SUPPLEMENTARY INFORMATION

Appendix S2

for doi: 10.1098/rspb.2021.2452

Proceedings of the Royal Society B Biological Sciences

Elephant seal foraging success is enhanced in Antarctic coastal polynyas

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Table S1. Number of seals used for the analysis. Instrumented refers to all seals initially considered for this study, while Antarctic foragers refers to seals that spend at least 50% of their foraging time south of 58.5°S (see **Fig. S1**).

Season	Tagging location	Latitude	Longitude	Instrumented		Antarctic foragers	
				Female	Male	Female	Male
2008/2009	Kerguelen Is.	49°20'S	70°20'E	0	9	0	4
2010/2011	Prydz Bay	68°34'S	77°58'E	0	20	0	20
2011/2012	Vincennes Bay	66°20'S	110°28'E	2	22	2	21
2011/2012	Prydz Bay	68°34'S	77°58'E	0	20	0	18
2012/2013	Kerguelen Is.	49°20'S	70°20'E	15	12	6	7
2013/2014	Kerguelen Is.	49°20'S	70°20'E	6	8	2	3
2013/2014	Kerguelen Is.	49°20'S	70°20'E	1	1	1	0
2014/2015	Kerguelen Is.	49°20'S	70°20'E	12	11	4	5
2015/2016	Prydz Bay	68°34'S	77°58'E	0	2	0	2
2015/2016	Kerguelen Is.	49°20'S	70°20'E	10	2	3	1
2016/2017	Prydz Bay	68°34'S	77°58'E	0	6	0	6
2016/2017	Kerguelen Is.	49°20'S	70°20'E	8	2	2	2
2017/2018	Kerguelen Is.	49°20'S	70°20'E	13	11	4	6
	Total			**67**	**126**	**24**	**95**

Table S2. Candidate mixed-effect models for polynya usage ordered by ΔAICc. The two best models have a very similar AICc value (ΔAICc = 0.884) and a cumulative weight of 100% making them essentially equivalent (Burnham and Anderson 2002). The difference between both model formulation is the inclusion of deployment location as a fixed effect in the top-ranked model.

Intercept	Tagging L oc ation	Behavioural state	Δ Drift rate	S ex	df	logLik	AICc	ΔAICc	weight
-0.1393	+	0.6536	0.2195	+	6	-10388.8	20789.67	0	0.609
0.3804		0.6537	0.22	+	5	-10390.3	20790.55	0.884	0.391
-2.5818	+	0.6533	0.2193		5	-10432.1	20874.17	84.498	0
-0.1786	+	0.6835		+	5	-10442	20893.94	104.267	0
0.3797		0.6837		+	4	-10443.6	20895.26	105.59	0
-0.8023		0.6535	0.2205		4	-10447.3	20902.5	112.833	0
-2.6125	+	0.6833			4	-10485.1	20978.16	188.494	0
-0.8069		0.6836			3	-10500.7	21007.43	217.76	0
-0.1313	+		0.3478	+	5	-10935	21879.93	1090.265	0
0.431			0.3484	+	4	-10936.5	21880.92	1091.254	0

Table S3. Candidate mixed-effect models for change in drift rate (foraging success) ordered by ΔAICc. The two best models have a similar AICc value (Delta AICc = 0.93) and a cumulative weight of 95.6%.

Intercept	Tagging location	Polynya usage	Behavioural state	Sex	df	logLik	AICc	ΔAICc	weight
0.0538	+	+	0.0108		7	23152.05	-46290.1	0	0.587
0.0476	+	+	0.011	+	8	23152.58	-46289.2	0.931	0.369
0.0569	+		0.0113		6	23148.07	-46284.1	5.962	0.03
0.0528	+		0.0115	+	7	23148.3	-46282.6	7.491	0.014
0.0777		+	0.0112		6	23142.71	-46273.4	16.676	0
0.0812		+	0.011	+	7	23143.5	-46273	17.085	0
0.0514	+	+			6	23140.83	-46269.7	20.426	0
0.0472	+	+		+	7	23141.06	-46268.1	21.982	0
0.0871			0.0115	+	6	23139.13	-46266.3	23.826	0
0.0828			0.0118		5	23137.74	-46265.5	24.609	0

