

Bound Together or Falling Apart? Foraging Association in Red Knots

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Background

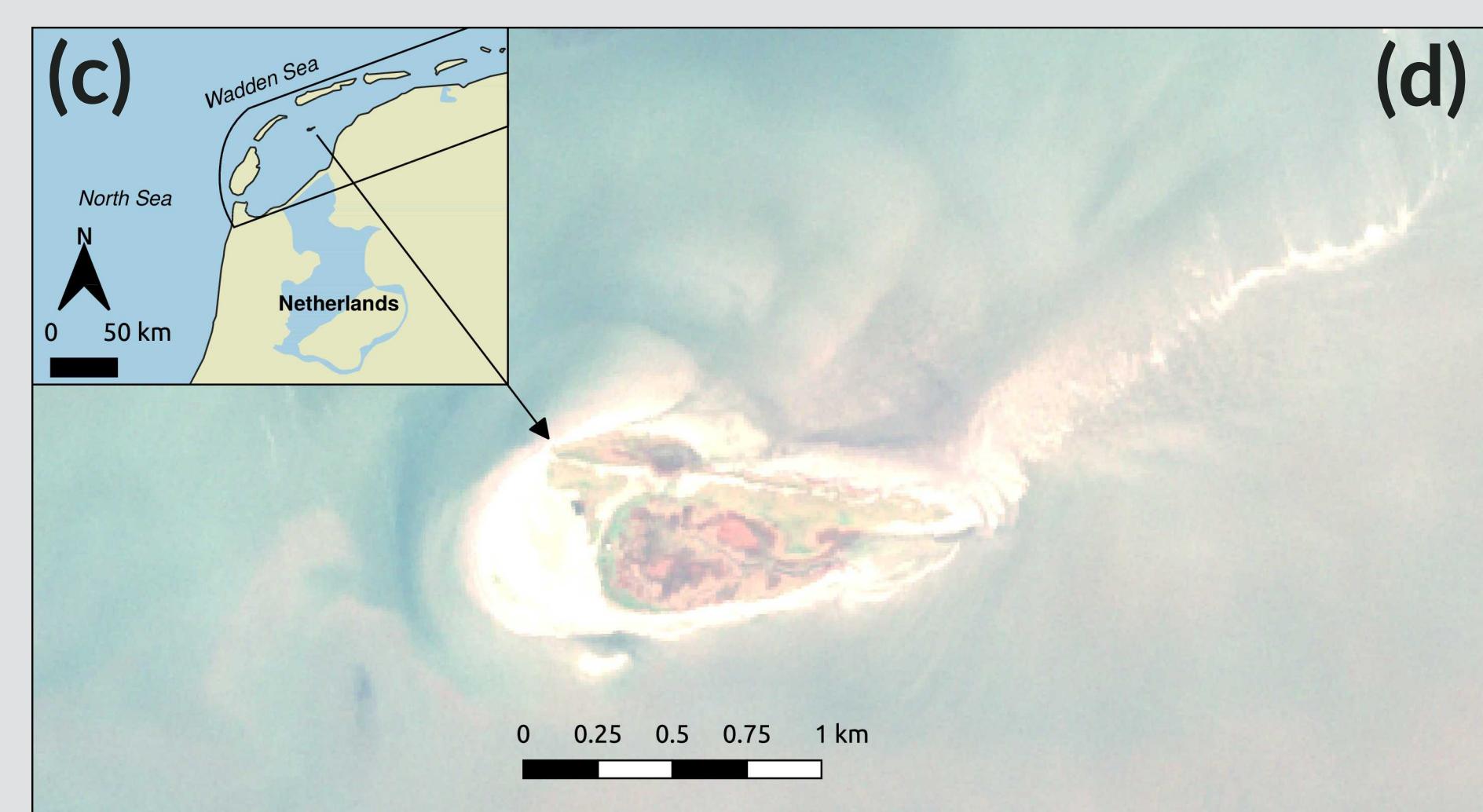
1 Waders such as red knots *Calidris canutus* gather in large non-breeding flocks in the Wadden Sea, where they forage on intertidal mudflats

2 Waders are highly social, but they have no 'friends' – no consistent non-random association between individuals (cite, cite)

