Suppose that we have focused on location and species

Suppose that we have 3 groups and that, after we remove the i-th individual, we have .

Furthermore, after removing the i-th individual, we also have and

These expressions are valid conditional on and . We could integrate out but for the moment being I will just try to keep things simple

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Multinomial piece

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Negative binomial piece

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We can combine both pieces to get:

Taking logs, this becomes: