × Day	0.01	-0.021	0.04
						Random (variance)	Bird ID (intercept)	6%		
							Day (slope)	1%		
							Residual	93%		
Simple	-390.2	0	0.701	1	Incubation constancy (proportion)	Fixed	Intercept (before)	0.943	0.925	0.962
							Period (post)	-0.049	-0.076	-0.025
						Random (variance)	Bird ID (intercept)	3%		
							Residual	97%		
Complex	-383.9	6.27	0.03	22.98	Incubation constancy (proportion)	Fixed	Intercept (before, removed)	0.94	0.875	1.009
							Period (post)	-0.108	-0.206	-0.012
							Parent (focal)	-0.007	-0.093	0.079
							Day	-0.001	-0.027	0.025
							Period × Parent	0.105	-0.034	0.242
							Period × Day	0.017	-0.028	0.061
							Parent × Day	-0.005	-0.042	0.033
							Period × Parent × Day	-0.016	-0.077	0.041
						Random (variance)	Bird ID (intercept)	7%		
							Day (slope)	1%		
							Residual	92%		
Day	1045.7	0	0.992	1	Bout length (hours)	Fixed	Intercept (before)	11.94	10.74	13.15
							Period (post)	-5.64	-7.5	-3.71
							Day	-0.07	-0.6	0.46
							Period × Day	1.39	0.57	2.22
						Random (variance)	Bird ID (intercept)	9%		
							Day (slope)	1%		
							Residual	90%		
Simple	1064	18.3	0	9918	Bout length (hours)	Fixed	Intercept (before)	12.08	11.52	12.64
							Period (post)	-2.85	-3.62	-2.1
						Random (variance)	Bird ID (intercept)	3%		
							Residual	97%		
Complex	1055.3	9.63	0.008	122.44	Bout length (hours)	Fixed	Intercept (before, removed)	11.64	9.77	13.63
							Period (post)	-4.92	-7.86	-2.06
							Parent (focal)	0.48	-2	3.08
							Day	-0.2	-0.97	0.56
							Period × Parent	-1.51	-5.42	2.36
							Period × Day	1.48	0.2	2.68
							Parent × Day	0.26	-0.8	1.41
							Period × Parent × Day	-0.13	-1.9	1.69
						Random (variance)	Bird ID (intercept)	9%		
							Day (slope)	1%		
							Residual	90%		

Shown are the posterior estimates (medians) of the effect sizes with the 95% credible intervals (CI) from a posterior distribution of 2,000 simulated values generated by the 'sim' function in R (Gelman & Su 2015). Variance components were estimated by the 'lmer' function in R (Bates *et al.* 2015).

N = 214 incubation bouts from 36 individuals from 18 nests (three pre- and three post-experimental bouts for each individual, except for one nest where only two post-experimental bouts per parent could be recorded due to nest predation). We used 72 as the number of independent observations for AICc computation, i.e. 36 individuals with pre- and post-experimental period.

[a]The difference in AICc between the first-ranked model and the given model.

[b]Akaike weight – the weight of evidence that a given model is the best approximating model (i.e., probability of the model).

[d]Evidence ratio – model weight of the first-ranked model relative to that of the given model (i.e., how many times is the first-ranked model more likely than the given model).

Table S5 | Difference in probability and length of exchange gap in before- and after-experiment period.

