SUPPLEMENTARY INFORMATION 1

Seasonal demography of different black rat (*Rattus rattus*) populations under contrasting natural habitats in Guadeloupe (Lesser Antilles, Caribbean)

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Table 1.

Habitats & Sites	Season	Age	Number of				Corrected	Mean (± SE)			
			traps	nights	sprung	rats	trapping rates	Eye lens weight (mg)	Body weight (g)	Body length (mm)	Tail length (mm)
SEMI-DECIDUOUS DRY											
Gros Morne-Deshaies	Wet	J+S	78	2	1	11	7.1	20.0 ± 0.5	76 ± 6	147 ± 5	194 ± 6
		A				1	0.6	*31.0; 31.5*	*132*	*160*	*195*
		Ind.				1	0.6	-	-	-	-
	Dry	J+S	119	3	28	0	0.0	-	-	-	-
		A				7	2.1	29.9 ± 0.7	127 ± 6	163 ± 5	219 ± 3
Barre de Cadoue	Wet	J+S	51	1	9	12	28.6	17.7 ± 0.7	66 ± 7	136 ± 5	192 ± 7
		A.				4	9.5	32.0 ± 1.5	112 ± 4	171 ± 4	220 ± 20
		Ind.				4	9.5	-	-	-	-
	Dry	J+S	176	5	12	0	0.0	-	-	-	-
		A				3	0.3	30.4 ± 0.8	122 ± 2	134 ± 1	219 ± 5
SEASONAL EVERGREEN											
Piton Sainte-Rose	Wet	J+S	42	2	12	11	15.3	21.9 ± 0.5	93 ± 7	153 ± 4	193 ± 8
		A				5	6.9	37.4 ± 0.9	159 ± 3	174 ± 7	232 ± 8
		Ind.				1	1.4	-	-	-	-
	Dry	J+S	60	2	15	0	0.0	-	-	-	-
		A				10	9.5	32.8 ± 1.0	165 ± 10	181 ± 7	210 ± 10
Espérance	Wet	J+S	37	1	9	12	42.9	19.8 ± 0.4	76 ± 6	147 ± 5	194 ± 6
		A				4	14.3	31.9 ± 1.0	140 ± 15	177 ± 4	230 ± 8
		Ind.				1	3.6	-	-	-	-
	Dry	J+S	72	2	15	0	0.0	-	-	-	-
		A				8	6.2	31.7 ± 0.6	160 ± 7	182 ± 2	221 ± 3
MOUNTAIN RAINFOREST											
Col des Mamelles	Wet	J+S	29	1	7	5	22.7	17.3 ± 0.5	71 ± 5	154 ± 4	178 ± 3
		A				7	31.8	33.3 ± 0.6	135 ± 6	185 ± 6	219 ± 6
	Dry	J+S	62	2	13	0	0.0	-	-	-	-
		A				12	10.8	30.4 ± 0.6	132 ± 5	171 ± 6	211 ± 4
		Ind.				1	0.9	-	-	-	-
Bras David	Wet	J+S	30	1	4	8	30.8	19.7 ± 0.4	69 ± 7	146 ± 5	174 ± 7
		A				6	23.1	34.4 ± 0.8	135 ± 4	175 ± 10	221 ± 2
		Ind.				1	3.8	-	-	-	-
	Dry	J+S	60	2	19	0	0.0	-	-	-	-
		A				12	11.9	30.9 ± 0.7	139 ± 8	171 ± 6	201 ± 4
		Ind.				2	2.0	-	-	-	-
SWAMP FOREST											
Maison de la mangrove	Wet	J+S	60	2	8	6	5.4	18.2 ± 0.8	90 ± 12	146 ± 6	190 ± 11
		A				2	1.8	*34.5; 31.0*	*150; 178*	*175; 165*	*235; 217*
		Ind.				1	0.9	-	-	-	-
	Dry	J+S	42	42	7	2	2.6	*13.9; 14.2*	*46; 53*	*112; 127*	*155; 166*
		A				5	6.5	29.7 ± 0.8	160 ± 10	160 ± 6	219 ± 6

SUPPLEMENTARY INFORMATION 2

Seasonal demography of different populations of the Black Rat (Rattus rattus) under contrasted natural habitats of Guadeloupe Island (Lesser Antilles, Caribbean)

Goedert_et_al.

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1. Packages and versions

R version 3.5.3 (2019-03-11) – "Great Truth" Copyright (C) 2019 The R Foundation for Statistical Computing Platform: x86_64-w64-mingw32/x64 (64-bit)

R Core Team (2019). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/.

R was used with RStudio v.1.1.463
RStudio Team (2018). RStudio: Integrated Development for R. RStudio, Inc., Boston, MA URL http://www.rstudio.com/.

```
library(plyr) # 1.8.4
library(tidyverse) # 1.2.1
library(tidybayes) # 1.1.0
library(brms) # 2.10.0
library(ggplot2) # 3.2.1
library(bayesplot) # 1.7.0
library(coda) # 0.19-3
library(R2jags) # 0.5-7
library(gridExtra) # 2.3
library(grid) # 3.5.3
```