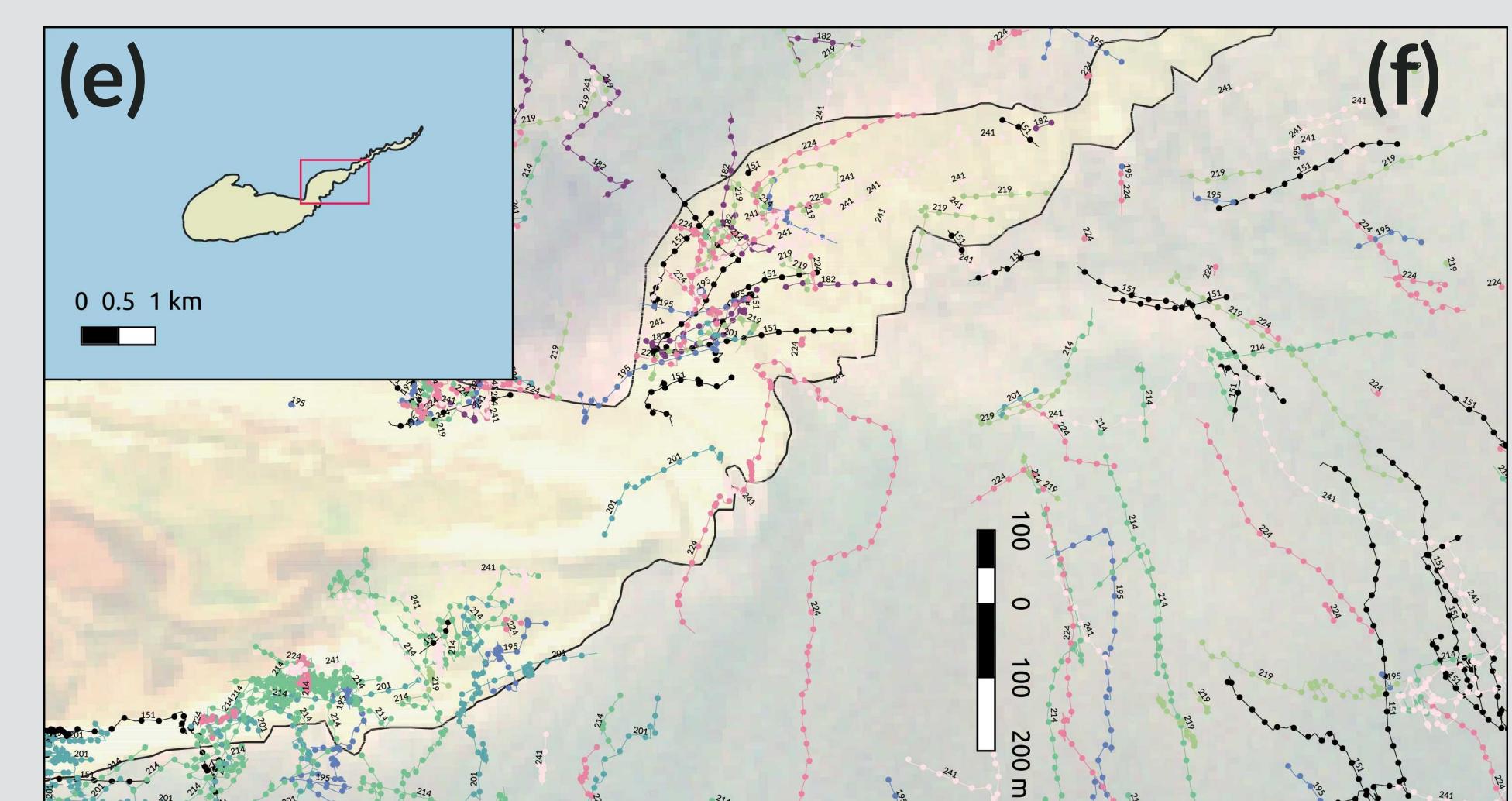
3 ATLAS allows high frequency tracking of multiple knots, and calculation of pair-wise 'coherence' (cite)



