

Appendix 2: Home Range Analysis for the 60 Sampling Regimes

Odd Jacobson

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Background

The purpose of this document is to show the outputs of the home range analysis from the 60 sampling regimes. This includes the: 1) variogram regressions with the fitted movement models and 2) the movement model summary information, and 3) home range estimates (See Appendix 1 for a detailed description of how home range analysis in *ctmm* works).

As a reminder, the 60 sampling regimes were generated from portions of our longitudinal movement dataset that were of the highest quality (two or more months of consistent data with very few temporal gaps), which we call “complete segments”. There are six complete segments from five groups because two of the complete segments came from the same group at different time periods (AA and AA2). How the sampling regimes were generated from the complete segments is described in the Methods section of the main text. We include the important information for every complete segment (i.e. labelled as “all”) and every sampling regime. The names of the sampling regimes are labelled with (C) for concentrated or (S) for spread, followed by the number of days in the data (e.g. C10).

Note on variograms: These plots are used as visualization tools to see if the data was sufficient to show range residency. Generally, what we are looking for is whether the empirical variograms plateau indicating range residency. If the variograms continue to increase, then this is an immediate sign that the data is not suitable for home range estimation. With irregular data, the variograms can look quite messy, which is generally not a problem. Also, they tend to be a bit more unpredictable toward larger time-lags which also is not normally an issue. In these plots, we also include the mean and confidence intervals for the top movement model (determined by AICc) fitted to the empirical variogram.

Note on model summaries: For the complete segments and sampling regimes from each group, we show a table showing the name of the selected movement model, the home range crossing time and the effective sample size. Overall, the *Ornstein–Uhlenbeck Foraging* (OUF) model was always selected, meaning that the data showed autocorrelated positions and velocities (See Appendix 1 for descriptions of the possible movement models). The effective sample sizes generally decrease with less days in the data. The effective sample sizes were generally above 10 for sampling regimes that had at least six days (e.g. C6, S6), but dropped to worrying low quantities with only 3 days (e.g. C3, S3).

Note on home range plots: These plots show the 95% UD estimates with 95% CIs of the AKDE home range estimates for the 60 sampling regimes. Each plot shows the total locations from the complete, but the closed green points are the locations that were selected in the regimes, and the open pink points are the locations that were thinned out.