2. Full data and management

```
dataRrattus<-read.table("data_Rattus_rattus_Guadeloupe.txt", header=T)
print(dataRrattus)
```

```
##     ID_collection Death_date       Species                Location
## 1          MNA180 04/10/2017 Rattus_rattus             Gros_Morne_GM
## 2          MNA181 04/10/2017 Rattus_rattus             Gros_Morne_GM
## 3          MNA182 04/10/2017 Rattus_rattus             Gros_Morne_GM
## 4          MNA183 04/10/2017 Rattus_rattus             Gros_Morne_GM
## 5          MNA184 04/10/2017 Rattus_rattus             Gros_Morne_GM
## 6          MNA185 04/10/2017 Rattus_rattus             Gros_Morne_GM
## 7          MNA186 04/10/2017 Rattus_rattus             Gros_Morne_GM
## 8          MNA187 05/10/2017 Rattus_rattus             Gros_Morne_GM
## 9          MNA188 05/10/2017 Rattus_rattus             Gros_Morne_GM
## 10         MNA189 05/10/2017 Rattus_rattus             Gros_Morne_GM
## 11         MNA190 05/10/2017 Rattus_rattus             Gros_Morne_GM
## 12         MNA191 05/10/2017 Rattus_rattus             Gros_Morne_GM
## 13         MNA192 06/10/2017 Rattus_rattus             Esperance_ESP
## 14         MNA193 06/10/2017 Rattus_rattus             Esperance_ESP
## 15         MNA194 06/10/2017 Rattus_rattus             Esperance_ESP
## 16         MNA195 06/10/2017 Rattus_rattus             Esperance_ESP
## 17         MNA196 06/10/2017 Rattus_rattus             Esperance_ESP
## 18         MNA197 06/10/2017 Rattus_rattus             Esperance_ESP
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## 21         MNA200 06/10/2017 Rattus_rattus             Esperance_ESP
## 22         MNA201 06/10/2017 Rattus_rattus             Esperance_ESP
## 23         MNA202 06/10/2017 Rattus_rattus             Esperance_ESP
## 24         MNA203 06/10/2017 Rattus_rattus             Esperance_ESP
```

```
## 25         MNA204 06/10/2017 Rattus_rattus             Esperance_ESP
## 26         MNA205 06/10/2017 Rattus_rattus             Esperance_ESP
## 27         MNA206 06/10/2017 Rattus_rattus             Esperance_ESP
## 28         MNA207 06/10/2017 Rattus_rattus             Esperance_ESP
## 29         MNA208 06/10/2017 Rattus_rattus             Esperance_ESP
## 30         MNA209 06/10/2017 Rattus_rattus          Piton_Ste_Rose_PR
## 31         MNA210 06/10/2017 Rattus_rattus          Piton_Ste_Rose_PR
## 32         MNA211 06/10/2017 Rattus_rattus          Piton_Ste_Rose_PR
## 33         MNA212 06/10/2017 Rattus_rattus          Piton_Ste_Rose_PR
## 34         MNA213 06/10/2017 Rattus_rattus          Piton_Ste_Rose_PR
## 35         MNA214 06/10/2017 Rattus_rattus          Piton_Ste_Rose_PR
## 36         MNA215 06/10/2017 Rattus_rattus          Piton_Ste_Rose_PR
## 37         MNA216 07/10/2017 Rattus_rattus          Piton_Ste_Rose_PR
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## 47         MNA226 08/10/2017 Rattus_rattus              Bras_David_BD
## 48         MNA227 08/10/2017 Rattus_rattus              Bras_David_BD
## 49         MNA228 08/10/2017 Rattus_rattus              Bras_David_BD
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## 52         MNA231 08/10/2017 Rattus_rattus              Bras_David_BD
## 53         MNA232 08/10/2017 Rattus_rattus              Bras_David_BD
## 54         MNA233 08/10/2017 Rattus_rattus              Bras_David_BD
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## 62         MNA241 10/10/2017 Rattus_rattus       Col_des_Mamelles_MM
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## 74         MNA253 11/10/2017 Rattus_rattus        Barre_de_Cadoue_CA
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## 77         MNA256 11/10/2017 Rattus_rattus        Barre_de_Cadoue_CA
## 78         MNA257 11/10/2017 Rattus_rattus        Barre_de_Cadoue_CA
```

```
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## 161        MNA475 27/03/2018 Rattus_rattus  Esperance___creole_garden
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## 163        MNA477 27/03/2018 Rattus_rattus  Esperance___creole_garden
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## 165        MNA479 27/03/2018 Rattus_rattus  Esperance___creole_garden
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## 167        MNA481 27/03/2018 Rattus_rattus              Esperance_ESP
## 168 Not_Collected 07/10/2017 Rattus_rattus          Piton_Ste_Rose_PR
## 169 Not_Collected 11/10/2017 Rattus_rattus         Barre_de_Cadoue_CA
## 170 Not_Collected 11/10/2017 Rattus_rattus         Barre_de_Cadoue_CA
## 171 Not_Collected 12/10/2017 Rattus_rattus Maison_de_la_mangrove_MANG
## 172 Not_Collected 23/03/2018 Rattus_rattus        Col_des_Mamelles_MM
##                               Environment Capture_season Length_corpse_mm
## 1       semi_deciduous_tropical_dry_forest            Wet             15.5
## 2       semi_deciduous_tropical_dry_forest            Wet             16.0
## 3       semi_deciduous_tropical_dry_forest            Wet             13.8
## 4       semi_deciduous_tropical_dry_forest            Wet             14.3
## 5       semi_deciduous_tropical_dry_forest            Wet             14.0
## 6       semi_deciduous_tropical_dry_forest            Wet             15.5
## 7       semi_deciduous_tropical_dry_forest            Wet             14.8
## 8       semi_deciduous_tropical_dry_forest            Wet             13.2
## 9       semi_deciduous_tropical_dry_forest            Wet             12.8
## 10      semi_deciduous_tropical_dry_forest            Wet             16.4
## 11      semi_deciduous_tropical_dry_forest            Wet             12.4
## 12      semi_deciduous_tropical_dry_forest            Wet             16.0
## 13  seasonal_evergreen_tropical_rainforest            Wet               NA
```

```
## 14  seasonal_evergreen_tropical_rainforest          Wet            17.0
## 15  seasonal_evergreen_tropical_rainforest          Wet            16.2
## 16  seasonal_evergreen_tropical_rainforest          Wet            19.1
## 17  seasonal_evergreen_tropical_rainforest          Wet            14.0
## 18  seasonal_evergreen_tropical_rainforest          Wet            17.5
## 19  seasonal_evergreen_tropical_rainforest          Wet            14.5
## 20  seasonal_evergreen_tropical_rainforest          Wet            17.5
## 21  seasonal_evergreen_tropical_rainforest          Wet            18.7
## 22  seasonal_evergreen_tropical_rainforest          Wet            13.3
## 23  seasonal_evergreen_tropical_rainforest          Wet            13.8
## 24  seasonal_evergreen_tropical_rainforest          Wet            14.5
## 25  seasonal_evergreen_tropical_rainforest          Wet            15.2
## 26  seasonal_evergreen_tropical_rainforest          Wet            13.9
## 27  seasonal_evergreen_tropical_rainforest          Wet            13.0
## 28  seasonal_evergreen_tropical_rainforest          Wet            14.6
## 29  seasonal_evergreen_tropical_rainforest          Wet            14.5
## 30  seasonal_evergreen_tropical_rainforest          Wet            15.2
## 31  seasonal_evergreen_tropical_rainforest          Wet            15.5
## 32  seasonal_evergreen_tropical_rainforest          Wet            17.5
## 33  seasonal_evergreen_tropical_rainforest          Wet            15.6
## 34  seasonal_evergreen_tropical_rainforest          Wet            19.2
## 35  seasonal_evergreen_tropical_rainforest          Wet            15.7
## 36  seasonal_evergreen_tropical_rainforest          Wet            16.4
## 37  seasonal_evergreen_tropical_rainforest          Wet            15.3
## 38  seasonal_evergreen_tropical_rainforest          Wet            17.7
## 39  seasonal_evergreen_tropical_rainforest          Wet            17.4
## 40  seasonal_evergreen_tropical_rainforest          Wet            17.5
## 41  seasonal_evergreen_tropical_rainforest          Wet            13.3
## 42  seasonal_evergreen_tropical_rainforest          Wet            15.5
## 43  seasonal_evergreen_tropical_rainforest          Wet            15.8
## 44  seasonal_evergreen_tropical_rainforest          Wet            12.8
## 45  seasonal_evergreen_tropical_rainforest          Wet            15.4
## 46                    mountain_rainforest          Wet            13.5
## 47                    mountain_rainforest          Wet            17.5
## 48                    mountain_rainforest          Wet            14.0
## 49                    mountain_rainforest          Wet            19.5
## 50                    mountain_rainforest          Wet            15.0
## 51                    mountain_rainforest          Wet            17.0
## 52                    mountain_rainforest          Wet            12.0
## 53                    mountain_rainforest          Wet            17.5
## 54                    mountain_rainforest          Wet            20.0
## 55                    mountain_rainforest          Wet            13.5
## 56                    mountain_rainforest          Wet            16.0
## 57                    mountain_rainforest          Wet            16.0
## 58                    mountain_rainforest          Wet            14.0
## 59                    mountain_rainforest          Wet            16.0
## 60                    mountain_rainforest          Wet              NA
## 61                    mountain_rainforest          Wet            19.5
## 62                    mountain_rainforest          Wet            15.8
## 63                    mountain_rainforest          Wet            16.5
## 64                    mountain_rainforest          Wet            15.5
## 65                    mountain_rainforest          Wet            14.2
## 66                    mountain_rainforest          Wet            18.5
## 67                    mountain_rainforest          Wet            18.0
```

```
## 68                     mountain_rainforest           Wet            15.2
## 69                     mountain_rainforest           Wet            19.8
## 70                     mountain_rainforest           Wet            16.2
## 71                     mountain_rainforest           Wet            20.5
## 72                     mountain_rainforest           Wet            17.0
## 73      semi_deciduous_tropical_dry_forest           Wet            17.0
## 74      semi_deciduous_tropical_dry_forest           Wet            13.0
## 75      semi_deciduous_tropical_dry_forest           Wet            12.5
## 76      semi_deciduous_tropical_dry_forest           Wet            14.5
## 77      semi_deciduous_tropical_dry_forest           Wet            17.5
## 78      semi_deciduous_tropical_dry_forest           Wet            15.0
## 79      semi_deciduous_tropical_dry_forest           Wet            16.4
## 80      semi_deciduous_tropical_dry_forest           Wet            12.9
## 81      semi_deciduous_tropical_dry_forest           Wet            12.5
## 82      semi_deciduous_tropical_dry_forest           Wet            16.5
## 83      semi_deciduous_tropical_dry_forest           Wet            14.1
## 84      semi_deciduous_tropical_dry_forest           Wet            13.4
## 85      semi_deciduous_tropical_dry_forest           Wet            17.9
## 86      semi_deciduous_tropical_dry_forest           Wet            12.3
## 87      semi_deciduous_tropical_dry_forest           Wet            15.0
## 88      semi_deciduous_tropical_dry_forest           Wet            11.2
## 89      semi_deciduous_tropical_dry_forest           Wet              NA
## 90                             swamp_forest           Wet            17.5
## 91                             swamp_forest           Wet            15.5
## 92                             swamp_forest           Wet            14.5
## 93                             swamp_forest           Wet            17.0
## 94                             swamp_forest           Wet            14.2
## 95                             swamp_forest           Wet            16.5
## 96                             swamp_forest           Wet            13.6
## 97                             swamp_forest           Wet            13.0
## 98      semi_deciduous_tropical_dry_forest           Wet              NA
## 99                             swamp_forest           Dry            15.0
## 100                            swamp_forest           Dry            18.0
## 101                            swamp_forest           Dry            15.5
## 102                            swamp_forest           Dry            16.0
## 103                            swamp_forest           Dry            11.2
## 104                            swamp_forest           Dry            12.7
## 105                            swamp_forest           Dry            15.3
## 106     semi_deciduous_tropical_dry_forest           Dry            13.4
## 107     semi_deciduous_tropical_dry_forest           Dry            13.5
## 108     semi_deciduous_tropical_dry_forest           Dry            13.3
## 109 seasonal_evergreen_tropical_rainforest           Dry            19.1
## 110 seasonal_evergreen_tropical_rainforest           Dry            20.5
## 111 seasonal_evergreen_tropical_rainforest           Dry            19.5
## 112 seasonal_evergreen_tropical_rainforest           Dry            19.2
## 113 seasonal_evergreen_tropical_rainforest           Dry            20.0
## 114     semi_deciduous_tropical_dry_forest           Dry            15.0
## 115     semi_deciduous_tropical_dry_forest           Dry            15.4
## 116     semi_deciduous_tropical_dry_forest           Dry              NA
## 117 seasonal_evergreen_tropical_rainforest           Dry            15.0
## 118 seasonal_evergreen_tropical_rainforest           Dry            14.6
## 119 seasonal_evergreen_tropical_rainforest           Dry            16.8
## 120 seasonal_evergreen_tropical_rainforest           Dry            16.9
## 121     semi_deciduous_tropical_dry_forest           Dry            15.6
```

```
## 122     semi_deciduous_tropical_dry_forest           Dry             16.0
## 123 seasonal_evergreen_tropical_rainforest           Dry             19.5
## 124     semi_deciduous_tropical_dry_forest           Dry             17.3
## 125     semi_deciduous_tropical_dry_forest           Dry             18.5
## 126     semi_deciduous_tropical_dry_forest           Dry             16.4
## 127                    mountain_rainforest           Dry             14.5
## 128                    mountain_rainforest           Dry             17.9
## 129                    mountain_rainforest           Dry             19.2
## 130                    mountain_rainforest           Dry             18.3
## 131                    mountain_rainforest           Dry             18.5
## 132                    mountain_rainforest           Dry             17.3
## 133                    mountain_rainforest           Dry             17.0
## 134                    mountain_rainforest           Dry             14.3
## 135                    mountain_rainforest           Dry             18.5
## 136                    mountain_rainforest           Dry             20.0
## 137                    mountain_rainforest           Dry             18.5
## 138                    mountain_rainforest           Dry             17.5
## 139                    mountain_rainforest           Dry             18.7
## 140                    mountain_rainforest           Dry             19.0
## 141                    mountain_rainforest           Dry             16.2
## 142                    mountain_rainforest           Dry             17.0
## 143                    mountain_rainforest           Dry             15.9
## 144                    mountain_rainforest           Dry             15.4
## 145                    mountain_rainforest           Dry             15.8
## 146                    mountain_rainforest           Dry             16.4
## 147                    mountain_rainforest           Dry             14.1
## 148                    mountain_rainforest           Dry             14.6
## 149                    mountain_rainforest           Dry             16.6
## 150                    mountain_rainforest           Dry             17.6
## 151                    mountain_rainforest           Dry             16.8
## 152                    mountain_rainforest           Dry             16.5
## 153 seasonal_evergreen_tropical_rainforest           Dry             18.0
## 154 seasonal_evergreen_tropical_rainforest           Dry             18.0
## 155 seasonal_evergreen_tropical_rainforest           Dry             18.5
## 156 seasonal_evergreen_tropical_rainforest           Dry             19.0
## 157 seasonal_evergreen_tropical_rainforest           Dry             17.0
## 158 seasonal_evergreen_tropical_rainforest           Dry             19.0
## 159 seasonal_evergreen_tropical_rainforest           Dry             18.3
## 160                          Creole_garden           Dry             18.5
## 161                          Creole_garden           Dry             17.5
## 162                          Creole_garden           Dry             17.5
## 163                          Creole_garden           Dry             19.5
## 164                          Creole_garden           Dry             18.0
## 165                          Creole_garden           Dry             18.0
## 166                          Creole_garden           Dry             18.5
## 167 seasonal_evergreen_tropical_rainforest           Dry             18.0
## 168 seasonal_evergreen_tropical_rainforest           Wet               NA
## 169     semi_deciduous_tropical_dry_forest           Wet               NA
## 170     semi_deciduous_tropical_dry_forest           Wet               NA
## 171                           swamp_forest           Wet               NA
## 172                    mountain_rainforest           Dry               NA
##     Weight_eviscerated_g Weight_mean_eye_lens_mg Age_class_estimate
## 1                     64                  18.695           Juvenile
## 2                     74                  22.310           Subadult
```

```
## 3    76  21.880  Subadult
## 4    62  16.690  Juvenile
## 5    72  19.170  Juvenile
## 6    84  22.695  Subadult
## 7    86  20.470  Subadult
## 8    54  18.010  Juvenile
## 9    50  19.485  Juvenile
## 10   89  22.850  Subadult
## 11   53  17.215  Juvenile
## 12  107  31.255     Adult
## 13   NA  20.590  Subadult
## 14  108  34.125     Adult
## 15   74  24.200  Subadult
## 16   63  20.715  Subadult
## 17   NA  18.855  Juvenile
## 18   96  32.470     Adult
## 19   64  19.115  Juvenile
## 20  120  33.220     Adult
## 21  139  29.815  Subadult
## 22   52  19.320  Juvenile
## 23   93  22.210  Subadult
## 24   75  17.490  Juvenile
## 25   NA  21.190  Subadult
## 26   48  18.365  Juvenile
## 27   41  17.190  Juvenile
## 28   61  19.045  Juvenile
## 29   62  20.290  Subadult
## 30   60  19.835  Juvenile
## 31   72  23.105  Subadult
## 32  130  36.240     Adult
## 33   62  20.395  Subadult
## 34  137  39.340     Adult
## 35   86  21.905  Subadult
## 36   NA  23.285  Subadult
## 37  122  41.140     Adult
## 38  123  35.360     Adult
## 39   95  24.785  Subadult
## 40  138  34.800     Adult
## 41   48  19.850  Juvenile
## 42   64  23.900  Subadult
## 43   71  18.920  Juvenile
## 44   46  19.655  Juvenile
## 45   99  25.265  Subadult
## 46  113  36.950     Adult
## 47  103  31.420     Adult
## 48   38  16.655  Juvenile
## 49  115  33.000     Adult
## 50   79  21.275  Subadult
## 51  105  36.725     Adult
## 52   38  19.895  Juvenile
## 53   98  31.770     Adult
## 54  118  36.565     Adult
## 55   43  17.780  Juvenile
## 56   64  20.650  Subadult
```

```
## 57                55          21.585       Subadult
## 58                55          19.405       Juvenile
## 59                62          20.435       Subadult
## 60                NA          14.470       Juvenile
## 61               119          36.310          Adult
## 62                55          17.220       Juvenile
## 63                95          35.350          Adult
## 64                61          17.350       Juvenile
## 65                45          18.950       Juvenile
## 66               125          30.945          Adult
## 67               103          30.560          Adult
## 68                59          16.545       Juvenile
## 69               110          33.785          Adult
## 70                62          16.275       Juvenile
## 71               107          33.840          Adult
## 72               110          32.090          Adult
## 73                98          25.300       Subadult
## 74                49          17.450       Juvenile
## 75                35          14.300       Juvenile
## 76                54          20.925       Subadult
## 77                93          14.650       Juvenile
## 78                66          17.500       Juvenile
## 79                91          33.450          Adult
## 80                34          14.550       Juvenile
## 81                38          16.195       Juvenile
## 82                84          28.600       Subadult
## 83                59          19.200       Juvenile
## 84                49          19.630       Juvenile
## 85                99          34.000          Adult
## 86                46          15.850       Juvenile
## 87                59          19.750       Juvenile
## 88                31          11.950       Juvenile
## 89                NA              NA           <NA>
## 90               110          34.050          Adult
## 91                85          21.150       Subadult
## 92                60          17.150       Juvenile
## 93               120          20.655       Subadult
## 94                56          27.900       Subadult
## 95               124          31.000          Adult
## 96                85          21.850       Subadult
## 97                50          18.600       Juvenile
## 98                NA              NA           <NA>
## 99               109          26.080       Subadult
## 100              152          29.010       Subadult
## 101              137          30.600          Adult
## 102              138          29.535       Subadult
## 103               36          13.855       Juvenile
## 104               40          13.960       Juvenile
## 105              104          33.230          Adult
## 106              105          28.985       Subadult
## 107               96          32.640          Adult
## 108              102          29.625       Subadult
## 109              128          38.100          Adult
## 110              134          30.265          Adult
```

```
## 111  162  29.465  Subadult
## 112  107  43.190     Adult
## 113  153  29.495  Subadult
## 114   NA  29.070  Subadult
## 115   NA  27.470  Subadult
## 116   NA     NA      <NA>
## 117   80  31.360     Adult
## 118   81  29.040  Subadult
## 119   NA  33.850     Adult
## 120  136  32.330     Adult
## 121  112  31.200     Adult
## 122   98  28.270  Subadult
## 123  173  30.495     Adult
## 124   95  34.185     Adult
## 125   92  27.555  Subadult
## 126  112  31.840     Adult
## 127   90  30.470     Adult
## 128  120  31.895     Adult
## 129  142  35.990     Adult
## 130  124  29.050  Subadult
## 131  126  31.755     Adult
## 132  102  25.675  Subadult
## 133   99  29.580  Subadult
## 134   55  25.810  Subadult
## 135  100  31.075     Adult
## 136  150  36.740     Adult
## 137  112  25.725  Subadult
## 138  102  28.450  Subadult
## 139  117  28.260  Subadult
## 140  141  30.655     Adult
## 141  101  28.690  Subadult
## 142  119  29.385  Subadult
## 143   88  29.470  Subadult
## 144   96  27.165  Subadult
## 145  122  33.785     Adult
## 146  127  29.690  Subadult
## 147   91  26.970  Subadult
## 148  100  35.125     Adult
## 149   98  29.495  Subadult
## 150  128  35.400     Adult
## 151  100  30.735     Adult
## 152   90  33.485     Adult
## 153  119  30.395     Adult
## 154  140  36.020     Adult
## 155  140  30.460     Adult
## 156  160  32.550     Adult
## 157  109  29.120  Subadult
## 158  131  33.655     Adult
## 159  120  30.495     Adult
## 160  133  32.970     Adult
## 161  126  33.110     Adult
## 162  126  31.370     Adult
## 163  169  34.680     Adult
## 164  138  30.770     Adult
```

```
## 165                 134                 31.110             Adult
## 166                 147                 31.925             Adult
## 167                 154                 31.050             Adult
## 168                  NA                     NA              <NA>
## 169                  NA                     NA              <NA>
## 170                  NA                     NA              <NA>
## 171                  NA                     NA              <NA>
## 172                  NA                     NA              <NA>
##     Sex_autopsie Reproductive_states Testicle_length_cm Placental_scars
## 1              M    non_reproductive                0.7              NA
## 2              M    non_reproductive                0.8              NA
## 3              F    non_reproductive                 NA               0
## 4              F    non_reproductive                 NA               0
## 5              F    non_reproductive                 NA               0
## 6              M    non_reproductive                0.9              NA
## 7              F        reproductive                 NA               1
## 8              M    non_reproductive                0.8              NA
## 9              F    non_reproductive                 NA               0
## 10             F        reproductive                 NA               1
## 11             M    non_reproductive                0.8              NA
## 12             F        reproductive                 NA               1
## 13          <NA>                <NA>                 NA              NA
## 14             M        reproductive                2.5              NA
## 15             F        reproductive                 NA               1
## 16             F    non_reproductive                 NA               0
## 17             F    non_reproductive                 NA               0
## 18             F        reproductive                 NA               1
## 19             M    non_reproductive                0.6               0
## 20             F        reproductive                 NA               1
## 21             F        reproductive                 NA               1
## 22             F        reproductive                 NA               1
## 23             F        reproductive                 NA               1
## 24             F        reproductive                 NA               1
## 25             F    non_reproductive                 NA              NA
## 26             F    non_reproductive                 NA               0
## 27             F    non_reproductive                 NA               0
## 28             M    non_reproductive                0.7              NA
## 29             F    non_reproductive                 NA               0
## 30             M    non_reproductive                0.8              NA
## 31             F    non_reproductive                 NA               0
## 32             M        reproductive                2.5              NA
## 33             F        reproductive                 NA               1
## 34             M        reproductive                2.4              NA
## 35             F    non_reproductive                 NA               0
## 36             M        reproductive                1.1              NA
## 37             F        reproductive                 NA               1
## 38             F        reproductive                 NA               1
## 39             M    non_reproductive                0.8              NA
## 40             F        reproductive                 NA               1
## 41             M    non_reproductive                0.7              NA
## 42             F    non_reproductive                 NA               0
## 43             F    non_reproductive                 NA               0
## 44             M    non_reproductive                0.8              NA
## 45             M    non_reproductive                0.8              NA
```

```
## 46            F        reproductive                NA              1
## 47            F        reproductive                NA              1
## 48            F    non_reproductive                NA              0
## 49            F        reproductive                NA              1
## 50            F        reproductive                NA              1
## 51            M        reproductive               2.0             NA
## 52            F    non_reproductive                NA              0
## 53            F        reproductive                NA              1
## 54            F        reproductive                NA              1
## 55            M    non_reproductive               0.7             NA
## 56            F    non_reproductive                NA              0
## 57            M    non_reproductive               0.8             NA
## 58            F    non_reproductive                NA              0
## 59            M    non_reproductive               0.6             NA
## 60            F    non_reproductive                NA              0
## 61            F        reproductive                NA              1
## 62            F    non_reproductive                NA              0
## 63            F        reproductive                NA              1
## 64            M    non_reproductive               0.6             NA
## 65            M    non_reproductive               0.6             NA
## 66            F        reproductive                NA              1
## 67            F        reproductive                NA              1
## 68            F    non_reproductive                NA              0
## 69            M        reproductive               1.9             NA
## 70            F    non_reproductive                NA              0
## 71            F        reproductive                NA              1
## 72            F        reproductive                NA              1
## 73            F        reproductive                NA              1
## 74            M    non_reproductive               0.6             NA
## 75            M    non_reproductive               0.6             NA
## 76            F    non_reproductive                NA              0
## 77            M        reproductive               2.3             NA
## 78            M    non_reproductive               0.8             NA
## 79            F        reproductive                NA              1
## 80            F    non_reproductive                NA              0
## 81            M    non_reproductive               0.7             NA
## 82            F        reproductive                NA              1
## 83            M    non_reproductive               0.7             NA
## 84            M    non_reproductive               0.7             NA
## 85            M        reproductive               2.5             NA
## 86            M    non_reproductive               0.5             NA
## 87            F        reproductive                NA              1
## 88            F    non_reproductive                NA              0
## 89         <NA>               <NA>                NA             NA
## 90            M        reproductive               2.6             NA
## 91            F    non_reproductive                NA              0
## 92            F    non_reproductive                NA              0
## 93            F        reproductive                NA              1
## 94            F    non_reproductive                NA              0
## 95            F        reproductive                NA              1
## 96            F        reproductive                NA              1
## 97            F    non_reproductive                NA              0
## 98         <NA>               <NA>                NA             NA
## 99            F    non_reproductive                NA              0
```

```
## 100          M       reproductive              2.3             NA
## 101          F       reproductive               NA              1
## 102          F       reproductive               NA              1
## 103          F   non_reproductive               NA              0
## 104          M   non_reproductive              0.5             NA
## 105          M   non_reproductive              0.9             NA
## 106          F   non_reproductive               NA              0
## 107          F   non_reproductive               NA              0
## 108          F       reproductive               NA              1
## 109          F       reproductive               NA              1
## 110          M       reproductive              2.5             NA
## 111          M       reproductive              2.7             NA
## 112          M       reproductive              2.5             NA
## 113          M       reproductive              2.6             NA
## 114          M   non_reproductive              0.9             NA
## 115          M   non_reproductive              1.1             NA
## 116       <NA>               <NA>               NA             NA
## 117          F       reproductive               NA              1
## 118          M   non_reproductive              1.1             NA
## 119          M       reproductive              2.5             NA
## 120          M       reproductive              2.4             NA
## 121          F   non_reproductive               NA              0
## 122          F   non_reproductive               NA              0
## 123          M       reproductive              2.6             NA
## 124          M       reproductive              2.4             NA
## 125          M       reproductive              2.6             NA
## 126          F       reproductive               NA              1
## 127          F   non_reproductive               NA              0
## 128          M       reproductive              2.2             NA
## 129          F   non_reproductive               NA              0
## 130          F       reproductive               NA              1
## 131          M       reproductive              2.4             NA
## 132          M       reproductive              2.1             NA
## 133          M       reproductive              2.4             NA
## 134          F   non_reproductive               NA              0
## 135          M       reproductive              2.6             NA
## 136          M       reproductive              2.4             NA
## 137          M       reproductive              2.5             NA
## 138          F   non_reproductive               NA              0
## 139          M       reproductive              2.6             NA
## 140          M       reproductive              2.5             NA
## 141          F   non_reproductive               NA              0
## 142          F       reproductive               NA              1
## 143          M       reproductive              2.2             NA
## 144          M       reproductive              2.6             NA
## 145          F       reproductive               NA              1
## 146          F       reproductive               NA              1
## 147          M       reproductive              2.4             NA
## 148          F   non_reproductive               NA              0
## 149          M       reproductive              2.6             NA
## 150          M       reproductive              2.3             NA
## 151          F       reproductive               NA              1
## 152          F       reproductive               NA              1
## 153          M       reproductive              2.5             NA
```

```
## 154            F        reproductive                NA               1
## 155            F        reproductive                NA               1
## 156            M        reproductive               2.3              NA
## 157            M        reproductive               2.3              NA
## 158            F        reproductive                NA               1
## 159            F        reproductive                NA               1
## 160            M        reproductive               2.5              NA
## 161            F        reproductive                NA               1
## 162            M        reproductive               2.4              NA
## 163            M        reproductive               2.5              NA
## 164            F        reproductive                NA               1
## 165            F    non_reproductive                NA               0
## 166            F        reproductive                NA               1
## 167            F        reproductive                NA               1
## 168         <NA>                <NA>                NA              NA
## 169         <NA>                <NA>                NA              NA
## 170         <NA>                <NA>                NA              NA
## 171         <NA>                <NA>                NA              NA
## 172         <NA>                <NA>                NA              NA
##     Gestating_female       Morphe
## 1                 NA        indet
## 2                 NA        indet
## 3                  0        indet
## 4                  0        indet
## 5                  0        indet
## 6                 NA        indet
## 7                  0        indet
## 8                 NA        indet
## 9                  0        indet
## 10                 0        indet
## 11                NA        indet
## 12                 0        indet
## 13                NA        indet
## 14                NA       rattus
## 15                 0       rattus
## 16                 0        indet
## 17                 0       rattus
## 18                 0       rattus
## 19                 0       rattus
## 20                 0  frugivorous
## 21                 0        indet
## 22                 0        indet
## 23                 0 alexandrinus
## 24                 0       rattus
## 25                NA        indet
## 26                 0       rattus
## 27                 0       rattus
## 28                NA        indet
## 29                 0        indet
## 30                NA        indet
## 31                 0        indet
## 32                NA        indet
## 33                 0        indet
## 34                NA        indet
```

```
## 35                0        indet
## 36               NA        indet
## 37                0 alexandrinus
## 38                0 alexandrinus
## 39               NA       rattus
## 40                1 alexandrinus
## 41               NA  frugivorous
## 42                0  frugivorous
## 43                0  frugivorous
## 44               NA       rattus
## 45               NA alexandrinus
## 46                0       rattus
## 47                0 alexandrinus
## 48                0       rattus
## 49                0       rattus
## 50                1       rattus
## 51               NA       rattus
## 52                0       rattus
## 53                0       rattus
## 54                1       rattus
## 55               NA       rattus
## 56                0       rattus
## 57               NA alexandrinus
## 58                0       rattus
## 59               NA       rattus
## 60                0 alexandrinus
## 61                0       rattus
## 62                0       rattus
## 63                0       rattus
## 64               NA       rattus
## 65               NA       rattus
## 66                0       rattus
## 67                0       rattus
## 68                0       rattus
## 69               NA alexandrinus
## 70                0       rattus
## 71                0 alexandrinus
## 72                0       rattus
## 73                0  frugivorous
## 74               NA  frugivorous
## 75               NA  frugivorous
## 76                0  frugivorous
## 77               NA  frugivorous
## 78               NA  frugivorous
## 79                0  frugivorous
## 80                0        indet
## 81               NA  frugivorous
## 82                0  frugivorous
## 83               NA        indet
## 84               NA  frugivorous
## 85               NA  frugivorous
## 86               NA  frugivorous
## 87                0  frugivorous
## 88                0  frugivorous
```

```
## 89               NA        indet
## 90               NA alexandrinus
## 91                0 alexandrinus
## 92                0 alexandrinus
## 93                0 alexandrinus
## 94                0 alexandrinus
## 95                1 alexandrinus
## 96                0 alexandrinus
## 97                0        indet
## 98               NA        indet
## 99                0 alexandrinus
## 100              NA Alexandrinus
## 101               0 Alexandrinus
## 102               1 Alexandrinus
## 103               0        indet
## 104              NA Alexandrinus
## 105              NA Alexandrinus
## 106               0  frugivorous
## 107               0  frugivorous
## 108               0  frugivorous
## 109               0 Alexandrinus
## 110              NA Alexandrinus
## 111              NA  frugivorous
## 112              NA  frugivorous
## 113              NA       rattus
## 114              NA Alexandrinus
## 115              NA Alexandrinus
## 116              NA        indet
## 117               0       rattus
## 118              NA Alexandrinus
## 119              NA Alexandrinus
## 120              NA  frugivorous
## 121               0  frugivorous
## 122               0 Alexandrinus
## 123              NA  frugivorous
## 124              NA  frugivorous
## 125              NA  frugivorous
## 126               1  frugivorous
## 127               0  frugivorous
## 128              NA       rattus
## 129               0       rattus
## 130               1       rattus
## 131              NA       rattus
## 132              NA       rattus
## 133              NA       rattus
## 134               0       rattus
## 135              NA       rattus
## 136              NA       rattus
## 137              NA       rattus
## 138               0 alexandrinus
## 139              NA       rattus
## 140              NA       rattus
## 141               0       rattus
## 142               1       rattus
```

```
## 143              NA       rattus
## 144              NA        indet
## 145               0        indet
## 146               1        indet
## 147              NA        indet
## 148               0        indet
## 149              NA        indet
## 150              NA        indet
## 151               1        indet
## 152               0        indet
## 153              NA alexandrinus
## 154               1       rattus
## 155               0 alexandrinus
## 156              NA  frugivorous
## 157              NA alexandrinus
## 158               0 alexandrinus
## 159               0  frugivorous
## 160              NA  frugivorous
## 161               1       rattus
## 162              NA       rattus
## 163              NA alexandrinus
## 164               1 alexandrinus
## 165               0  frugivorous
## 166               0  frugivorous
## 167               1       rattus
## 168              NA         <NA>
## 169              NA         <NA>
## 170              NA         <NA>
## 171              NA         <NA>
## 172              NA         <NA>
```

```r
# renaming columns to gain table space
names(dataRrattus)[names(dataRrattus) == "ID_collection"] <- "ID"
names(dataRrattus)[names(dataRrattus) == "Death_date"] <- "Date"
names(dataRrattus)[names(dataRrattus) == "Species"] <- "sp"
names(dataRrattus)[names(dataRrattus) == "Location"] <- "loc"
names(dataRrattus)[names(dataRrattus) == "Environment"] <- "hab"
names(dataRrattus)[names(dataRrattus) == "Capture_season"] <-  "seas"
names(dataRrattus)[names(dataRrattus) == "Length_corpse_mm"] <- "lc"
names(dataRrattus)[names(dataRrattus) == "Weight_eviscerated_g"] <-  "ebm"
names(dataRrattus)[names(dataRrattus) == "Weight_mean_eye_lens_mg"] <-  "elm"
names(dataRrattus)[names(dataRrattus) == "Age_class_estimate"] <-  "age"
names(dataRrattus)[names(dataRrattus) == "Sex_autopsie"] <- "sex"
names(dataRrattus)[names(dataRrattus) == "Reproductive_states"] <- "rep"
names(dataRrattus)[names(dataRrattus) == "Testicle_length_cm"] <- "tl"
names(dataRrattus)[names(dataRrattus) == "Placental_scars"] <- "ps"
names(dataRrattus)[names(dataRrattus) == "Gestating_female"] <- "gf"
names(dataRrattus)[names(dataRrattus) == "Morphe"] <- "Mph"
# Renaming labels to gain table space
dataRrattus$ID<-revalue(dataRrattus$ID, c("Not_Collected"="NC"))
dataRrattus$sp<-revalue(dataRrattus$sp, c("Rattus_rattus"="Rr"))
dataRrattus$loc<-revalue(dataRrattus$loc, c("Gros_Morne_GM"="GM",
                                            "Esperance_ESP"="ESP",
                                            "Piton_Ste_Rose_PR"="PR",
                                            "Bras_David_BD"="BD",
                                            "Col_des_Mamelles_MM"="MM",
                                            "Barre_de_Cadoue_CA"="CA",
                                            "Maison_de_la_mangrove_MANG"="MANG",
                                            "Esperance___creole_garden"="ECG"))
dataRrattus$hab<-revalue(dataRrattus$hab, c("semi_deciduous_tropical_dry_forest"
                                            ="dec",
                                            "seasonal_evergreen_tropical_rainforest"
                                            ="eve",
                                            "mountain_rainforest"="mnt",
                                            "swamp_forest"="swa",
                                            "Creole_garden"="cg"))
dataRrattus$age<-revalue(dataRrattus$age, c("Juvenile"="Juv",
                                            "Subadult"="Sub",
                                            "Adult"="Ad"))
dataRrattus$rep<-revalue(dataRrattus$rep, c("non_reproductive"="NR",
                                            "reproductive"="R",
                                            "Adult"="Ad"))
dataRrattus$Morphe<-revalue(dataRrattus$Morphe, c("indet"="ind",
                                            "rattus"="r",
                                            "frugivorous"="f",
                                            "alexandrinus"="a",
                                            "Alexandrinus"="a"))
dataRrattus$elm<-round(dataRrattus$elm, 1)
```

