

Supplementary material

Table S1. Number of male and female penguins tracked from Béchervaise Island each year, presented alongside the number of foraging trips per season and chick-rearing period (guard and crèche).

		Birds	Total trips	Guard trips	Crèche trips
1992-93	Female	3	3	1	2
	Male	5	8	5	3
	Total	8	11	6	5
1993-94	Female	3	8	7	1
	Male	4	7	5	2
	Total	7	15	12	3
1994-95	Female	2	2	2	0
	Male	2	2	2	0
	Total	4	4	4	0
1995-96	Female	0	0	0	0
	Male	1	2	2	0
	Total	1	2	2	0
1996-97	Female	1	2	2	0
	Male	1	2	2	0
	Total	2	4	4	0
1998-99	Female	3	11	7	4
	Male	3	8	5	3
	Total	6	19	12	7
2000-01	Female	10	19	14	5
	Male	12	22	12	10
	Total	22	41	26	15
2001-02	Female	2	5	5	0
	Male	3	6	5	1
	Total	5	11	10	1
2002-03	Female	3	4	1	3
	Male	4	11	10	1
	Total	7	15	11	4
2003-04	Female	1	1	1	0
	Male	1	2	2	0
	Total	2	3	3	0
Total	Female	28	55	40	15
	Male	36	70	50	20
	Total	64	125	90	35

Table S2. Results of linear mixed effects models for trip-level diving parameters in relation to sex and stage, allowing an interaction term. Estimated means \pm SE are presented on the natural log scale, and the logit scale for proportion of bottom time. See *Methods* and Table 1 for details of diving parameters and model fits. Note that females during guard are the reference level. Significant p-values are highlighted in bold text.

Response variable	Predictor variable	Coefficients			
		Est	SE	t-value	p-value
Foraging trip duration (hours)	Intercept	3.80	0.14	26.82	<0.0001
	Sex (male)	-0.31	0.18	-1.72	0.68
	Stage (crèche)	0.38	0.23	1.61	<0.0001
	Sex (male) * Stage (crèche)	0.69	0.31	2.09	<0.05
Dives per foraging trip	Intercept	6.42	0.16	40.98	<0.001
	Sex (male)	-0.65	0.21	-3.07	0.08
	Stage (crèche)	0.53	0.28	1.91	<0.001
	Sex (male) * Stage (crèche)	1.05	0.37	2.84	<0.01
Vertical distance travelled (km)	Intercept	2.64	0.16	16.60	<0.001
	Sex (male)	-0.32	0.20	-1.64	0.64
	Stage (crèche)	0.48	0.24	1.99	<0.001
	Sex (male) * Stage (crèche)	0.72	0.32	2.22	<0.05
Number of wiggles	Intercept	7.60	0.30	25.72	<0.001
	Sex (male)	-0.39	0.22	-1.72	0.53
	Stage (crèche)	0.63	0.29	2.18	<0.001
	Sex (male) * Stage (crèche)	0.78	0.39	2.01	<0.05
Vertical dive rate (m h ⁻¹)	Intercept	5.67	0.12	47.28	<0.001
	Sex (male)	0.28	0.18	2.38	<0.05
	Stage (crèche)	0.16	0.14	1.16	0.74
	Sex (male) * Stage (crèche)	-0.23	0.18	-1.27	0.21
Proportion of bottom time	Intercept	-0.01	0.11	-0.01	0.68
	Sex (male)	-0.06	0.87	-0.73	0.83
	Stage (crèche)	-0.15	0.10	-1.61	0.79
	Sex (male) * Stage (crèche)	0.25	0.13	1.96	0.06
ACPUE _t	Intercept	2.50	0.15	16.88	<0.001
	Sex (male)	-0.05	0.05	-1.11	0.55
	Stage (crèche)	0.08	0.05	0.14	0.18
	Sex (male) * Stage (crèche)	0.08	0.07	1.15	0.26
Dive frequency (h ⁻¹)	Intercept	2.70	0.07	37.70	<0.001
	Sex (male)	-0.03	0.08	-0.42	0.94
	Stage (crèche)	0.01	0.10	0.11	0.39
	Sex (male) * Stage (crèche)	0.08	0.13	0.63	0.53

Table S3. Results of linear mixed effects models for bout-level diving parameters in relation to sex and stage. Estimated means \pm SE are presented on the natural log scale, and the logit scale for proportion of dives in bout. Results presented as in Table S2.