^aRed knot – ^bWadden Sea mudflats



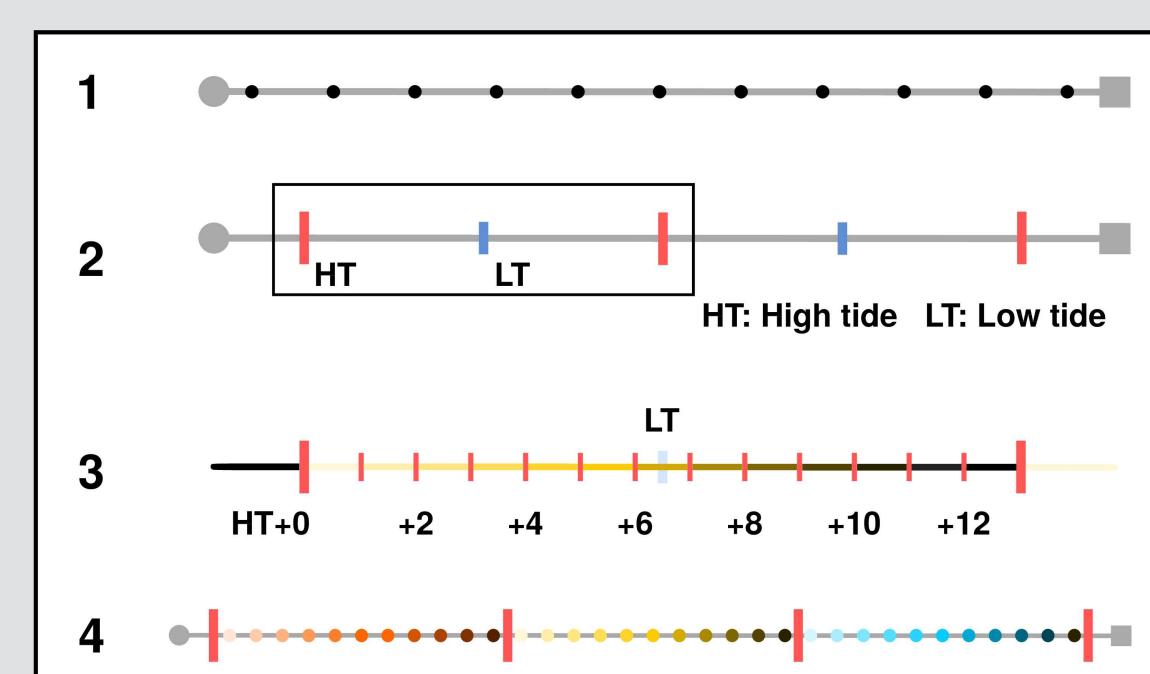
^cStudy site – ^dIsland of Griend



^eTracking towers – ^fKnot positions

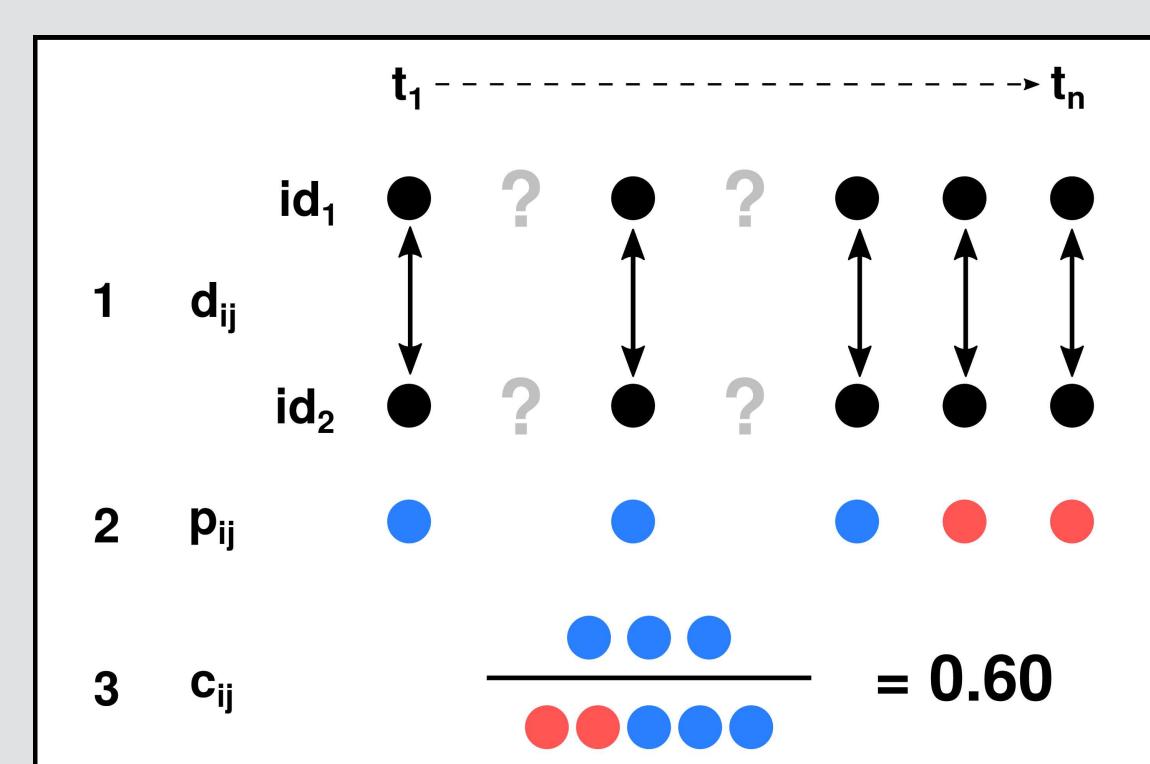
Data handling

Identify tidal segments



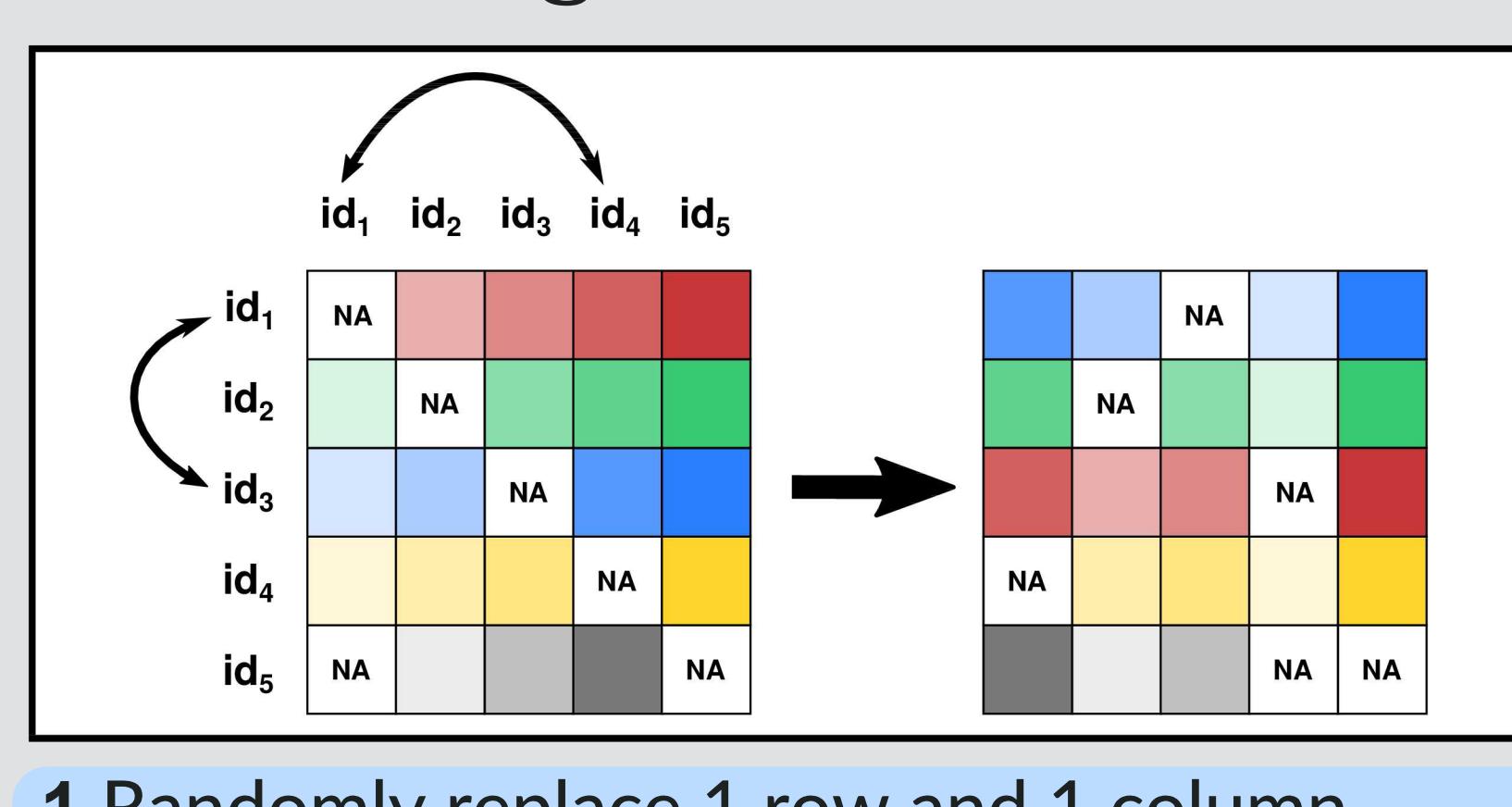
- 1 Obtained the 'lifetime' track
- 2 Identified tidal intervals from water-level data
- 3 Classified data by tidal interval
- 4 Classified data by hours since high tide

Randomising coherence



- 1 Distances between time-matched positions
- 2 Count distances < proximity threshold
- 3 Calculate pairwise coherence in tidal interval