3. Relative age of females

```
# data preparation and selection
dataRrattus_F<-dataRrattus[which(dataRrattus$sex =="F"),] # females
dataRrattus_F<-dataRrattus_F[which(dataRrattus_F$elm!="NA"),] # mean eye lens mass
dataRrattus_F<-dataRrattus_F[which(dataRrattus_F$ps!="NA"),] # placental scars
print(dataRrattus_F %>% select(ID, ps, elm, loc))
```

```
##         ID ps  elm  loc
## 3   MNA182  0 21.9   GM
## 4   MNA183  0 16.7   GM
## 5   MNA184  0 19.2   GM
## 7   MNA186  1 20.5   GM
## 9   MNA188  0 19.5   GM
## 10  MNA189  1 22.9   GM
## 12  MNA191  1 31.3   GM
## 15  MNA194  1 24.2  ESP
## 16  MNA195  0 20.7  ESP
## 17  MNA196  0 18.9  ESP
## 18  MNA197  1 32.5  ESP
## 20  MNA199  1 33.2  ESP
## 21  MNA200  1 29.8  ESP
## 22  MNA201  1 19.3  ESP
## 23  MNA202  1 22.2  ESP
## 24  MNA203  1 17.5  ESP
## 26  MNA205  0 18.4  ESP
## 27  MNA206  0 17.2  ESP
## 29  MNA208  0 20.3  ESP
## 31  MNA210  0 23.1   PR
## 33  MNA212  1 20.4   PR
## 35  MNA214  0 21.9   PR
## 37  MNA216  1 41.1   PR
## 38  MNA217  1 35.4   PR
## 40  MNA219  1 34.8   PR
## 42  MNA221  0 23.9   PR
## 43  MNA222  0 18.9   PR
## 46  MNA225  1 37.0   BD
## 47  MNA226  1 31.4   BD
## 48  MNA227  0 16.7   BD
## 49  MNA228  1 33.0   BD
## 50  MNA229  1 21.3   BD
## 52  MNA231  0 19.9   BD
## 53  MNA232  1 31.8   BD
## 54  MNA233  1 36.6   BD
## 56  MNA235  0 20.6   BD
## 58  MNA237  0 19.4   BD
## 60  MNA239  0 14.5   BD
## 61  MNA240  1 36.3   MM
## 62  MNA241  0 17.2   MM
## 63  MNA242  1 35.4   MM
## 66  MNA245  1 30.9   MM
## 67  MNA246  1 30.6   MM
## 68  MNA247  0 16.5   MM
```

```
## 70  MNA249  0 16.3   MM
## 71  MNA250  1 33.8   MM
## 72  MNA251  1 32.1   MM
## 73  MNA252  1 25.3   CA
## 76  MNA255  0 20.9   CA
## 79  MNA258  1 33.5   CA
## 80  MNA259  0 14.6   CA
## 82  MNA261  1 28.6   CA
## 87  MNA266  1 19.8   CA
## 88  MNA267  0 11.9   CA
## 91  MNA270  0 21.1 MANG
## 92  MNA271  0 17.1 MANG
## 93  MNA272  1 20.7 MANG
## 94  MNA273  0 27.9 MANG
## 95  MNA274  1 31.0 MANG
## 96  MNA275  1 21.9 MANG
## 97  MNA276  0 18.6 MANG
## 99  MNA413  0 26.1 MANG
## 101 MNA415  1 30.6 MANG
## 102 MNA416  1 29.5 MANG
## 103 MNA417  0 13.9 MANG
## 106 MNA420  0 29.0   CA
## 107 MNA421  0 32.6   CA
## 108 MNA422  1 29.6   CA
## 109 MNA423  1 38.1   PR
## 117 MNA431  1 31.4   PR
## 121 MNA435  0 31.2   GM
## 122 MNA436  0 28.3   GM
## 126 MNA440  1 31.8   GM
## 127 MNA441  0 30.5   BD
## 129 MNA443  0 36.0   BD
## 130 MNA444  1 29.1   BD
## 134 MNA448  0 25.8   BD
## 138 MNA452  0 28.4   MM
## 141 MNA455  0 28.7   MM
## 142 MNA456  1 29.4   MM
## 145 MNA459  1 33.8   BD
## 146 MNA460  1 29.7   BD
## 148 MNA462  0 35.1   MM
## 151 MNA465  1 30.7   MM
## 152 MNA466  1 33.5   MM
## 154 MNA468  1 36.0  ESP
## 155 MNA469  1 30.5  ESP
## 158 MNA472  1 33.7  ESP
## 159 MNA473  1 30.5  ESP
## 161 MNA475  1 33.1  ECG
## 164 MNA478  1 30.8  ECG
## 165 MNA479  0 31.1  ECG
## 166 MNA480  1 31.9  ECG
## 167 MNA481  1 31.1  ESP
```