I. AA Group

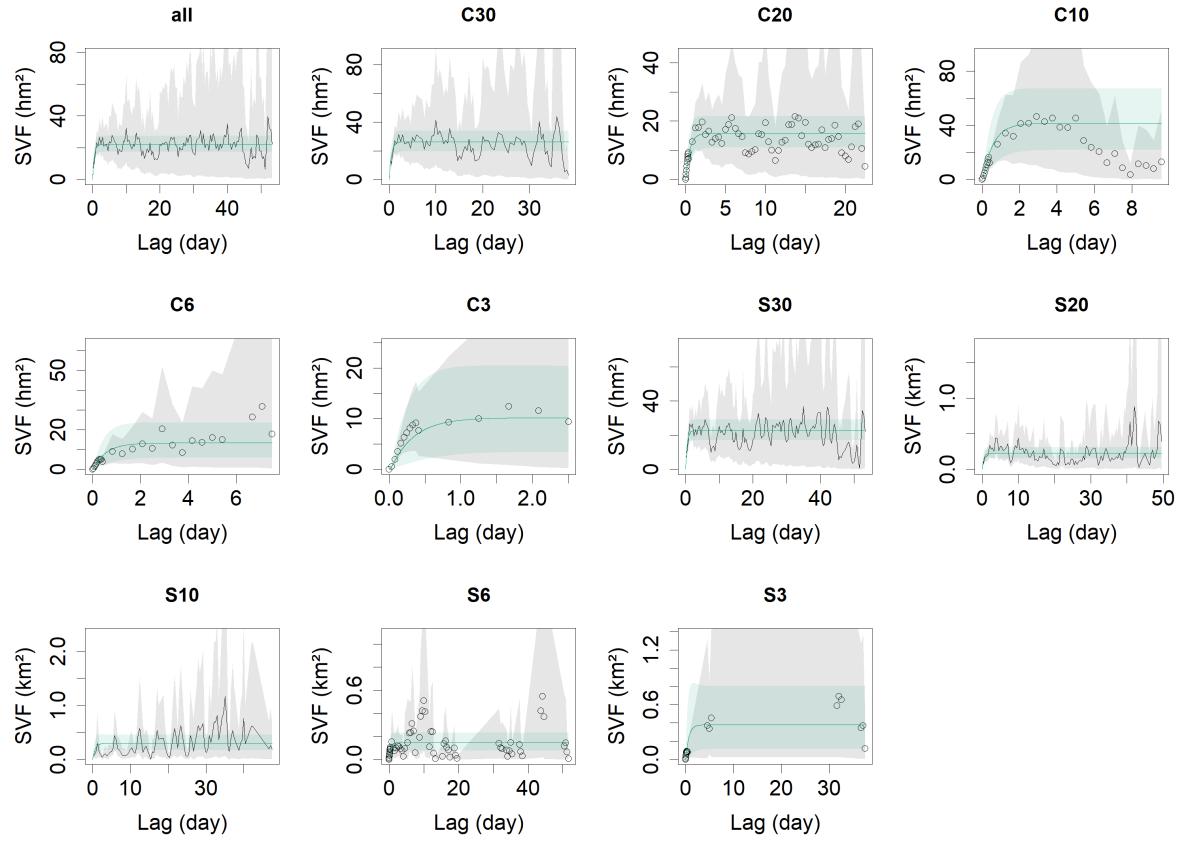


Figure 1: AA Variograms and Model Fits

i. Variograms

ii. Model Summary

Table 1: Model summary information for AA group

individual.local.identifier	Model Name	HR Crossing Time (hours)	Effective Sample Size
all	OUF anisotropic	11.371441	74.355955
C30	OUF anisotropic	11.411160	50.743983
C20	OUF	12.207090	33.361336
C10	OUF anisotropic	13.565069	12.821228
C6	OUF anisotropic	13.026774	8.754520
C3	OUF anisotropic	7.722914	5.405608
S30	OUF anisotropic	11.430881	55.372453
S20	OUF	10.920601	33.785164
S10	OUF	16.476402	17.054786
S6	OUF	10.689319	13.894728
S3	OUF	15.627924	4.502154

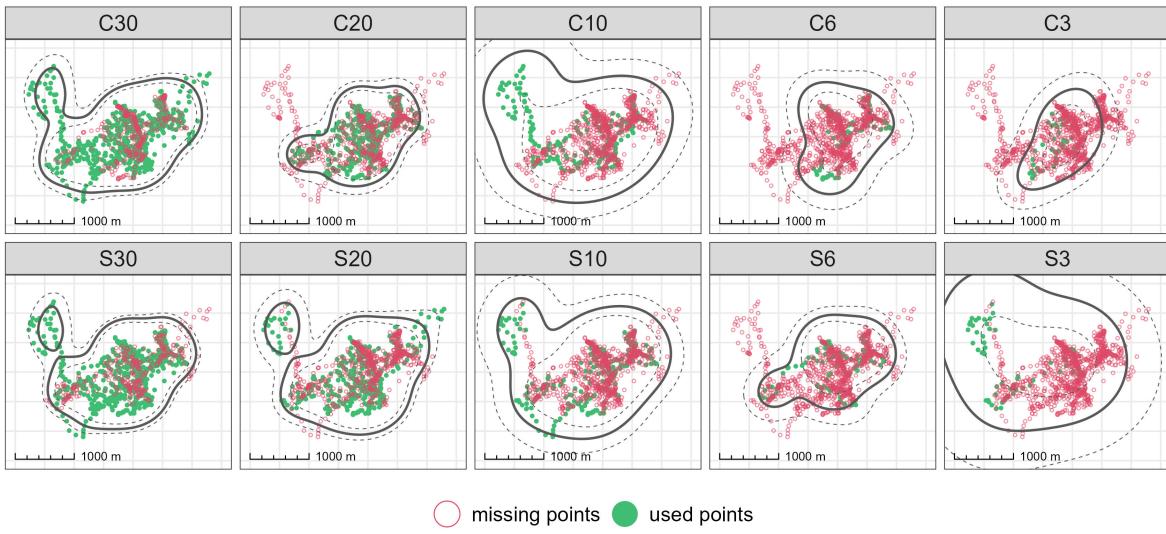


Figure 2: Home Range Estimates from AA sampling regimes plotted over data

iii. HR Performance Maps

I. RR Group

i. Variograms Below are the variograms for RR group. Similarly to CE group, there appears to be a shift after about a month.