Model	AIC	ΔAICc [a]	w_i [b]	ER [d]	Response	Effect type	Effect	Estimate	95% CI Lower	95% CI Upper
Day	236.4	6.92	0.03	31.82	Exchange gap (binomial scale)	Fixed	Intercept (before)	1.54	0.4	2.77
							Period (post)	0.91	-0.85	2.64
							Day	0.04	-0.46	0.6
							Period × Day	-0.51	-1.35	0.3
						Random (variance)	Bird ID (intercept)	99%		
							Day (slope)	1%		
Simple	229.4	0	0.964	1	Exchange gap (binomial scale)	Fixed	Intercept (before)	1.33	0.77	1.92
							Period (post)	0.21	-0.46	0.89
						Random	Bird ID (intercept)	1.06		
Complex	239.8	10.3	0.006	172.16	Exchange gap (binomial scale)	Fixed	Intercept (before, removed)	1.09	-0.28	2.66
							Period (post)	-0.18	-2.39	2.1
							Parent (focal)	1.64	-1.33	4.45
							Day	-0.02	-0.76	0.7
							Period × Parent	2.15	-2.11	6.24
							Period × Day	0.32	-0.81	1.46
							Parent × Day	0.4	-0.81	1.57
							Period × Parent × Day	-2.08	-3.76	-0.34
						Random (variance)	Bird ID (intercept)	99.6%		
							Day (slope)	0.4%		
Day	1862.9	5.61	0.057	16.51	Exchange gap (minutes)	Fixed	Intercept (before)	8.68	-23.7	42.25
							Period (post)	100.1	53.72	147.7
							Day	2.58	-11.82	16.68
							Period × Day	-40.62	-64.01	-17.99
						Random (variance)	Bird ID (intercept)	29%		
							Day (slope)	3%		
							Residual	68%		
Simple	1889.4	32.15	0	9586519	Exchange gap (minutes)	Fixed	Intercept (before)	2.62	-15.63	21.73
							Period (post)	33.04	10.85	54.5
						Random (variance)	Bird ID (intercept)	15%		
							Residual	85%		
Complex	1857.3	0	0.943	1	Exchange gap (minutes)	Fixed	Intercept (before, removed)	3.04	-38.43	43.71
							Period (post)	24.93	-37.64	91.44
							Parent (focal)	2.05	-63.35	67.22
							Day	0.25	-20.89	19.97
							Period × Parent	150.82	55.66	242.48
							Period × Day	-11.22	-43.8	20.99
							Parent × Day	1.32	-27.78	31.18
							Period × Parent × Day	-51.71	-94.35	-7.46
						Random (variance)	Bird ID (intercept)	27%		
							Day (slope)	2%		
							Residual	71%		

Shown are the posterior estimates (medians) of the effect sizes with the 95% credible intervals (CI) from a posterior distribution of 2,000 simulated values generated by the 'sim' function in R (Gelman & Su 2015). Variance components were estimated by the 'lmer' function in R (Bates *et al.* 2015).

$N_{binomial}$ = 214 exchange gaps from 36 individuals from 18 nests (three before- and three post-experimental gaps for each individual, except for one nest where only two post-experimental bouts per parent could be recorded due to nest predation). We used 72 as the number of observations for AICc computation, i.e, 36 individuals with pre- and post-experimental period.

$N_{minutes}$ = 164 non-zero exchange gaps (subset from $N_{binomial}$) from 35 individuals from 18 nests. We used 68 as the number of observations for AICc computation, because the exchange gap was zero for one individual in the before-experimental period and for another individual in the after-experimental period.

[a]The difference in AICc between the first-ranked model and the given model.

[b]Akaike weight – the weight of evidence that a given model is the best approximating model (i.e., probability of the model).

[d]Evidence ratio – model weight of the first-ranked model relative to that of the given model (i.e., how many times is the first-ranked model more likely than the given model).

Table S6 | Effect of mass loss of the removed parent on its nest attendance and bout length in the after-experimental period.

