Supplementary material.

***Table S1**. Number of little auks tracked with geolocators. (a) Number of available tracks per colony; (b) Number of geolocators deployed per year and colony, and retrieved in subsequent years (deployed/retrieved).*

(a)

	# individuals	**# tracks**	**# years tracked**
Bjørnøya	51	79	8 (2010-2018)
Hornsund	63	74	3 (2015-2018)
Isfjorden	16	20	3 (2012-2015)
Kongsfjorden	16	24	5 (2010-2015)
Franz Josef Land	42	51	5 (2013-2018)
all	188	248	8 (2010-2018)

(b)

	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Bjørnøya		>1/1		>5/5	30/13	16/13	30/20	21/10
Hornsund						32/30	40/34	40/18
Isfjorden			32/11	25/7	30/3	8/1		
Kongsfjorden	40/12	34/2	17/4					
Franz Josef Land				>9/9	30/20	30/12	29/9	25/8

Text S1. *Little auk survival modeling*

The first step in single-state CMR modeling consists of testing the assumption of independence of fates and identity of rates among individuals by implementing goodness-of-fit (GOF) tests on the time-dependent (or Cormack-Jolly-Seber, CJS) model (Lebreton et al. 1992). To test whether this general model fitted our data, we used the program U-CARE (Choquet et al. 2009). The overall GOF test of the CJS model indicated a clear lack of fit for all three datasets (Table 1) mostly caused by significant transience and trap-dependence (as indicated by significant tests 3.SR and 2.CT; Table 1). This transience could be explained by non-breeders and/or birds breeding in other parts of the colony being captured within our study plots, especially in Isfjorden and Kongsfjorden where captures are done randomly (i.e. captures did not target birds from specific nests). These birds, which are unlikely to be resighted, could lead to significant transience. The trap-dependence could be explained by some birds breeding in parts of the study plots less easily observed, and/or being fitted with color combinations more difficult to read (i.e. certain colors are more difficult to assess depending on the light conditions).

The generalization of the CJS model accounting for trap-dependence and transience was thus used and the remaining heterogeneity was accounted for by scaling model deviances using an overdispersion parameter ($\hat{c}$) calculated, after discarding the 3.SR and 2.CT components, by dividing the χ^2 statistics by its degrees of freedom (Table 1, Choquet et al. 2009). The trap-dependence was dealt with using the Pradel and Sanz-Aguilar approach (Pradel & Sanz-Aguilar 2012), based on multi-even modeling. The transience was dealt with by considering two “age” classes in survival (age being defined in a CMR sense as the number of years following the 1st capture): the survival the year following the 1st capture or ringing, and the survival afterwards (i.e. survival of non-transient individuals) (Pradel et al. 1997).

Using a step-down approach (Lebreton et al. 1992), we modeled the recapture probabilities (p) first and then the survival probabilities (ϕ). Recapture rates of little auks varied through time and among colonies (average recapture rates for the trap-happy and trap-shy individuals, respectively: 0.79 and 0.50 in Kongsfjorden, 0.68 and 0.35 in Isfjorden, 0.96 and 0.60 at Bjørnøya). We focused on the second age-class (i.e. non-transient birds) to assess the synchrony in survival among the three colonies. We did not constrain the survival of the first age class (i.e. we let these survival rates vary freely through time and among colonies) because adding such constraints (e.g. considering additive, instead of interactive, colony effect) implies not being able to estimate all survival parameters in the second age class. Model selection was based on the Akaike Information Criterion (Burnham & Anderson 2002), adjusted for overdispersion (QAIC). The lower the QAIC, the better the trade-off between prediction bias and parsimony. If the difference in QAIC values between two models is <2 units of AIC, the models have equal statistical support and in the case of nested models, the simplest one was preferred.