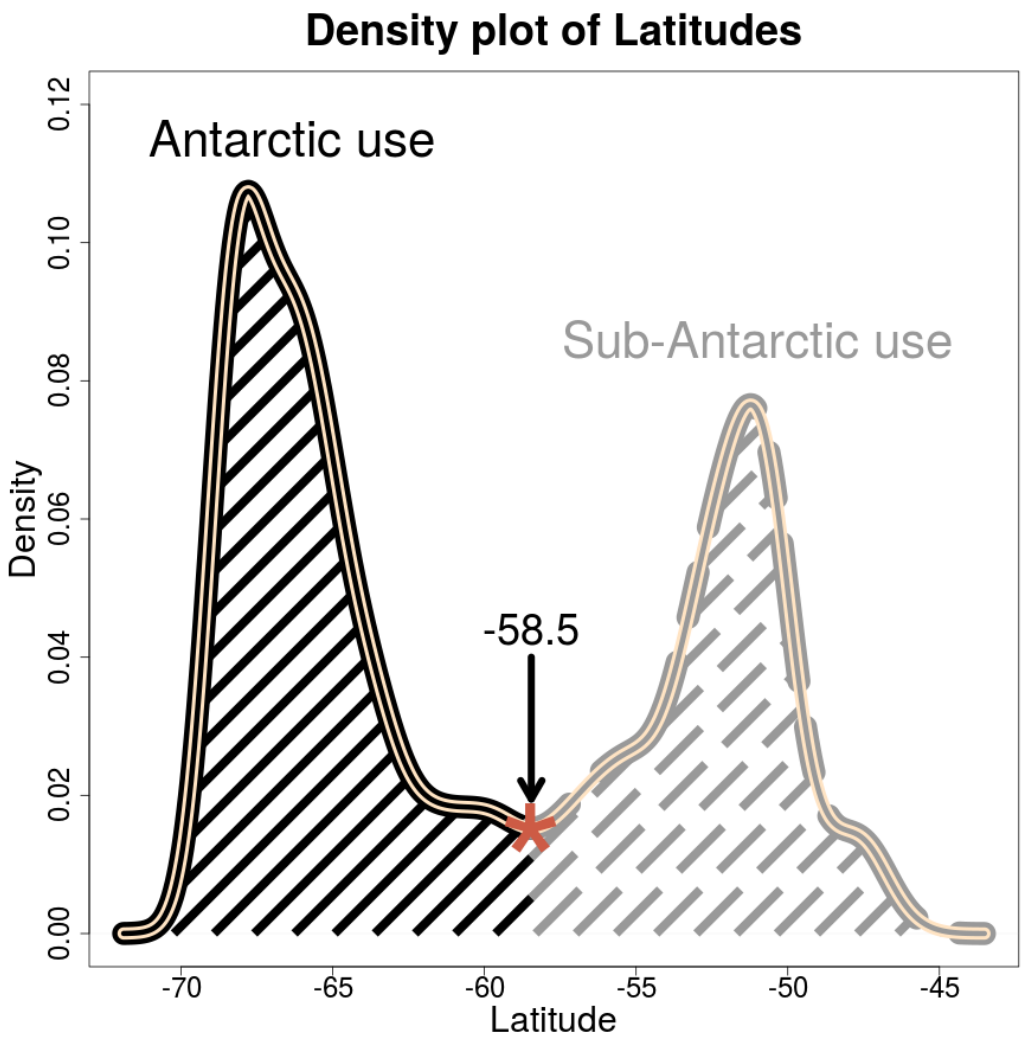

Fig. S1. Density distribution of state-space filtered latitudes from 119 tracked southern elephant seals. The minimum density value in-between the two peaks occurs at 58.5°S. This value is used as a threshold to demarcate seals as Antarctic vs non-Antarctic foragers.