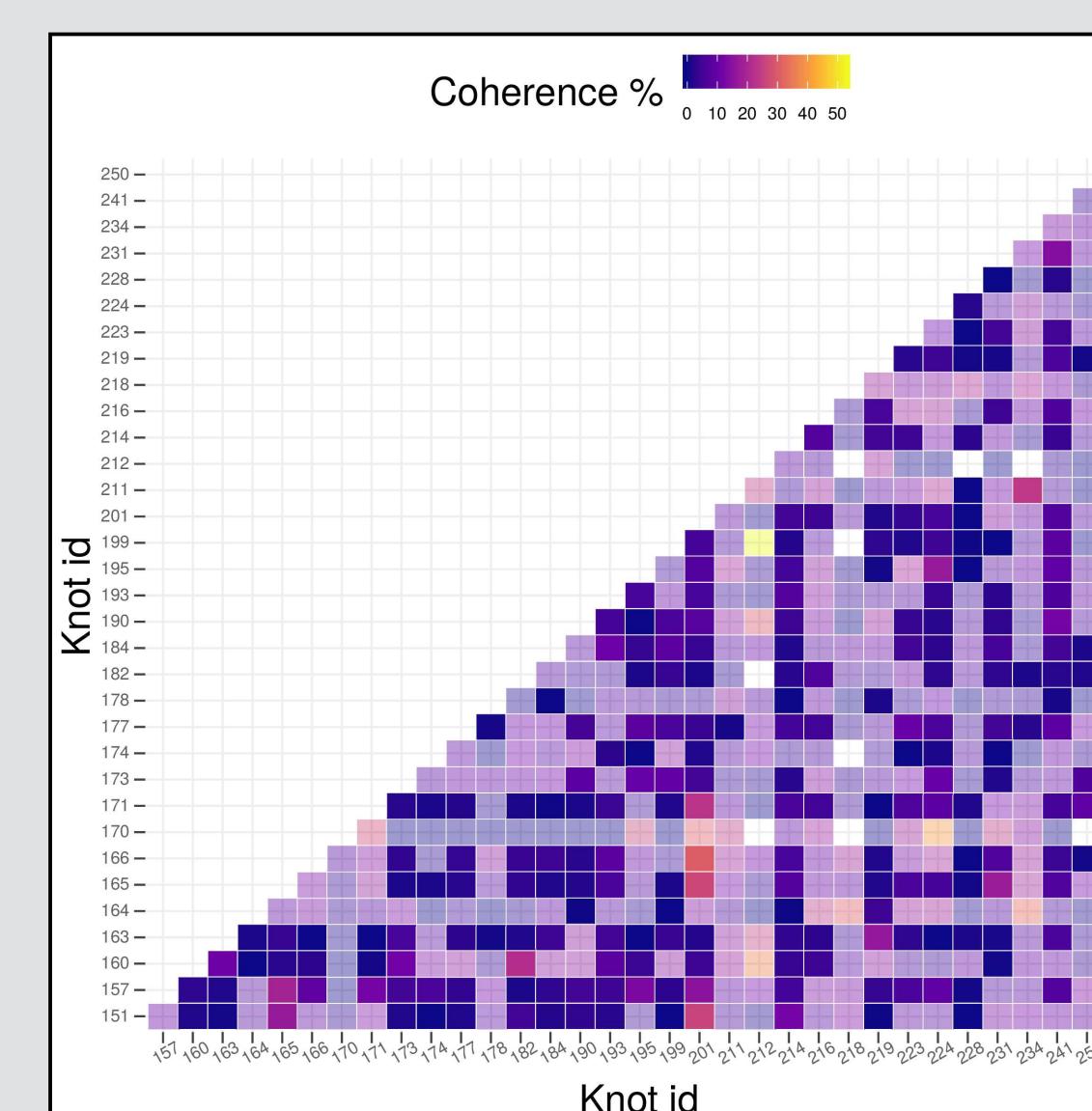
Calculating coherence



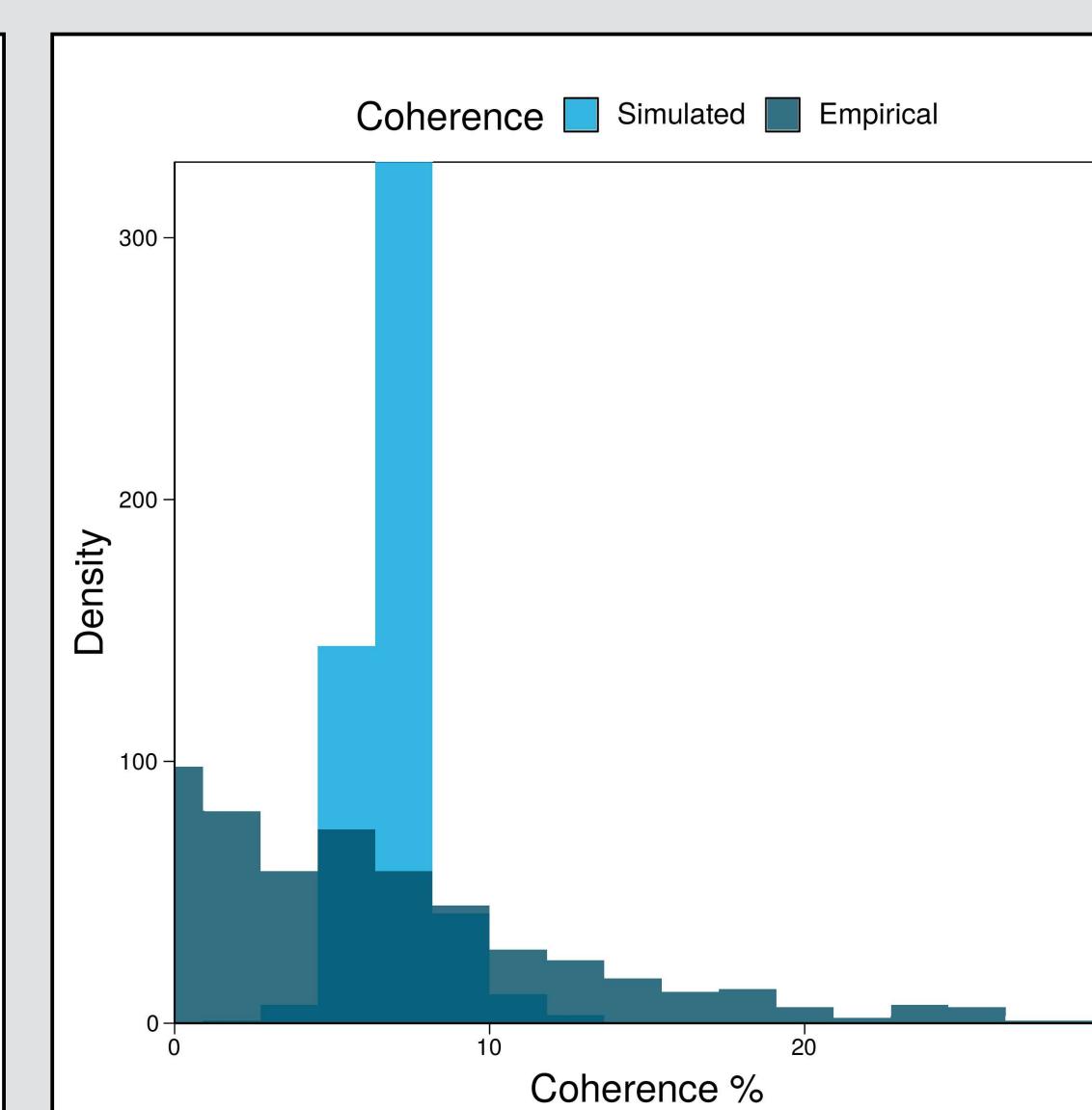
- 1 Randomly replace 1 row and 1 column 100x for a mean matrix

