

Supporting Information

Research Article: Exploration speed in captivity predicts foraging tactics and diet in free-living red knots

Authors: Selin Ersoy, Christine E. Beardsworth, Anne Dekinga, Marcel T. J. van der Meer, Theunis Piersma, Ton G. G. Groothuis, Allert I. Bijleveld

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- Supplementary Video S3: An example video from field observation shows the use of different foraging tactics (tactile and visual).

Supplementary Figure S1: Mobile arena to score exploration speed at the field site

The floor of the unit consists of sea water of 20 cm height and 4 identical sand patches 61cm x 40cm x 25cm for birds to explore.



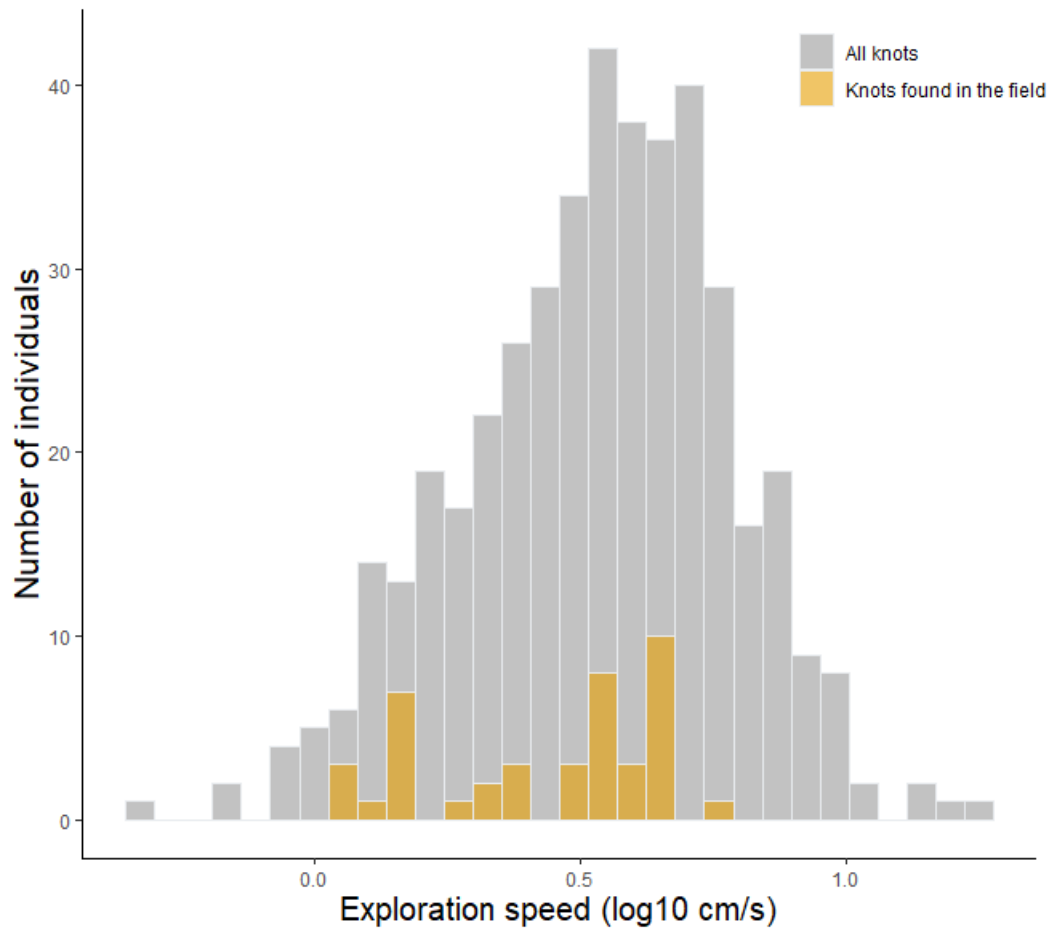
Supplementary Figure S2: Indoor arena to score exploratory behaviour in captivity

The floor of the unit consists of salt water of 30 cm height and 5 identical sand patches 1m x 1m x 35cm for birds to explore in a room measuring 7m x 7m x 3m.