Model	AIC	ΔAICc [a]	w_i [b]	ER [d]	Response	Effect type	Effect	Estimate	95% CI Lower	95% CI Upper
Sex	-15.2	0	0.98	1	Incubation constancy (proportion)	Fixed	Intercept (♀)	0.925	0.838	1.01
							Mass loss	-0.005	-0.09	0.082
							Sex (♂)	-0.094	-0.19	0.008
							Mass loss × sex	0.044	-0.06	0.153
						Random (variance)	Bird ID (intercept)	0%		
							Mass loss (slope)	0%		
							Residual	100%		
Simple	-7.4	7.81	0.02	49.55	Incubation constancy (proportion)	Fixed	Intercept	0.866	0.815	0.917
							Mass loss	0.015	-0.03	0.064
						Random (variance)	Bird ID (intercept)	0%		
							Mass loss (slope)	0%		
							Residual	100%		
Sex	309.9	0	0.988	1	Bout length (hours)	Fixed	Intercept (♀)	9.917	8.024	11.77
							Mass loss	-0.871	-2.75	0.985
							Sex (♂)	-1.004	-3.18	1.221
							Mass loss × sex	1.676	-0.6	3.849
						Random (variance)	Bird ID (intercept)	5%		
							Mass loss (slope)	0%		
							Residual	95%		
Simple	318.8	8.86	0.012	83.88	Bout length (hours)	Fixed	Intercept	9.446	8.385	10.55
							Mass loss	0.073	-0.98	1.179
						Random (variance)	Bird ID (intercept)	1%		
							Mass loss (slope)	0%		
							Residual	99%		

Shown are the posterior estimates (medians) of the effect sizes with the 95% credible intervals (CI) from a posterior distribution of 2,000 simulated values generated by the 'sim' function in R (Gelman & Su 2015). Variance components were estimated by the 'lmer' function in R (Bates *et al.* 2015).

N = 53 incubation bouts from 18 individuals (three post-experimental bouts for each individual with exception of one where due to nest predation the parent has only two post-experimental bouts). We used 18 as the number of independent observations for AICc computation.

Mass loss (g). as a fixed effect, was z-transformed (mean-centred and divided by SD).

[a]The difference in AICc between the first-ranked model and the given model.

[b]Akaike weight – the weight of evidence that a given model is the best approximating model (i.e., probability of the model).

[d]Evidence ratio – model weight of the first-ranked model relative to that of the given model (i.e., how many times is the first-ranked model more likely than the given model).

Table S7 | **Effect of compensation on focal parent's nest attendance and bout length in the after-experimental period.**

Model	AIC	ΔAICc [a]	w_i [b]	ER [d]	Response	Effect type	Effect	Estimate	95% CI Lower	95% CI Upper
Sex	-147.7	0	0.996	1	Incubation constancy (proportion)	Fixed	Intercept (♀)	0.925	0.9	0.95
							Compensation	-0.012	-0.037	0.012
							Sex (♂)	-0.007	-0.051	0.04
							Compensation × sex	0.012	-0.03	0.053
						Random (variance)	Bird ID (intercept)	28%		
							Compensation (slope)	15%		
							Residual	57%		
Simple	-136.5	11.26	0.004	279.31	Incubation constancy (proportion)	Fixed	Intercept	0.923	0.902	0.943
							Compensation	-0.005	-0.025	0.014
						Random (variance)	Bird ID (intercept)	28%		
							Compensation (slope)	15%		
							Residual	57%		
Sex	317.8	0	0.918	1	Bout length (hours)	Fixed	Intercept (control, ♀)	8.217	6.939	9.553
							Compensation	-1.248	-2.827	0.22
							Sex (♂)	2.724	0.305	5.019
							Compensation × sex	1.806	-0.281	4.076
						Random (variance)	Bird ID (intercept)	0%		
							Compensation (slope)	0%		
							Residual	100%		
Simple	322.7	4.84	0.082	11.27	Bout length (hours)	Fixed	Intercept	9.06	7.896	10.277
							Compensation	-0.67	-1.891	0.501
						Random (variance)	Bird ID (intercept)	5%		
							Compensation (slope)	2%		
							Residual	93%		

Shown are the posterior estimates (medians) of the effect sizes with the 95% credible intervals (CI) from a posterior distribution of 2,000 simulated values generated by the 'sim' function in R (Gelman & Su 2015). Variance components were estimated by the 'lmer' function in R (Bates *et al.* 2015).

