Variation in distance between consecutive animal locations

This should be the abstract

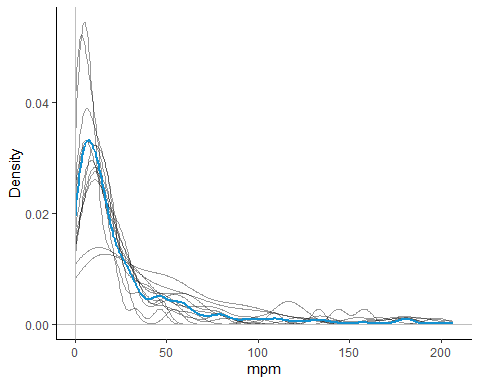
# Questions

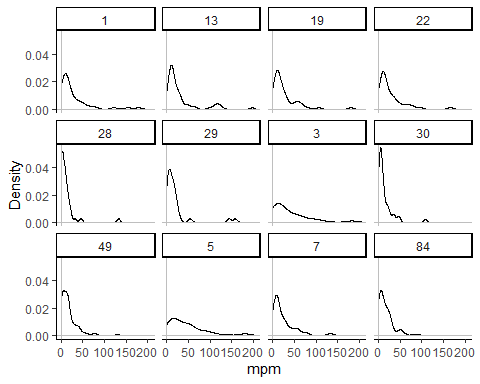
* What is the distribution of distances between consecutive recorded locations?
* Are there differences between individuals or can we use the same distribution to describe these distances between two locations?

The reasoning behind this, is that distances between locations can be used later on to describe variation in step length when simulating animal movement under simple models such as random walk.

### MPM: meters per minute

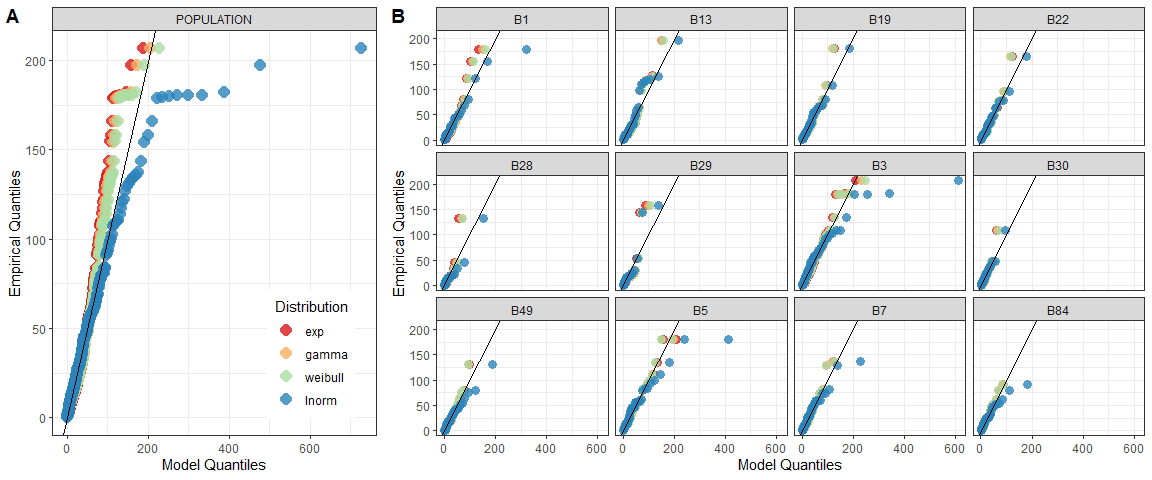
Due to the variation in time between consecutive locations, we scaled the step lengths to displacement in one minute. **Visualize the variation and distribution of these distances between locations**





# Fit distribution

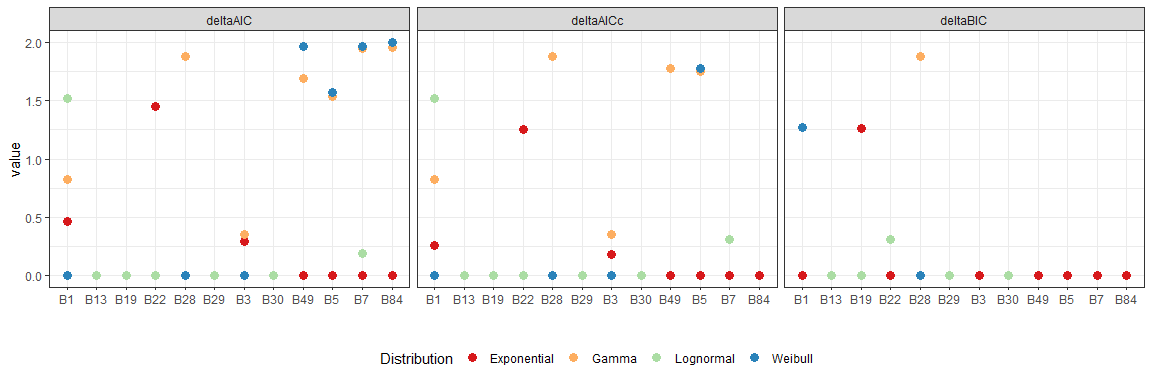
Useful resource to use the package [fitdistrplus](https://cran.r-project.org/web/packages/fitdistrplus/vignettes/FAQ.html) Also check [this](https://stackoverflow.com/questions/37152482/power-law-fitted-by-fitdistr-function-in-package-fitdistrplus). Should I do the opimization by hand?



## Information criteria

So, for each individual, which is the best fitting distribution, based on AIC or BIC? This is the distribution with the lowest AIC or BIC score for each individual. These are basically the distributions that will be used for the mixed distribution model later on.