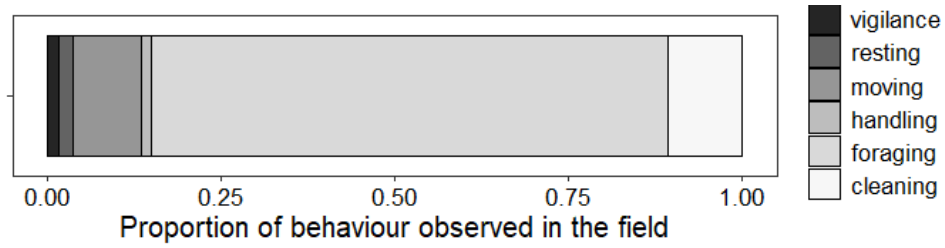
Supplementary Figure S3: Histogram of individuals with measured exploration scores

The distribution of the exploratory scores of individual red knots which were followed in the field (in yellow) and all red knots with exploratory score (in grey).



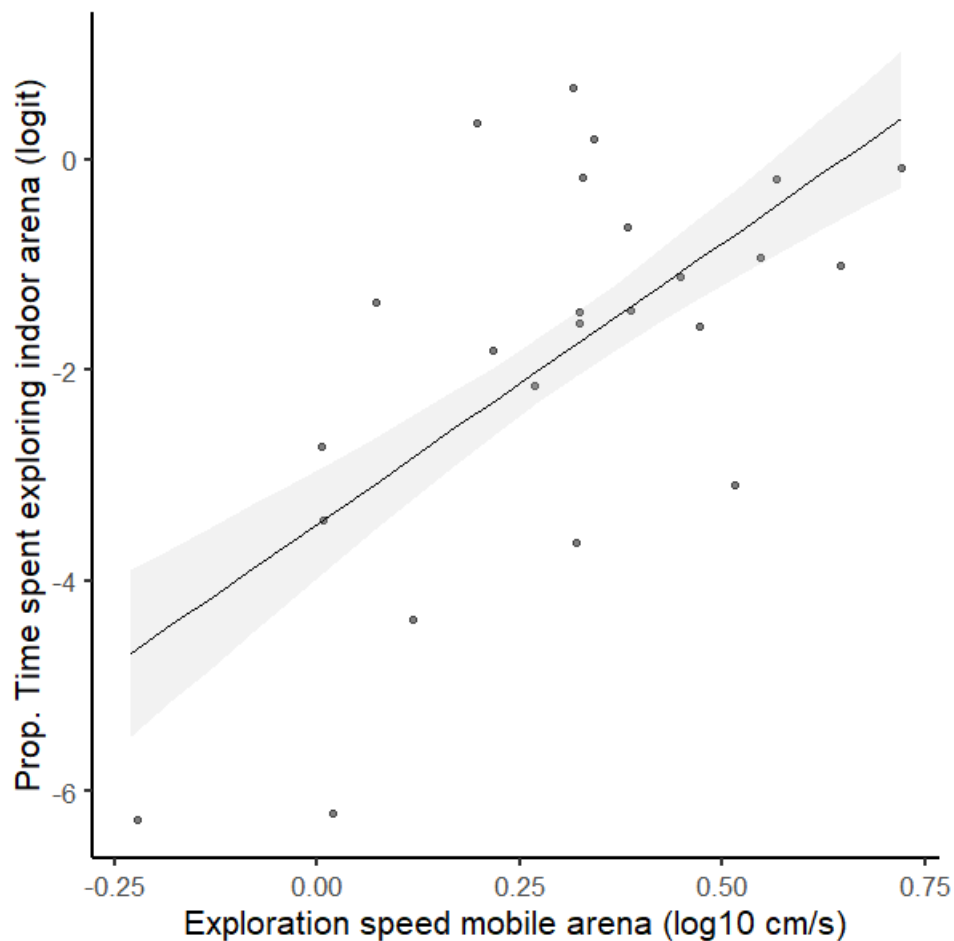
Supplementary Figure S4: All observed behaviours in the field

Observed behaviours from low tide field observations: foraging 74%, cleaning 11%, moving 0.9%, resting 0.2%, vigilance 0.1%, handling 0.1%.