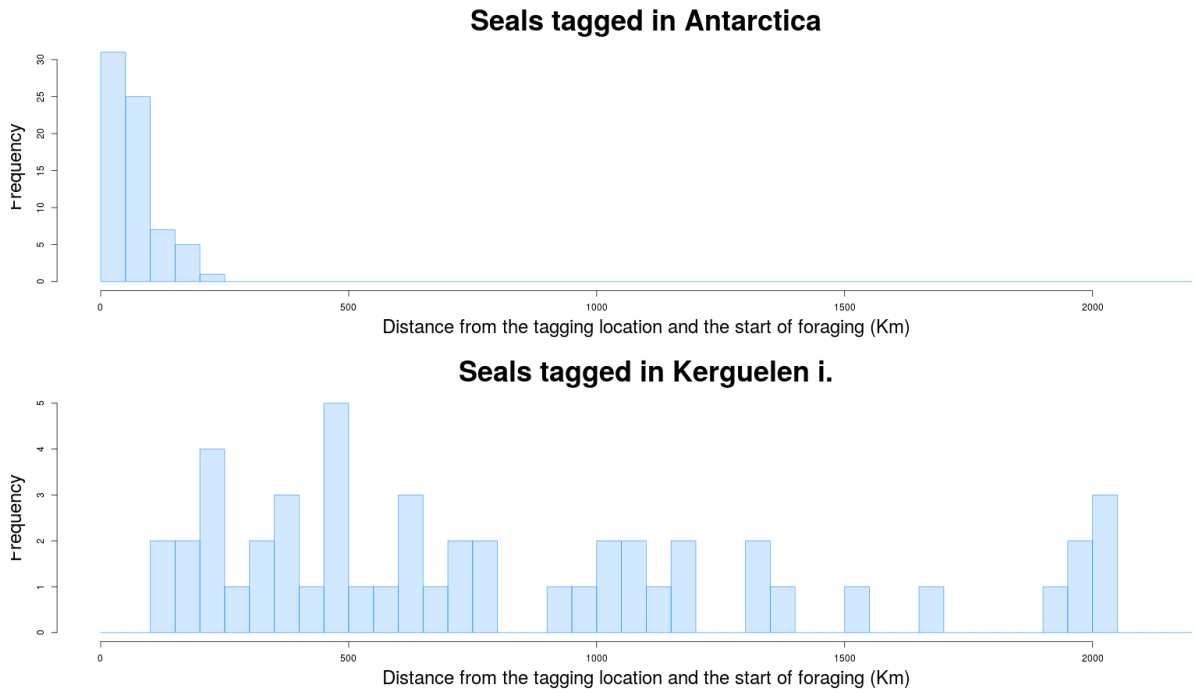

Fig. S2. Histogram showing the distance (km) from the tagging location to the commencement of drift diving (considered the start of foraging).