## # A tibble: 12 x 2  
## # Groups: Individual [12]  
## Individual `Best model`   
## <chr> <chr>   
## 1 B1 Exponential (BIC), Weibull (AIC)   
## 2 B13 Lognormal   
## 3 B19 Lognormal   
## 4 B22 Exponential (BIC), Lognormal (AIC)  
## 5 B28 Weibull   
## 6 B29 Lognormal   
## 7 B3 Exponential (BIC), Weibull (AIC)   
## 8 B30 Lognormal   
## 9 B49 Exponential   
## 10 B5 Exponential   
## 11 B7 Exponential   
## 12 B84 Exponential

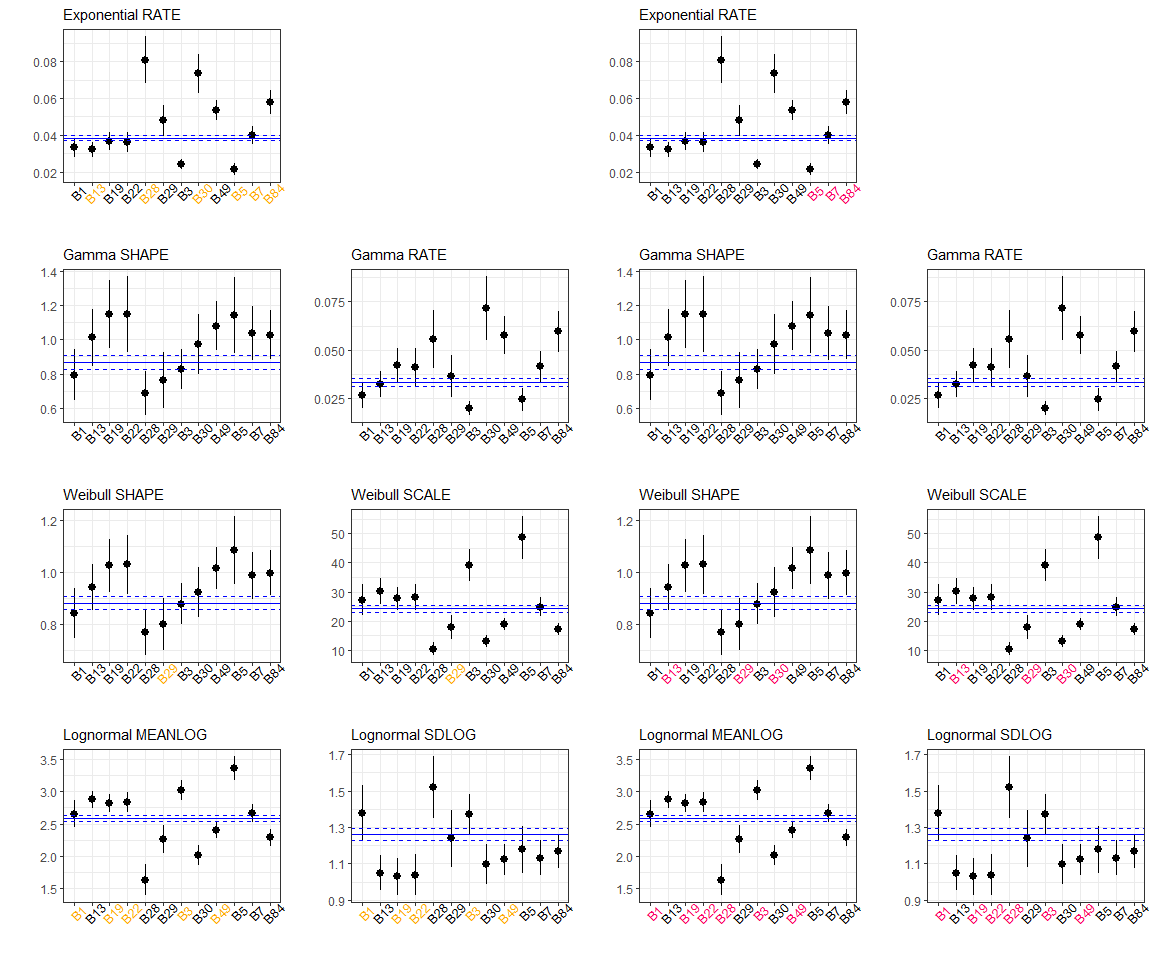
However, it is not as straight-forward since there are multiple competing models for certain individuals, which we consider as those within less than 2 units of the delta AIC or BIC. When using AIC, there are competing models for almost every individual, whereas with BIC, only 4 of the individuals have competing models.  Now we can compare what we call *models*, in which we compare a model that does complete pooling and considers all the data together, and the other model that considers individual variation, and so it fits a separate distribution to the data from each individual.

The individual variation models will fit a distribution to each individual. At one level we will use the same distribution for all individuals and only consider variation in parameters. At the next level, we will consider a change in parameters and distributions, where individuals can have different distributions, and this is what we call the mixed distribution model for individual variation.

Considering just focusing on BIC because of JMP’s paper, and also in this specific case, it provides less competing models for each individual

## Probability distribution parameters

We can compare the different parameter values estimated for each distribution and their standard deviations. These parameters can give us some insight into some of the characteristics of each set of distances moved per minute, such as which individuals have higher means or longer tails in the distribution of their distances moved per minute. The x axis in the following plots highlights which individuals have the lowest BIC (yellow) or AIC(magenta) with that model. The blue lines show the value of that parameter for the population level model, and dashed blue lines show the upper and lower limits of that parameter estimate. Overall, at the population level, the lognormal model had the lowest AIC and BIC values.

 # References