3.1. Bayesian generalized linear mixed model with binomial error (Logistic regression)

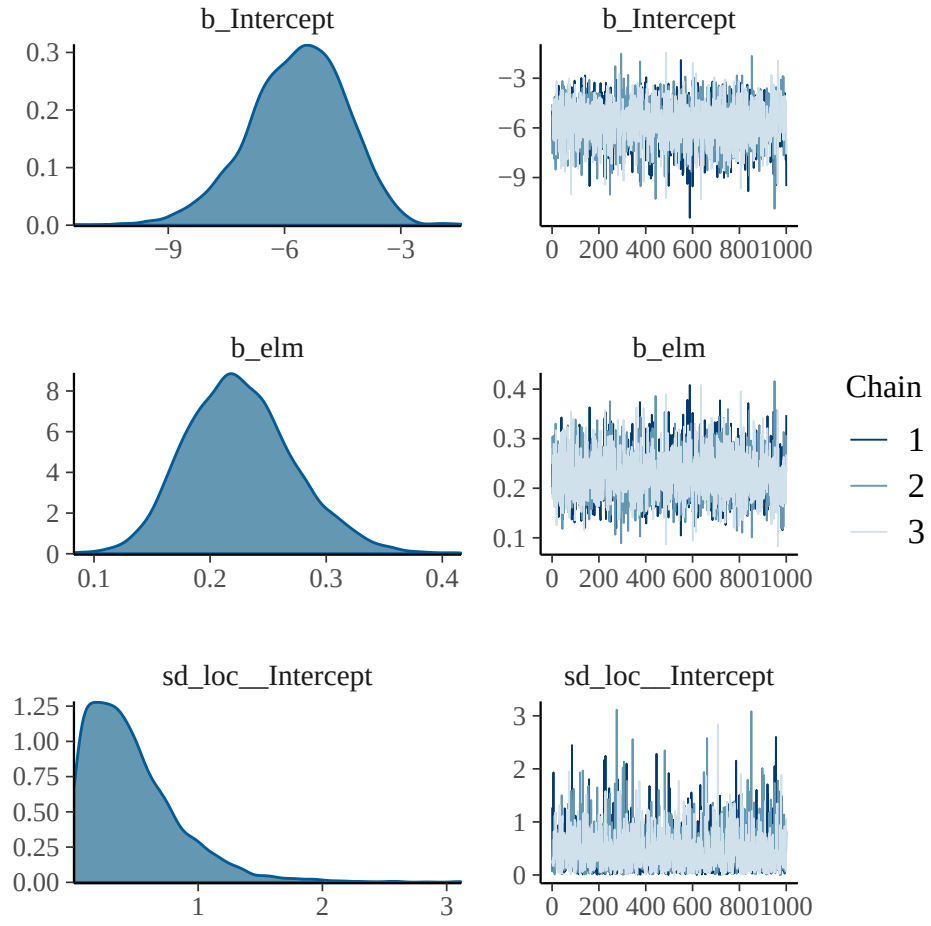
The reproductive status of females was fitted to mean eye lens weight using a binomial error and a logit link. A trapping site random intercept was set. Flat priors were chosen.

```
priorf <- c(prior_string("normal(0,10)", class = "b"), # flat priors for betas
            prior_(~cauchy(0,25), class = ~sd,
                   group = ~loc, coef = ~Intercept)) # flat prior for the random intercept

modf <- brm(ps ~ elm+(1|loc), data = dataRrattus_F,
            family = 'bernoulli', prior = priorf,
            iter = 20000, chains = 3, thin=10, refresh = 0)
```

3.2. Model checking

3.2.1. Bayesian convergence

```
plot(modf)
```



Bayesian fit yielded in good mixing of chains.