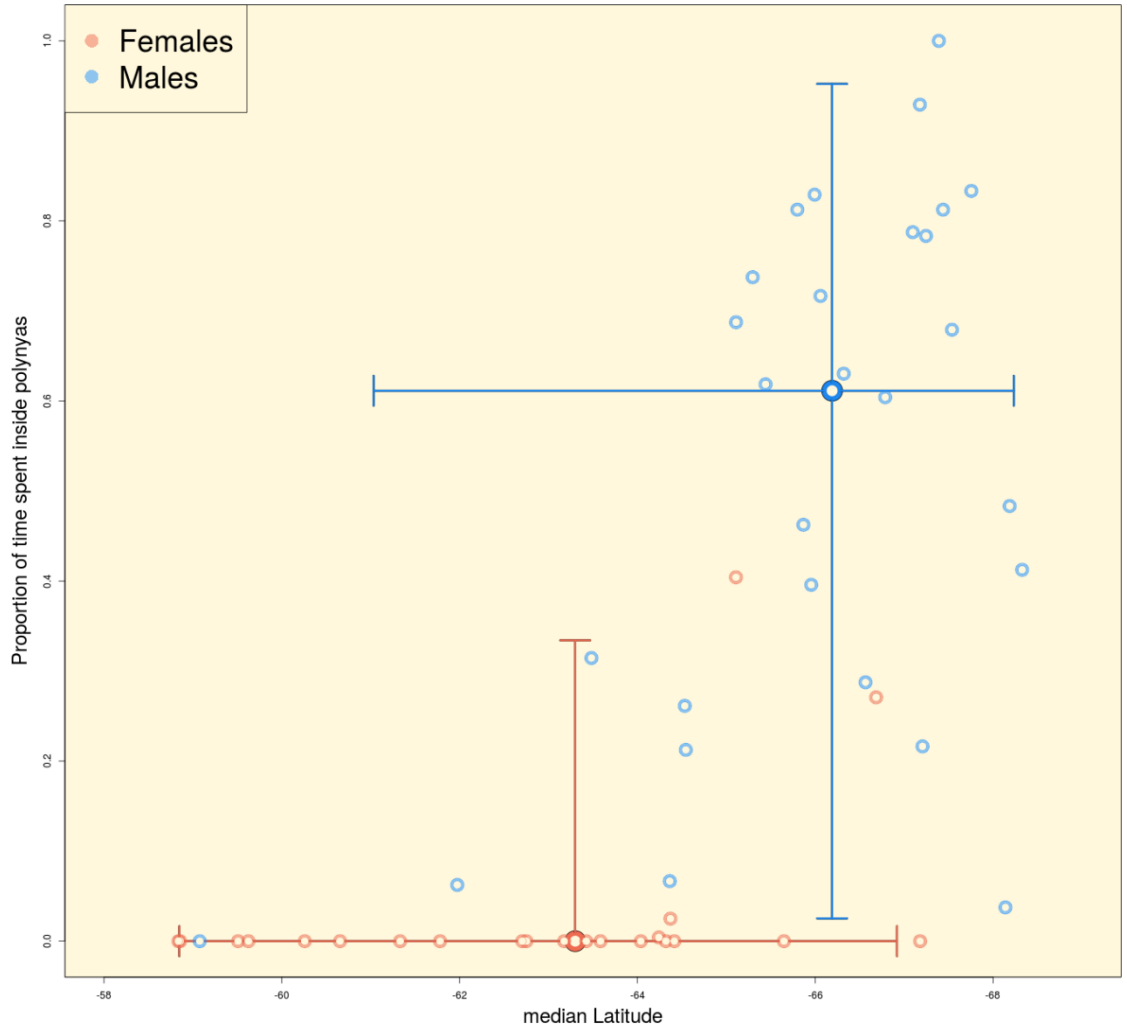

Fig. S3. Plot showing time spent inside polynya areas for Antarctic foraging male (n=28; blue) and female (n=22; red) southern elephant seals instrumented at Iles Kerguelen. Results presented for individual seals (circles) and mean ± 95% CI for each sex.