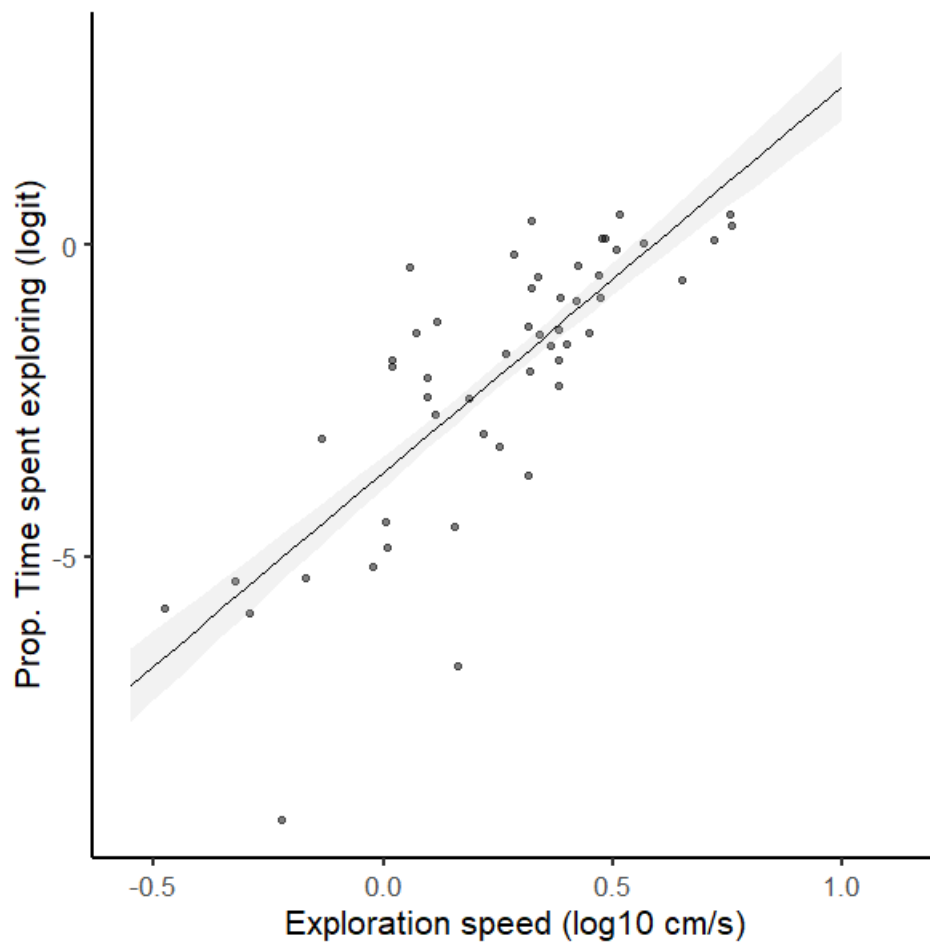
Supplementary Figure S5: Correlation between mobile and indoor arena

Correlation between the results from the same individuals measured in newly developed mobile method (x axis) on exploration speed (mean speed log₁₀ cm/s) and the established indoor method (y axis) on exploration behaviour (proportion of time spent searching and walking) in red knots. Probabilities and 95 % confidence intervals are predicted by a GLM with gaussian error distribution.



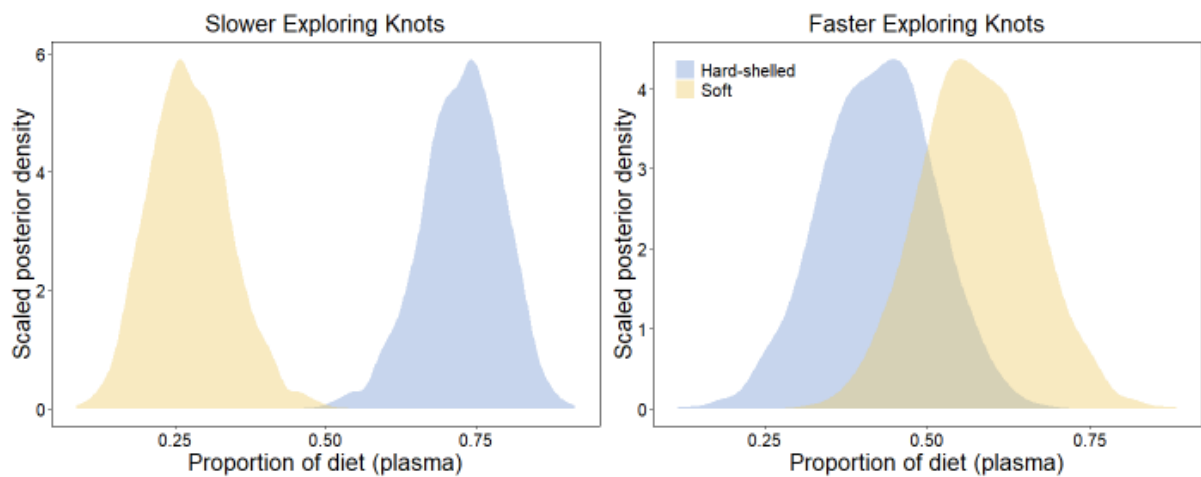
Supplementary Figure S6: Correlation between speed and behaviour

Correlation between different techniques to score exploration personality on movement scores (mean speed log10 cm/s on the x axis) and behavioural scores (proportion of time spent probing and walking on the y axis). Probabilities and 95 % confidence intervals are predicted by a GLM with gaussian error distribution. $y = -3.64 + 6.19 x$, $R = 0.62$.