Response variable	Predictor variable	Coefficients			
		Est	SE	t-value	p-value
Total number of bouts	Intercept	2.97	0.16	18.54	<0.0001
	Sex (male)	-0.49	0.21	-2.28	0.26
	Stage (crèche)	0.44	0.26	1.66	<0.0001
	Sex (male) * Stage (crèche)	0.89	0.35	2.52	<0.05
Dives per bout	Intercept	2.47	0.10	24.26	<0.001
	Sex (male)	-0.02	0.10	-0.24	0.51
	Stage (crèche)	0.15	0.07	2.16	0.06
	Sex (male) * Stage (crèche)	-0.11	0.11	-1.07	0.28
Proportion of dives in bouts	Intercept	0.69	0.18	3.81	<0.0001
	Sex (male)	0.43	0.17	2.45	0.19
	Stage (crèche)	0.52	0.21	2.44	0.55
	Sex (male) * Stage (crèche)	-0.77	0.28	-2.74	<0.01

Table S4. Results of linear mixed effects models for dive-level parameters in relation to other dive-level variables, sex, stage and solar position. Estimated means \pm SE are presented on the natural log scale. Results presented as in Table S2.

Response variable	Predictor variable	Coefficients			
		Est	SE	t-value	p-value
Depth (m)	Intercept	3.23	0.09	34.32	<0.0001
	Sex (male)	0.10	0.06	1.64	0.43
	Stage (crèche)	0.01	0.01	0.31	<0.0001
	Sex (male) * Stage (crèche)	-0.14	0.02	-8.10	<0.0001
	Solar	-0.01	0.01	-10.45	0.16
	Solar (quadratic)	0.01	0.01	10.43	<0.0001
	Duration (s)	Intercept	2.90	0.02	177.60
Depth		0.47	0.01	508.46	<0.0001
Sex (male)		0.03	0.02	1.77	0.89
Stage (crèche)		0.05	0.01	15.04	<0.001
Sex (male) * Stage (crèche)		-0.08	0.01	-16.93	<0.0001
Solar		-0.01	0.01	-3.77	<0.0001
Solar (quadratic)		-0.01	0.01	-1.02	0.38
Bottom duration (s)	Intercept	-0.85	0.03	-24.79	<0.0001
	Depth	-0.60	0.01	-218.73	<0.0001
	Duration	1.46	0.01	289.67	<0.0001
	Sex (male)	0.05	0.03	2.11	0.08
	Stage (crèche)	-0.01	0.01	2.38	0.78
	Sex (male) * Stage (crèche)	-0.19	0.01	-2.82	<0.01
	Solar	0.01	0.01	2.16	<0.0001
	Solar (quadratic)	-0.01	0.01	-3.62	<0.001
Wiggles	Intercept	-0.77	0.11	-6.98	<0.0001
	Bottom duration	0.68	0.01	161.55	<0.0001
	Sex (male)	-0.02	0.04	0.54	0.48
	Stage (crèche)	-0.04	0.01	-4.80	<0.001
	Sex (male) * Stage (crèche)	0.01	0.01	1.27	0.21
	Solar	0.01	0.01	0.83	<0.0001
	Solar (quadratic)	0.01	0.01	0.75	0.47
ACPUE _d	Intercept	-1.80	0.11	-15.73	<0.0001
	Duration	-0.06	0.01	-14.57	<0.0001
	Sex (male)	-0.01	0.04	-0.37	0.77
	Stage (crèche)	-0.07	0.01	-7.88	<0.0001
	Sex (male) * Stage (crèche)	0.07	0.01	5.41	<0.001
	Solar	0.01	0.01	1.60	<0.0001
	Solar (quadratic)	-0.01	0.01	0.77	0.50