3.2.2. Check for dispersion

```
residmodf <- residuals(modf, type='pearson', summary=FALSE)
SSresmodf <- apply(residmodf^2,1,sum)
dff <- nrow(dataRrattus_F) - 3 # number of model coefficients
Dispf <- SSresmodf/dff
data.frame(Mean=round(mean(Dispf),2), SE=round(sd(Dispf)/dff,2))
```

```
##   Mean SE
## 1 1.01  0
```

Mean dispersion very close to 1.0, indicating an absence of variance heterogeneity.

3.3. Model results

3.3.1. Coefficients estimation

```
modf
```

```
##  Family: bernoulli
##   Links: mu = logit
## Formula: ps ~ elm + (1 | loc)
##    Data: dataRrattus_F (Number of observations: 94)
## Samples: 3 chains, each with iter = 20000; warmup = 10000; thin = 10;
##          total post-warmup samples = 3000
##
## Group-Level Effects:
## ~loc (Number of levels: 8)
##               Estimate Est.Error l-95% CI u-95% CI Rhat Bulk_ESS Tail_ESS
## sd(Intercept)     0.47      0.38     0.02     1.39 1.00     2962     3075
##
## Population-Level Effects:
##           Estimate Est.Error l-95% CI u-95% CI Rhat Bulk_ESS Tail_ESS
## Intercept    -5.67      1.26    -8.32    -3.44 1.00     2867     2922
## elm           0.23      0.05     0.14     0.32 1.00     2904     2805
##
## Samples were drawn using sampling(NUTS). For each parameter, Eff.Sample
## is a crude measure of effective sample size, and Rhat is the potential
## scale reduction factor on split chains (at convergence, Rhat = 1).
```

3.3.2. Graphical displays

```
# see output in section 8 of the present Supplementary Material
mod_femrep<-marginal_effects(modf)
Female_age<-plot(mod_femrep, plot = FALSE)[[1]] +
  scale_color_grey() +
  scale_fill_grey()+
  ylim(c(0,1))+
  labs(y = "Placental scars or embryos (Probability, 95%Cr.I)")+
  labs(x = "")+
  theme(legend.position="bottom")+
  ggtitle("Females")
```

4. Relative age of males

```
# data preparation and selection
dataRrattus_M<-dataRrattus[which(dataRrattus$sex =="M"),]
dataRrattus_M<-dataRrattus_M[which(dataRrattus_M$elm!="NA"),]
# replace testis length by a binary with cutoff at 2 cm
for(i in 1:nrow(dataRrattus_M)){
  if(dataRrattus_M$tl[i]<2){
    dataRrattus_M$tlb[i]=0
  }
  if(dataRrattus_M$tl[i]>=2){
    dataRrattus_M$tlb[i]=1
  }
}
print(dataRrattus_M %>% select(ID, tl, tlb, elm, loc))
```

```
##         ID  tl tlb  elm  loc
## 1   MNA180 0.7   0 18.7   GM
## 2   MNA181 0.8   0 22.3   GM
## 6   MNA185 0.9   0 22.7   GM
## 8   MNA187 0.8   0 18.0   GM
## 11  MNA190 0.8   0 17.2   GM
## 14  MNA193 2.5   1 34.1  ESP
## 19  MNA198 0.6   0 19.1  ESP
## 28  MNA207 0.7   0 19.0  ESP
## 30  MNA209 0.8   0 19.8   PR
## 32  MNA211 2.5   1 36.2   PR
## 34  MNA213 2.4   1 39.3   PR
## 36  MNA215 1.1   0 23.3   PR
## 39  MNA218 0.8   0 24.8   PR
## 41  MNA220 0.7   0 19.9   PR
## 44  MNA223 0.8   0 19.7   PR
## 45  MNA224 0.8   0 25.3   PR
## 51  MNA230 2.0   1 36.7   BD
## 55  MNA234 0.7   0 17.8   BD
## 57  MNA236 0.8   0 21.6   BD
## 59  MNA238 0.6   0 20.4   BD
## 64  MNA243 0.6   0 17.4   MM
## 65  MNA244 0.6   0 18.9   MM
## 69  MNA248 1.9   0 33.8   MM
## 74  MNA253 0.6   0 17.4   CA
## 75  MNA254 0.6   0 14.3   CA
## 77  MNA256 2.3   1 14.7   CA
## 78  MNA257 0.8   0 17.5   CA
## 81  MNA260 0.7   0 16.2   CA
## 83  MNA262 0.7   0 19.2   CA
## 84  MNA263 0.7   0 19.6   CA
## 85  MNA264 2.5   1 34.0   CA
## 86  MNA265 0.5   0 15.8   CA
## 90  MNA269 2.6   1 34.0 MANG
## 100 MNA414 2.3   1 29.0 MANG
## 104 MNA418 0.5   0 14.0 MANG
## 105 MNA419 0.9   0 33.2 MANG
```

```
## 110 MNA424 2.5   1 30.3   PR
## 111 MNA425 2.7   1 29.5   PR
## 112 MNA426 2.5   1 43.2   PR
## 113 MNA427 2.6   1 29.5   PR
## 114 MNA428 0.9   0 29.1   GM
## 115 MNA429 1.1   0 27.5   GM
## 118 MNA432 1.1   0 29.0   PR
## 119 MNA433 2.5   1 33.9   PR
## 120 MNA434 2.4   1 32.3   PR
## 123 MNA437 2.6   1 30.5   PR
## 124 MNA438 2.4   1 34.2   GM
## 125 MNA439 2.6   1 27.6   GM
## 128 MNA442 2.2   1 31.9   BD
## 131 MNA445 2.4   1 31.8   BD
## 132 MNA446 2.1   1 25.7   BD
## 133 MNA447 2.4   1 29.6   BD
## 135 MNA449 2.6   1 31.1   BD
## 136 MNA450 2.4   1 36.7   BD
## 137 MNA451 2.5   1 25.7   MM
## 139 MNA453 2.6   1 28.3   MM
## 140 MNA454 2.5   1 30.7   MM
## 143 MNA457 2.2   1 29.5   MM
## 144 MNA458 2.6   1 27.2   BD
## 147 MNA461 2.4   1 27.0   BD
## 149 MNA463 2.6   1 29.5   MM
## 150 MNA464 2.3   1 35.4   MM
## 153 MNA467 2.5   1 30.4  ESP
## 156 MNA470 2.3   1 32.5  ESP
## 157 MNA471 2.3   1 29.1  ESP
## 160 MNA474 2.5   1 33.0  ECG
## 162 MNA476 2.4   1 31.4  ECG
## 163 MNA477 2.5   1 34.7  ECG
```

4.1. Bayesian Generalized linear mixed model with binomial error (Logistic regression)

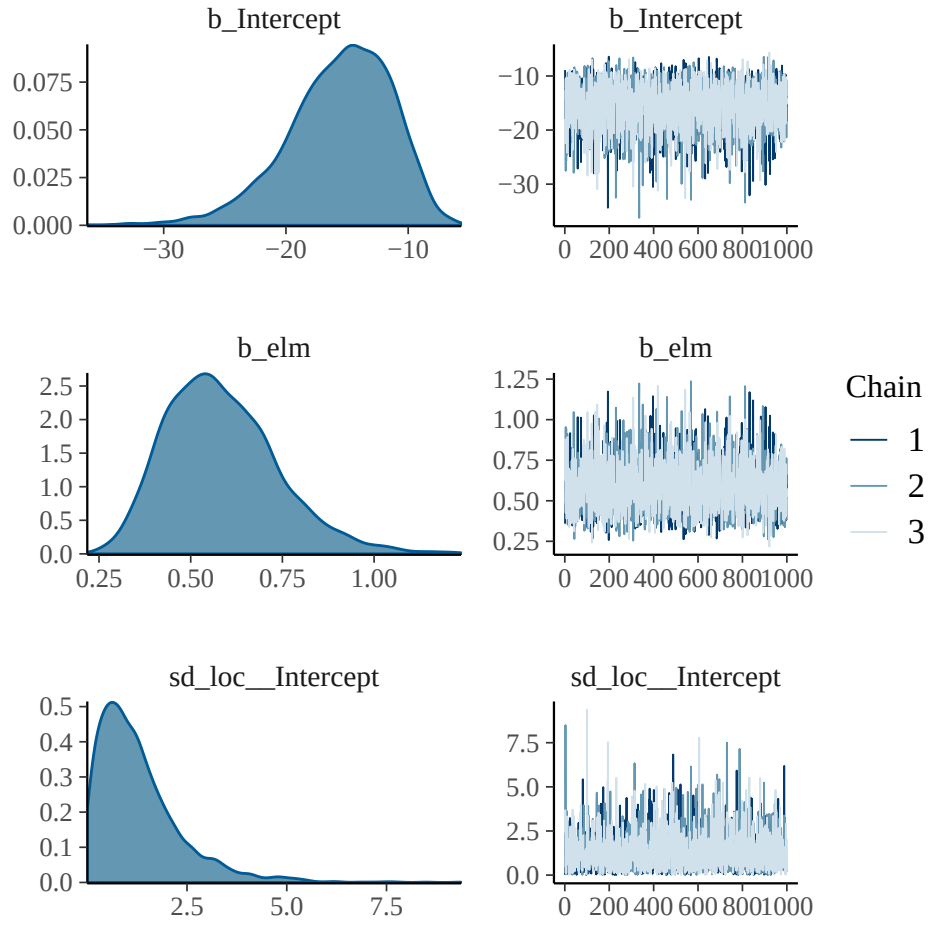
The reproductive status of males was fitted to mean eye lens weight using a binomial error and a logit link. A trapping site random intercept was set. Flat priors were chosen.

```
# one outlier removed - ID_collection = MNA256
dataRrattus_M<-dataRrattus_M[which(dataRrattus_M$ID!="MNA256"),]

priorm <- c(prior_string("normal(0,10)", class = "b"), # flat priors for betas
            prior_(~cauchy(0,25), class = ~sd,
            group = ~loc, coef = ~Intercept)) # flat prior for the random intercept

modm <- brm(tlb ~ elm+(1|loc), data = dataRrattus_M,
            family = 'bernoulli', prior = priorm,
            iter = 20000, chains = 3, thin=10, refresh = 0)
```

4.2. Model checking

4.2.1. Bayesian convergence

```
plot(modm)
```



Bayesian fit yielded in good mixing of chains.

4.2.2. Check for dispersion

```
residmodm <- residuals(modm, type='pearson', summary=FALSE)
SSresmodm <- apply(residmodm^2,1,sum)
dfm <- nrow(dataRrattus_M) - 3 # number of model coefficients
Dispm <- SSresmodm/dfm
data.frame(Mean=round(mean(Dispm),2), SE=round(sd(Dispm)/dfm,2))
```

```
##   Mean SE
## 1 1.28  0
```

The dispersion parameter is close to one indicating good fit to the data.