Supplementary Figure S7: MixSIAR Posterior distribution for plasma

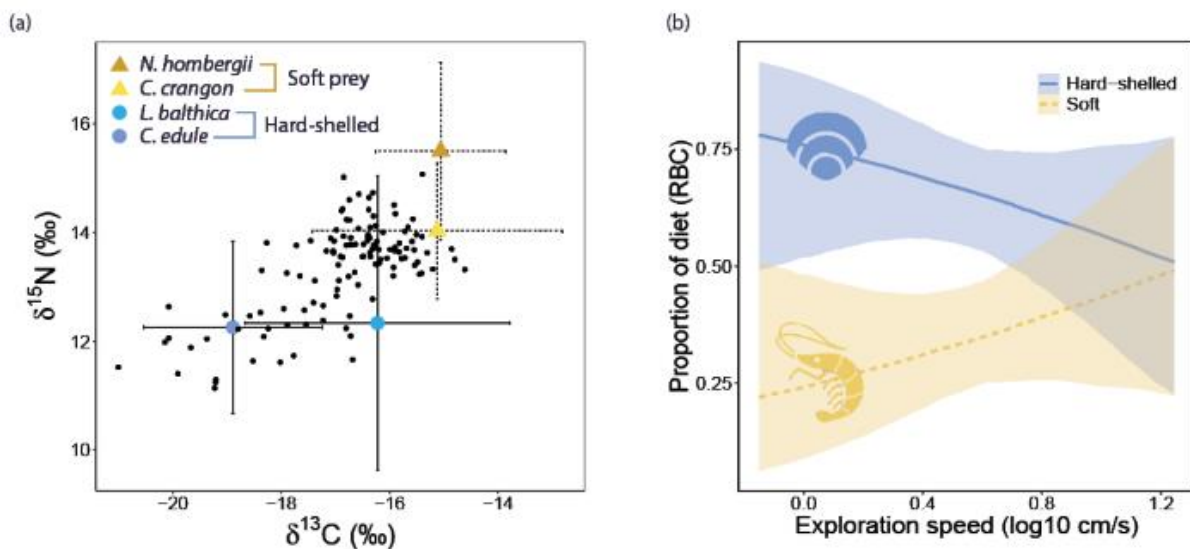
Posterior distribution of model estimates for slower exploring knots (on the left) and faster exploring knots (on the right). Diet estimated from plasma stable isotope samples. For slower exploring red knots, the model estimate of $p_{\text{hard-shelled prey}}$ is 0.76 (Median, 2.5 % CrI = 0.61, 97.5 % CrI = 0.88) and $p_{\text{soft prey}}$ is 0.24 (Median, 2.5 % CrI = 0.12, 97.5 % CrI = 0.39). For faster exploring red knots, model estimate of $p_{\text{hard-shelled prey}}$ is 0.4 (Median, 2.5 % CrI = 0.22, 97.5 % CrI = 0.58) and $p_{\text{soft prey}}$ is 0.6 (Median, 2.5 % CrI = 0.42, 97.5 % CrI = 0.7).