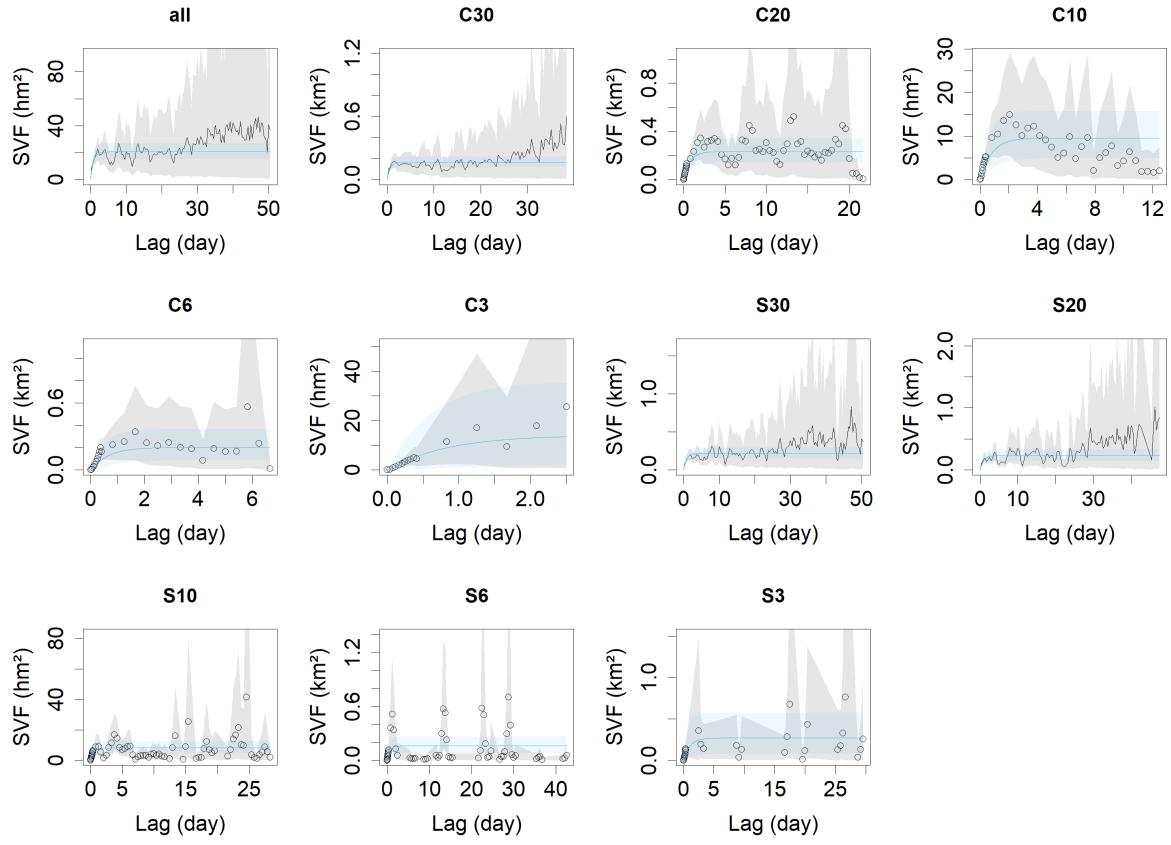


Figure 3: RR Variograms and Model Fits

ii. Model Summary

Table 2: Model summary information for RR group

individual.local.identifier	Model Name	HR Crossing Time (hours)	Effective Sample Size
all	OUF anisotropic	18.978032	46.095745
C30	OUF anisotropic	14.940166	42.308345
C20	OUF anisotropic	18.378469	21.158712
C10	OUF anisotropic	18.983334	12.050660
C6	OUF anisotropic	15.490440	8.136280
C3	OUF anisotropic	19.279959	2.775899
S30	OUF anisotropic	19.606929	35.785444
S20	OUF anisotropic	21.798724	24.326656
S10	OUF anisotropic	9.871898	15.892846
S6	OUF anisotropic	15.080781	11.807712
S3	OUF anisotropic	24.882872	4.536988

HR Performance Maps Below are the HR performance maps for RR group. Spread sampling regimes did not seem to perform better than concentrated for this group. There is not much of a difference based on the maps alone.

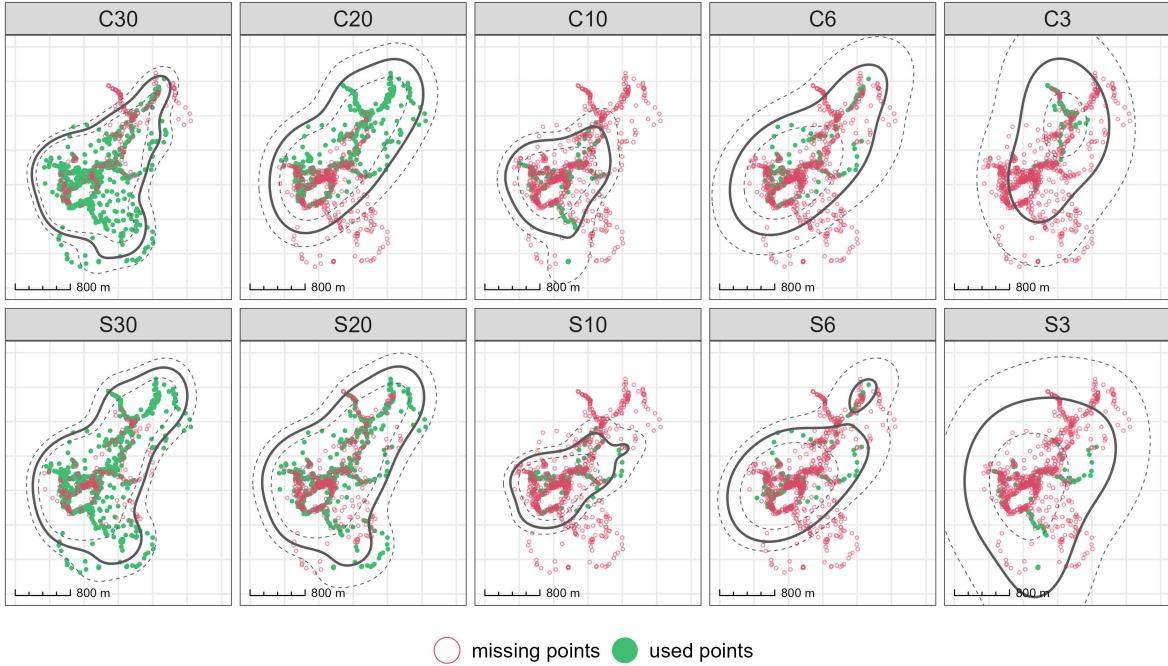


Figure 4: Home Range Estimates from RR sampling regimes plotted over data

III. CE Group

i. Variograms Below are the variograms for CE group. Notice how in the complete segment, the empirical variogram asymptotes then jumps up to a higher asymptote. This is the result of this group shifting within their range, which is only captured if the time lag is longer than about one month.

