

Supplementary Material

Table S1. Summary of northern rockhopper penguin breeding colonies in the Tristan da Cunha archipelago and Gough Island and the corresponding census year where available. Accuracy codes: 1 direct counts of all nests; 2 density of nests in transects extrapolated to area; 3 shore-based or boat-based scan counts of apparently incubating adults; 4 penguin numbers on beach, converted to pairs following Ryan (2005). Amsterdam and St. Paul islands in the southern Indian Ocean are included for context.

Island	Colony ID	Colony	Latitude	Longitude	Breeding pairs	Year of census	Accuracy code	Reference
Tristan da Cunha	1	Jew's Point East	-37.071	-12.249	731	2015	1	TCD/RSPB unpubl. data
	2	Big Gulch	-37.107	-12.220	721	2015	1	TCD/RSPB unpubl. data
	3	Phoenix Beach	-37.110	-12.218	162	2015	1	TCD/RSPB unpubl. data
	4	East End of Sandy Point	-37.118	-12.218	851	2015	1	TCD/RSPB unpubl. data
	5	Trypot Bay	-37.146	-12.254	231	2015	1	TCD/RSPB unpubl. data
	6	Goat Road Gulch	-37.152	-12.259	480	2015	1	TCD/RSPB unpubl. data
	7	Stony Beach	-37.160	-12.268	101	2015	1	TCD/RSPB unpubl. data
	8	Stony Hill	-37.165	-12.272	307	2015	1	TCD/RSPB unpubl. data
		<i>TOTAL</i>			3584			
Inaccessible	9	Blenden Hall	-37.293	-12.698	2768	2016	2	TCD/RSPB unpubl. data
	10	Warren's Cliff	-37.285	-12.689	4529	2011	2	Ryan et al. 2019
	11	Where the pig fell off	-37.283	-12.675	3630	2018	4	Ryan et al. 2019/Ryan 2005

Island	Colony ID	Colony	Latitude	Longitude	Breeding pairs	Year of census	Accuracy code	Reference
	12	Salt Beach	-37.290	-12.666	31254	2016	2	TCD/RSPB unpubl. data
	13	Waterfall	-37.292	-12.657	1500	2009	2	TCD/RSPB unpubl. data
	14	Pig Beach	-37.295	-12.649	800	2018	4	Ryan et al. 2019/Ryan 2005
	15	East Point	-37.300	-12.642	600	2018	4	Ryan et al. 2019/Ryan 2005
	16	South Hill	-37.317	-12.687	200	2018	4	Ryan et al. 2019/Ryan 2005
		<i>TOTAL</i>			45281			
Nightingale	17	Sergeant Major	-37.418	-12.477	18190	2017	2	TCD/RSPB unpubl. data
	17a	A	-37.416	-12.476	573	2017	2	TCD/RSPB unpubl. data
	17b	B	-37.419	-12.478	1020	2017	2	TCD/RSPB unpubl. data
	17c	C	-37.418	-12.476	294	2017	2	TCD/RSPB unpubl. data
	17d	D	-37.419	-12.478	297	2017	2	TCD/RSPB unpubl. data
	17e	E	-37.418	-12.476	47	2017	1	TCD/RSPB unpubl. data
	18	Ned's Cave	-37.429	-12.482	250	2019	3	Ryan pers. com.
		<i>TOTAL</i>			20671			

Island	Colony ID	Colony	Latitude	Longitude	Breeding pairs	Year of census	Accuracy code	Reference
Alex/Middle	19	A	-37.410	-12.480	53196	2016	2	TCD/RSPB unpubl. data
	20	B	-37.411	-12.478	8957	2016	2	TCD/RSPB unpubl. data
	<i>TOTAL</i>				62153			
Gough	21	The Glen/	-40.322	-9.899	3250	2006	2	Cuthbert et al. 2009
	22	Sophora Glen	-40.323	-9.899				
	23	Admirals	-40.345	-9.879	1789	2017	3	RSPB unpubl. data
	24	Seal Beach	-40.353	-9.883	1384	2019	3	RSPB unpubl. data
	25	Tumbledown	-40.357	-9.884	2546	2019	3	RSPB unpubl. data
	26	Rockhopper Point	-40.364	-9.929	7590	2019	3	RSPB unpubl. Data
	27	Remaining colonies			13309-51391	2004/2006	3	Cuthbert et al. 2009
Atlantic Ocean Total		<i>TOTAL</i>			164089-196389			
Amsterdam		<i>TOTAL</i>	-37.83	77.55	12161	2015		Barbraud et al. 2020
St Paul		<i>TOTAL</i>	-38.73	77.52	9023	1993		Guinard et al. 1998
Indian Ocean Total		<i>TOTAL</i>			21184			

Table S2. Summary of device deployments on male and female northern rockhopper penguins on islands belonging to the Tristan da Cunha group between 2012 and 2016. The devices deployed on Inaccessible Island downloaded data to a base station and were therefore not retrieved. Note that the sum of the number of penguins with complete tracks during crèche from Table 1 in the main article and the total for crèche here do not match. This is because three penguins performed both long and short crèche trips.

Stage	Sex	Island	Year	Device deployments	Devices retrieved	Data sets recovered	No. of birds with tracks (no. of birds with multiple trips)	No. of birds with complete tracks	No. of complete tracks used in analysis	No. of incomplete tracks not used in analysis
Incubation	male	Gough	2012	10	10	6	6	6	7	0
			2013	10	0	0	0	0	0	0
		Nightingale	2012	10	4	4	4	0	0	4
			2013	10	8	7	7	2	2	5
			2016	10	10	10	10	10	10	0
	female	Gough	2012	6	2	1	1	1	1	0
			2013	10	6	3	3	3	3	0
		Nightingale	2012	6	3	3	0	0	0	3
			2013	7	4	4	2	2	2	0
			2016	10	10	10	10	10	11	0
Brood-guard	female	Gough	2012	20	14	12	12 (4)	12	17	0
			2013	20	18	11	11 (1)	11	15	0
		Inaccessible	2016	10	-	6	6	6	7	0
		Nightingale	2012	15	11	11	11 (3)	9	11	3
			2013	38	21	13	13 (4)	13	18	0
			2016	24	21	21	21(20)	20	70	5
	Crèche	male and female	Nightingale	2012	3	2	2	2	2	0
			2013	11	6	6	4	4	2	
			2016	20	16	16	16	32	0	
				250	166	146	139	127	212	22

Table S3. Summary of sampling intervals for all deployments on northern rockhopper penguins on Nightingale, Inaccessible and Gough islands in 2012, 2013 and 2016 during the three stages of the species' breeding cycle.

Year	Sex	Device	Island	Sampling interval	Data sets with complete tracks
		Type			
Incubation	2012	CatTraqs ¹	Gough	0-1/12-13 every 5 mins	8
	2013	IGotU ¹		60 mins	3
	2012	CatTraqs ¹	Nightingale	0-1/12-13 every 5 min or 60 mins	0
	2013	IGotU ¹		00:00-01:00 h and 12:00 - 13:00 h every 5 min or 60 mins	4
	2016	Pathtrack GEO		15 mins (males) 10 mins (females)	21
Brood-guard	2012	CatTraq	Gough	0.75 mins and 1.5 mins	17
		Sirtrack		2 mins	0
	2013	IGotU		0.75 mins	5
		Sirtrack		2 mins	10
	2012	CatTraq	Nightingale	0.75 mins	8
		Sirtrack		3 mins	3
	2013	IGotU		0.75 mins	4
		Sirtrack		2 mins	14
	2016	Pathtrack GEO		3 mins	70
	2016	Pathtrack GEO +RT	Inaccessible	3 mins	7
Crèche	2012	CatTraq	Nightingale	0.75 mins	2
	2013	IGotU		0.75 mins	4
	2016	Pathtrack GEO		3 mins	32

¹see Cottin et al. (2012) and Whitehead et al. (2016)

References

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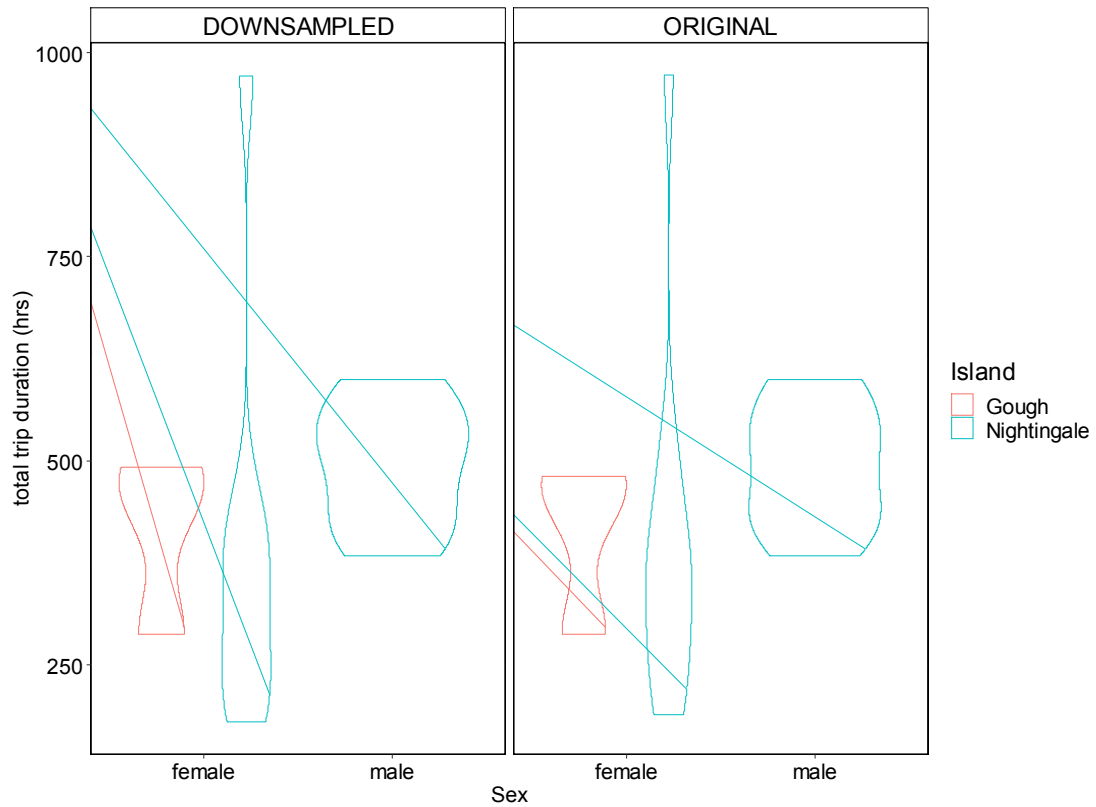