4.3. Model results

4.3.1. Coefficients estimations

```
# derive to Table 3 of the article
modm
```

```
##  Family: bernoulli
##   Links: mu = logit
## Formula: tlb ~ elm + (1 | loc)
##    Data: dataRrattus_M (Number of observations: 67)
## Samples: 3 chains, each with iter = 20000; warmup = 10000; thin = 10;
##          total post-warmup samples = 3000
##
## Group-Level Effects:
## ~loc (Number of levels: 8)
##               Estimate Est.Error l-95% CI u-95% CI Rhat Bulk_ESS Tail_ESS
## sd(Intercept)     1.30      1.06     0.06     4.05 1.00     2938     2812
##
## Population-Level Effects:
##           Estimate Est.Error l-95% CI u-95% CI Rhat Bulk_ESS Tail_ESS
## Intercept   -15.62      4.27   -25.32    -8.84 1.00     3041     2923
## elm           0.58      0.15     0.34     0.93 1.00     3052     2804
##
## Samples were drawn using sampling(NUTS). For each parameter, Eff.Sample
## is a crude measure of effective sample size, and Rhat is the potential
## scale reduction factor on split chains (at convergence, Rhat = 1).
```

4.3.2. Graphical displays

```
# see output in section 8 of the present Supplementary Material
mod_testis<-marginal_effects(modm)
Male_age<-plot(mod_testis, plot = FALSE)[[1]] +
  scale_color_grey() +
  scale_fill_grey()+
  ylim(c(0,1))+
  labs(y = "Testis above 2 cm (Probability, 95%Cr.I)")+
  labs(x = "")+
  theme(legend.position="bottom")+
  ggtitle("Males")
```

5. Variation in eviscerated body mass of adult black rats according to sex, habitat and season

```
# data preparation and selection
dataRrattus_W<-dataRrattus[which(dataRrattus$ebm!="NA"),]
dataRrattus_W<-dataRrattus_W[which(dataRrattus_W$age =="Ad"),]
dataRrattus_W<-dataRrattus_W[which(dataRrattus_W$hab!="cg"),]
print(dataRrattus_W %>% select(ID, ebm, sex, hab, seas, loc))
```

```
##         ID ebm sex hab seas  loc
## 12  MNA191 107   F dec  Wet   GM
## 14  MNA193 108   M eve  Wet  ESP
## 18  MNA197  96   F eve  Wet  ESP
## 20  MNA199 120   F eve  Wet  ESP
## 32  MNA211 130   M eve  Wet   PR
## 34  MNA213 137   M eve  Wet   PR
## 37  MNA216 122   F eve  Wet   PR
## 38  MNA217 123   F eve  Wet   PR
## 40  MNA219 138   F eve  Wet   PR
## 46  MNA225 113   F mnt  Wet   BD
## 47  MNA226 103   F mnt  Wet   BD
## 49  MNA228 115   F mnt  Wet   BD
## 51  MNA230 105   M mnt  Wet   BD
## 53  MNA232  98   F mnt  Wet   BD
## 54  MNA233 118   F mnt  Wet   BD
## 61  MNA240 119   F mnt  Wet   MM
## 63  MNA242  95   F mnt  Wet   MM
## 66  MNA245 125   F mnt  Wet   MM
## 67  MNA246 103   F mnt  Wet   MM
## 69  MNA248 110   M mnt  Wet   MM
## 71  MNA250 107   F mnt  Wet   MM
## 72  MNA251 110   F mnt  Wet   MM
## 79  MNA258  91   F dec  Wet   CA
## 85  MNA264  99   M dec  Wet   CA
## 90  MNA269 110   M swa  Wet MANG
## 95  MNA274 124   F swa  Wet MANG
## 101 MNA415 137   F swa  Dry MANG
## 105 MNA419 104   M swa  Dry MANG
## 107 MNA421  96   F dec  Dry   CA
## 109 MNA423 128   F eve  Dry   PR
## 110 MNA424 134   M eve  Dry   PR
## 112 MNA426 107   M eve  Dry   PR
## 117 MNA431  80   F eve  Dry   PR
## 120 MNA434 136   M eve  Dry   PR
## 121 MNA435 112   F dec  Dry   GM
## 123 MNA437 173   M eve  Dry   PR
## 124 MNA438  95   M dec  Dry   GM
## 126 MNA440 112   F dec  Dry   GM
## 127 MNA441  90   F mnt  Dry   BD
## 128 MNA442 120   M mnt  Dry   BD
## 129 MNA443 142   F mnt  Dry   BD
## 131 MNA445 126   M mnt  Dry   BD
## 135 MNA449 100   M mnt  Dry   BD
```

```
## 136 MNA450 150   M mnt  Dry   BD
## 140 MNA454 141   M mnt  Dry   MM
## 145 MNA459 122   F mnt  Dry   BD
## 148 MNA462 100   F mnt  Dry   MM
## 150 MNA464 128   M mnt  Dry   MM
## 151 MNA465 100   F mnt  Dry   MM
## 152 MNA466  90   F mnt  Dry   MM
## 153 MNA467 119   M eve  Dry  ESP
## 154 MNA468 140   F eve  Dry  ESP
## 155 MNA469 140   F eve  Dry  ESP
## 156 MNA470 160   M eve  Dry  ESP
## 158 MNA472 131   F eve  Dry  ESP
## 159 MNA473 120   F eve  Dry  ESP
## 167 MNA481 154   F eve  Dry  ESP
```

The Creole garden habitat was not included in the analysis due to few observations (n=7)

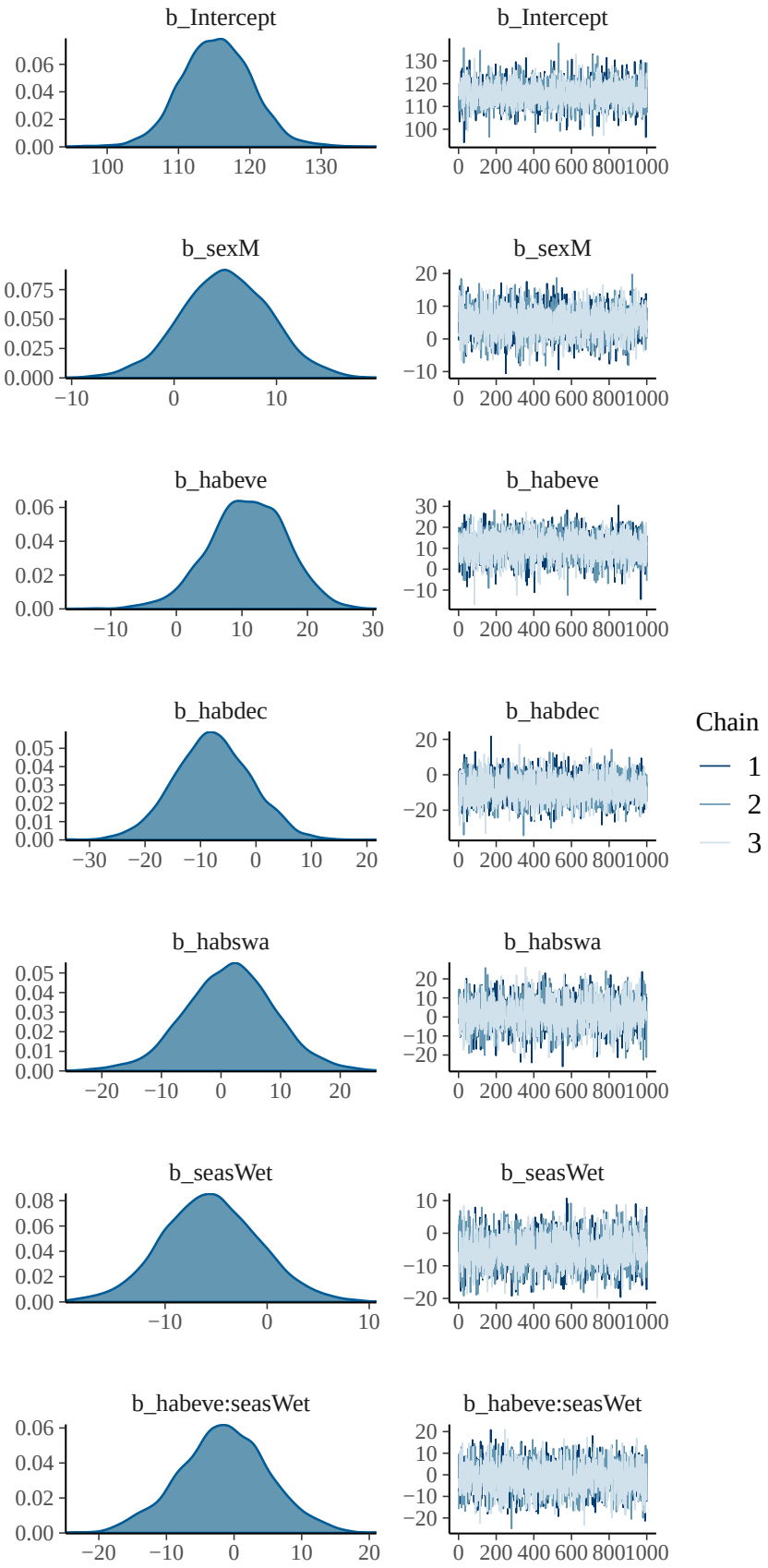
5.1. Bayesian linear mixed model with gaussian error

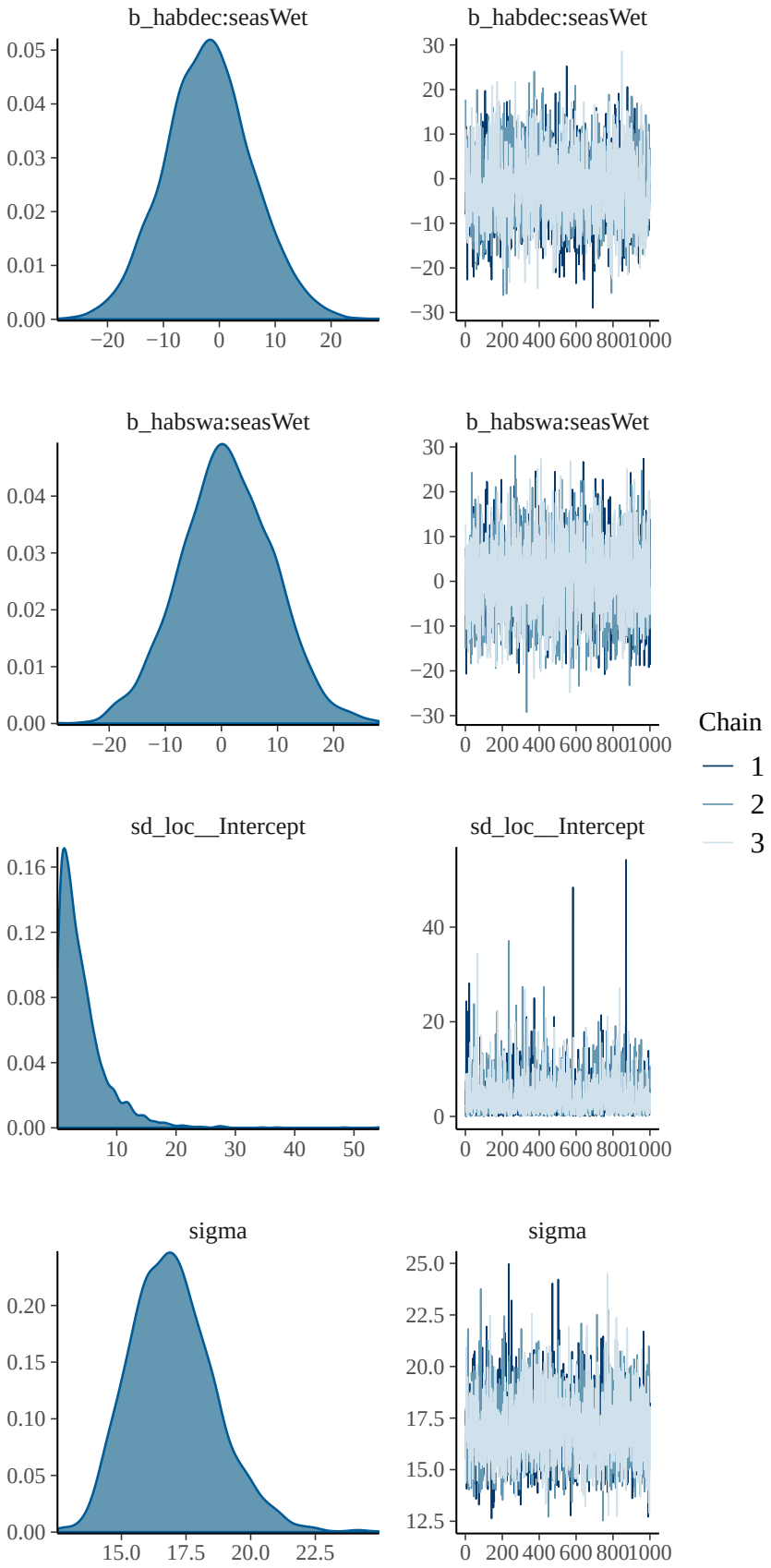
```
priorw <- c(prior_string("normal(0,10)", class = "b"),
           prior_(~cauchy(0,25), class = ~sd,
                  group = ~loc, coef = ~Intercept),
           set_prior("normal(0,10)", class="sigma"))

modw <- brm(ebm ~ sex + (hab+seas)^2 + (1|loc), data = dataRrattus_W,
            prior = priorw,
            iter = 20000, chains = 3, thin=10, refresh=0)
```

5.2. Model checking

5.2.1. Bayesian convergence

```
plot(modw, N=7)
```

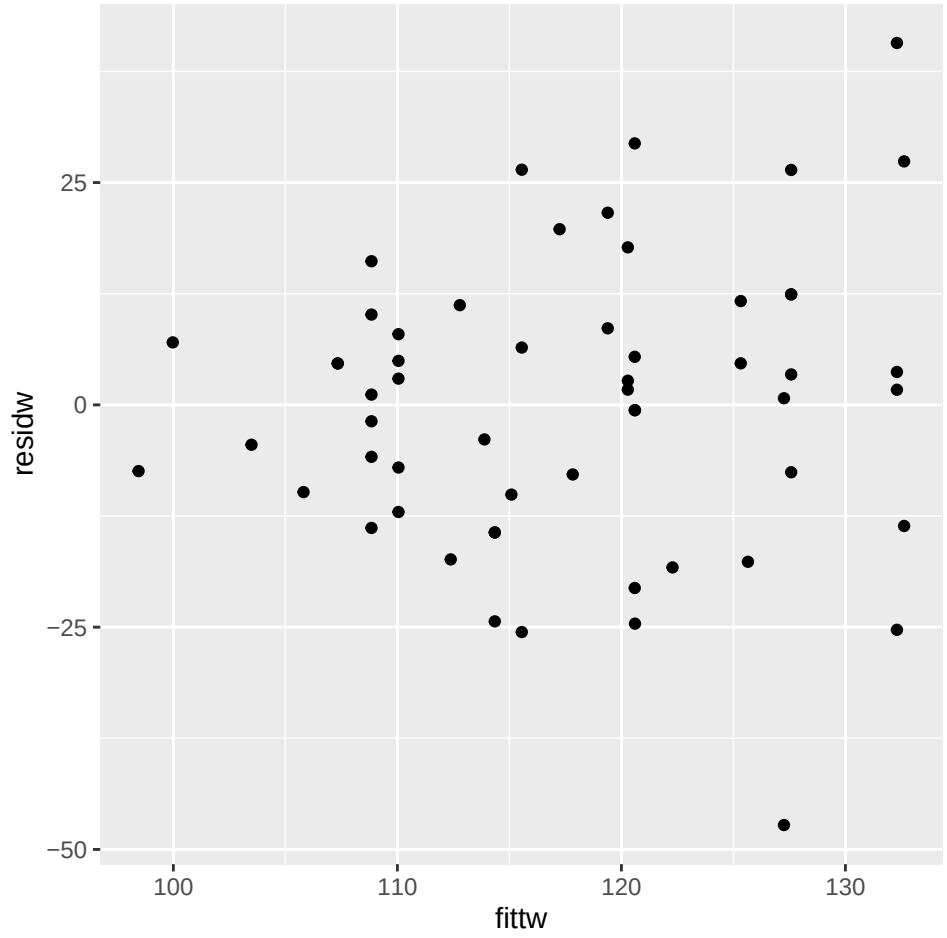

b_Intercept
b_Intercept
b_sexM
b_sexM
b_habeve
b_habeve
b_habdec
b_habdec
b_habswa
b_habswa
b_seasWet
b_seasWet
b_habeve:seasWet
b_habeve:seasWet
Chain
1
2
3


b_habdec:seasWet
b_habdec:seasWet
b_habswa:seasWet
b_habswa:seasWet
sd_loc__Intercept
sd_loc__Intercept
sigma
sigma
Chain
1
2
3

Bayesian fit yielded in good mixing of chains.

5.2.2. Variance homoscedasticity

```
residw = resid(modw)[, "Estimate"]
fittw = fitted(modw)[, "Estimate"]
ggplot() + geom_point(data = NULL, aes(y = residw, x = fittw))
```



There are no major problems with the Gaussian variance error distribution. Although variance seems inflated for larger fitted values, this is mainly caused by two extreme points and >90% of residuals are within a range of values within -25 and +25. We keep with a Gaussian error variance for this model.

5.3. Model results

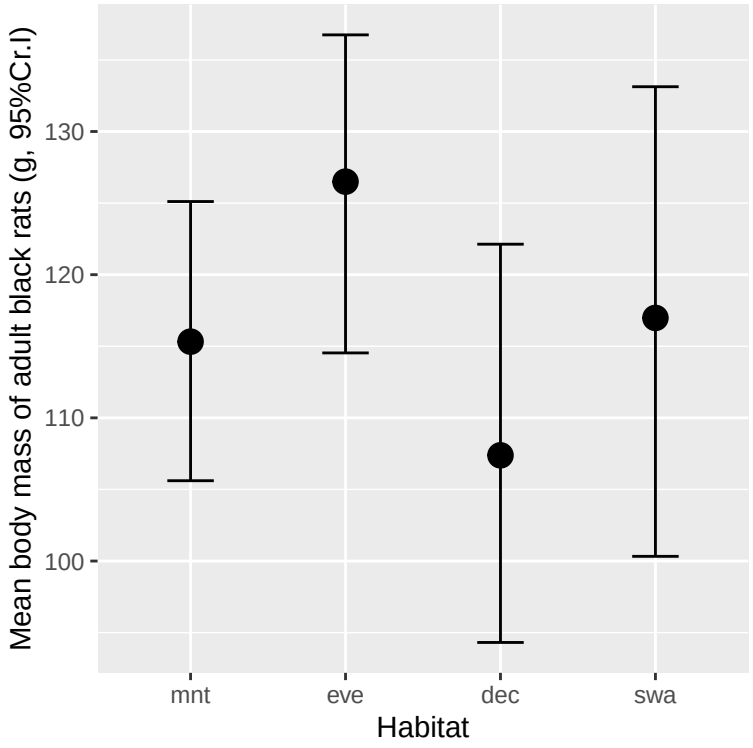
5.3.1. Coefficients estimations

```
modw
```

```
##  Family: gaussian
##   Links: mu = identity; sigma = identity
## Formula: ebm ~ sex + (hab + seas)^2 + (1 | loc)
##    Data: dataRrattus_W (Number of observations: 57)
## Samples: 3 chains, each with iter = 20000; warmup = 10000; thin = 10;
##          total post-warmup samples = 3000
##
## Group-Level Effects:
## ~loc (Number of levels: 7)
##               Estimate Est.Error l-95% CI u-95% CI Rhat Bulk_ESS Tail_ESS
## sd(Intercept)     4.17      4.19     0.12    14.80 1.00     2755     2649
##
## Population-Level Effects:
##                Estimate Est.Error l-95% CI u-95% CI Rhat Bulk_ESS Tail_ESS
## Intercept        115.35      5.04   105.61   125.11 1.00     2853     2666
## sexM               5.04      4.35    -3.71    13.60 1.00     2645     2853
## habeve            10.86      5.94    -1.22    21.84 1.00     2934     2770
## habdec            -7.75      6.95   -21.36     5.71 1.00     3051     2898
## habswa             1.49      7.49   -13.80    16.40 1.00     2741     2883
## seasWet           -5.50      4.72   -14.52     4.07 1.00     2654     2471
## habeve:seasWet    -1.47      6.58   -14.63    11.57 1.00     3003     2652
## habdec:seasWet    -1.86      7.88   -17.16    14.22 1.00     2693     2753
## habswa:seasWet     1.05      8.30   -15.19    17.14 1.00     2992     2855
##
## Family Specific Parameters:
##       Estimate Est.Error l-95% CI u-95% CI Rhat Bulk_ESS Tail_ESS
## sigma    17.00      1.65    14.22    20.59 1.00     2880     2666
##
## Samples were drawn using sampling(NUTS). For each parameter, Eff.Sample
## is a crude measure of effective sample size, and Rhat is the potential
## scale reduction factor on split chains (at convergence, Rhat = 1).
```

5.3.2. Graphical display

```
BW<-marginal_effects(modw, effects = "hab")
plot(BW, plot = FALSE)[[1]] +
  scale_color_grey() +
  labs(y = "Mean body mass of adult black rats (g, 95%Cr.I)")+
  labs(x = "Habitat")+
  theme(legend.position="bottom")
```



6. Variation in trapping rate of adult black rats according to habitats and seasons

```
# data selection and preparation
dataRrattus_TR<-read.table("data_trapping_Rattus_rattus_Guadeloupe.txt", header=T)
dataRrattus_TR_Ad<-dataRrattus_TR[which(dataRrattus_TR$Age =="A"),]
print(dataRrattus_TR_Ad)
```

```
##                     Site             Habitat Season Age n_capt effort
## 2    Gros_Morne_Deshaies  Semi_deciduous_dry    wet   A      1     78
## 4    Gros_Morne_Deshaies  Semi_deciduous_dry    dry   A      7    119
## 6        Barre_de_Cadoue  Semi_deciduous_dry    wet   A      4     51
## 8        Barre_de_Cadoue  Semi_deciduous_dry    dry   A      3    176
## 10     Piton_Sainte_Rose  Seasonal_evergreen    wet   A      5     42
## 12     Piton_Sainte_Rose  Seasonal_evergreen    dry   A     10     60
## 14             Esperance  Seasonal_evergreen    wet   A      4     37
## 16             Esperance  Seasonal_evergreen    dry   A      8     72
## 18      Col_des_Mamelles Mountain_rainforest    wet   A      7     29
## 20      Col_des_Mamelles Mountain_rainforest    dry   A     12     62
## 22            Bras_David Mountain_rainforest    wet   A      6     30
## 24            Bras_David Mountain_rainforest    dry   A     12     60
## 26 Maison_de_la_mangrove        Swamp_forest    wet   A      2     60
## 28 Maison_de_la_mangrove        Swamp_forest    dry   A      5     42
##    night t_effort sprung t_effort_corr obs_rate
## 2      2      156      1           155    0.006
## 4      3      357     28           329    0.021
## 6      1       51      9            42    0.095
## 8      5      880     12           868    0.003
## 10     2       84     12            72    0.069
## 12     2      120     15           105    0.095
## 14     1       37      9            28    0.143
## 16     2      144     15           129    0.062
## 18     1       29      7            22    0.318
## 20     2      124     13           111    0.108
## 22     1       30      4            26    0.231
## 24     2      120     19           101    0.119
## 26     2      120      8           112    0.018
## 28     2       84      7            77    0.065
```

6.1. Bayesian generalized linear mixed model with betabinomial error

```
# Binomial error with logit
modTR_binom <- brm(n_capt|trials(t_effort_corr) ~ (Habitat+Season)^2,
                   prior = set_prior('normal(0, 10)'),
                   data = dataRrattus_TR_Ad, family = binomial(),
                   iter = 20000, chains = 3, thin=10, refresh = 0)
# check dispersion
residTR_binom <- residuals(modTR_binom, type='pearson', summary=FALSE)
SSresidTR_binom <- apply(residTR_binom^2,1,sum)
dfTR_binnom <- nrow(dataRrattus_TR_Ad) - 5 # number of model coefficients
DispTR_binom <- SSresidTR_binom/dfTR_binnom
data.frame(Mean=round(mean(DispTR_binom),2),
           SE=round(sd(DispTR_binom)/dfTR_binnom,2))
```

```
##   Mean   SE
## 1 2.38 0.03
```

There is overdispersion with the binomial model, the dispersion parameter being > 2.00.

```
# Functions defining the betabinomial error distribution in 'brms'
# Paul Bürkner(2019)
#https://cran.r-project.org/web/packages/brms/vignettes/
#brms_customfamilies.html#the-beta-binomial-distribution

beta_binomial2 <- custom_family(
  "beta_binomial2", dpars = c("mu", "phi"),
  links = c("logit", "log"), lb = c(NA, 0),
  type = "int", vars = "vint1[n]"
)

stan_funs <- "
  real beta_binomial2_lpmf(int y, real mu, real phi, int T) {
    return beta_binomial_lpmf(y | T, mu * phi, (1 - mu) * phi);
  }
  int beta_binomial2_rng(real mu, real phi, int T) {
    return beta_binomial_rng(T, mu * phi, (1 - mu) * phi);
  }
"
stanvars <- stanvar(scode = stan_funs, block = "functions")

log_lik_beta_binomial2 <- function(i, draws) {
  mu <- draws$dpars$mu[, i]
  phi <- draws$dpars$phi
  trials <- draws$data$vint1[i]
  y <- draws$data$Y[i]
  beta_binomial2_lpmf(y, mu, phi, trials)
}

predict_beta_binomial2 <- function(i, draws, ...) {
  mu <- draws$dpars$mu[, i]
  phi <- draws$dpars$phi
  trials <- draws$data$vint1[i]
  beta_binomial2_rng(mu, phi, trials)
}
```