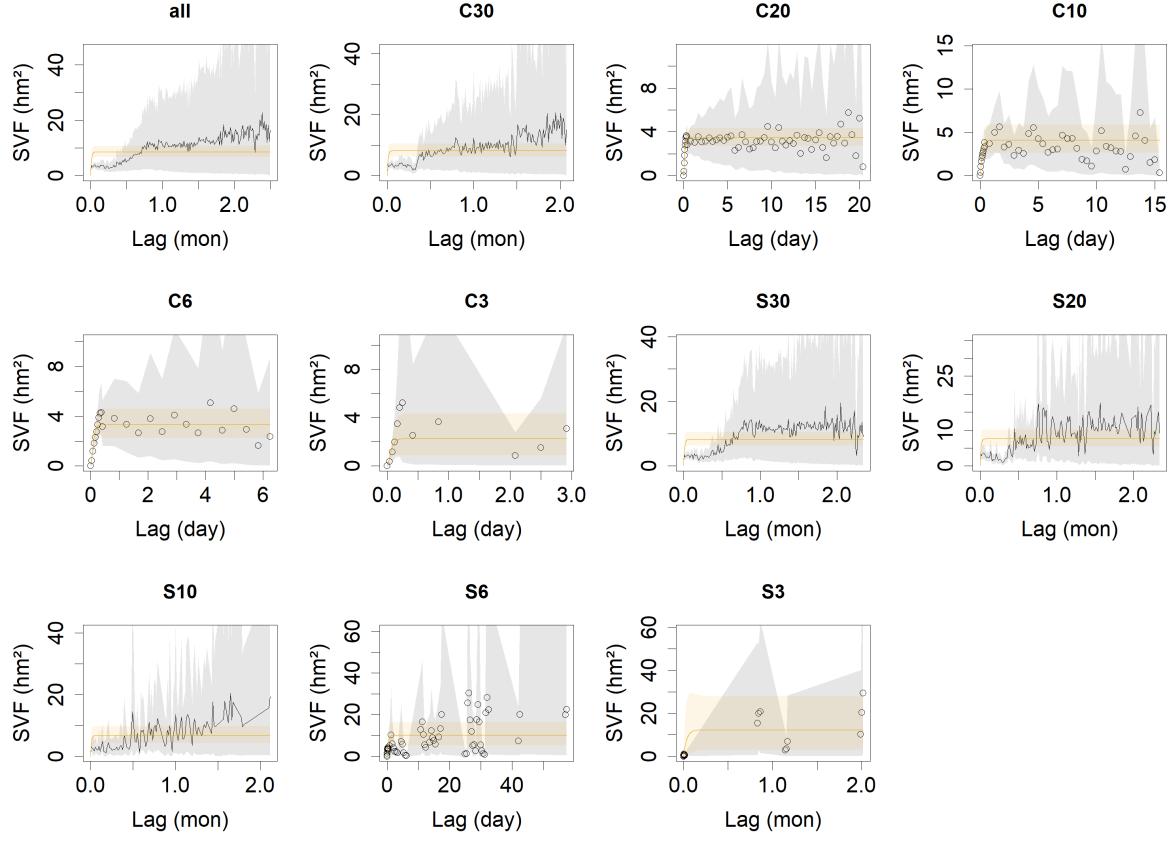


Figure 5: AA Variograms and Model Fits

ii. Model Summary

Table 3: Model summary information for CE group

individual.local.identifier	Model Name	HR Crossing Time (hours)	Effective Sample Size
all	OUF anisotropic	8.7813209	73.193752
C30	OUF	7.8875677	57.588565
C20	OUF	3.1045567	71.052081
C10	OUF anisotropic	3.8892913	23.890902
C6	OUf	1.2448895	31.505435
C3	OUf	0.8695337	6.541128
S30	OUF anisotropic	8.3635957	57.523148
S20	OUF	8.1590701	40.592830
S10	OUF anisotropic	6.5044688	23.701797
S6	OUF anisotropic	8.7724103	12.174717
S3	OUF	24.8253527	3.605531

iii. HR Performance Maps Below are the HR performance maps. Notice how the concentrated regimes performed very poorly because they fail to capture the shift in space-use.

