The following supplement accompanies the article

Within-pair similarity in migration route and female winter foraging effort predict pair breeding performance in a monogamous seabird

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Supplementary methods

Section 1 - Daily activity and energy budgets

Daily activity budgets were calculated as in Fayet et al. (2016). Daylight immersion data were classified in 3 behavioural classes: sitting on the water (≥ 98% wet), sustained flight (≥ 98% dry), and foraging (> 2% dry and > 2% wet). Nightly activity was inferred from 4 birds which simultaneously carried a geolocator on both legs, which on average spent 42% of night time with a leg tucked against their body out of the water (sleeping) and the rest of the time sitting on the water (see Fayet et al. 2016 for details). This classification allowed us to estimate, for each bird, the amount of daylight hours it spent sitting, flying and foraging each day of the non-breeding season, and the cumulative time spent in each behavioural class over the whole non-breeding season.

We used these estimates to calculate approximate daily energy expenditure using a model developed on murres by Elliott et al. (2013), using the following equation:

$$DEE\ (Watts) = 8.9 * T_R + 148 * T_F + 28 * T_{WS} + 27 * T_D$$

where here T_R is the time sleeping (time leg tucking at night), T_F the time in flight, T_{WS} time sitting on the water surface and T_D the time foraging. These results were then converted to kJ/day. In Fayet et al. (2016) the allometric equation developed for auks by Shaffer (2011) (Field Metabolic Rate = 15.537 * mass$^{0.689}$, in kJ/day) was used to adjust the results for an average 370g puffin, here we calculated more accurate estimates by using the individual weight of each puffin measured during chick-rearing to calculate its daily energy expenditure. The total energy expenditure overwinter was obtained by summing the daily energy expenditure of each bird over the whole winter.

References:

Elliott, K. H., Ricklefs, R. E., Gaston, A. J., Hatch, S. A., Speakman, J. R. & Davoren, G. K. 2013 High flight costs, but low dive costs, in auks support the biomechanical hypothesis for flightlessness in penguins. *PNAS* **110**, 9380–9384.

Fayet, A. L., Freeman, R., Shoji, A., Boyle, D., Kirk, H. L., Dean, B. J., Perrins, C. M. & Guilford, T. 2016 Drivers and fitness consequences of dispersive migration in a pelagic seabird. *Behavioral Ecology* , arw013.

Shaffer, S. A. 2011 A review of seabird energetics using the doubly labeled water method. *Comp. Biochem. Physiol. A-Mol. Integr. Physiol.* **158**, 315–322.

Section 2 - Within-individual route similarity

Within-individual routes were most similar (NND = 280 ± 27 km, n = 18 pairs of tracks), and within-individual NND was significantly smaller than both NND between partners (LMM, χ_1^2 = 12.1, P < 0.001) and between non-partners (LMM, χ_1^2 = 19.8, P < 0.001). When analysed at a monthly scale, within-individual route similarity remained high throughout the winter (Table S1).

Supplementary figure

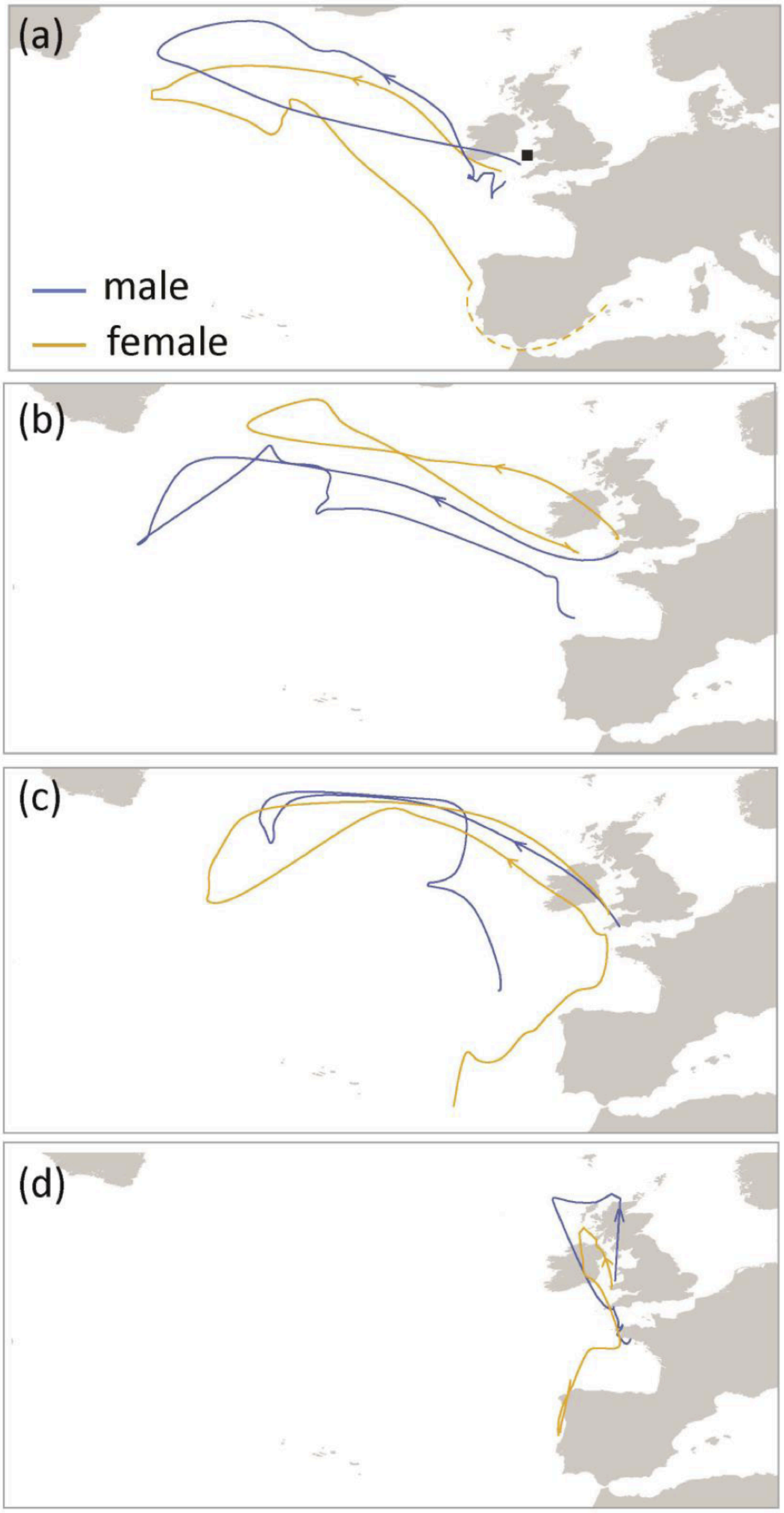

Figure S1. Examples of the non-breeding movements of 4 pairs. The colony is indicated with a black square on the first panel. The trajectories shown, obtained by smoothing the links between 4-day median positions, are approximate — for example puffins do not fly over land (accuracy < 200km).

Supplementary table

Table S1. Monthly averages of nearest neighbour distance within-individuals, between partners and non-partners, and the pairwise comparisons between each group. The statistics are obtained from LMMs. WI = within-individual, P = between partners, NP = between non-partners. Means ± SE.

Month	Within-individual NND (km)	Between partners NND (km)	Between non-partners NND (km)	Statistics
July	222 ± 24	210 ± 54	456 ± 25	WI – NP: X_{21} = 2.6, P = 0.109 WI – P: X_{21} = 0.6, P = 0.445
August	238 ± 23	337 ± 48	810 ± 22	WI –NP: X_{21} = 13.2, P < 0.001 WI – P: X_{21} = 0.5, P = 0.495
September	239 ± 70	387 ± 115	761 ± 40	WI – NP: X_{21} = 14.6, P < 0.001 WI – P: X_{21} = 1.7, P = 0.197
October	297 ± 26	537 ± 53	669 ± 19	WI – NP: X_{21} = 14.4, P < 0.001 WI – P: X_{21} = 2.8, P = 0.095
November	228 ± 15	520 ± 27	438 ± 13	WI – NP: X_{21} = 6.3, P = 0.012 WI – P: X_{21} = 2.9, P = 0.090
December	142 ± 13	464 ± 25	416 ± 11	WI – NP: X_{21} = 12.5, P < 0.001 WI – P: X_{21} = 5.2, P = 0.022
January	165 ± 10	401 ± 24	472 ± 11	WI – NP: X_{21} = 17.7, P < 0.001 WI – P: X_{21} = 9.5, P = 0.002
February	252 ± 20	617 ± 25	633 ± 16	WI – NP: X_{21} = 12.2, P < 0.001 WI – P: X_{21} = 8.1, P = 0.004