N = 53 incubation bouts from 18 individuals (three post-experimental bouts for each individual with exception of one where due to nest predation the parent incubated only for two post-experimental bouts). We used 18 as the number of independent observations for AICc computation.

Compensation (proportion) was z-transformed (mean-centred and divided by SD).

[a]The difference in AICc between the first-ranked model and the given model.

[b]Akaike weight – the weight of evidence that a given model is the best approximating model (i.e., probability of the model).

[d]Evidence ratio – model weight of the first-ranked model relative to that of the given model (i.e., how many times is the first-ranked model more likely than the given model).

ETHICS

All field procedures were performed in accordance with the relevant guidelines and regulations, and approved by the U.S. Department of the Interior, U.S. Fish and Wildlife Service, and State of Alaska Department of Fish and Game (permit no. 23520, MB210494-2, 13-122). The proportion of successful nests (at least one egg hatched or young left the nest) was similar in the experimental and non-experimental nests (Table S8).

The initial experimental plan was to remove an off-nest parent just before it was coming back to its nest (i.e. with refilled energy stores before taking over incubation) and to keep it for 24h, effectively manipulating its partner (the incubating parent) for 24h. The removed parent was then to be starved for 12 hours (simulating what would have happened when it incubated; estimating mass loss during an incubation bout was part of a different project) and given ad lib food for another 12 hours.

Because it turned out that catching the off-nest parent was too difficult, we resorted to a backup plan, namely to remove the incubating parent just before the end of its incubation bout and to keep it for 24 hours. In this way, its mate (i.e. the returning parent) would incubate first its regular incubation bout (~12 hours) and then be 'treated' for 12 hours (the expected bout of its partner). Unfortunately, we then made the mistake to keep the 12-hour starvation protocol for the first eight individuals. Two females in this group died. In line with the 'Refinement guidelines' (2002), with an effort to maximize the scientific benefit while minimizing suffering to the animals, we abandoned the starvation protocol as soon as we realized our mistake. Whether the two females starved to death is unclear because semipalmated sandpipers are able to continuously incubate (i.e. starve) for 24 hours or even longer (see Actograms in Bulla 2017). Moreover, the proportion of parents that returned to the nest (18 out of 27 birds) was similar for starved and non-starved parents (starved: 2/2 males, 2/4 females; non-starved: 10/10 males and 4/7 females), and so was the time it took a parent to return to the nest upon release from captivity (Figure S7).

Regardless of the protocol (with or without starvation) we released the birds with weights similar to those at capture (Figure S8 and the above 'Captivity conditions' section). Such changes in body mass are smaller than those typically experienced by parents during their incubation bout (our unpublished data) and smaller than those reported previously (Parra *et al.* 2014). Mass change during captivity was a weak predictor of how long it took a released parent to return to the nest (Table S9; but see a tendency for longer return times of females that lost more mass). Nevertheless, we did not detect major differences between focal (non-captured) and captive parents in their after-treatment incubation behaviour (Table S4). Importantly, the five females that did not return to the nest (if anything) lost less body mass in captivity than females that did return (Figure S8), suggesting that other factors were responsible for desertion.

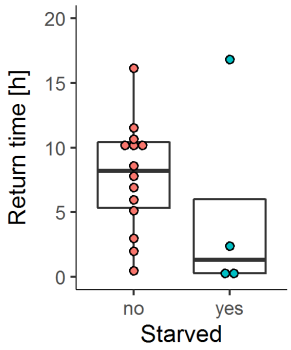

Figure S4 | Time it took the released parent to return to the nest. Each dot represents an individual, its colour whether the captive individual was first starved for 12h and then with ad lib food for the remaining 12h of captivity (in blue) or with ad lib food for the whole 24h captivity period (red). Box plots depict median (horizontal line inside the box), the 25th and 75th percentiles (box), the 25th and 75th percentiles ±1.5 times the interquartile range or the minimum/maximum value, whichever is smaller (bars), and the outliers (black dots).