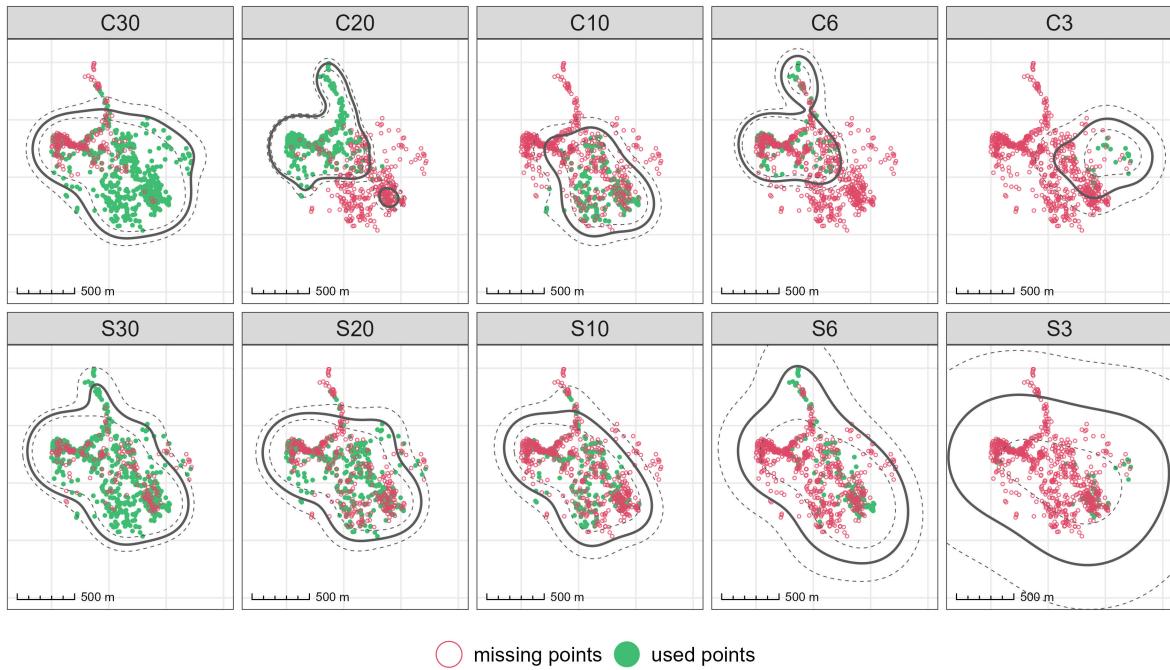


Figure 6: Home Range Estimates from AA sampling regimes plotted over data

IV. AA2 Group

i. Variograms Below are the variograms for AA2 group, which is just another complete segment selected from AA group.

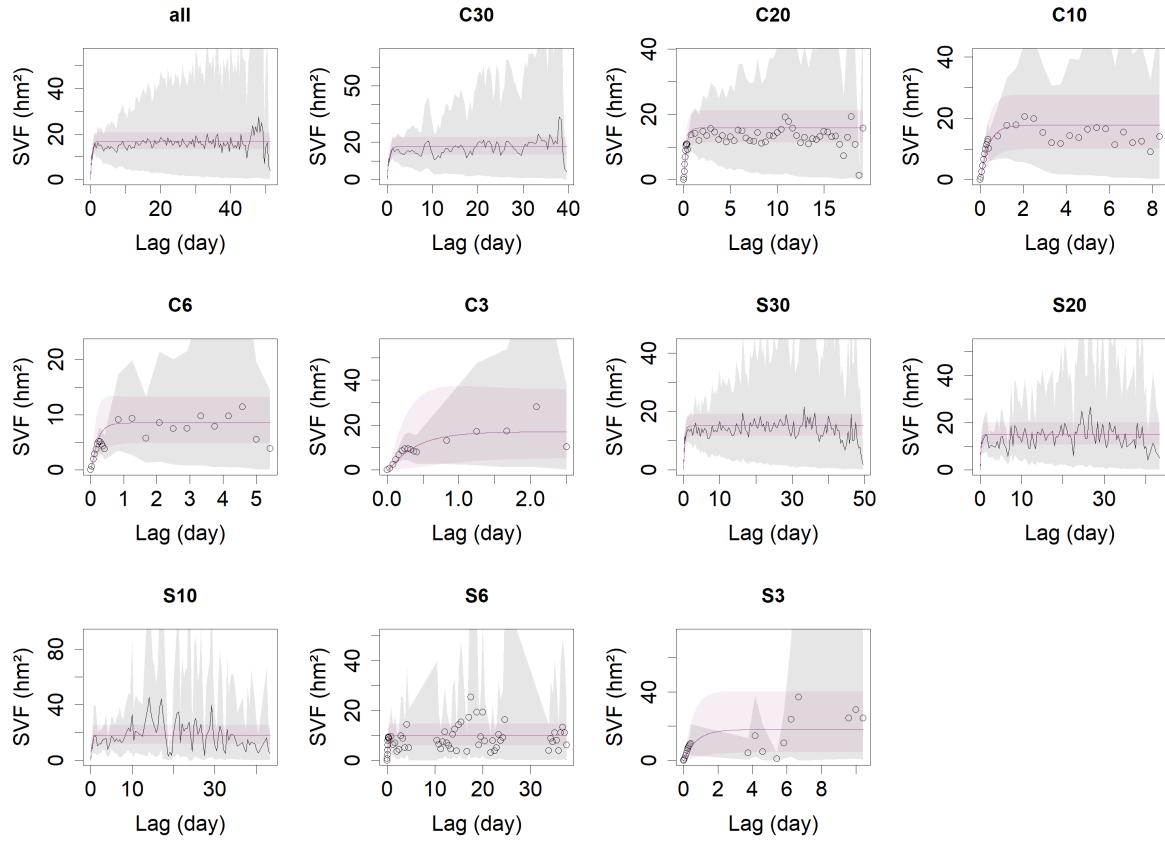


Figure 7: AA2 Variograms and Model Fits

ii. Model Summary

Table 4: Model summary information for AA2 group

individual.local.identifier	Model Name	HR Crossing Time (hours)	Effective Sample Size
all	OUF anisotropic	9.273814	81.297831
C30	OUF anisotropic	10.385718	54.182818
C20	OUF anisotropic	6.939681	39.549168
C10	OUF anisotropic	9.232590	15.629816
C6	OUF	4.543344	15.999752
C3	OUF	9.248229	4.635231
S30	OUF anisotropic	7.992799	63.016910
S20	OUF anisotropic	5.932028	40.313983
S10	OUF	7.153679	27.176787
S6	OUF	4.132458	20.193451
S3	OUF anisotropic	17.471853	3.859595

iii. HR Performance Maps Below are the HR performance maps for AA2 group.