Supplementary Figure S7: MixSIAR Diet analysis for red blood cell

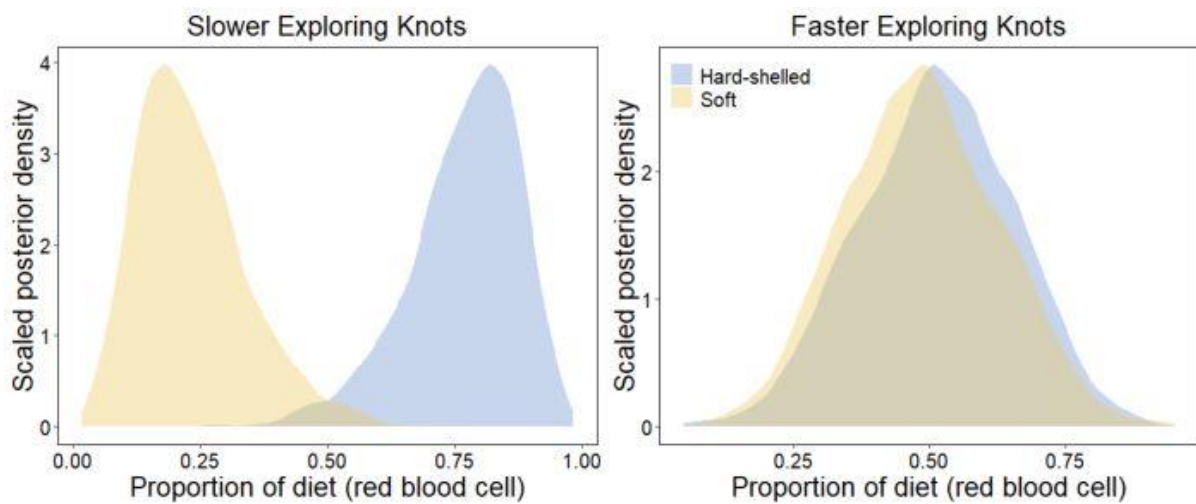
(a) Biplot of carbon ($\delta^{13}\text{C}$, x axis) and nitrogen ($\delta^{15}\text{N}$, y axis) stable isotope values. Black dots are isotopic signatures of individual red knots from red blood cell. Different prey items plotted on; soft preys (brown shrimp *Crangon crangon* and polychaete worm *Nephtys hombergii*) and hard-shelled preys (cockle *Cerastoderma edule* and balthic tellin *Limecola balthica*).

(b). Posterior distributions for red knot diet proportions (estimated using blood cell stable isotope samples) as a function of exploration speed (\log_{10} cm/s) measured in the mobile arena for the first time. MixSIAR model predicted that on average, red knots proportionally consumed more hard-shelled prey (Median = 0.67, 2.5 % CrI = 0.56, 97.5 % CrI = 0.75) than soft prey (Median = 0.34, 2.5 % CrI = 0.23, 97.5 % CrI = 0.44). Slower explorers depend upon hard-shelled prey while faster explorers consume both soft- and hard-shelled prey. Proportion of diet estimated from the Bayesian mixing model for isotope analysis MixSIAR. Lines depict posterior means, and shading displays the 95% credible intervals.



Supplementary Figure S9: MixSIAR Posterior distribution for red blood cell

Posterior distribution of model estimates for slower exploring knots (on the left) and faster exploring knots (on the right). Diet estimated from red blood cell stable isotope samples. For slower exploring red knots, the model estimate of $p_{\text{hard-shelled prey}}$ is 0.77 (Median, 2.5 % CrI = 0.51, 97.5 % CrI = 0.94) and $p_{\text{soft prey}}$ is 0.23 (Median, 2.5 % CrI = 0.65, 97.5 % CrI = 0.49). For faster exploring red knots, model estimate of $p_{\text{hard-shelled prey}}$ is 0.51 (Median, 2.5 % CrI = 0.23, 97.5 % CrI = 0.79) and $p_{\text{soft prey}}$ is 0.49 (Median, 2.5 % CrI = 0.51, 97.5 % CrI = 0.94).



Supplementary Table S1: Ethogram of all videos recorded behaviours in the field

Behaviour	Description
Aerial Vigilance	Looking up by tilting the head
Ingesting	Ingesting prey item (cockle/white shellfish, shrimp, worm, not specified)
Kleptoparasitism	Prey item stolen by other bird (common gull, another knot, black-headed gull, other)
Walking	Moving to another location. Can be slow or fast, also on one leg. During foraging only count walking when >2 sec when bird moves in certain direction and head is up > 90° angle
Flying	Taking off by flapping and then moving to another location
Tactile searching	Looking for food buried in the ground, the bill forming a 45° angle with the horizontal, probing in the sand
Visual searching	Looking for food on the surface, head is 45° to 90° angle, head moves actively to look around
Handling	Handling prey items. Prey needs to be visible or obvious ingestion at the end of handling
Social interference from focal bird	Any kind of social interaction from focal bird to another bird
Social interference from other bird to focal bird	Any kind of social interaction from another bird to the focal bird
Resting	Standing still with its head under its feathers, can be on one leg
Standing	Standing on one or two legs with the bill in a 90° angle, without moving, for >2 sec
Preening	Cleaning and/or rearranging its feathers with the bill, by flapping or shaking, scratching with its foot, stretching wings and legs
Ground Vigilance	Head turning side to side with the bill in a 90° angle. Only if >1sec
Bathing	The bird is in the water washing itself
Miscellaneous	Behaviour that does not fit the descriptions above
Out of sight	The bird cannot be seen by the observer