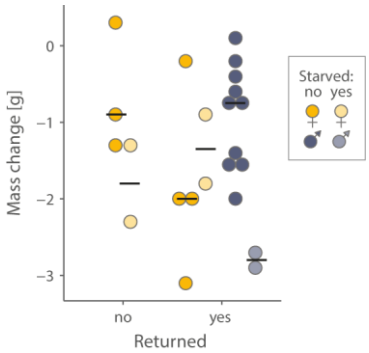

Figure S5 | Change in body mass between start and end of the captive period for individuals that were starved or not and that returned to the nest to incubate or not. Each dot represents one individual, its colour sex (female – yellow, male – grey-blue) and shade the feeding protocol (24 hours ad libitum – solid, 12 hours starved and then 12 hours ad libitum – light). Black lines indicate medians. *N* = 23 released individuals.

Table S8 | Number of nests with given fate.

Nest	Failed	Successful	Unknown
Experimental	13	12	4
Non-experimental	40	15	10

Table S9 | Return time in relation to mass change and sex.

				95% CI	
Model	Effect type	Effect	Estimate	Lower	Upper
Return time [h]	Fixed	Intercept (♀)	6.50	2.11	10.81
		Mass change (g)	-4.26	-8.63	0.54
		Sex (♂)	0.30	-4.97	6.16
		Mass change × Sex	3.45	-2.04	8.97

Shown are the posterior estimates (medians) of the effect sizes with the 95% credible intervals (CI) from a posterior distribution of 2,000 simulated values generated by the 'sim' function in R (Gelman & Su 2015). Variance components were estimated by the 'lmer' function in R (Bates *et al.* 2015). *N* = 18 individuals that returned to the nest upon release from captivity; mass change was z-transformed.

References

Bates, D., Maechler, M., Bolker, B. & Walker, S. (2015) Fitting Linear Mixed-Effects Models Using lme4. *Journal of Statistical Software,* **67,** 1-48. http://doi.org/10.18637/jss.v067.i01.

Bulla, M. (2017) Supporting information for 'Flexible parental care: Uniparental incubation in biparentally incubating shorebirds'. *Open Science Framework*, http://doi.org/10.17605/OSF.IO/3RSNY.

Bulla, M., Cresswell, W., Rutten, A.L., Valcu, M. & Kempenaers, B. (2015) Biparental incubation-scheduling: no experimental evidence for major energetic constraints. *Behavioral Ecology,* **26,** 30-37. http://doi.org/10.1093/beheco/aru156.

Bulla, M., Valcu, M., Rutten, A.L. & Kempenaers, B. (2013) Data from: Biparental incubation patterns in a high-Arctic breeding shorebird: how do pairs divide their duties? *Dryad Data Repository*, http://doi.org/10.5061/dryad.nh8f0.

Bulla, M., Valcu, M., Rutten, A.L. & Kempenaers, B. (2014) Biparental incubation patterns in a high-Arctic breeding shorebird: how do pairs divide their duties? *Behavioral Ecology,* **25,** 152-164. http://doi.org/10.1093/beheco/art098.

Gelman, A. & Su, Y.-S. (2015) arm: Data Analysis Using Regression and Multilevel/Hierarchical Models. R package version 1.8-6., http://CRAN.R-project.org/package=arm.

Parra, J.E., Beltrán, M., Zefania, S., Dos Remedios, N. & Székely, T. (2014) Experimental assessment of mating opportunities in three shorebird species. *Animal Behaviour,* **90,** 83-90. http://doi.org/10.1016/j.anbehav.2013.12.030.

Wickham, H. (2009) *ggplot2: Elegant Graphics for Data Analysis*. Springer Publishing Company, Incorporated.