Figure S1. Violin plots of the distribution of northern rockhopper trip durations (in hr) during incubation based on high-resolution GPS sampling at 10-60 min regular intervals (ORIGINAL) and when the same data were down-sampled to two locations per day (DOWNSAMPLED), matching the lowest temporal resolution of any of our sampling devices.

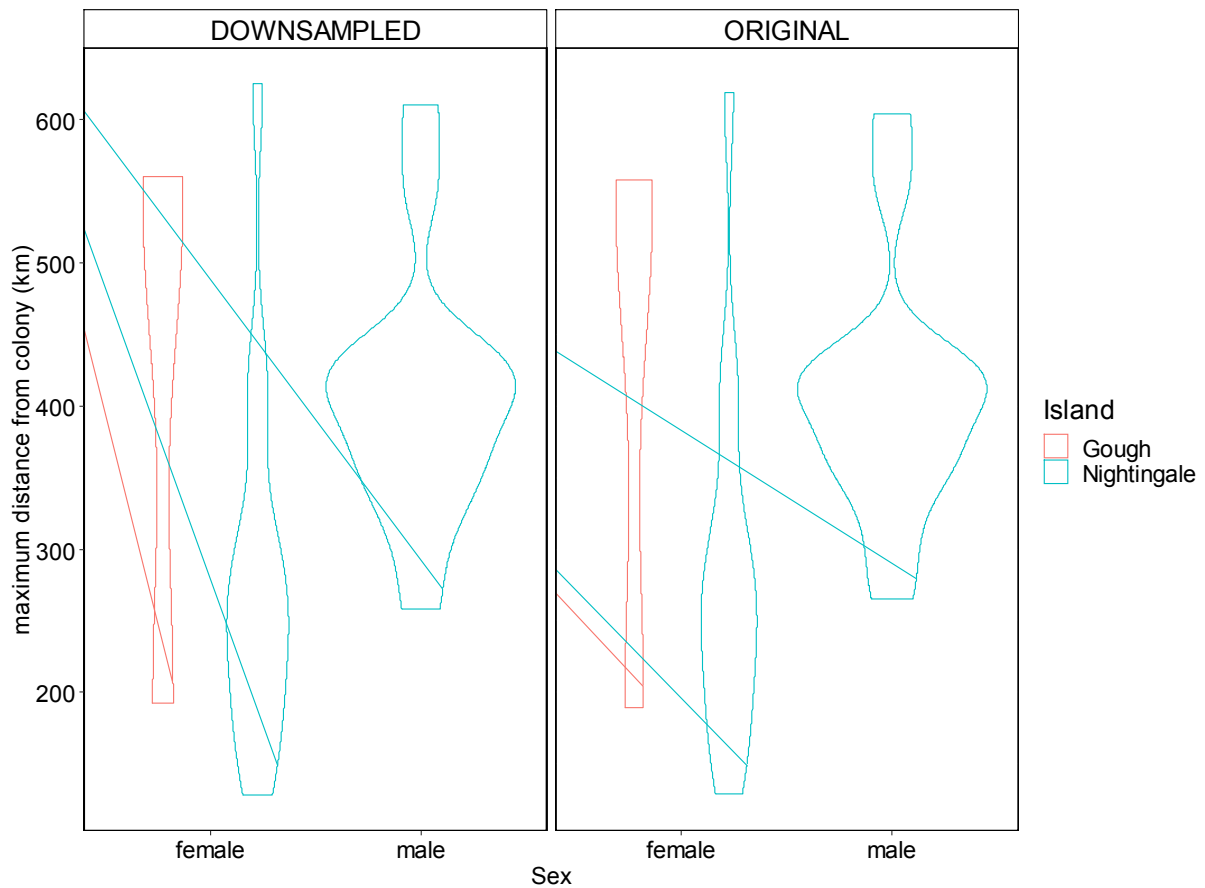


Figure S2. Violin plots of the distribution of northern rockhopper trip foraging ranges (in km) during incubation based on high-resolution GPS sampling at 10-60 min regular intervals (ORIGINAL) and when the same data were down-sampled to two locations per day (DOWNSAMPLED), matching the lowest temporal resolution of any of our sampling devices.