Knot coherence between & within tides

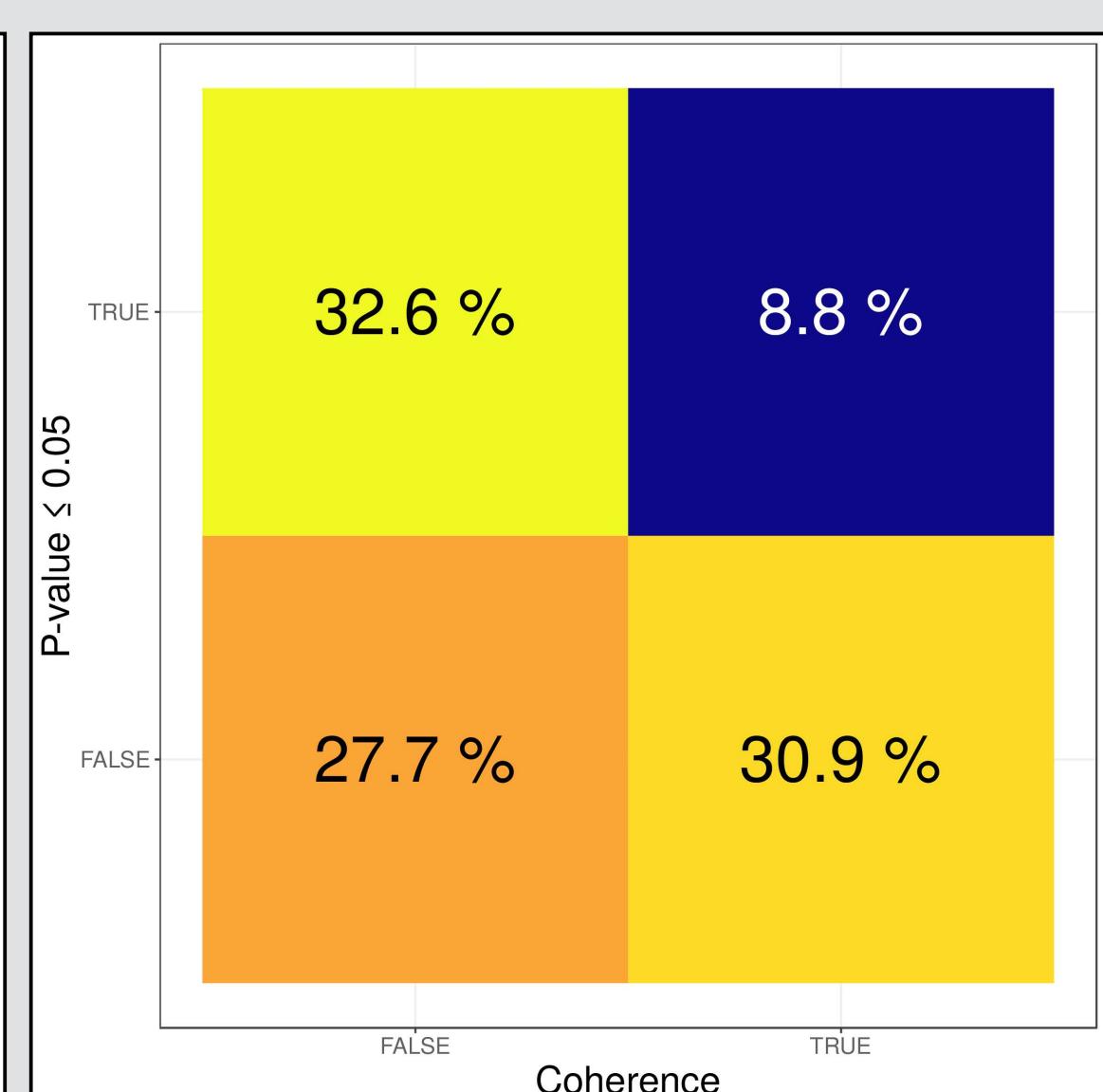
Data summary
Knots 34
Data points 346,414
Tracking days 25
Tidal intervals 44



