

# Package ‘ABCp2’

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**Type** Package

**Title** Approximate Bayesian Computational Model for Estimating P2

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**Author** M. Catherine Duryea, Andrew D. Kern, Robert M. Cox, and Ryan Calsbeek

**Maintainer** M. Catherine Duryea <katie.duryea@gmail.com>

**Description** Tests the goodness of fit of a distribution of offspring to the Normal, Poisson, and Gamma distribution and estimates the proportional paternity of the second male (P2) based on the best fit distribution.

**Depends** MASS

**License** GPL-2

**NeedsCompilation** no

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 ABC\_P2\_gamma

 ABC Estimation of P2 for Gamma Distribution
 

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### Description

This function fits offspring data to a special case of the gamma distribution, in which zero values of offspring are excluded and all values are rounded to a whole number, and estimates P2 based on that distribution and the specified priors.

### Usage

```
ABC_P2_gamma(n, ObsMean, S_Lo, S_Hi, R_Lo, R_Hi, delta, iter)
```

### Arguments

n	number of observations.
ObsMean	the observed mean number of offspring sired by the second male.
S_Lo	minimum shape value for the distribution.
S_Hi	maximum shape value for the distribution.
R_Lo	minimum rate value for the distribution.
R_Hi	maximum rate value for the distribution.
delta	maximum allowed difference between the estimated mean and observed mean number of offspring produced by the second male.
iter	number of iterations used to build the posterior.

### Value

posterior	Posterior distribution of P2 values.
Shape	Vector of values for the shape parameter.
Rate	Vector of values for the rate parameter.

### Author(s)

M. Catherine Duryea, Andrew D. Kern, Robert M. Cox, and Ryan Calsbeek

### Examples

```
#Fit the Shape and Rate hyperpriors to a distribution of offspring.

data(fungus)
fit_dist_gamma(fungus$Total_Offspring)

#Use hyperiors and priors calculated from the data to estimate P2.
#Plot the saved distributions for the Shape and Rate parameters.
#Adjust, if necessary.
```

```

fungus_P2<-ABC_P2_gamma(12, 9.9, 1.14, 2.52, 0.06, 0.18, 0.1, 100)
hist(fungus_P2$posterior)
hist(fungus_P2$Shape)
hist(fungus_P2$Rate)

```

---

ABC\_P2\_norm

*ABC Estimation of P2 for Normal Distribution*


---

### Description

This function fits offspring data to a special case of the normal distribution, in which zero and negative values of offspring are excluded, and estimates P2 based on that distribution and the specified priors.

### Usage

```
ABC_P2_norm(n, ObsMean, M_Lo, M_Hi, SD_Lo, SD_Hi, delta, iter)
```

### Arguments

n	number of observations.
ObsMean	the observed mean number of offspring sired by the second male.
M_Lo	minimum mean value for the distribution.
M_Hi	maximum mean value for the distribution.
SD_Lo	minimum standard deviation value for the distribution.
SD_Hi	maximum standard deviation value for the distribution.
delta	maximum allowed difference between the estimated mean and observed mean number of offspring produced by the second male.
iter	number of iterations used to build the posterior.

### Value

posterior	Posterior distribution of P2 values.
Avg	Vector of values for the mean parameter.
Std	Vector of values for the standard deviation parameter.

### Author(s)

M. Catherine Duryea, Andrew D. Kern, Robert M. Cox, and Ryan Calsbeek

**Examples**

```
#Fit the Mean and Standard Deviation hyperpriors to a distribution of offspring.

data(fungus)
fit_dist_norm(fungus$Total_Offspring)

#Use hyperiors and priors calculated from the data to estimate P2.
#Plot the saved distributions for the Mean and Standard Deviation parameters.
#Adjust, if necessary.

fungus_P2<-ABC_P2_norm(12, 9.9, 11.35, 17.31, 8.22, 12.44, 0.1, 100)
hist(fungus_P2$posterior)
hist(fungus_P2$Avg)
hist(fungus_P2$Std)
```

---

ABC\_P2\_pois

*ABC Estimation of P2 for Poisson Distribution*


---

**Description**

This function fits offspring data to the Poisson distribution and estimates P2 based on that distribution and the specified priors.

**Usage**

```
ABC_P2_pois(n, ObsMean, L_Lo, L_Hi, delta, iter)
```

**Arguments**

n	the number of observations.
ObsMean	the observed mean number of offspring sired by the second male.
L_Lo	minimum lambda value for the distribution.
L_Hi	maximum lambda value for the distribution.
delta	maximum allowed difference between the estimated mean and observed mean number of offspring produced by the second male.
iter	number of iterations used to build the posterior.

**Value**

posterior	Posterior distribution of P2 values.
Lambda	Vector of values for the lambda parameter.

**Author(s)**

M. Catherine Duryea, Andrew D. Kern, Robert M. Cox, and Ryan Calsbeek

**Examples**

```
#Fit the Lambda hyperprior to a distribution of offspring.

data(fungus)
fit_dist_pois(fungus$Total_Offspring)

#Use hyperiors and priors calculated from the data to estimate P2.
#Plot the saved distributions for the Lambda parameter.
#Adjust, if necessary.

fungus_P2<-ABC_P2_pois(12, 9.9, 13.24, 15.42, 0.1, 100)
hist(fungus_P2$posterior)
hist(fungus_P2$Lambda)
```

---

fit\_dist\_gamma

*Fit Offspring Distribution to the Gamma Distribution*


---

**Description**

This function fits offspring data to a special case of the gamma distribution, in which zero values of offspring are excluded and all values are rounded to a whole number, and tests the goodness of fit using the chi-squared test.

**Usage**

```
fit_dist_gamma(dist)
```

**Arguments**

`dist` a numeric vector of data values for number of offspring per dam.

**Value**

<code>estimate</code>	Shape and rate parameters estimated from the supplied distribution.
<code>sd</code>	Standard deviation of the shape and rate estimates.
<code>vcov</code>	Variance/covariance matrix of the shape and rate estimates.
<code>loglik</code>	the log-likelihood of the shape and rate estimates.
<code>n</code>	The number of observations.
<code>statistic</code>	The chi-squared test statistic.
<code>parameter</code>	Degrees of freedom for the chi-squared test.
<code>p.value</code>	P-value for the chi-squared test.
<code>data_gamma</code>	Vector of values generated from a special case of the gamma distribution.

**Author(s)**

M. Catherine Duryea, Andrew D. Kern, Robert M. Cox, and Ryan Calsbeek

**Examples**

```
#Fit the Shape and Rate parameters to a distribution of offspring.
#Test the goodness of fit.

data(fungus)
fungus_fit<-fit_dist_gamma(fungus$Total_Offspring)
fungus_fit$fit_gamma
fungus_fit$chi_gamma
hist(fungus_fit$data_gamma)
```

---

fit\_dist\_norm

*Fit Offspring Distribution to the Normal Distribution*


---

**Description**

This function fits offspring data to a special case of the normal distribution, in which zero and negative values of offspring are excluded, and tests the goodness of fit using the chi-squared test.

**Usage**

```
fit_dist_norm(dist)
```

**Arguments**

dist            a numeric vector of data values for number of offspring per dam.

**Value**

estimate	Mean and standard deviation parameters estimated from the supplied distribution.
sd	Standard deviation of the mean and standard deviation estimates.
vcov	Variance/covariance matrix of the mean and standard deviation estimates.
loglik	the log-likelihood of the mean and standard deviation estimates.
n	The number of observations.
statistic	The chi-squared test statistic.
parameter	Degrees of freedom for the chi-squared test.
p.value	P-value for the chi-squared test.
data_norm	Vector of values generated from a special case of the normal distribution.

**Author(s)**

M. Catherine Duryea, Andrew D. Kern, Robert M. Cox, and Ryan Calsbeek

**Examples**

```
#Fit the Mean and Standard Deviation parameters to a distribution of offspring.
#Test the goodness of fit.
```

```
data(fungus)
fungus_fit<-fit_dist_norm(fungus$Total_Offspring)
fungus_fit$fit_norm
fungus_fit$chi_norm
fungus_fit$data_norm
```

---

fit\_dist\_pois

*Fit Offspring Distribution to the Poisson Distribution*


---

**Description**

This function fits offspring data to the Poisson distribution, and tests the goodness of fit using the chi-squared test.

**Usage**

```
fit_dist_pois(dist)
```

**Arguments**

dist            a numeric vector of data values for number of offspring per dam.

**Value**

estimate	Lambda parameter estimated from the supplied distribution.
sd	Standard deviation of the lambda estimate.
vcov	Variance/covariance matrix of the lambda estimate.
loglik	the log-likelihood of the lambda estimate.
n	The number of observations.
statistic	The chi-squared test statistic.
parameter	Degrees of freedom for the chi-squared test.
p.value	P-value for the chi-squared test.
data_pois	Vector of values generated from the Poisson distribution.

**Author(s)**

M. Catherine Duryea, Andrew D. Kern, Robert M. Cox, and Ryan Calsbeek

### Examples

```
#Fit the Lambda parameter to a distribution of offspring.  
#Test the goodness of fit.  
  
data(fungus)  
fungus_fit<-fit_dist_pois(fungus$Total_Offspring)  
fungus_fit$fit_pois  
fungus_fit$chi_pois  
hist(fungus_fit$data_pois)
```

---

fungus

*Sperm Precedence Data from the Fungus Beetle*

---

### Description

Offspring counts and proportional paternity by mating order for a breeding experiment of the fungus beetle conducted by JK Conner (1995).

### Usage

```
data(fungus)
```

### Format

A data frame with 12 observations on the following 4 variables.

Female a numeric vector to identify females.

P2 proportional paternity of the second male.

Total\_Offspring total number of offspring for the female.

No\_2nd\_Male number of offspring sired by the second male.

### Source

J. K. Conner (1995) Extreme variability in sperm precedence in the fungus beetle, *Bolitotherus cornutus* (Coleoptera Tenebrionidae), *Ethology Ecology & Evolution* 7, 277-280.

### Examples

```
#Fit fungus beetle data to the normal distribution and test goodness of fit.  
data(fungus)  
fit_dist_norm(fungus$Total_Offspring)
```

---

newt

*Sperm Precedence Data from the Rough-Skinned Newt*

---

### Description

Offspring counts from two clutches and proportional paternity by mating order for a breeding experiment of the rough-skinned newt conducted by Jones et al., (2002)

### Usage

```
data(newt)
```

### Format

A data frame with 10 observations on the following 10 variables.

Female a numeric code to identify females.

No\_1st\_Clutch total offspring in the first clutch.

P2\_1 proportional paternity of the second male for the first clutch.

No\_2nd\_Male\_1st\_Clutch total offspring sired by the second male from the first clutch.

No\_2nd\_Clutch total offspring in the second clutch.

P2\_2 proportional paternity of the second male for the second clutch.

No\_2nd\_Male\_2nd\_Clutch total offspring sired by the second male from the second clutch.

Total\_2nd\_Male total offspring sired by the second male from both clutches.

Total\_Offspring total offspring for both clutches.

Total\_P2 total overall proportional paternity of the second male for both clutches.

### Source

A. G. Jones, E. M. Adams, and S. J. Arnold (2002) A mechanism of first-male precedence in a vertebrate. *Proceedings of the National Academy of Sciences of the United States of America* **99**, 2078-2081.

### Examples

```
#Fit newt data to the Poisson distribution and test goodness of fit.
data(newt)
fit_dist_pois(newt$Total_Offspring)
```

---

rove

*Sperm Precedence Data from the Rove Beetle*

---

### Description

Offspring counts and proportional paternity by mating order for a breeding experiment of the rove beetle conducted by T Benken et al., (1999).

### Usage

```
data(rove)
```

### Format

A data frame with 17 observations on the following 4 variables.

Female a numeric vector to identify females.

Total\_Offspring total number of offspring for the female.

P2 proportional paternity of the second male.

No\_2nd\_Male number of offspring sired by the second male.

### Source

T. Benken, A. Knaak, C. Gack, M. Eberle, and K. Peschke (1999) Variation of sperm precedence in the rove beetle, *Aleochara curtula* (Coleoptera: Staphylinidae), *Behaviour* **136**, 1065-1077.

### Examples

```
#Fit rove beetle data to the normal distribution and test goodness of fit.
data(rove)
fit_dist_norm(rove$Total_Offspring)
```

---

soap

*Sperm Precedence Data from the Soapberry Bug*

---

### Description

Offspring counts and proportional paternity by mating order for a breeding experiment of the soapberry bug conducted by SP Carroll (1991).

### Usage

```
data(soap)
```

**Format**

A data frame with 18 observations on the following 4 variables.

Female a numeric vector to identify females.

P2 proportional paternity of the second male.

Total\_Offspring total number of offspring for the female.

No\_2nd\_Male number of offspring sired by the second male.

**Source**

S. P. Carroll (1991) The adaptive significance of mate guarding in the soapberry bug, *Jadera haematoloma* (Hemiptera: Rhopalidae), *Journal of Insect Behavior*, **4**, 509-530.

**Examples**

```
#Fit soapberry bug data to the normal distribution and test goodness of fit.  
data(soap)  
fit_dist_norm(soap$Total_Offspring)
```

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