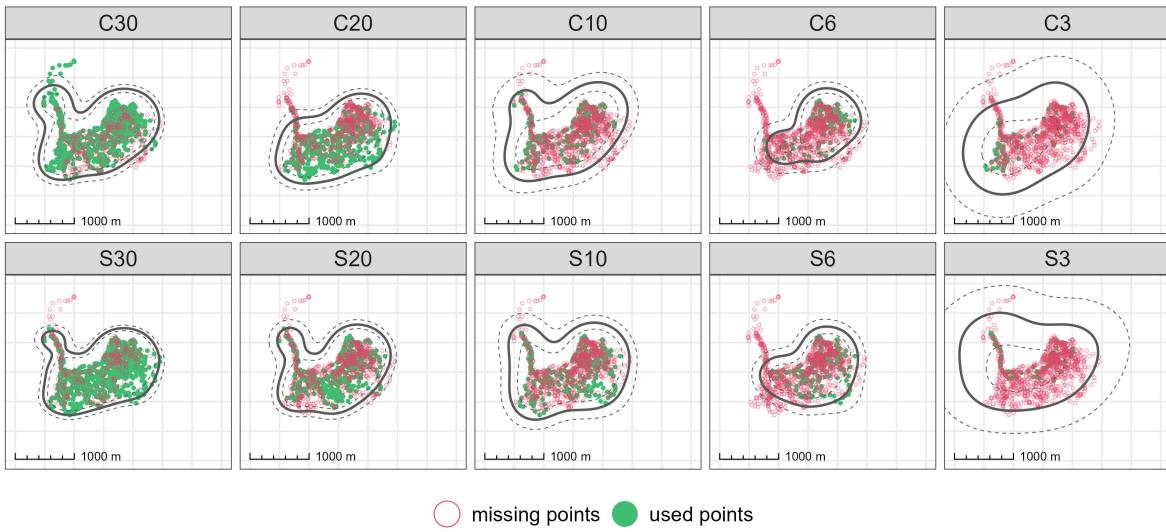


Figure 8: Home Range Estimates from AA2 sampling regimes plotted over data

V. SP Group

i. Variograms Below are the variograms for SP group. These tend to be messier than the other groups because this segment has a longer duration and therefore the time lag bins are more frequent. The messiness does not cause an issue; the main point of these is to see if there is an asymptote.

