Supplement for: countfitteR: efficient selection of count distributions to assess DNA damage

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Abstract: Count data, one of the most common data types in many fields. In personalized medicine and pharmacology, the analysis is relevant for numerous applications, such as cancer and ageing research and in the evaluation of drug efficacy [1–5]. By default it is assumed to follow the Poisson distribution. This assumption, however, may lead to biased results and faulty conclusions in data bodies with excess zero values (zero-inflation [6,7]), a variance larger than the mean (overdispersion), or both. In such cases, the standard assumption of a Poisson distribution would skew the estimation of mean and variance, and other models like the negative binomial (NB), zero-inflated Poisson or zero-inflated NB distributions should be employed. The model chosen has an influence on the parameter estimation (mean value and confidence interval). Yet the choice of the most suitable distribution model is not trivial. To support and simplify this process, we have implemented the countfitteR software, which is provided as an R package and a web server. We show the application of our software based on examples of count data from phenotypic imaging as used in radiomics and precision medicine: DNA double-strand breaks (DSBs) [8]. DSBs are a highly specific and sensitive molecular biomarker for monitoring DNA damage in cancer, aging research and the evaluation of drug efficacy, and are detected and quantified by foci formation in fluorescence microscopy. In analyzing a large number of datasets of a molecular pharmacological markers (phosphorylated Histone H2AX and p53 binding protein [9,10]), countfitteR demonstrated an equal or superior statistical performance compared to the usually employed two-step procedure, with an overall power of up to 98 %. In addition, it still gave information in cases with no result at all from the two-step procedure. In our data sample we found that the NB distribution was the most frequent, with the Poisson distribution taking second place. Originally designed for the analysis of foci in biomedical image data, countfitteR can be used in a variety of areas where non-Poisson distributed counting data is prevalent.

1 General information about the countfitteR graphical user interface

1.1 Charts

Each chart may be saved in the `.svg` (Scalable Vector Graphic) format. A download button is always located at the top of a chart.

1.2 Tables

Tables may be downloaded in a specified format or printed using the buttons at the top of the table.

1.3 Data upload

The data format suitable for upload is the `.csv` file, where a single column corresponds to a single count (Note: example files are included in the package). **Use raw counts instead a pivot table!** If your document does not have headers, specify it using the "Header" checkbox. In this case, **countfitteR** will automatically name your counts with the index number of a count prefixed by 'C'.

1.4 Count data

This panel contains descriptive statistics and summaries of the input data. It consists of three subpanels:
1. *Count table*: the input dataset in the tabular format allowing sanity checks and manual modification. 2. *Summary*: summary statistics of the input data (respectively mean, standard deviation, median, median absolute deviate, minimum, maximum, number of elements).
3. *Distribution*: a bar chart of the counts distribution followed by a pivot table.

1.5 Fitted models

1. *Mean value estimates*: the estimated value of mean (λ) and its confidence intervals. The BIC indicates the most appropriate distribution.

2. *Coefficients*: coefficients of fitted models.
3. *Decision*: the most appropriate model and the strength of the evidence [11].

1.6 Compare distributions

The bar charts represent theoretical counts depending on the chosen distribution. Red dots describe the real number of counts. The visualized data is also available in the tabular format.

1.7 Settings

Separate experiments: if this checkbox is marked, the **countfitteR** assumes that experiments are separate and fits the distribution to each individually and independently. Otherwise, all counts are simultaneously fitted to a single model. It is more appropriate for situations, where there is assumption that all samples may be describe by the same distribution, for example in case of technical replicates.

Confidence level: the confidence level of confidence intervals.

Count distributions: count distributions fitted to data: Poisson, Negative Binomial, Zero-Inflated Poisson, Zero-Inflated Negative Binomial. Possible distributions are described further in the manual.

2 Usage of the countfitteR software via the R console

```r
# Generate poisson (Poisson_data) and negative binomial (nBinomial_data)
# distributed count data in silico. Here 200 random integer numbers
# (= 200 cells) were generated for both distributions.
# The simulation was set to mimic data with a low number of counts (low number
# of foci per cell in average).

set.seed(007)
df <- data.frame(Poisson_data = rpois(200, 1.85),
                 nBinomial_data = rnbinom(200, 8.5, 0.8))

# Inspect the first 10 and last 10 data points via the head() and tail()
# functions, respectively.

head(df, n = 10)
```

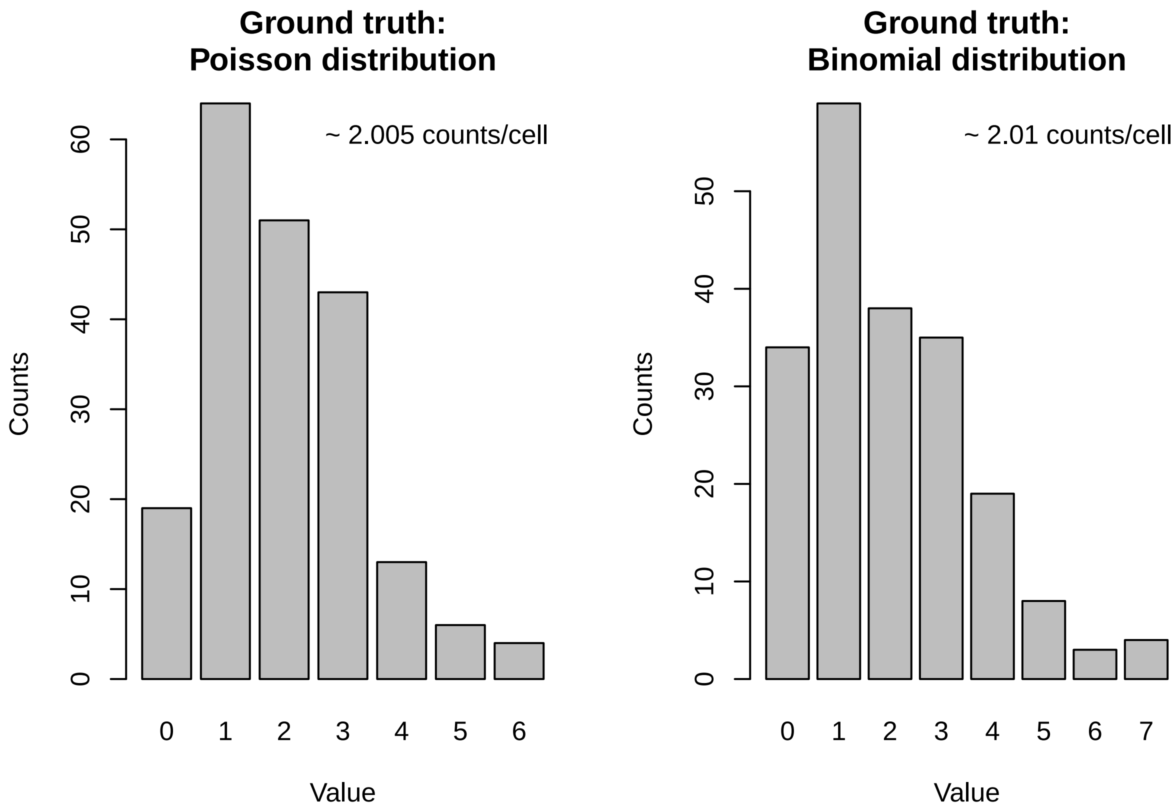
```
##    Poisson_data nBinomial_data
## 1             6              3
## 2             1              0
## 3             0              0
## 4             0              3
## 5             1              2
## 6             3              2
## 7             1              1
## 8             5              1
## 9             1              7
## 10            2              1
```

```r
tail(df, n = 10)
```

```
##     Poisson_data nBinomial_data
## 191            1              3
## 192            2              1
## 193            3              1
## 194            2              0
## 195            0              2
## 196            1              2
## 197            1              3
## 198            4              1
## 199            1              0
## 200            1              1
```

```r
# Visualize the count data after tabulation of the frequencies of both data sets.
# The red vertical lines indicate the arithmetic means of the data samples.

mean_poisson <- mean(df[, "Poisson_data"])
mean_binomial <- mean(df[, "nBinomial_data"])

par(mfrow = c(1,2), cex = 0.8)

# Plot for the data with a Poisson distribution
barplot(table(df[, "Poisson_data"]), main = "Ground truth:\nPoisson distribution",
        xlab = "Value", ylab = "Counts")
legend("topright", paste("~", mean_poisson, "counts/cell"), bty = "n")
```

```r
# Plot for the data with a negative binomial distribution
barplot(table(df[, "nBinomial_data"]), main = "Ground truth:\nBinomial distribution",
        xlab = "Value", ylab = "Counts")
legend("topright", paste("~", mean_binomial, "counts/cell"), bty = "n")
```




```r
# Note the arithmetic means (Mean ~ 2) and median (Median ~ 2) of the samples
# are very similar, as determined by the summary() function.

summary(df)
```

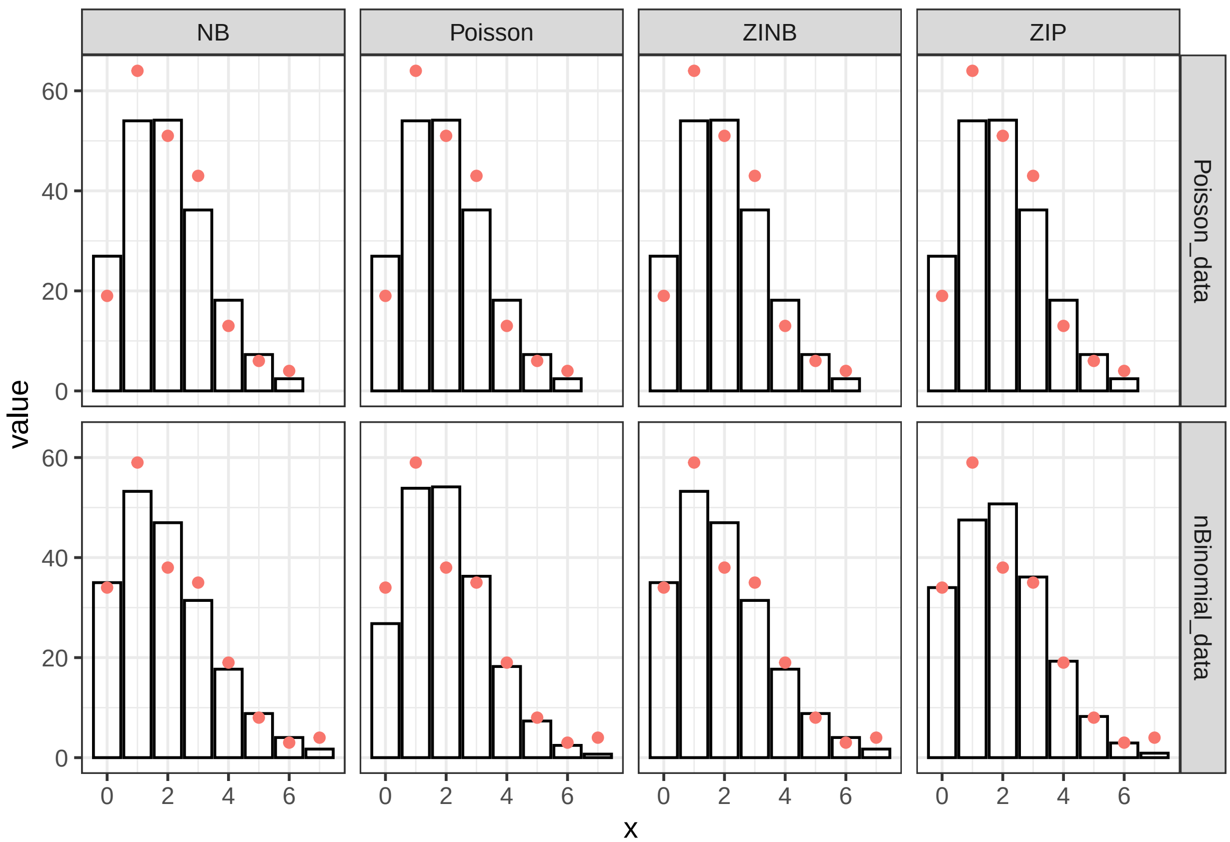
```
##   Poisson_data   nBinomial_data
##  Min.   :0.000   Min.   :0.00
##  1st Qu.:1.000   1st Qu.:1.00
##  Median :2.000   Median :2.00
##  Mean   :2.005   Mean   :2.01
##  3rd Qu.:3.000   3rd Qu.:3.00
##  Max.   :6.000   Max.   :7.00
```

```r
# For the analysis the countfitteR package is loaded

library(countfitteR)

# Next we use the fit_counts() function to fit counts to distributions. In our
# case the data are fitted to the Poisson, Negative Binomial (NB), Zero-Inflated
# Poisson (ZIP) and the Zero-Inflated Negative Binomial (ZINB) distributions.
```

```r
fc <- fit_counts(df, model = "all")
summ <- summary_fitlist(fc)

# Next, the decide() function is used to select the most appropriate
# distribution for the count data in the html-friendly format.

decide(summ, separate = TRUE)
```

```
## [1] "Count name: nBinomial_data<br/>The most appropriate model (model with the lowest BIC value): NB
```

```r
# Next, the empirical distribution of counts with the distribution defined by
# the model fitted to counts are compared. The bar charts represent theoretical
# counts depending on the chosen distribution. Red dots describe the real number
# of counts.

fitcmp <- compare_fit(df, fitlist = fit_counts(df, model = "all"))
plot_fitcmp(fitcmp)
```




```r
# Finally, the counts are fitted to model(s) using the count name as the
# explanatory variable. Estimates are presented in the table below along with the
# BIC values of their models from the summary_fitlist() function. Estimated
# coefficients of models (lambda for all distributions, theta for NB and ZINB,
# r for ZIP and ZINB).

results <- summary_fitlist(fc)

# Sort the dataset according to their BIC values and print them as table.
```

```r
knitr::kable(results[order (results[["BIC"]]),])
```

	count	lambda	lower	upper	BIC	theta	r	model
1	Poisson_data	2.005000	1.818057	2.211166	666.8974	NA	NA	Poisson
3	Poisson_data	2.005010	1.818064	2.211179	672.1961	NA	0.0000034	ZIP
5	Poisson_data	2.005000	1.818050	2.211174	672.1975	2.715018e+04	NA	NB
7	Poisson_data	2.004999	1.818052	2.211171	677.4951	2.836674e+05	0.0000078	ZINB
6	nBinomial_data	2.010000	1.796391	2.249009	728.5517	6.261040e+00	NA	NB
2	nBinomial_data	2.010000	1.822812	2.216410	731.1431	NA	NA	Poisson
4	nBinomial_data	2.135487	1.902169	2.397424	733.3299	NA	0.0587695	ZIP
8	nBinomial_data	2.010036	1.796331	2.249165	733.8502	6.261978e+00	0.0000182	ZINB

3 Overdispersion of count data

One of the important features of the Poisson distribution is the equality of variance and expected value. Although count data is commonly assumed to be Poisson-distributed, we often encounter overdispersed datasets, when the variance is bigger than the mean. Three distributions included in **countfitteR**: Zero-Inflated Poisson (ZIP), Negative Binomial (NB) and Zero-negative Binomial (ZINB) model overdispersed counts.

Overdispersion may be caused by the increased variability of counts, for example when a counting algorithm under- and overcounts. In such situation the data might have the NB distribution. The other cause of overdispersion is called zero-inflation and occurs in datasets, where some factor introduced faulty zeros. That means that some counts, regardless of their real state, are treated as zeros. In this case, data has the ZIP distribution. If both faulty zeros and increased variance affect the data, the ZINB distribution is the most appropriate.

3.1 Overdispersed count data distribution

Poisson and Negative Binomial distributions have the same expected value. In case of ZIP and ZINB, the expected value is smaller than the real average number of foci per cell.

Table S1: Expected value and variance of Poisson, ZIP, NB and ZINB distributions. λ: Poisson parameter (number of occurrences, e.g., average number of foci per cell). r: zero inflation (fraction of occurrences treated as zeros, e.g., fraction of cells treated by system as having no foci regardless of their real state). θ: dispersion parameter.

Distribution name	Expected value	Variance
Poisson	$E(X) = \lambda$	$\text{var}(X) = \lambda$
ZIP	$E(X) = (1 - r)\lambda$	$\text{var}(X) = \lambda(1 - r)(1 + \lambda r)$
NB	$E(X) = \lambda$	$\text{var}(X) = \lambda + \frac{\lambda^2}{\theta}$

Distribution name	Expected value	Variance
ZINB	$E(X) = (1-r)\lambda$	$\mathrm{var}(X) = (1-r)\lambda\left(1 + r\lambda + \frac{1}{\theta}\right)$

Depending on the value of r the variance of ZIP and ZINB may be smaller or bigger than the variance of Poisson distribution. In case of the NB distribution, the variance is always bigger than for the Poisson distribution, although the difference becomes negligible, when the θ is much bigger than λ^2.

Parameters:

- λ - Poisson parameter (average number of foci per cell).
- r - zero inflation (fraction of cells treated by system as having no foci regardless of their real state).
- θ - dispersion parameter.

Usually the NB distribution is parameterized using μ and θ, but to make comparison clearer, we use λ instead of μ. In this parameterization, NB and ZINB are treated as the mixture of Poisson and Gamma (Γ) distributions.

Table S2: Probability mass functions of Poisson, ZIP, NB and ZINB distributions. λ: Poisson parameter (number of occurrences, e.g., average number of foci per cell). r: zero inflation (fraction of occurrences treated as zeros, e.g., fraction of cells treated by system as having no foci regardless of their real state). θ: dispersion parameter.

Distribution name	pmf
Poisson	$P\{X = k\} = \frac{\lambda^k \exp^{-\lambda}}{k!}$
Zero-inflated Poisson	$P\{X = k\} = \begin{cases} r + (1-r)\exp^{-\lambda}, \text{if } k = 0 \\ r\frac{\lambda^k \exp^{-\lambda}}{k!}, \text{if } k = 1, 2, \dots \end{cases}$
Negative Binomial	$P\{X = k\} = \frac{\Gamma(\theta + k)}{\Gamma(\theta)k!}\left(\left(\frac{\theta}{\theta+\lambda}\right)^{\theta}\left(\frac{\lambda}{\theta+\lambda}\right)\right)^{k}$
Zero-inflated Negative Binomial	$P\{X = k\} = \begin{cases} r + (1-r)\left(\frac{\theta}{\theta+\lambda}\right)^{\theta}, \text{if } k = 0 \\ (1-r)\frac{\Gamma(\theta+k)}{\Gamma(\theta)k!}\left(\left(\frac{\theta}{\theta+\lambda}\right)^{\theta}\left(\frac{\lambda}{\theta+\lambda}\right)\right)^{k}, \text{if } k = 1, 2 \end{cases}$

3.2 Results of the simulation

Figure S1: Empirical power of countfitteR and two-step test for Poisson distribution. n: number of counts in the sample. λ: Poisson parameter (number of occurrences, e.g., average number of foci per cell).

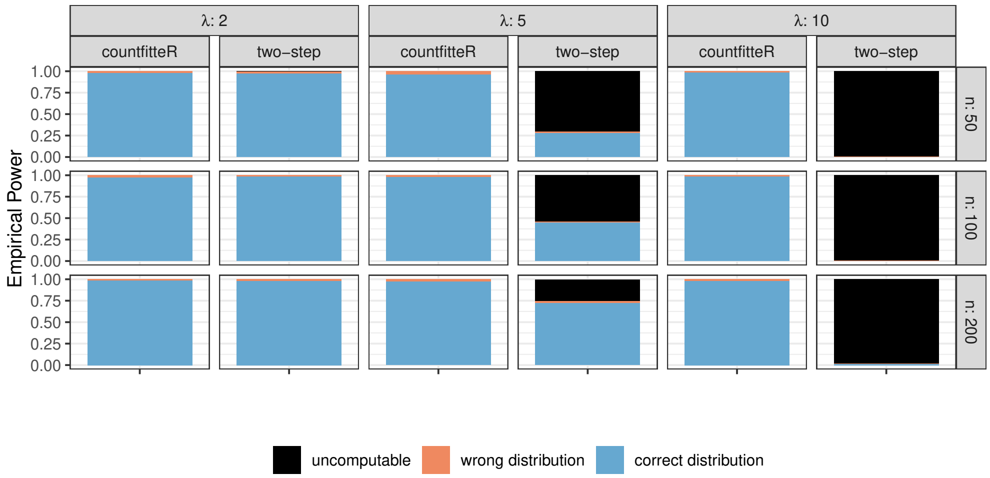
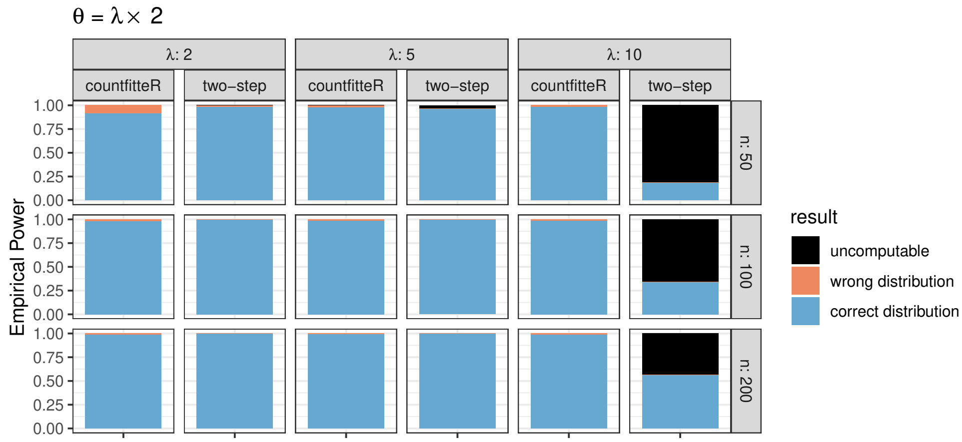
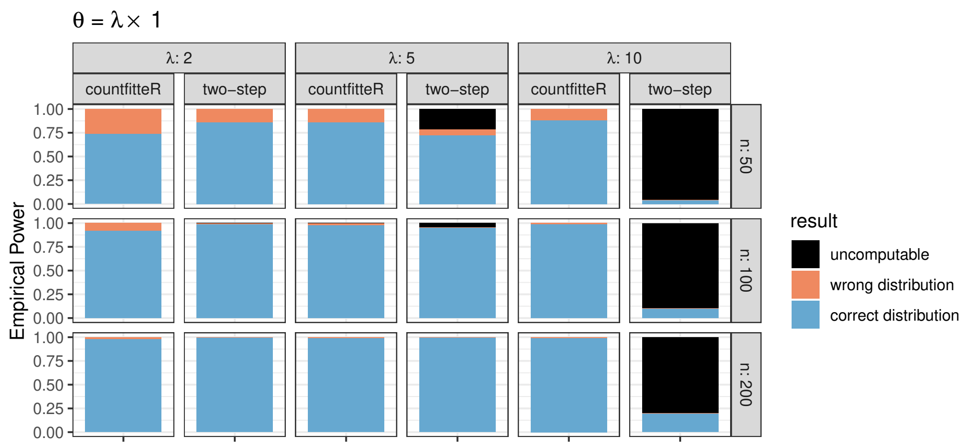


Figure S2: Empirical power of countfitteR and two-step test for NB distribution. λ: Poisson parameter (number of occurrences, e.g., average number of foci per cell). θ: dispersion parameter.





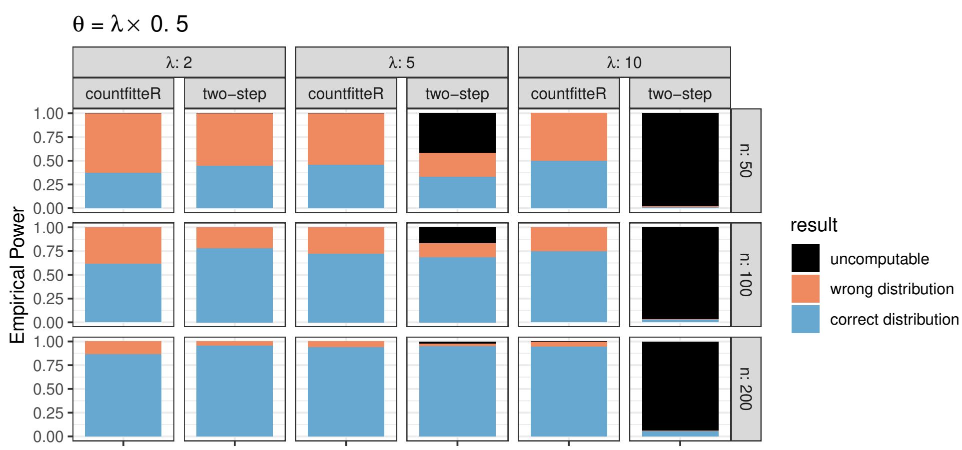


Table S3: Comparison of countfitteR empirical power with two-step procedure for Poisson distribution with three possible sample sizes (n = 50, 100, 200) and three possible means (λ = 2, 5, 10).

model	method	n	lambda	pow_mean	pow_sd	uncomputable
pois	countfitteR	50	2	0.9780000	0.1467567	0
pois	countfitteR	100	2	0.9760000	0.1531256	0
pois	countfitteR	200	2	0.9850000	0.1216133	0
pois	countfitteR	50	5	0.9600000	0.1960572	0
pois	countfitteR	100	5	0.9770000	0.1499783	0
pois	countfitteR	200	5	0.9720000	0.1650553	0
pois	countfitteR	50	10	0.9840000	0.1255379	0
pois	countfitteR	100	10	0.9880000	0.1089397	0
pois	countfitteR	200	10	0.9800000	0.1400701	0
pois	two-step	50	2	0.9808468	0.1371326	8
pois	two-step	100	2	0.9880000	0.1089397	0
pois	two-step	200	2	0.9800000	0.1400701	0
pois	two-step	50	5	0.9595960	0.1972373	703
pois	two-step	100	5	0.9759825	0.1532707	542
pois	two-step	200	5	0.9690860	0.1732011	256
pois	two-step	50	10	1.0000000	0.0000000	998
pois	two-step	100	10	0.3333333	0.5773503	997
pois	two-step	200	10	0.8571429	0.3631365	986

Table S4: Comparison of countfitteR and two-step procedure empirical power for ZIP distribution with three possible sample sizes (n = 50, 100, 200), three possible means (λ = 2, 5, 10), and dispersion parameter r ranging from 0.1 to 0.9.

model	method	n	lambda	size	pow_mean	pow_sd	uncomputable
nb	countfitteR	50	2	1.0	0.9150000	0.2790212	0
nb	countfitteR	100	2	1.0	0.9800000	0.1400701	0
nb	countfitteR	200	2	1.0	0.9890000	0.1043546	0
nb	countfitteR	50	2	2.0	0.7410000	0.4383048	0
nb	countfitteR	100	2	2.0	0.9210000	0.2698737	0
nb	countfitteR	200	2	2.0	0.9820000	0.1330176	0
nb	countfitteR	50	2	4.0	0.3760000	0.4846224	0
nb	countfitteR	100	2	4.0	0.6200000	0.4856293	0
nb	countfitteR	200	2	4.0	0.8650000	0.3418946	0
nb	countfitteR	50	5	2.5	0.9790000	0.1434558	0
nb	countfitteR	100	5	2.5	0.9850000	0.1216133	0
nb	countfitteR	200	5	2.5	0.9920000	0.0891288	0
nb	countfitteR	50	5	5.0	0.8590000	0.3481957	0
nb	countfitteR	100	5	5.0	0.9800000	0.1400701	0
nb	countfitteR	200	5	5.0	0.9930000	0.0834144	0
nb	countfitteR	50	5	10.0	0.4610000	0.4987261	0
nb	countfitteR	100	5	10.0	0.7240000	0.4472405	0
nb	countfitteR	200	5	10.0	0.9410000	0.2357426	0
nb	countfitteR	50	10	5.0	0.9840000	0.1255379	0
nb	countfitteR	100	10	5.0	0.9860000	0.1175492	0
nb	countfitteR	200	10	5.0	0.9890000	0.1043546	0
nb	countfitteR	50	10	10.0	0.8840000	0.3203852	0
nb	countfitteR	100	10	10.0	0.9880000	0.1089397	0
nb	countfitteR	200	10	10.0	0.9900000	0.0995485	0
nb	countfitteR	50	10	20.0	0.4980000	0.5002462	0
nb	countfitteR	100	10	20.0	0.7520000	0.4320679	0
nb	countfitteR	200	10	20.0	0.9490000	0.2201078	0
nb	two-step	50	2	1.0	0.9870000	0.1133307	0
nb	two-step	100	2	1.0	0.9980000	0.0446990	0
nb	two-step	200	2	1.0	1.0000000	0.0000000	0
nb	two-step	50	2	2.0	0.8610000	0.3461196	0
nb	two-step	100	2	2.0	0.9900000	0.0995485	0
nb	two-step	200	2	2.0	0.9990000	0.0316228	0
nb	two-step	50	2	4.0	0.4490000	0.4976411	0
nb	two-step	100	2	4.0	0.7820000	0.4130940	0
nb	two-step	200	2	4.0	0.9550000	0.2074079	0
nb	two-step	50	5	2.5	0.9968944	0.0556700	34
nb	two-step	100	5	2.5	0.9990000	0.0316228	0
nb	two-step	200	5	2.5	1.0000000	0.0000000	0
nb	two-step	50	5	5.0	0.9210191	0.2698809	215
nb	two-step	100	5	5.0	0.9958159	0.0645829	44
nb	two-step	200	5	5.0	1.0000000	0.0000000	3
nb	two-step	50	5	10.0	0.5684932	0.4957111	416
nb	two-step	100	5	10.0	0.8250905	0.3801190	171
nb	two-step	200	5	10.0	0.9753846	0.1550294	25
nb	two-step	50	10	5.0	1.0000000	0.0000000	811
nb	two-step	100	10	5.0	1.0000000	0.0000000	657
nb	two-step	200	10	5.0	1.0000000	0.0000000	438
nb	two-step	50	10	10.0	1.0000000	0.0000000	959

model	method	n	lambda	size	pow_mean	pow_sd	uncomputable
nb	two-step	100	10	10.0	1.0000000	0.0000000	899
nb	two-step	200	10	10.0	1.0000000	0.0000000	801
nb	two-step	50	10	20.0	0.7000000	0.4701623	980
nb	two-step	100	10	20.0	0.8666667	0.3457459	970
nb	two-step	200	10	20.0	0.9833333	0.1290994	940

Table S5: Comparison of countfitteR empirical and two-step procedure empirical power for NB distribution with three possible sample sizes (n = 50, 100, 200), three possible means (λ = 2, 5, 10), and three possible sizes ($\theta = \frac{\lambda}{2}$, λ, 2λ).

model	method	n	lambda	r	pow_mean	pow_sd	uncomputable
zip	countfitteR	50	2	0.1	0.7970000	0.4024338	0
zip	countfitteR	100	2	0.1	0.8830000	0.3215811	0
zip	countfitteR	200	2	0.1	0.9370000	0.2430845	0
zip	countfitteR	50	5	0.1	0.9610000	0.1936918	0
zip	countfitteR	100	5	0.1	0.9870000	0.1133307	0
zip	countfitteR	200	5	0.1	0.9900000	0.0995485	0
zip	countfitteR	50	10	0.1	0.9930000	0.0834144	0
zip	countfitteR	100	10	0.1	0.9950000	0.0705690	0
zip	countfitteR	200	10	0.1	0.9960000	0.0631505	0
zip	countfitteR	50	2	0.2	0.8590000	0.3481957	0
zip	countfitteR	100	2	0.2	0.9280000	0.2586173	0
zip	countfitteR	200	2	0.2	0.9680000	0.1760881	0
zip	countfitteR	50	5	0.2	0.9930000	0.0834144	0
zip	countfitteR	100	5	0.2	0.9950000	0.0705690	0
zip	countfitteR	200	5	0.2	0.9920000	0.0891288	0
zip	countfitteR	50	10	0.2	0.9920000	0.0891288	0
zip	countfitteR	100	10	0.2	0.9960000	0.0631505	0
zip	countfitteR	200	10	0.2	0.9940000	0.0772656	0
zip	countfitteR	50	2	0.3	0.8920000	0.3105357	0
zip	countfitteR	100	2	0.3	0.9390000	0.2394501	0
zip	countfitteR	200	2	0.3	0.9800000	0.1400701	0
zip	countfitteR	50	5	0.3	0.9820000	0.1330176	0
zip	countfitteR	100	5	0.3	0.9840000	0.1255379	0
zip	countfitteR	200	5	0.3	0.9900000	0.0995485	0
zip	countfitteR	50	10	0.3	0.9870000	0.1133307	0
zip	countfitteR	100	10	0.3	0.9890000	0.1043546	0
zip	countfitteR	200	10	0.3	0.9950000	0.0705690	0
zip	countfitteR	50	2	0.4	0.9000000	0.3001501	0
zip	countfitteR	100	2	0.4	0.9470000	0.2241456	0
zip	countfitteR	200	2	0.4	0.9900000	0.0995485	0
zip	countfitteR	50	5	0.4	0.9870000	0.1133307	0
zip	countfitteR	100	5	0.4	0.9920000	0.0891288	0
zip	countfitteR	200	5	0.4	0.9890000	0.1043546	0
zip	countfitteR	50	10	0.4	0.9930000	0.0834144	0
zip	countfitteR	100	10	0.4	0.9950000	0.0705690	0
zip	countfitteR	200	10	0.4	0.9900000	0.0995485	0
zip	countfitteR	50	2	0.5	0.9230000	0.2667248	0
zip	countfitteR	100	2	0.5	0.9670000	0.1787259	0
zip	countfitteR	200	2	0.5	0.9860000	0.1175492	0
zip	countfitteR	50	5	0.5	0.9840000	0.1255379	0
zip	countfitteR	100	5	0.5	0.9830000	0.1293357	0
zip	countfitteR	200	5	0.5	0.9980000	0.0446990	0
zip	countfitteR	50	10	0.5	0.9890000	0.1043546	0
zip	countfitteR	100	10	0.5	0.9960000	0.0631505	0
zip	countfitteR	200	10	0.5	0.9930000	0.0834144	0
zip	countfitteR	50	2	0.6	0.8750000	0.3308844	0
zip	countfitteR	100	2	0.6	0.9470000	0.2241456	0
zip	countfitteR	200	2	0.6	0.9880000	0.1089397	0

model	method	n	lambda	r	pow_mean	pow_sd	uncomputable
zip	countfitteR	50	5	0.6	0.9870000	0.1133307	0
zip	countfitteR	100	5	0.6	0.9880000	0.1089397	0
zip	countfitteR	200	5	0.6	0.9880000	0.1089397	0
zip	countfitteR	50	10	0.6	0.9830000	0.1293357	0
zip	countfitteR	100	10	0.6	0.9910000	0.0944877	0
zip	countfitteR	200	10	0.6	0.9940000	0.0772656	0
zip	countfitteR	50	2	0.7	0.7820000	0.4130940	0
zip	countfitteR	100	2	0.7	0.9260000	0.2619019	0
zip	countfitteR	200	2	0.7	0.9810000	0.1365930	0
zip	countfitteR	50	5	0.7	0.9850000	0.1216133	0
zip	countfitteR	100	5	0.7	0.9880000	0.1089397	0
zip	countfitteR	200	5	0.7	0.9920000	0.0891288	0
zip	countfitteR	50	10	0.7	0.9900000	0.0995485	0
zip	countfitteR	100	10	0.7	0.9870000	0.1133307	0
zip	countfitteR	200	10	0.7	0.9920000	0.0891288	0
zip	countfitteR	50	2	0.8	0.5350000	0.4990231	0
zip	countfitteR	100	2	0.8	0.8000000	0.4002002	0
zip	countfitteR	200	2	0.8	0.9480000	0.2221381	0
zip	countfitteR	50	5	0.8	0.9820000	0.1330176	0
zip	countfitteR	100	5	0.8	0.9890000	0.1043546	0
zip	countfitteR	200	5	0.8	0.9860000	0.1175492	0
zip	countfitteR	50	10	0.8	0.9880000	0.1089397	0
zip	countfitteR	100	10	0.8	0.9870000	0.1133307	0
zip	countfitteR	200	10	0.8	0.9940000	0.0772656	0
zip	countfitteR	50	2	0.9	0.2030000	0.4024338	0
zip	countfitteR	100	2	0.9	0.3130000	0.4639464	0
zip	countfitteR	200	2	0.9	0.5480000	0.4979397	0
zip	countfitteR	50	5	0.9	0.8980000	0.3027997	0
zip	countfitteR	100	5	0.9	0.9840000	0.1255379	0
zip	countfitteR	200	5	0.9	0.9940000	0.0772656	0
zip	countfitteR	50	10	0.9	0.9770000	0.1499783	0
zip	countfitteR	100	10	0.9	0.9860000	0.1175492	0
zip	countfitteR	200	10	0.9	0.9920000	0.0891288	0
zip	two-step	50	2	0.1	0.0000000	0.0000000	545
zip	two-step	100	2	0.1	0.0000000	0.0000000	660
zip	two-step	200	2	0.1	0.0000000	0.0000000	701
zip	two-step	50	5	0.1	0.0000000	0.0000000	907
zip	two-step	100	5	0.1	0.0000000	0.0000000	921
zip	two-step	200	5	0.1	0.0000000	0.0000000	998
zip	two-step	50	10	0.1	NaN	NA	1000
zip	two-step	100	10	0.1	NaN	NA	1000
zip	two-step	200	10	0.1	NaN	NA	1000
zip	two-step	50	2	0.2	0.0000000	0.0000000	208
zip	two-step	100	2	0.2	0.0000000	0.0000000	0
zip	two-step	200	2	0.2	0.0000000	0.0000000	0
zip	two-step	50	5	0.2	0.0870000	0.2819761	0
zip	two-step	100	5	0.2	0.1540000	0.3611294	0
zip	two-step	200	5	0.2	0.6920000	0.4618976	0
zip	two-step	50	10	0.2	0.2900000	0.4539891	0
zip	two-step	100	10	0.2	0.6990000	0.4589222	0
zip	two-step	200	10	0.2	0.9990000	0.0316228	0
zip	two-step	50	2	0.3	0.0000000	0.0000000	0

model	method	n	lambda	r	pow_mean	pow_sd	uncomputable
zip	two-step	100	2	0.3	0.0000000	0.0000000	0
zip	two-step	200	2	0.3	0.0000000	0.0000000	0
zip	two-step	50	5	0.3	0.0880000	0.2834367	0
zip	two-step	100	5	0.3	0.4500000	0.4977427	0
zip	two-step	200	5	0.3	0.6060000	0.4888793	0
zip	two-step	50	10	0.3	0.7590000	0.4279043	0
zip	two-step	100	10	0.3	0.9950000	0.0705690	0
zip	two-step	200	10	0.3	1.0000000	0.0000000	0
zip	two-step	50	2	0.4	0.0010000	0.0316228	0
zip	two-step	100	2	0.4	0.0000000	0.0000000	0
zip	two-step	200	2	0.4	0.0000000	0.0000000	0
zip	two-step	50	5	0.4	0.0650000	0.2466492	0
zip	two-step	100	5	0.4	0.3620000	0.4808193	0
zip	two-step	200	5	0.4	0.2910000	0.4544508	0
zip	two-step	50	10	0.4	0.9410000	0.2357426	0
zip	two-step	100	10	0.4	1.0000000	0.0000000	0
zip	two-step	200	10	0.4	1.0000000	0.0000000	0
zip	two-step	50	2	0.5	0.0060000	0.0772656	0
zip	two-step	100	2	0.5	0.0000000	0.0000000	0
zip	two-step	200	2	0.5	0.0000000	0.0000000	0
zip	two-step	50	5	0.5	0.0180000	0.1330176	0
zip	two-step	100	5	0.5	0.1060000	0.3079917	0
zip	two-step	200	5	0.5	0.0470000	0.2117447	0
zip	two-step	50	10	0.5	0.6480000	0.4778329	0
zip	two-step	100	10	0.5	0.9990000	0.0316228	0
zip	two-step	200	10	0.5	1.0000000	0.0000000	0
zip	two-step	50	2	0.6	0.0100000	0.0995485	0
zip	two-step	100	2	0.6	0.0010000	0.0316228	0
zip	two-step	200	2	0.6	0.0000000	0.0000000	0
zip	two-step	50	5	0.6	0.0000000	0.0000000	0
zip	two-step	100	5	0.6	0.0080000	0.0891288	0
zip	two-step	200	5	0.6	0.0010000	0.0316228	0
zip	two-step	50	10	0.6	0.1860000	0.3893014	0
zip	two-step	100	10	0.6	0.8428428	0.3641312	1
zip	two-step	200	10	0.6	1.0000000	0.0000000	1
zip	two-step	50	2	0.7	0.0300000	0.1706726	0
zip	two-step	100	2	0.7	0.0070000	0.0834144	0
zip	two-step	200	2	0.7	0.0000000	0.0000000	0
zip	two-step	50	5	0.7	0.0000000	0.0000000	0
zip	two-step	100	5	0.7	0.0000000	0.0000000	0
zip	two-step	200	5	0.7	0.0000000	0.0000000	0
zip	two-step	50	10	0.7	0.0270000	0.1621644	0
zip	two-step	100	10	0.7	0.1251251	0.3310265	1
zip	two-step	200	10	0.7	0.9660000	0.1813198	0
zip	two-step	50	2	0.8	0.0130000	0.1133307	0
zip	two-step	100	2	0.8	0.0360000	0.1863833	0
zip	two-step	200	2	0.8	0.0150000	0.1216133	0
zip	two-step	50	5	0.8	0.0160000	0.1255379	0
zip	two-step	100	5	0.8	0.0030000	0.0547174	0
zip	two-step	200	5	0.8	0.0000000	0.0000000	0
zip	two-step	50	10	0.8	0.0560000	0.2300368	0
zip	two-step	100	10	0.8	0.0000000	0.0000000	0

model	method	n	lambda	r	pow_mean	pow_sd	uncomputable
zip	two-step	200	10	0.8	0.0670000	0.2501471	0
zip	two-step	50	2	0.9	0.0050000	0.0705690	0
zip	two-step	100	2	0.9	0.0100000	0.0995485	0
zip	two-step	200	2	0.9	0.0300000	0.1706726	0
zip	two-step	50	5	0.9	0.0370741	0.1890383	2
zip	two-step	100	5	0.9	0.0730000	0.2602667	0
zip	two-step	200	5	0.9	0.0180000	0.1330176	0
zip	two-step	50	10	0.9	0.0050251	0.0707453	5
zip	two-step	100	10	0.9	0.0080000	0.0891288	0
zip	two-step	200	10	0.9	0.0000000	0.0000000	0

Table S6: Comparison of countfitteR and two-step 2procedure empirical power for ZINB distribution with three possible sample sizes (n = 50, 100, 200), three possible means (λ = 2, 5, 10), three possible sizes ($\theta = \frac{\lambda}{2}$, λ, 2λ), and dispersion parameter r ranging from 0.1 to 0.9.

model	method	n	lambda	size	r	pow_mean	pow_sd	uncomputable
zinb	countfitteR	50	2	1.0	0.1	0.0010000	0.0316228	0
zinb	countfitteR	100	2	1.0	0.1	0.0010000	0.0316228	0
zinb	countfitteR	200	2	1.0	0.1	0.0040000	0.0631505	0
zinb	countfitteR	50	2	2.0	0.1	0.0000000	0.0000000	0
zinb	countfitteR	100	2	2.0	0.1	0.0010000	0.0316228	0
zinb	countfitteR	200	2	2.0	0.1	0.0010000	0.0316228	0
zinb	countfitteR	50	2	4.0	0.1	0.0000000	0.0000000	0
zinb	countfitteR	100	2	4.0	0.1	0.0000000	0.0000000	0
zinb	countfitteR	200	2	4.0	0.1	0.0000000	0.0000000	0
zinb	countfitteR	50	5	2.5	0.1	0.0470000	0.2117447	0
zinb	countfitteR	100	5	2.5	0.1	0.1720000	0.3775693	0
zinb	countfitteR	200	5	2.5	0.1	0.5190000	0.4998889	0
zinb	countfitteR	50	5	5.0	0.1	0.0180000	0.1330176	0
zinb	countfitteR	100	5	5.0	0.1	0.0740000	0.2619019	0
zinb	countfitteR	200	5	5.0	0.1	0.3160000	0.4651455	0
zinb	countfitteR	50	5	10.0	0.1	0.0160000	0.1255379	0
zinb	countfitteR	100	5	10.0	0.1	0.0460000	0.2095899	0
zinb	countfitteR	200	5	10.0	0.1	0.1230000	0.3286016	0
zinb	countfitteR	50	10	5.0	0.1	0.2640000	0.4410198	0
zinb	countfitteR	100	10	5.0	0.1	0.4980000	0.5002462	0
zinb	countfitteR	200	10	5.0	0.1	0.7720000	0.4197525	0
zinb	countfitteR	50	10	10.0	0.1	0.1070000	0.3092679	0
zinb	countfitteR	100	10	10.0	0.1	0.2360000	0.4248347	0
zinb	countfitteR	200	10	10.0	0.1	0.4250000	0.4945904	0
zinb	countfitteR	50	10	20.0	0.1	0.0420000	0.2006895	0
zinb	countfitteR	100	10	20.0	0.1	0.0950000	0.2933617	0
zinb	countfitteR	200	10	20.0	0.1	0.1420000	0.3492248	0
zinb	countfitteR	50	2	1.0	0.2	0.0010000	0.0316228	0
zinb	countfitteR	100	2	1.0	0.2	0.0080000	0.0891288	0
zinb	countfitteR	200	2	1.0	0.2	0.0680000	0.2518719	0
zinb	countfitteR	50	2	2.0	0.2	0.0000000	0.0000000	0
zinb	countfitteR	100	2	2.0	0.2	0.0030000	0.0547174	0
zinb	countfitteR	200	2	2.0	0.2	0.0250000	0.1562031	0
zinb	countfitteR	50	2	4.0	0.2	0.0000000	0.0000000	0
zinb	countfitteR	100	2	4.0	0.2	0.0000000	0.0000000	0
zinb	countfitteR	200	2	4.0	0.2	0.0060000	0.0772656	0
zinb	countfitteR	50	5	2.5	0.2	0.1690000	0.3749394	0
zinb	countfitteR	100	5	2.5	0.2	0.5580000	0.4968731	0
zinb	countfitteR	200	5	2.5	0.2	0.9250000	0.2635231	0
zinb	countfitteR	50	5	5.0	0.2	0.1110000	0.3142893	0
zinb	countfitteR	100	5	5.0	0.2	0.3580000	0.4796520	0
zinb	countfitteR	200	5	5.0	0.2	0.6670000	0.4715224	0
zinb	countfitteR	50	5	10.0	0.2	0.0500000	0.2180540	0
zinb	countfitteR	100	5	10.0	0.2	0.1350000	0.3418946	0
zinb	countfitteR	200	5	10.0	0.2	0.2500000	0.4332294	0
zinb	countfitteR	50	10	5.0	0.2	0.5650000	0.4960051	0
zinb	countfitteR	100	10	5.0	0.2	0.8300000	0.3758208	0
zinb	countfitteR	200	10	5.0	0.2	0.9660000	0.1813198	0

model	method	n	lambda	size	r	pow_mean	pow_sd	uncomputable
zinb	countfitteR	50	10	10.0	0.2	0.2930000	0.4553662	0
zinb	countfitteR	100	10	10.0	0.2	0.4550000	0.4982201	0
zinb	countfitteR	200	10	10.0	0.2	0.7070000	0.4553662	0
zinb	countfitteR	50	10	20.0	0.2	0.0940000	0.2919747	0
zinb	countfitteR	100	10	20.0	0.2	0.1750000	0.3801572	0
zinb	countfitteR	200	10	20.0	0.2	0.2700000	0.4441816	0
zinb	countfitteR	50	2	1.0	0.3	0.0060000	0.0772656	0
zinb	countfitteR	100	2	1.0	0.3	0.0250000	0.1562031	0
zinb	countfitteR	200	2	1.0	0.3	0.1430000	0.3502480	0
zinb	countfitteR	50	2	2.0	0.3	0.0030000	0.0547174	0
zinb	countfitteR	100	2	2.0	0.3	0.0130000	0.1133307	0
zinb	countfitteR	200	2	2.0	0.3	0.1400000	0.3471607	0
zinb	countfitteR	50	2	4.0	0.3	0.0000000	0.0000000	0
zinb	countfitteR	100	2	4.0	0.3	0.0030000	0.0547174	0
zinb	countfitteR	200	2	4.0	0.3	0.0430000	0.2029586	0
zinb	countfitteR	50	5	2.5	0.3	0.3930000	0.4886612	0
zinb	countfitteR	100	5	2.5	0.3	0.8010000	0.3994478	0
zinb	countfitteR	200	5	2.5	0.3	0.9880000	0.1089397	0
zinb	countfitteR	50	5	5.0	0.3	0.2680000	0.4431392	0
zinb	countfitteR	100	5	5.0	0.3	0.5570000	0.4969889	0
zinb	countfitteR	200	5	5.0	0.3	0.8500000	0.3572501	0
zinb	countfitteR	50	5	10.0	0.3	0.1060000	0.3079917	0
zinb	countfitteR	100	5	10.0	0.3	0.2420000	0.4285086	0
zinb	countfitteR	200	5	10.0	0.3	0.3770000	0.4848774	0
zinb	countfitteR	50	10	5.0	0.3	0.7520000	0.4320679	0
zinb	countfitteR	100	10	5.0	0.3	0.9500000	0.2180540	0
zinb	countfitteR	200	10	5.0	0.3	0.9820000	0.1330176	0
zinb	countfitteR	50	10	10.0	0.3	0.4050000	0.4911377	0
zinb	countfitteR	100	10	10.0	0.3	0.6630000	0.4729214	0
zinb	countfitteR	200	10	10.0	0.3	0.7590000	0.4279043	0
zinb	countfitteR	50	10	20.0	0.3	0.1750000	0.3801572	0
zinb	countfitteR	100	10	20.0	0.3	0.2770000	0.4477404	0
zinb	countfitteR	200	10	20.0	0.3	0.4110000	0.4922614	0
zinb	countfitteR	50	2	1.0	0.4	0.0070000	0.0834144	0
zinb	countfitteR	100	2	1.0	0.4	0.0500000	0.2180540	0
zinb	countfitteR	200	2	1.0	0.4	0.2350000	0.4242110	0
zinb	countfitteR	50	2	2.0	0.4	0.0020000	0.0446990	0
zinb	countfitteR	100	2	2.0	0.4	0.0260000	0.1592148	0
zinb	countfitteR	200	2	2.0	0.4	0.2590000	0.4383048	0
zinb	countfitteR	50	2	4.0	0.4	0.0020000	0.0446990	0
zinb	countfitteR	100	2	4.0	0.4	0.0060000	0.0772656	0
zinb	countfitteR	200	2	4.0	0.4	0.1260000	0.3320154	0
zinb	countfitteR	50	5	2.5	0.4	0.5420000	0.4984822	0
zinb	countfitteR	100	5	2.5	0.4	0.9140000	0.2805043	0
zinb	countfitteR	200	5	2.5	0.4	0.9990000	0.0316228	0
zinb	countfitteR	50	5	5.0	0.4	0.3980000	0.4897304	0
zinb	countfitteR	100	5	5.0	0.4	0.6920000	0.4618976	0
zinb	countfitteR	200	5	5.0	0.4	0.9450000	0.2280943	0
zinb	countfitteR	50	5	10.0	0.4	0.1600000	0.3667895	0
zinb	countfitteR	100	5	10.0	0.4	0.3070000	0.4614802	0
zinb	countfitteR	200	5	10.0	0.4	0.5260000	0.4995734	0
zinb	countfitteR	50	10	5.0	0.4	0.8620000	0.3450726	0

model	method	n	lambda	size	r	pow_mean	pow_sd	uncomputable
zinb	countfitteR	100	10	5.0	0.4	0.9720000	0.1650553	0
zinb	countfitteR	200	10	5.0	0.4	0.9880000	0.1089397	0
zinb	countfitteR	50	10	10.0	0.4	0.5280000	0.4994652	0
zinb	countfitteR	100	10	10.0	0.4	0.7510000	0.4326502	0
zinb	countfitteR	200	10	10.0	0.4	0.8460000	0.3611294	0
zinb	countfitteR	50	10	20.0	0.4	0.2020000	0.4016931	0
zinb	countfitteR	100	10	20.0	0.4	0.3590000	0.4799472	0
zinb	countfitteR	200	10	20.0	0.4	0.5320000	0.4992246	0
zinb	countfitteR	50	2	1.0	0.5	0.0100000	0.0995485	0
zinb	countfitteR	100	2	1.0	0.5	0.0720000	0.2586173	0
zinb	countfitteR	200	2	1.0	0.5	0.2820000	0.4501985	0
zinb	countfitteR	50	2	2.0	0.5	0.0040000	0.0631505	0
zinb	countfitteR	100	2	2.0	0.5	0.0440000	0.2051977	0
zinb	countfitteR	200	2	2.0	0.5	0.3060000	0.4610603	0
zinb	countfitteR	50	2	4.0	0.5	0.0010000	0.0316228	0
zinb	countfitteR	100	2	4.0	0.5	0.0130000	0.1133307	0
zinb	countfitteR	200	2	4.0	0.5	0.1910000	0.3932857	0
zinb	countfitteR	50	5	2.5	0.5	0.6640000	0.4725752	0
zinb	countfitteR	100	5	2.5	0.5	0.9510000	0.2159760	0
zinb	countfitteR	200	5	2.5	0.5	1.0000000	0.0000000	0
zinb	countfitteR	50	5	5.0	0.5	0.5130000	0.5000811	0
zinb	countfitteR	100	5	5.0	0.5	0.7830000	0.4124089	0
zinb	countfitteR	200	5	5.0	0.5	0.9740000	0.1592148	0
zinb	countfitteR	50	5	10.0	0.5	0.2190000	0.4137756	0
zinb	countfitteR	100	5	10.0	0.5	0.3770000	0.4848774	0
zinb	countfitteR	200	5	10.0	0.5	0.6330000	0.4822277	0
zinb	countfitteR	50	10	5.0	0.5	0.9260000	0.2619019	0
zinb	countfitteR	100	10	5.0	0.5	0.9740000	0.1592148	0
zinb	countfitteR	200	10	5.0	0.5	0.9970000	0.0547174	0
zinb	countfitteR	50	10	10.0	0.5	0.6280000	0.4835802	0
zinb	countfitteR	100	10	10.0	0.5	0.7390000	0.4393997	0
zinb	countfitteR	200	10	10.0	0.5	0.8720000	0.3342570	0
zinb	countfitteR	50	10	20.0	0.5	0.2910000	0.4544508	0
zinb	countfitteR	100	10	20.0	0.5	0.3480000	0.4765744	0
zinb	countfitteR	200	10	20.0	0.5	0.6580000	0.4746170	0
zinb	countfitteR	50	2	1.0	0.6	0.0250000	0.1562031	0
zinb	countfitteR	100	2	1.0	0.6	0.0880000	0.2834367	0
zinb	countfitteR	200	2	1.0	0.6	0.2210000	0.4151281	0
zinb	countfitteR	50	2	2.0	0.6	0.0040000	0.0631505	0
zinb	countfitteR	100	2	2.0	0.6	0.0530000	0.2241456	0
zinb	countfitteR	200	2	2.0	0.6	0.3260000	0.4689818	0
zinb	countfitteR	50	2	4.0	0.6	0.0000000	0.0000000	0
zinb	countfitteR	100	2	4.0	0.6	0.0120000	0.1089397	0
zinb	countfitteR	200	2	4.0	0.6	0.1790000	0.3835441	0
zinb	countfitteR	50	5	2.5	0.6	0.7060000	0.4558199	0
zinb	countfitteR	100	5	2.5	0.6	0.9580000	0.2006895	0
zinb	countfitteR	200	5	2.5	0.6	1.0000000	0.0000000	0
zinb	countfitteR	50	5	5.0	0.6	0.5890000	0.4922614	0
zinb	countfitteR	100	5	5.0	0.6	0.8600000	0.3471607	0
zinb	countfitteR	200	5	5.0	0.6	0.9850000	0.1216133	0
zinb	countfitteR	50	5	10.0	0.6	0.2910000	0.4544508	0
zinb	countfitteR	100	5	10.0	0.6	0.4470000	0.4974318	0

model	method	n	lambda	size	r	pow_mean	pow_sd	uncomputable
zinb	countfitteR	200	5	10.0	0.6	0.6890000	0.4631344	0
zinb	countfitteR	50	10	5.0	0.6	0.9770000	0.1499783	0
zinb	countfitteR	100	10	5.0	0.6	0.9750000	0.1562031	0
zinb	countfitteR	200	10	5.0	0.6	0.9990000	0.0316228	0
zinb	countfitteR	50	10	10.0	0.6	0.6960000	0.4602128	0
zinb	countfitteR	100	10	10.0	0.6	0.7770000	0.4164666	0
zinb	countfitteR	200	10	10.0	0.6	0.8900000	0.3130463	0
zinb	countfitteR	50	10	20.0	0.6	0.3030000	0.4597852	0
zinb	countfitteR	100	10	20.0	0.6	0.4540000	0.4981286	0
zinb	countfitteR	200	10	20.0	0.6	0.7640000	0.4248347	0
zinb	countfitteR	50	2	1.0	0.7	0.0160000	0.1255379	0
zinb	countfitteR	100	2	1.0	0.7	0.0690000	0.2535810	0
zinb	countfitteR	200	2	1.0	0.7	0.1890000	0.3917045	0
zinb	countfitteR	50	2	2.0	0.7	0.0060000	0.0772656	0
zinb	countfitteR	100	2	2.0	0.7	0.0470000	0.2117447	0
zinb	countfitteR	200	2	2.0	0.7	0.2790000	0.4487319	0
zinb	countfitteR	50	2	4.0	0.7	0.0010000	0.0316228	0
zinb	countfitteR	100	2	4.0	0.7	0.0090000	0.0944877	0
zinb	countfitteR	200	2	4.0	0.7	0.1620000	0.3686352	0
zinb	countfitteR	50	5	2.5	0.7	0.6810000	0.4663223	0
zinb	countfitteR	100	5	2.5	0.7	0.9250000	0.2635231	0
zinb	countfitteR	200	5	2.5	0.7	0.9950000	0.0705690	0
zinb	countfitteR	50	5	5.0	0.7	0.6370000	0.4811055	0
zinb	countfitteR	100	5	5.0	0.7	0.9280000	0.2586173	0
zinb	countfitteR	200	5	5.0	0.7	0.9950000	0.0705690	0
zinb	countfitteR	50	5	10.0	0.7	0.3090000	0.4623124	0
zinb	countfitteR	100	5	10.0	0.7	0.5250000	0.4996245	0
zinb	countfitteR	200	5	10.0	0.7	0.7770000	0.4164666	0
zinb	countfitteR	50	10	5.0	0.7	0.9850000	0.1216133	0
zinb	countfitteR	100	10	5.0	0.7	0.9770000	0.1499783	0
zinb	countfitteR	200	10	5.0	0.7	0.9990000	0.0316228	0
zinb	countfitteR	50	10	10.0	0.7	0.7640000	0.4248347	0
zinb	countfitteR	100	10	10.0	0.7	0.8290000	0.3766974	0
zinb	countfitteR	200	10	10.0	0.7	0.9000000	0.3001501	0
zinb	countfitteR	50	10	20.0	0.7	0.3230000	0.4678567	0
zinb	countfitteR	100	10	20.0	0.7	0.5460000	0.4981286	0
zinb	countfitteR	200	10	20.0	0.7	0.8410000	0.3658591	0
zinb	countfitteR	50	2	1.0	0.8	0.0160000	0.1255379	0
zinb	countfitteR	100	2	1.0	0.8	0.0580000	0.2338604	0
zinb	countfitteR	200	2	1.0	0.8	0.1060000	0.3079917	0
zinb	countfitteR	50	2	2.0	0.8	0.0000000	0.0000000	0
zinb	countfitteR	100	2	2.0	0.8	0.0310000	0.1734044	0
zinb	countfitteR	200	2	2.0	0.8	0.1920000	0.3940702	0
zinb	countfitteR	50	2	4.0	0.8	0.0000000	0.0000000	0
zinb	countfitteR	100	2	4.0	0.8	0.0030000	0.0547174	0
zinb	countfitteR	200	2	4.0	0.8	0.0660000	0.2484063	0
zinb	countfitteR	50	5	2.5	0.8	0.5370000	0.4988786	0
zinb	countfitteR	100	5	2.5	0.8	0.7950000	0.4039036	0
zinb	countfitteR	200	5	2.5	0.8	0.9730000	0.1621644	0
zinb	countfitteR	50	5	5.0	0.8	0.5920000	0.4917090	0
zinb	countfitteR	100	5	5.0	0.8	0.9210000	0.2698737	0
zinb	countfitteR	200	5	5.0	0.8	0.9990000	0.0316228	0

model	method	n	lambda	size	r	pow_mean	pow_sd	uncomputable
zinb	countfitteR	50	5	10.0	0.8	0.3150000	0.4647483	0
zinb	countfitteR	100	5	10.0	0.8	0.5650000	0.4960051	0
zinb	countfitteR	200	5	10.0	0.8	0.8350000	0.3713663	0
zinb	countfitteR	50	10	5.0	0.8	0.9850000	0.1216133	0
zinb	countfitteR	100	10	5.0	0.8	0.9950000	0.0705690	0
zinb	countfitteR	200	10	5.0	0.8	1.0000000	0.0000000	0
zinb	countfitteR	50	10	10.0	0.8	0.7860000	0.4103320	0
zinb	countfitteR	100	10	10.0	0.8	0.8330000	0.3731625	0
zinb	countfitteR	200	10	10.0	0.8	0.8970000	0.3041110	0
zinb	countfitteR	50	10	20.0	0.8	0.4080000	0.4917090	0
zinb	countfitteR	100	10	20.0	0.8	0.6010000	0.4899378	0
zinb	countfitteR	200	10	20.0	0.8	0.8680000	0.3386601	0
zinb	countfitteR	50	2	1.0	0.9	0.0150000	0.1216133	0
zinb	countfitteR	100	2	1.0	0.9	0.0270000	0.1621644	0
zinb	countfitteR	200	2	1.0	0.9	0.0500000	0.2180540	0
zinb	countfitteR	50	2	2.0	0.9	0.0010000	0.0316228	0
zinb	countfitteR	100	2	2.0	0.9	0.0130000	0.1133307	0
zinb	countfitteR	200	2	2.0	0.9	0.0510000	0.2201078	0
zinb	countfitteR	50	2	4.0	0.9	0.0000000	0.0000000	0
zinb	countfitteR	100	2	4.0	0.9	0.0000000	0.0000000	0
zinb	countfitteR	200	2	4.0	0.9	0.0100000	0.0995485	0
zinb	countfitteR	50	5	2.5	0.9	0.2610000	0.4393997	0
zinb	countfitteR	100	5	2.5	0.9	0.4230000	0.4942826	0
zinb	countfitteR	200	5	2.5	0.9	0.6520000	0.4765744	0
zinb	countfitteR	50	5	5.0	0.9	0.3190000	0.4663223	0
zinb	countfitteR	100	5	5.0	0.9	0.7020000	0.4576084	0
zinb	countfitteR	200	5	5.0	0.9	0.9480000	0.2221381	0
zinb	countfitteR	50	5	10.0	0.9	0.1980000	0.3986916	0
zinb	countfitteR	100	5	10.0	0.9	0.5600000	0.4966353	0
zinb	countfitteR	200	5	10.0	0.9	0.8710000	0.3353677	0
zinb	countfitteR	50	10	5.0	0.9	0.8930000	0.3092679	0
zinb	countfitteR	100	10	5.0	0.9	0.9880000	0.1089397	0
zinb	countfitteR	200	10	5.0	0.9	1.0000000	0.0000000	0
zinb	countfitteR	50	10	10.0	0.9	0.7830000	0.4124089	0
zinb	countfitteR	100	10	10.0	0.9	0.8420000	0.3649235	0
zinb	countfitteR	200	10	10.0	0.9	0.9260000	0.2619019	0
zinb	countfitteR	50	10	20.0	0.9	0.4090000	0.4918953	0
zinb	countfitteR	100	10	20.0	0.9	0.6540000	0.4759312	0
zinb	countfitteR	200	10	20.0	0.9	0.9190000	0.2729716	0
zinb	two-step	50	2	1.0	0.1	0.0679916	0.2518633	44
zinb	two-step	100	2	1.0	0.1	0.0720000	0.2586173	0
zinb	two-step	200	2	1.0	0.1	0.0520000	0.2221381	0
zinb	two-step	50	2	2.0	0.1	0.1007121	0.3011003	17
zinb	two-step	100	2	2.0	0.1	0.1121121	0.3156624	1
zinb	two-step	200	2	2.0	0.1	0.1220000	0.3274496	0
zinb	two-step	50	2	4.0	0.1	0.1499493	0.3572028	13
zinb	two-step	100	2	4.0	0.1	0.1490000	0.3562667	0
zinb	two-step	200	2	4.0	0.1	0.2200000	0.4144536	0
zinb	two-step	50	5	2.5	0.1	0.1011122	0.3016298	11
zinb	two-step	100	5	2.5	0.1	0.1880000	0.3909077	0
zinb	two-step	200	5	2.5	0.1	0.4330000	0.4957386	0
zinb	two-step	50	5	5.0	0.1	0.1285141	0.3348294	4

model	method	n	lambda	size	r	pow_mean	pow_sd	uncomputable
zinb	two-step	100	5	5.0	0.1	0.2270000	0.4191022	0
zinb	two-step	200	5	5.0	0.1	0.5500000	0.4977427	0
zinb	two-step	50	5	10.0	0.1	0.1440081	0.3512748	7
zinb	two-step	100	5	10.0	0.1	0.2350000	0.4242110	0
zinb	two-step	200	5	10.0	0.1	0.4780000	0.4997657	0
zinb	two-step	50	10	5.0	0.1	0.0170512	0.1295270	3
zinb	two-step	100	10	5.0	0.1	0.0230000	0.1499783	0
zinb	two-step	200	10	5.0	0.1	0.0170000	0.1293357	0
zinb	two-step	50	10	10.0	0.1	0.0030181	0.0548820	6
zinb	two-step	100	10	10.0	0.1	0.0070000	0.0834144	0
zinb	two-step	200	10	10.0	0.1	0.0000000	0.0000000	0
zinb	two-step	50	10	20.0	0.1	0.0000000	0.0000000	3
zinb	two-step	100	10	20.0	0.1	0.0010000	0.0316228	0
zinb	two-step	200	10	20.0	0.1	0.0000000	0.0000000	0
zinb	two-step	50	2	1.0	0.2	0.0760761	0.2652526	1
zinb	two-step	100	2	1.0	0.2	0.0770000	0.2667248	0
zinb	two-step	200	2	1.0	0.2	0.0780000	0.2683058	0
zinb	two-step	50	2	2.0	0.2	0.1130000	0.3167512	0
zinb	two-step	100	2	2.0	0.2	0.1000000	0.3001501	0
zinb	two-step	200	2	2.0	0.2	0.1900000	0.3924972	0
zinb	two-step	50	2	4.0	0.2	0.1661662	0.3724162	1
zinb	two-step	100	2	4.0	0.2	0.2030000	0.4024338	0
zinb	two-step	200	2	4.0	0.2	0.3480000	0.4765744	0
zinb	two-step	50	5	2.5	0.2	0.1750000	0.3801572	0
zinb	two-step	100	5	2.5	0.2	0.4450000	0.4972145	0
zinb	two-step	200	5	2.5	0.2	0.8530000	0.3542831	0
zinb	two-step	50	5	5.0	0.2	0.2170000	0.4124089	0
zinb	two-step	100	5	5.0	0.2	0.5180000	0.4999259	0
zinb	two-step	200	5	5.0	0.2	0.7700000	0.4210431	0
zinb	two-step	50	5	10.0	0.2	0.2280000	0.4197525	0
zinb	two-step	100	5	10.0	0.2	0.5230000	0.4997206	0
zinb	two-step	200	5	10.0	0.2	0.5080000	0.5001862	0
zinb	two-step	50	10	5.0	0.2	0.0310310	0.1734884	1
zinb	two-step	100	10	5.0	0.2	0.0190000	0.1365930	0
zinb	two-step	200	10	5.0	0.2	0.0050000	0.0705690	0
zinb	two-step	50	10	10.0	0.2	0.0090000	0.0944877	0
zinb	two-step	100	10	10.0	0.2	0.0010000	0.0316228	0
zinb	two-step	200	10	10.0	0.2	0.0000000	0.0000000	0
zinb	two-step	50	10	20.0	0.2	0.0000000	0.0000000	0
zinb	two-step	100	10	20.0	0.2	0.0000000	0.0000000	0
zinb	two-step	200	10	20.0	0.2	0.0000000	0.0000000	0
zinb	two-step	50	2	1.0	0.3	0.0680000	0.2518719	0
zinb	two-step	100	2	1.0	0.3	0.0660000	0.2484063	0
zinb	two-step	200	2	1.0	0.3	0.1080000	0.3105357	0
zinb	two-step	50	2	2.0	0.3	0.1030000	0.3041110	0
zinb	two-step	100	2	2.0	0.3	0.1420000	0.3492248	0
zinb	two-step	200	2	2.0	0.3	0.2400000	0.4272968	0
zinb	two-step	50	2	4.0	0.3	0.1580000	0.3649235	0
zinb	two-step	100	2	4.0	0.3	0.2260000	0.4184484	0
zinb	two-step	200	2	4.0	0.3	0.4730000	0.4995203	0
zinb	two-step	50	5	2.5	0.3	0.2740000	0.4462321	0
zinb	two-step	100	5	2.5	0.3	0.6640000	0.4725752	0

model	method	n	lambda	size	r	pow_mean	pow_sd	uncomputable
zinb	two-step	200	5	2.5	0.3	0.9220000	0.2683058	0
zinb	two-step	50	5	5.0	0.3	0.4330000	0.4957386	0
zinb	two-step	100	5	5.0	0.3	0.7540000	0.4308940	0
zinb	two-step	200	5	5.0	0.3	0.5950000	0.4911377	0
zinb	two-step	50	5	10.0	0.3	0.4100000	0.4920794	0
zinb	two-step	100	5	10.0	0.3	0.6330000	0.4822277	0
zinb	two-step	200	5	10.0	0.3	0.2310000	0.4216833	0
zinb	two-step	50	10	5.0	0.3	0.0350000	0.1838717	0
zinb	two-step	100	10	5.0	0.3	0.0140000	0.1175492	0
zinb	two-step	200	10	5.0	0.3	0.0040000	0.0631505	0
zinb	two-step	50	10	10.0	0.3	0.0060000	0.0772656	0
zinb	two-step	100	10	10.0	0.3	0.0000000	0.0000000	0
zinb	two-step	200	10	10.0	0.3	0.0000000	0.0000000	0
zinb	two-step	50	10	20.0	0.3	0.0000000	0.0000000	0
zinb	two-step	100	10	20.0	0.3	0.0000000	0.0000000	0
zinb	two-step	200	10	20.0	0.3	0.0000000	0.0000000	0
zinb	two-step	50	2	1.0	0.4	0.0580000	0.2338604	0
zinb	two-step	100	2	1.0	0.4	0.0640000	0.2448754	0
zinb	two-step	200	2	1.0	0.4	0.0980000	0.2974634	0
zinb	two-step	50	2	2.0	0.4	0.1210000	0.3262905	0
zinb	two-step	100	2	2.0	0.4	0.1240000	0.3297465	0
zinb	two-step	200	2	2.0	0.4	0.2690000	0.4436618	0
zinb	two-step	50	2	4.0	0.4	0.1630000	0.3695505	0
zinb	two-step	100	2	4.0	0.4	0.2310000	0.4216833	0
zinb	two-step	200	2	4.0	0.4	0.4740000	0.4995734	0
zinb	two-step	50	5	2.5	0.4	0.3970000	0.4895208	0
zinb	two-step	100	5	2.5	0.4	0.7840000	0.4117202	0
zinb	two-step	200	5	2.5	0.4	0.8520000	0.3552777	0
zinb	two-step	50	5	5.0	0.4	0.5950000	0.4911377	0
zinb	two-step	100	5	5.0	0.4	0.8120000	0.3909077	0
zinb	two-step	200	5	5.0	0.4	0.3490000	0.4768925	0
zinb	two-step	50	5	10.0	0.4	0.6030000	0.4895208	0
zinb	two-step	100	5	10.0	0.4	0.5820000	0.4934770	0
zinb	two-step	200	5	10.0	0.4	0.0730000	0.2602667	0
zinb	two-step	50	10	5.0	0.4	0.0690000	0.2535810	0
zinb	two-step	100	10	5.0	0.4	0.0200000	0.1400701	0
zinb	two-step	200	10	5.0	0.4	0.0000000	0.0000000	0
zinb	two-step	50	10	10.0	0.4	0.0070000	0.0834144	0
zinb	two-step	100	10	10.0	0.4	0.0000000	0.0000000	0
zinb	two-step	200	10	10.0	0.4	0.0000000	0.0000000	0
zinb	two-step	50	10	20.0	0.4	0.0000000	0.0000000	0
zinb	two-step	100	10	20.0	0.4	0.0000000	0.0000000	0
zinb	two-step	200	10	20.0	0.4	0.0000000	0.0000000	0
zinb	two-step	50	2	1.0	0.5	0.0450000	0.2074079	0
zinb	two-step	100	2	1.0	0.5	0.0330000	0.1787259	0
zinb	two-step	200	2	1.0	0.5	0.1060000	0.3079917	0
zinb	two-step	50	2	2.0	0.5	0.1000000	0.3001501	0
zinb	two-step	100	2	2.0	0.5	0.1160000	0.3203852	0
zinb	two-step	200	2	2.0	0.5	0.2840000	0.4511624	0
zinb	two-step	50	2	4.0	0.5	0.1630000	0.3695505	0
zinb	two-step	100	2	4.0	0.5	0.2360000	0.4248347	0
zinb	two-step	200	2	4.0	0.5	0.5040000	0.5002342	0