Table S2. *Goodness-of-fit (GOF) tests for little auks breeding in Svalbard at Kongsfjorden. Isfjorden and Bjørnøya (n = 781 capture histories from 2006 to 2018 for Kongsfjorden, 592 capture histories from 2005 to 2018 for Isfjorden and 972 capture histories from 2005 to 2018 for Bjørnøya). !^{2} is the Pearson statistic testing the null hypothesis that data are homogeneous, df is the associated degrees of freedom and p the p-value of this test; ĉ is the overdispersion parameter.*

		!^{2}	df	p	ĉ
Test 3.SR	Kongsfjorden	97.81	10	<0.001	
	Isfjorden	29.58	12	0.003	
	Bjørnøya	17.74	12	0.12	
Test 3.SM	Kongsfjorden	25.39	11	0.008	
	Isfjorden	30.32	18	0.034	
	Bjørnøya	8.11	10	0.62	
Test 2.CT	Kongsfjorden	135.44	10	<0.001	
	Isfjorden	201.03	11	<0.001	
	Bjørnøya	96.56	8	<0.001	
Test 2.CL	Kongsfjorden	33.66	12	<0.001	
	Isfjorden	47.31	23	0.002	
	Bjørnøya	2.75	6	0.84	
Overall test		725.68	143	<0.001	
Reduced test[a]		147.54	80	<0.001	1.84

[a]**:** test adjusted for transience and trap-dependence (i.e. without components 3.SR and 2.CT)

References

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Choquet R, Lebreton JD, Gimenez O, Reboulet AM, Pradel R (2009) U-CARE: Utilities for performing goodness of fit tests and manipulating CApture-REcapture data. Ecography 32:1071-1074

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Pradel R, Hines JE, Lebreton J-D, Nichols JD (1997) Capture-recapture survival models taking into account of transients. Biometrics 53:60-72

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Fig. S1. *Winter distribution of little auks breeding in Svalbard (Kongsfjorden, Isfjorden, Hornsund and Bjørnøya) and Franz Josef Land. Distribution is based on 188 little auks tracked throughout the year with light loggers (details in Methods). The four panels represent the winter distribution of little auks from all colonies per month from November to February. The color represents the overall area usage (see methods for details).*

Table S3. *Towards a parsimonious model: recapture rate modeling for little auks breeding in Kongsfjorden, Isfjorden and Bjørnøya. Subscript "g" represents the colony (i.e. g1 represents Kongsfjorden, g2 Isfjorden and g3 Bjørnøya), "t" represents the time dependence, subscript "m" the trap-dependence, subscript "a" the transience (newly marked versus already marked) and subscript "cst" refers to constant model (i.e. no time variation). Sign "." represents multiplicative effects (interactions) and sign "+" additive effects. The QAIC values have been calculated using an overdispersion parameter* $\hat{c} = 1.84$. *ΔQAIC corresponds to the difference between the QAIC of a given model and the lowest QAIC among the different models considered. Np represents the number of identifiable parameters.*

Model	***Np***	***Deviance***	***QAIC***	***ΔQAIC***
$\phi_{a1.g.t+a2.g.t}\ p_{[m+t].g}$	110	13231.72	7411.15	0.00
$\phi_{a1.g.t+a2.g.t}\ p_{m+g.t}$	108	13247.24	7415.59	4.44
$\phi_{a1.g.t+a2.g.t}\ p_{m.g.t}$	137	13155.05	7423.48	12.33
$\phi_{a1.g.t+a2.g.t}\ p_{m.g+t}$	90	13450.48	7490.04	78.89
$\phi_{a1.g.t+a2.g.t}\ p_{m+g+t}$	88	13465.93	7494.44	83.29
$\phi_{a1.g.t+a2.g.t}\ p_{m.g}$	78	13506.49	7496.49	85.34
$\phi_{a1.g.t+a2.g.t}\ p_{g.t}$	107	13548.70	7577.42	166.27
$\phi_{a1.g.t+a2.g.t}\ p_{m.t}$	95	13875.09	7730.81	319.66

Fig. S2. *Mole concentration (mole/m^3) of zooplankton expressed as nitrogen in sea water in core wintering areas of little auks in Nov-Dec 2009 and Jan-Feb 2010 according to ARCTIC_REANALYSIS_BIO_002_005 dataset based on TOPAZ4 reanalysis system assimilating available satellite and in situ observations (http://marine.copernicus.eu/documents/PUM/CMEMS-ARC-PUM-002-ALL.pdf).*