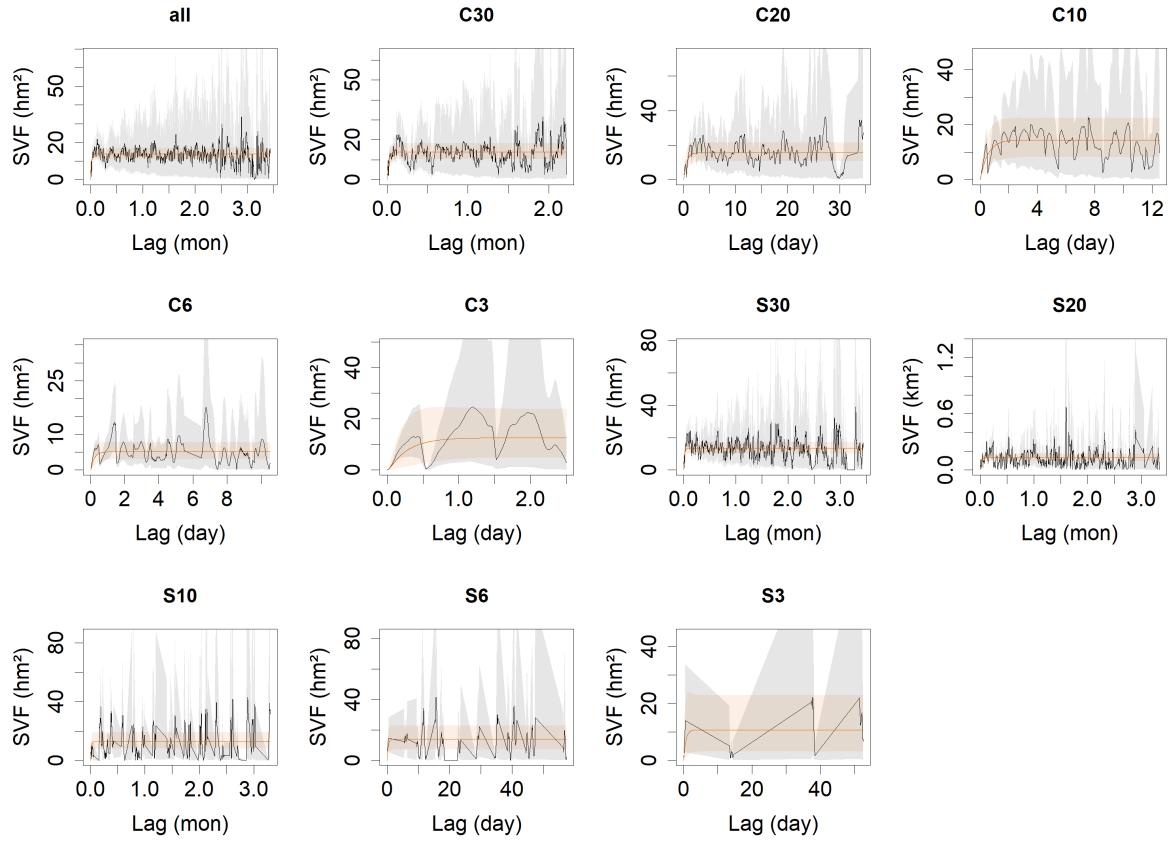


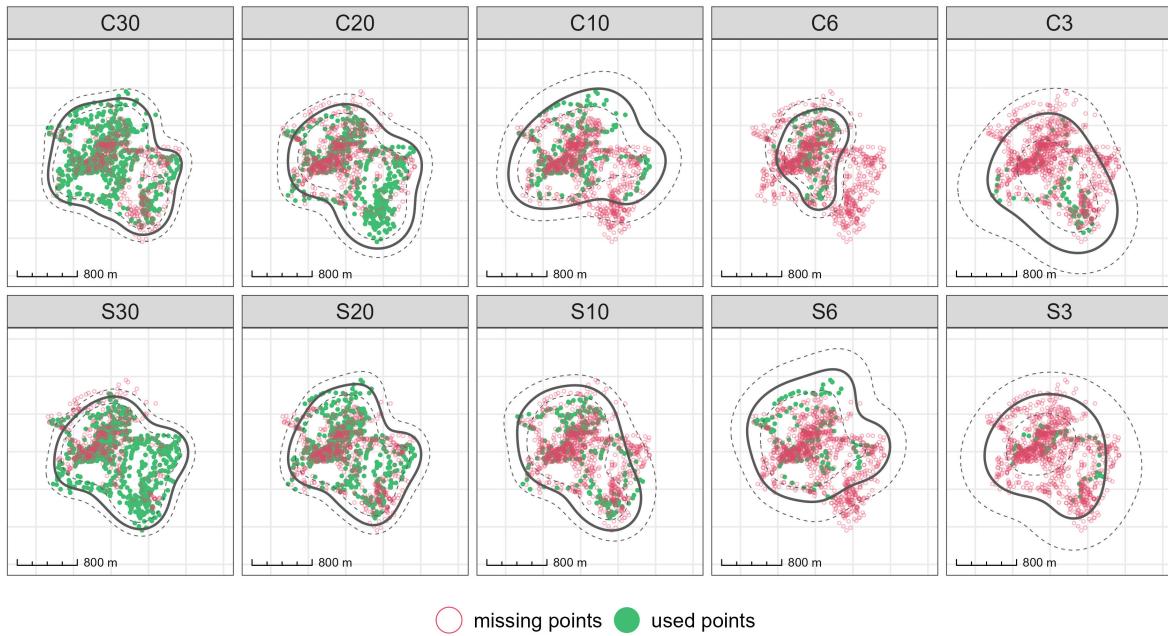
Figure 9: SP Variograms and Model Fits

ii. Model Summary

Table 5: Table 2: Model summary information for SP group

individual.local.identifier	Model Name	HR Crossing Time (hours)	Effective Sample Size
all	OUF anisotropic	13.624460	81.166993
C30	OUF anisotropic	14.526307	48.709825
C20	OUF	13.140053	31.818670
C10	OUF anisotropic	12.526639	15.743796
C6	OUF	4.702017	17.339935
C3	OUF	6.382257	6.674316
S30	OUF	11.509796	56.465935
S20	OUF anisotropic	11.075058	37.868752
S10	OUF anisotropic	9.578686	21.394681
S6	OUF anisotropic	8.567690	12.396154
S3	OUF	15.302549	4.384725

iii. HR Performance Maps Below are the HR performance maps for SP group.



○ missing points ● used points

Figure 10: Home Range Estimates from SP sampling regimes plotted over data

VI. FL Group

- i. **Variograms** Below are the variograms for FL group.