model	method	n	lambda	size	r	pow_mean	pow_sd	uncomputable
zinb	two-step	50	5	2.5	0.5	0.4840000	0.4999940	0
zinb	two-step	100	5	2.5	0.5	0.8100000	0.3924972	0
zinb	two-step	200	5	2.5	0.5	0.8370000	0.3695505	0
zinb	two-step	50	5	5.0	0.5	0.6790000	0.4670944	0
zinb	two-step	100	5	5.0	0.5	0.8090000	0.3932857	0
zinb	two-step	200	5	5.0	0.5	0.2410000	0.4279043	0
zinb	two-step	50	5	10.0	0.5	0.7000000	0.4584869	0
zinb	two-step	100	5	10.0	0.5	0.4960000	0.5002342	0
zinb	two-step	200	5	10.0	0.5	0.0120000	0.1089397	0
zinb	two-step	50	10	5.0	0.5	0.1320000	0.3386601	0
zinb	two-step	100	10	5.0	0.5	0.0300000	0.1706726	0
zinb	two-step	200	10	5.0	0.5	0.0000000	0.0000000	0
zinb	two-step	50	10	10.0	0.5	0.0060000	0.0772656	0
zinb	two-step	100	10	10.0	0.5	0.0000000	0.0000000	0
zinb	two-step	200	10	10.0	0.5	0.0000000	0.0000000	0
zinb	two-step	50	10	20.0	0.5	0.0010000	0.0316228	0
zinb	two-step	100	10	20.0	0.5	0.0000000	0.0000000	0
zinb	two-step	200	10	20.0	0.5	0.0000000	0.0000000	0
zinb	two-step	50	2	1.0	0.6	0.0380000	0.1912919	0
zinb	two-step	100	2	1.0	0.6	0.0390000	0.1936918	0
zinb	two-step	200	2	1.0	0.6	0.0720000	0.2586173	0
zinb	two-step	50	2	2.0	0.6	0.0700000	0.2552747	0
zinb	two-step	100	2	2.0	0.6	0.1060000	0.3079917	0
zinb	two-step	200	2	2.0	0.6	0.2100000	0.4075120	0
zinb	two-step	50	2	4.0	0.6	0.1370000	0.3440194	0
zinb	two-step	100	2	4.0	0.6	0.1960000	0.3971671	0
zinb	two-step	200	2	4.0	0.6	0.4550000	0.4982201	0
zinb	two-step	50	5	2.5	0.6	0.4780000	0.4997657	0
zinb	two-step	100	5	2.5	0.6	0.7910000	0.4067978	0
zinb	two-step	200	5	2.5	0.6	0.8690000	0.3375692	0
zinb	two-step	50	5	5.0	0.6	0.7110000	0.4535247	0
zinb	two-step	100	5	5.0	0.6	0.8270000	0.3784365	0
zinb	two-step	200	5	5.0	0.6	0.2020000	0.4016931	0
zinb	two-step	50	5	10.0	0.6	0.7600000	0.4272968	0
zinb	two-step	100	5	10.0	0.6	0.5090000	0.5001691	0
zinb	two-step	200	5	10.0	0.6	0.0150000	0.1216133	0
zinb	two-step	50	10	5.0	0.6	0.2650000	0.4415540	0
zinb	two-step	100	10	5.0	0.6	0.0370000	0.1888562	0
zinb	two-step	200	10	5.0	0.6	0.0180000	0.1330176	0
zinb	two-step	50	10	10.0	0.6	0.0270000	0.1621644	0
zinb	two-step	100	10	10.0	0.6	0.0010000	0.0316228	0
zinb	two-step	200	10	10.0	0.6	0.0020000	0.0446990	0
zinb	two-step	50	10	20.0	0.6	0.0060000	0.0772656	0
zinb	two-step	100	10	20.0	0.6	0.0020000	0.0446990	0
zinb	two-step	200	10	20.0	0.6	0.0000000	0.0000000	0
zinb	two-step	50	2	1.0	0.7	0.0270000	0.1621644	0
zinb	two-step	100	2	1.0	0.7	0.0290000	0.1678904	0
zinb	two-step	200	2	1.0	0.7	0.0490000	0.2159760	0
zinb	two-step	50	2	2.0	0.7	0.0670000	0.2501471	0
zinb	two-step	100	2	2.0	0.7	0.0660000	0.2484063	0
zinb	two-step	200	2	2.0	0.7	0.1310000	0.3375692	0
zinb	two-step	50	2	4.0	0.7	0.1010000	0.3014795	0

model	method	n	lambda	size	r	pow_mean	pow_sd	uncomputable
zinb	two-step	100	2	4.0	0.7	0.1440000	0.3512654	0
zinb	two-step	200	2	4.0	0.7	0.3030000	0.4597852	0
zinb	two-step	50	5	2.5	0.7	0.3410000	0.4742826	0
zinb	two-step	100	5	2.5	0.7	0.7090000	0.4544508	0
zinb	two-step	200	5	2.5	0.7	0.9100000	0.2863250	0
zinb	two-step	50	5	5.0	0.7	0.6960000	0.4602128	0
zinb	two-step	100	5	5.0	0.7	0.8790000	0.3262905	0
zinb	two-step	200	5	5.0	0.7	0.3790000	0.4853809	0
zinb	two-step	50	5	10.0	0.7	0.7840000	0.4117202	0
zinb	two-step	100	5	10.0	0.7	0.6070000	0.4886612	0
zinb	two-step	200	5	10.0	0.7	0.0400000	0.1960572	0
zinb	two-step	50	10	5.0	0.7	0.4390000	0.4965134	0
zinb	two-step	100	10	5.0	0.7	0.0840000	0.2775266	0
zinb	two-step	200	10	5.0	0.7	0.1000000	0.3001501	0
zinb	two-step	50	10	10.0	0.7	0.1230000	0.3286016	0
zinb	two-step	100	10	10.0	0.7	0.0620000	0.2412762	0
zinb	two-step	200	10	10.0	0.7	0.2280000	0.4197525	0
zinb	two-step	50	10	20.0	0.7	0.0210000	0.1434558	0
zinb	two-step	100	10	20.0	0.7	0.0410000	0.1983894	0
zinb	two-step	200	10	20.0	0.7	0.0820000	0.2745020	0
zinb	two-step	50	2	1.0	0.8	0.0190000	0.1365930	0
zinb	two-step	100	2	1.0	0.8	0.0100000	0.0995485	0
zinb	two-step	200	2	1.0	0.8	0.0240000	0.1531256	0
zinb	two-step	50	2	2.0	0.8	0.0460000	0.2095899	0
zinb	two-step	100	2	2.0	0.8	0.0340000	0.1813198	0
zinb	two-step	200	2	2.0	0.8	0.0750000	0.2635231	0
zinb	two-step	50	2	4.0	0.8	0.0490000	0.2159760	0
zinb	two-step	100	2	4.0	0.8	0.0720000	0.2586173	0
zinb	two-step	200	2	4.0	0.8	0.1730000	0.3784365	0
zinb	two-step	50	5	2.5	0.8	0.1900000	0.3924972	0
zinb	two-step	100	5	2.5	0.8	0.4570000	0.4983968	0
zinb	two-step	200	5	2.5	0.8	0.8480000	0.3592005	0
zinb	two-step	50	5	5.0	0.8	0.4900000	0.5001501	0
zinb	two-step	100	5	5.0	0.8	0.8390000	0.3677149	0
zinb	two-step	200	5	5.0	0.8	0.7720000	0.4197525	0
zinb	two-step	50	5	10.0	0.8	0.6680000	0.4711666	0
zinb	two-step	100	5	10.0	0.8	0.8620000	0.3450726	0
zinb	two-step	200	5	10.0	0.8	0.3000000	0.4584869	0
zinb	two-step	50	10	5.0	0.8	0.7490000	0.4338055	0
zinb	two-step	100	10	5.0	0.8	0.3640000	0.4813894	0
zinb	two-step	200	10	5.0	0.8	0.0090000	0.0944877	0
zinb	two-step	50	10	10.0	0.8	0.4510000	0.4978422	0
zinb	two-step	100	10	10.0	0.8	0.1620000	0.3686352	0
zinb	two-step	200	10	10.0	0.8	0.3880000	0.4875384	0
zinb	two-step	50	10	20.0	0.8	0.2420000	0.4285086	0
zinb	two-step	100	10	20.0	0.8	0.0990000	0.2988115	0
zinb	two-step	200	10	20.0	0.8	0.7400000	0.4388537	0
zinb	two-step	50	2	1.0	0.9	0.0100000	0.0995485	0
zinb	two-step	100	2	1.0	0.9	0.0040000	0.0631505	0
zinb	two-step	200	2	1.0	0.9	0.0080000	0.0891288	0
zinb	two-step	50	2	2.0	0.9	0.0120000	0.1089397	0
zinb	two-step	100	2	2.0	0.9	0.0170000	0.1293357	0

model	method	n	lambda	size	r	pow_mean	pow_sd	uncomputable
zinb	two-step	200	2	2.0	0.9	0.0150000	0.1216133	0
zinb	two-step	50	2	4.0	0.9	0.0170000	0.1293357	0
zinb	two-step	100	2	4.0	0.9	0.0300000	0.1706726	0
zinb	two-step	200	2	4.0	0.9	0.0260000	0.1592148	0
zinb	two-step	50	5	2.5	0.9	0.0570571	0.2320678	1
zinb	two-step	100	5	2.5	0.9	0.1180000	0.3227695	0
zinb	two-step	200	5	2.5	0.9	0.3230000	0.4678567	0
zinb	two-step	50	5	5.0	0.9	0.1301301	0.3366151	1
zinb	two-step	100	5	5.0	0.9	0.3400000	0.4739458	0
zinb	two-step	200	5	5.0	0.9	0.7610000	0.4266861	0
zinb	two-step	50	5	10.0	0.9	0.2352352	0.4243582	1
zinb	two-step	100	5	10.0	0.9	0.5900000	0.4920794	0
zinb	two-step	200	5	10.0	0.9	0.9250000	0.2635231	0
zinb	two-step	50	10	5.0	0.9	0.5533199	0.4973991	6
zinb	two-step	100	10	5.0	0.9	0.8690000	0.3375692	0
zinb	two-step	200	10	5.0	0.9	0.5660000	0.4958729	0
zinb	two-step	50	10	10.0	0.9	0.6723618	0.4695881	5
zinb	two-step	100	10	10.0	0.9	0.6410000	0.4799472	0
zinb	two-step	200	10	10.0	0.9	0.1480000	0.3552777	0
zinb	two-step	50	10	20.0	0.9	0.6844221	0.4649793	5
zinb	two-step	100	10	20.0	0.9	0.5200000	0.4998498	0
zinb	two-step	200	10	20.0	0.9	0.0690000	0.2535810	0

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