Pairwise coherence over the tracking period – values not significantly different from a random distribution are shaded over grey

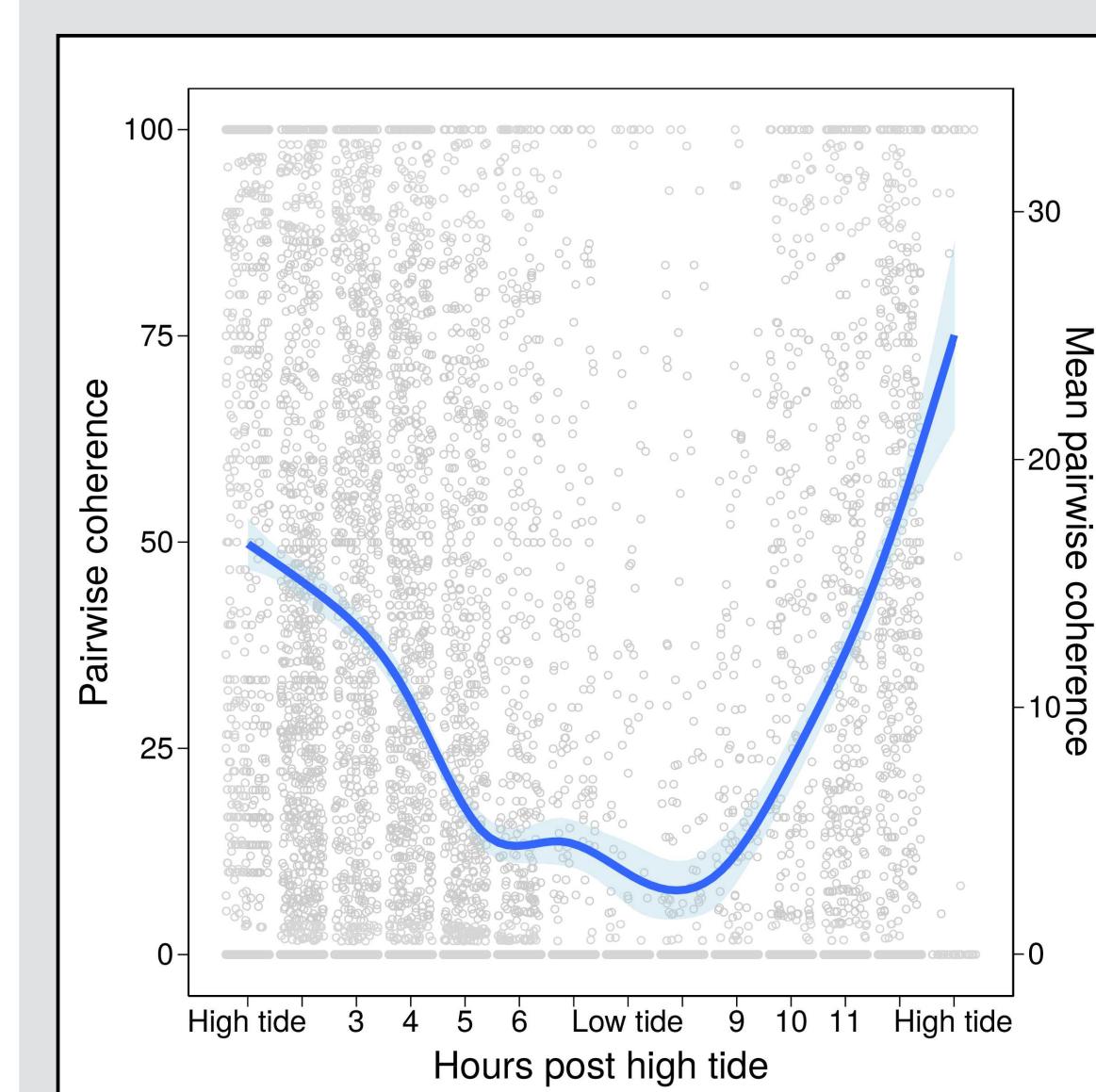


Empirical coherence and simulated coherence distributions over the tracking period



59% of pairwise coherences are not different from those expected by chance – 33% of pairs are less cohesive than expected – 9% of pairs are more cohesive than expected

Coherence over the tidal interval



Observation

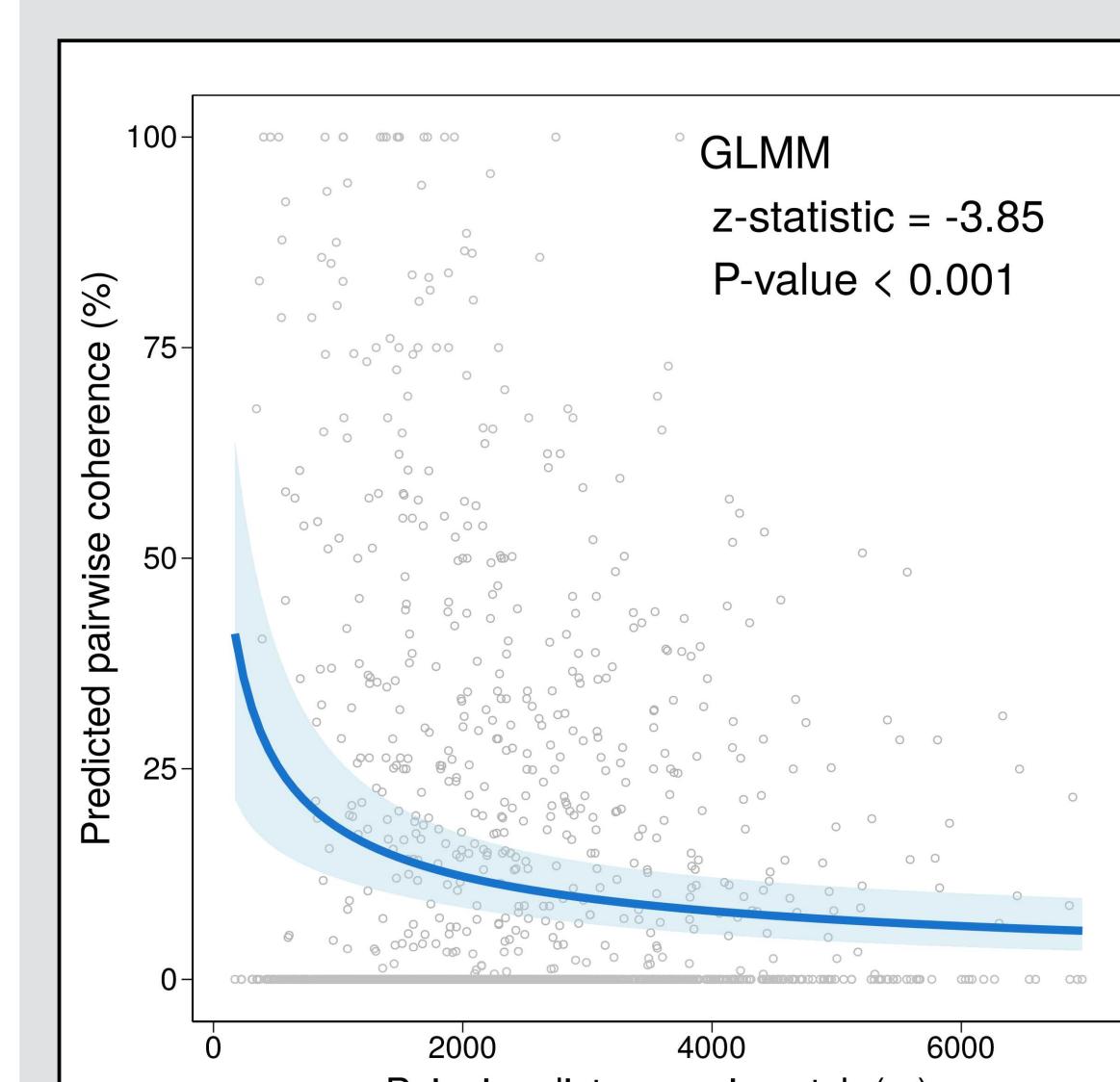
Knots' coherence is highest around high tide, and lowest around low tide

Question

Do knots find their 'friends' after foraging?

Model - GLMM

$$\text{Coherence}_{\text{advancing tide}} \sim \text{Coherence}_{\text{receding tide}} + \text{distance mismatch} + \text{random effects (pair, tidal interval)}$$



Result

Knots do not maintain pairwise bonds through a tidal interval.

Pairwise coherence post-foraging is determined by mismatches in distance covered during the tidal interval.

Summary/discussion?

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References Myers 1983, Conklin & Calwell 2007, Ekman 1967