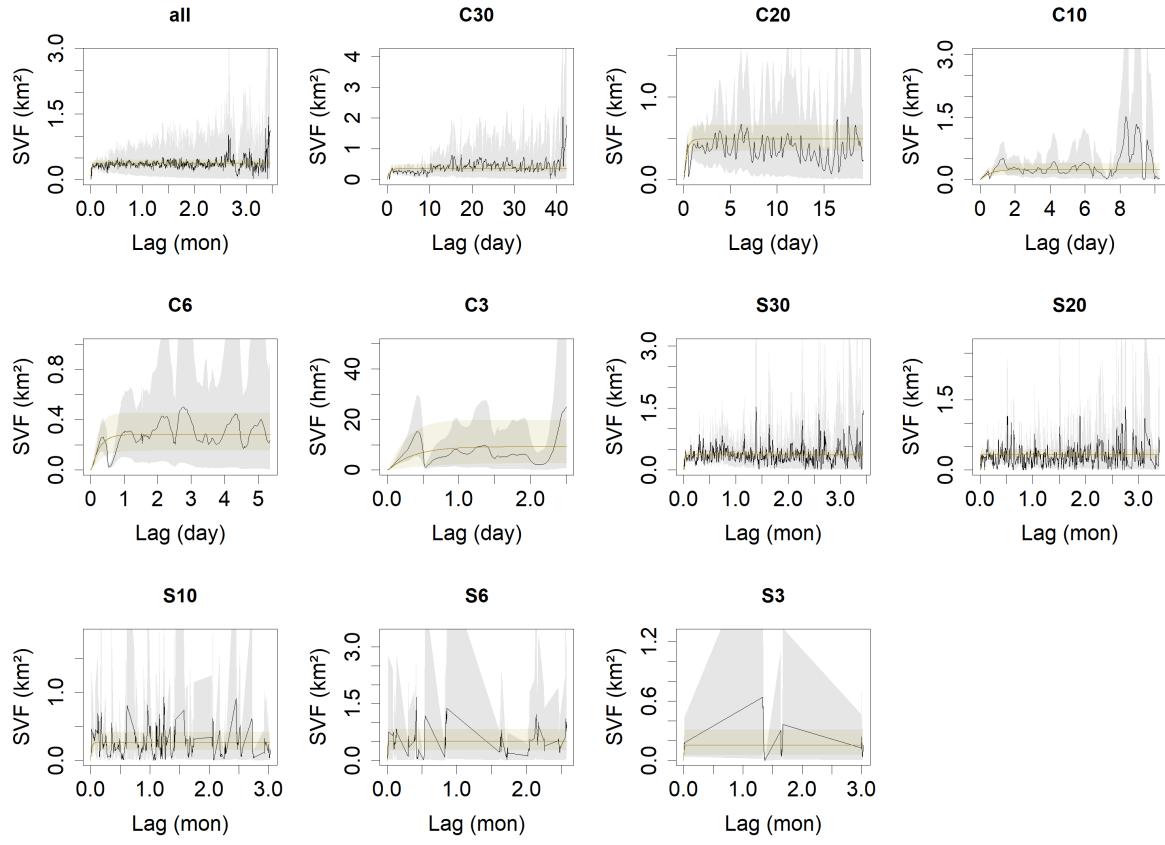


Figure 11: FL Variograms and Model Fits

ii. Model Summary

Table 6: Model summary information for FL group

individual.local.identifier	Model Name	HR Crossing Time (hours)	Effective Sample Size
all	OUF anisotropic	12.992068	95.955636
C30	OUF anisotropic	15.395619	35.198133
C20	OUF anisotropic	7.218778	38.959380
C10	OUF anisotropic	13.643672	12.552170
C6	OUF anisotropic	5.710013	13.713607
C3	OUF anisotropic	8.373327	4.471325
S30	OUF anisotropic	12.263379	50.788178
S20	OUF anisotropic	7.592231	39.964504
S10	OUF anisotropic	14.236334	15.236985
S6	OUF anisotropic	2.445047	12.805342
S3	OUF anisotropic	6.705427	5.509169

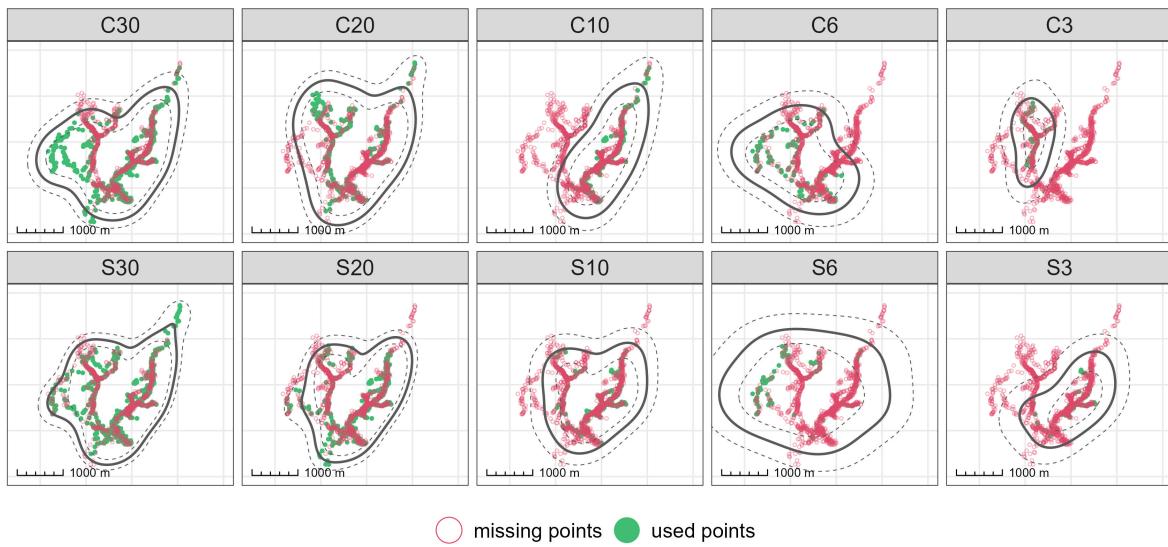


Figure 12: Home Range Estimates from FL sampling regimes plotted over data

iii. HR Performance Maps