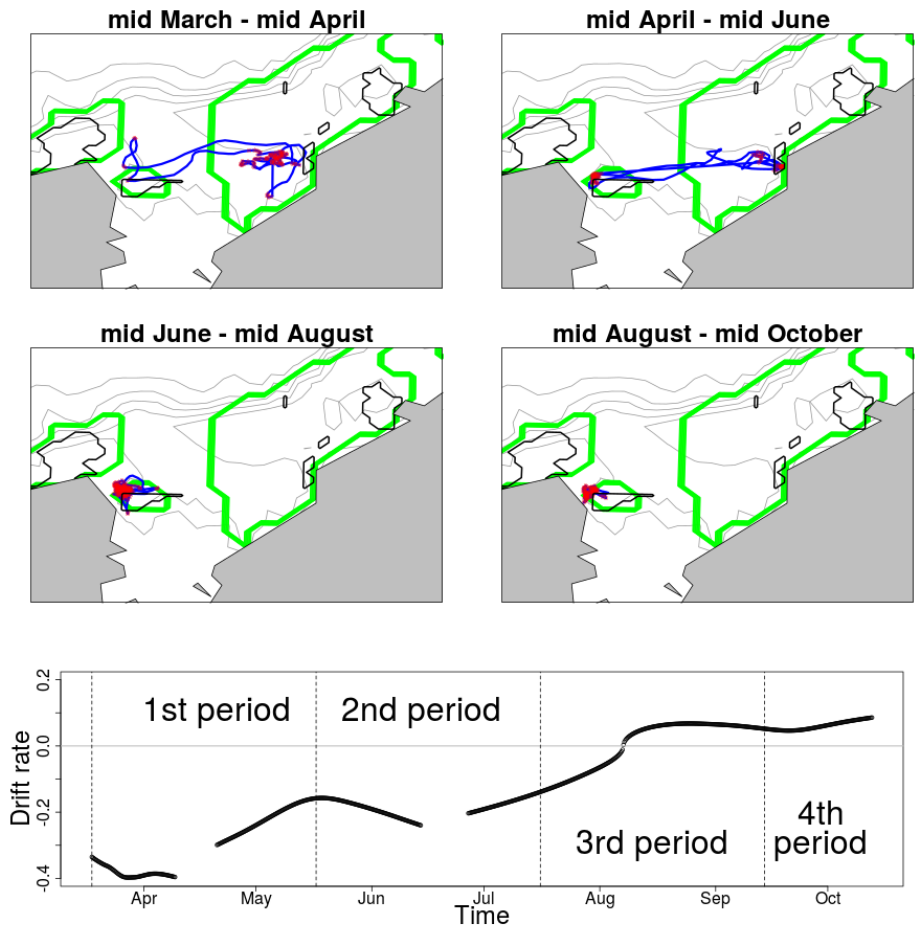

Fig. S4. Complete foraging track of a polynya specialist (immature male) instrumented in East Antarctica (Prydz Bay) with its corresponding drift rate time-series. Each map represents a 60-day period so the first map coincides with the temporal coverage of our analysis. Blue line represents transit periods and red circles show area-restricted search. During late summer-early winter the seal moves between the Prydz Bay and McKenzie polynyas, concentrating foraging inside them. As winter advances (from mid-June to mid-October) the seal remains performing area-restricted search behaviour within a very small location of McKenzie polynya, suggesting that it has been encroached by sea-ice. The drift rate time-series shows periods of gain and loss, but in the long term the seal gains body condition and becomes positively buoyant during the winter, while foraging inside the polynya. Green contours delimit polynya locations from Arrigo et al. (2003); further detail on polynya core activity regions (thin black contours) are obtained from the approach of Nihashi and Ohshima (2015) using thin-ice algorithms.

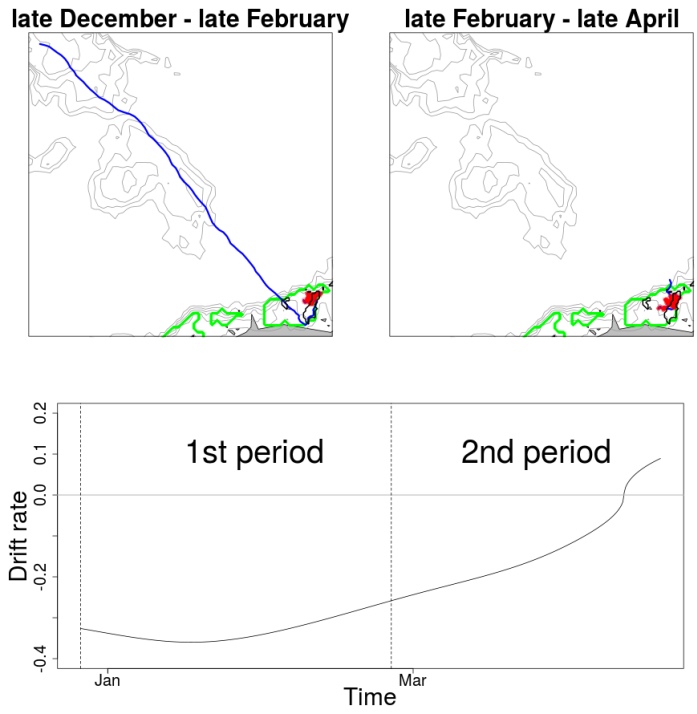

Fig. S5. Polynya specialist (immature male) instrumented in Kerguelen Is. travelled. to Farr Bay polynya started foraging close to the colony. During transit the seal is losing body condition, suggesting that it is prioritizing an earlier arrival to the polynya rather than foraging en route. Once inside the polynya it shows a rapid recovery of body condition. This tag transmitted for ~4 months, but the last transmissions (late April) shows it departing from the polynya, suggesting that it could be avoiding sea-ice encroachment.