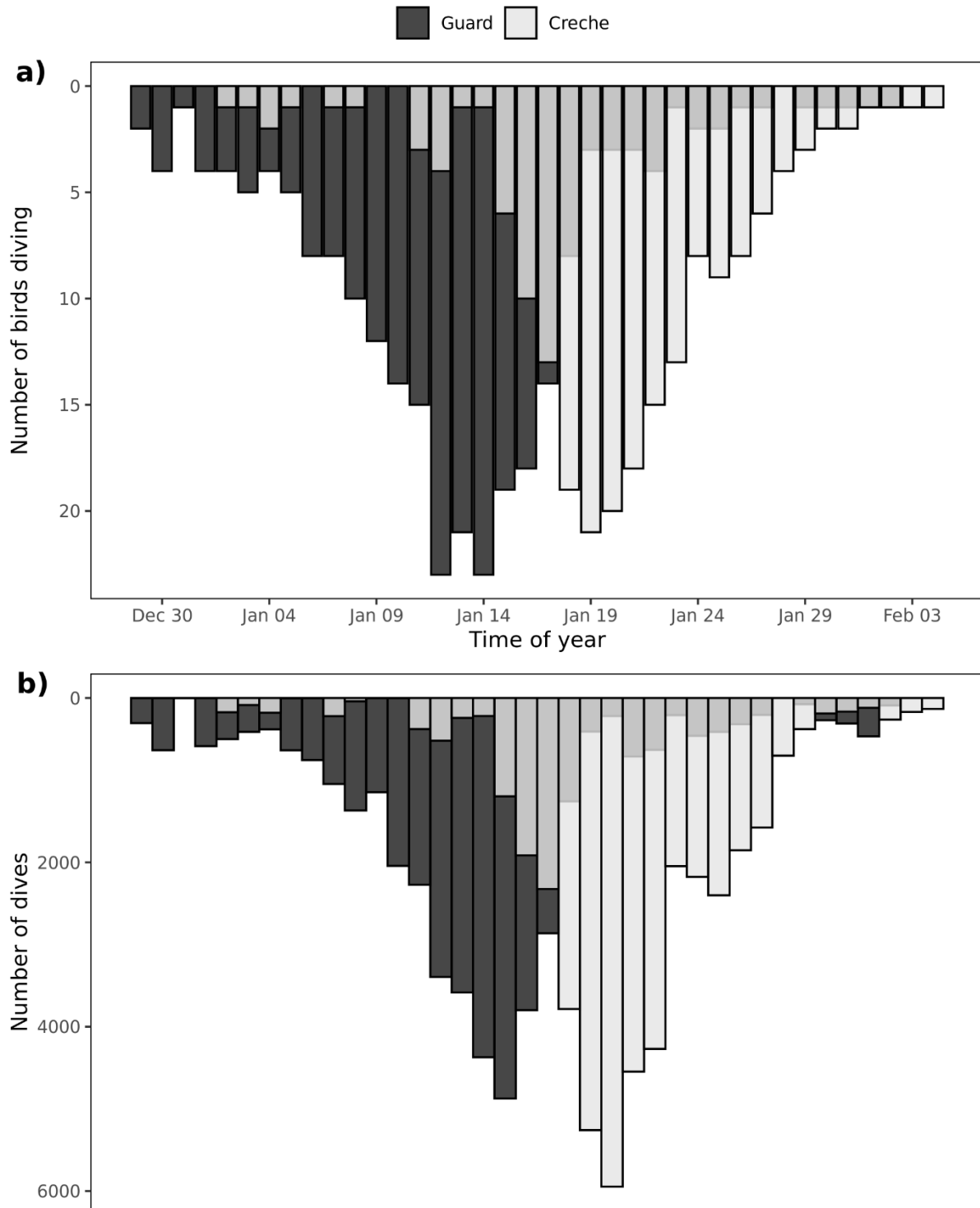


Fig. S1. Compiled TDR data showing the available observations of diving activity through time (total $n = 64$ birds, $n = 84,521$ foraging dives). Displayed over the chick-rearing period are the number of recorded a) penguins in the water diving, and b) foraging dives aggregated across all penguins. Shading represents guard (black) and crèche (grey) stages, with transparency to show overlap.