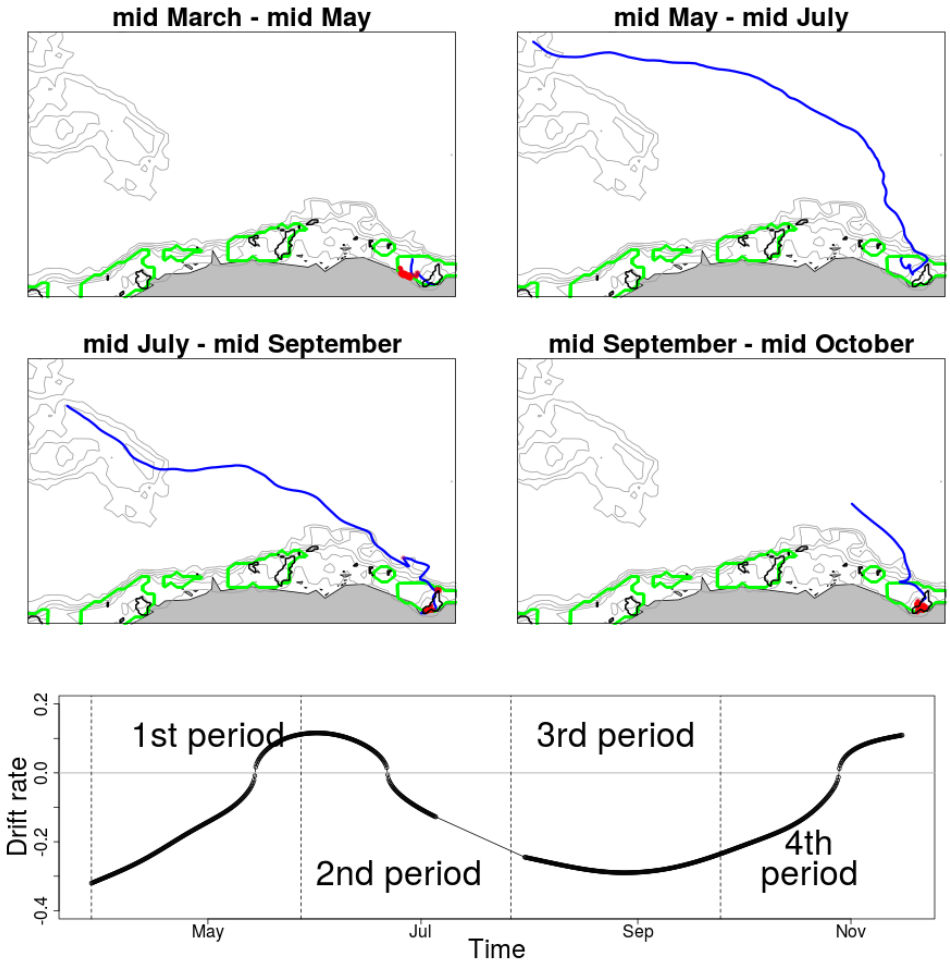

Fig. S6. Complete foraging track of a polynya specialist (immature male) instrumented in East Antarctica (Vincennes Bay) with its corresponding drift rate time-series. Each map represents a 60-day period so the first map coincides with the temporal coverage of our analysis. Blue line represents transit periods and red circles show area-restricted search. During late summer-early winter the seal forages at Vincennes Bay, concentrating foraging inside the polynya region and becoming positively buoyant. As winter advances (from mid-June to mid-October) the seal leaves the region and transits back to the colony to perform a mid-winter haul-out, reducing its drift rate during this transit period but also further during the haul-out fasting period (thin black line indicates absence of drift dive during land period). In late winter, the seal returns to the ocean with an even lower body condition and continues to lose condition (reducing its drift rate) while in transit returning to the polynya. Body condition starts to recover once foraging back within the polynya area. In the final (4^{th}) period, the seal increases its drift rate until becoming positively buoyant once again.