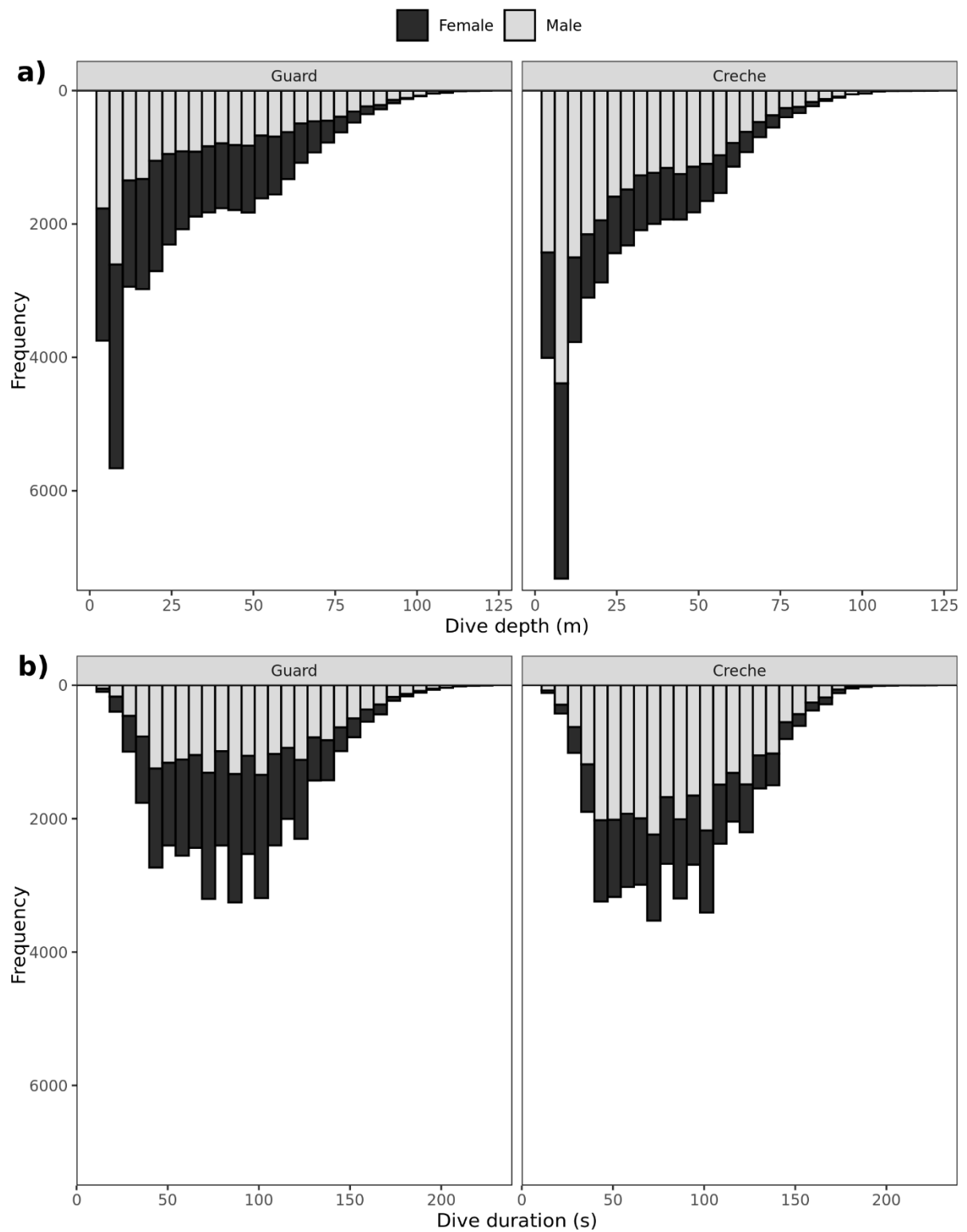


Fig. S2. Compiled TDR data showing the available observations of diving behaviour through time (total $n = 64$ birds, $n = 84,521$ foraging dives). Displayed is the frequency of diving a) depth and b) duration for females (black) and males (grey) over the two chick-rearing stages (guard and crèche).