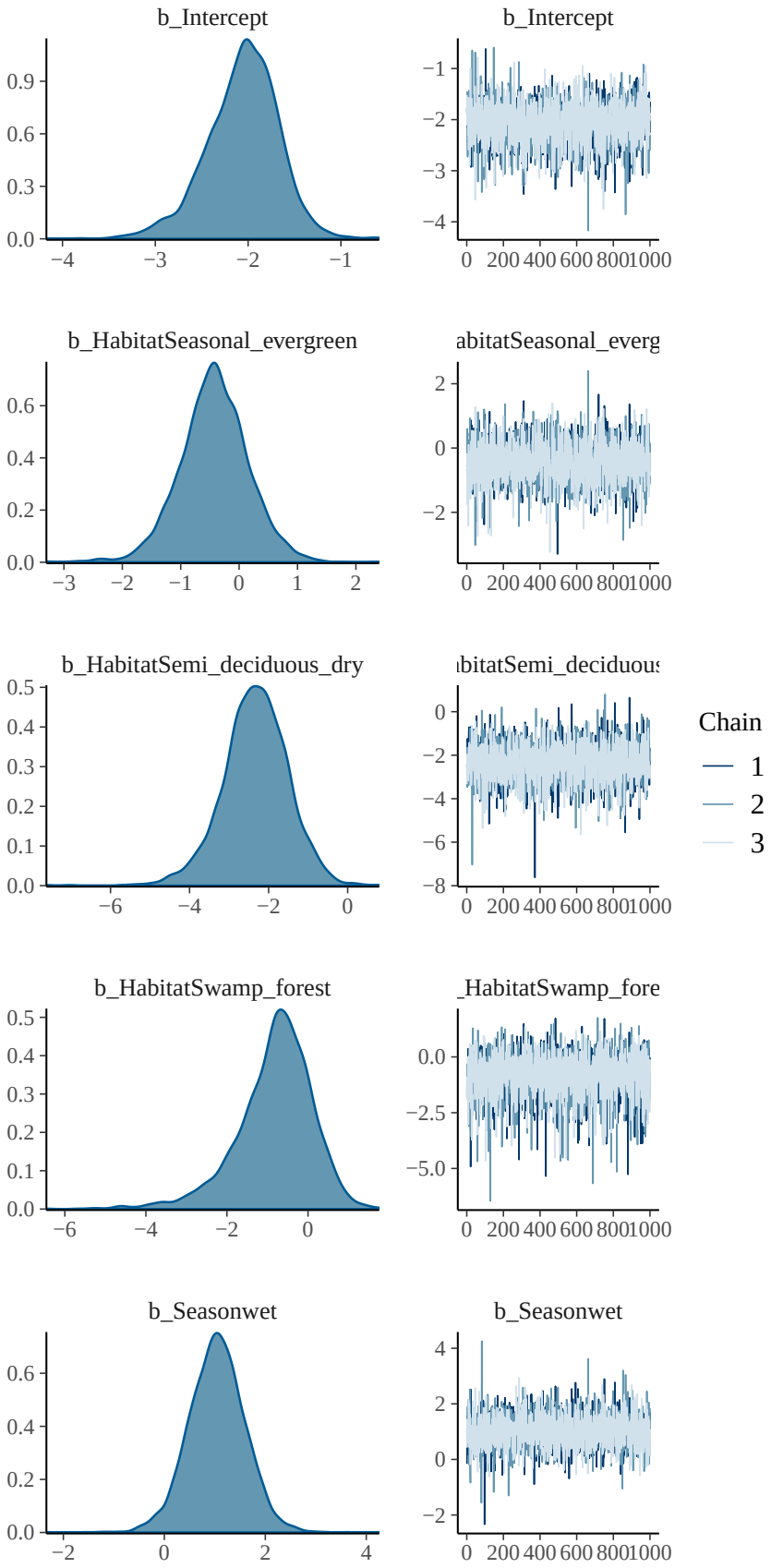
```
fitted_beta_binomial2 <- function(draws) {
  mu <- draws$dpars$mu
  trials <- draws$data$vint1
  trials <- matrix(trials, nrow = nrow(mu), ncol = ncol(mu), byrow = TRUE)
  mu * trials
}
```

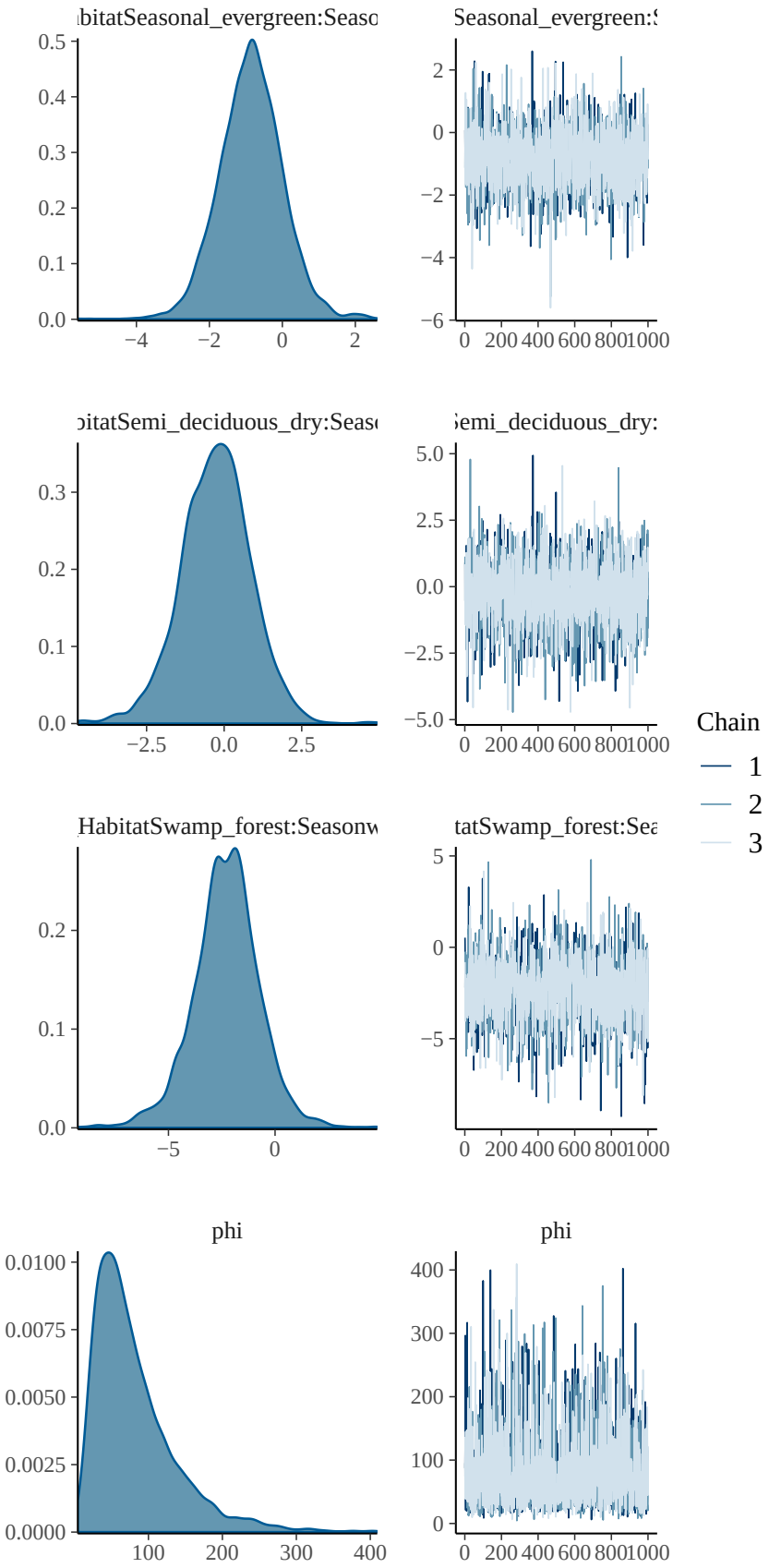
```
prior = set_prior('normal(0, 10)')
modTR_Bbinom <- brm(n_capt|vint(t_effort_corr) ~ (Habitat+Season)^2,
                    prior = prior,
                    data = dataRrattus_TR_Ad, family = beta_binomial2,
                    stanvars = stanvars, iter = 20000, chains = 3,
                    thin=10, refresh = 0)
```

6.2. Model checking

6.2.1. Bayesian convergence

```
plot(modTR_Bbinom, N=5)
```


b_Intercept
b_Intercept
b_HabitatSeasonal_evergreen
abitatSeasonal_everg
b_HabitatSemi_deciduous_dry
ıbitatSemi_deciduous
b_HabitatSwamp_forest
_HabitatSwamp_fore
b_Seasonwet
b_Seasonwet
Chain
1
2
3


bitatSeasonal_evergreen:Seaso
Seasonal_evergreen:S
bitatSemi_deciduous_dry:Seas
emi_deciduous_dry:
HabitatSwamp_forest:Seasonw
tatSwamp_forest:Sea
phi
phi
Chain
1
2
3

Bayesian fit yielded in good mixing of chains.

6.2.2. Dispersion

```
# check dispersion - have to be run outside RMarkdown
#residTR_Bbinom <- residuals(modTR_Bbinom, type='pearson', summary=FALSE)
#SSresidTR_Bbinom <- apply(residTR_Bbinom^2,1,sum)
#dfTR_Bbinnom <- nrow(dataRrattus_TR_Ad) - 5 # number of model coefficients
#DispTR_Bbinom <- SSresidTR_Bbinom/dfTR_Bbinnom
#data.frame(Mean=round(mean(DispTR_binom),2),
#SE=round(sd(DispTR_binom)/dfTR_binnom,2))
```

Dispersion calculated from a run of the model: Mean SE 1 0.96 0.05

There is no overdispersion with the betabinomial error model.

6.3. Model results

6.3.1. Coefficients estimations

```
modTR_Bbinom
```

```
##  Family: beta_binomial2
##   Links: mu = logit; phi = identity
## Formula: n_capt | vint(t_effort_corr) ~ (Habitat + Season)^2
##    Data: dataRrattus_TR_Ad (Number of observations: 14)
## Samples: 3 chains, each with iter = 20000; warmup = 10000; thin = 10;
##          total post-warmup samples = 3000
##
## Population-Level Effects:
##                                    Estimate Est.Error l-95% CI u-95% CI
## Intercept                             -2.06      0.39    -2.93    -1.36
## HabitatSeasonal_evergreen             -0.43      0.59    -1.59     0.74
## HabitatSemi_deciduous_dry             -2.33      0.83    -4.03    -0.77
## HabitatSwamp_forest                   -0.82      0.94    -3.04     0.72
## Seasonwet                              1.04      0.56    -0.08     2.12
## HabitatSeasonal_evergreen:Seasonwet   -0.86      0.87    -2.53     0.88
## HabitatSemi_deciduous_dry:Seasonwet   -0.26      1.13    -2.60     1.91
## HabitatSwamp_forest:Seasonwet         -2.29      1.56    -5.58     0.73
##                                    Rhat Bulk_ESS Tail_ESS
## Intercept                          1.00     2821     2948
## HabitatSeasonal_evergreen          1.00     2907     3074
## HabitatSemi_deciduous_dry          1.00     2830     2430
## HabitatSwamp_forest                1.00     2963     3000
## Seasonwet                          1.00     2856     2756
## HabitatSeasonal_evergreen:Seasonwet 1.00     2861     2732
## HabitatSemi_deciduous_dry:Seasonwet 1.00     2971     2908
## HabitatSwamp_forest:Seasonwet       1.00     2596     2735
##
## Family Specific Parameters:
##     Estimate Est.Error l-95% CI u-95% CI Rhat Bulk_ESS Tail_ESS
## phi    81.35     55.92    17.23   235.45 1.00     2882     2757
##
```

```
## Samples were drawn using sampling(NUTS). For each parameter, Eff.Sample
## is a crude measure of effective sample size, and Rhat is the potential
## scale reduction factor on split chains (at convergence, Rhat = 1).
```

6.3.2. Graphical display

```
TR<-marginal_effects(modTR_Bbinom, conditions = data.frame(t_effort_corr = 1), effects = "Habitat")
Adults<-plot(TR, plot = FALSE)[[1]] +
  theme(plot.title = element_text(size = 12,face="bold"),
        panel.background = element_blank(),
        axis.line = element_line(colour = "black"),
        axis.text.x = element_text(colour="black", size=7),
        axis.title.x = element_text(size=9))+
  ylim(c(0,0.6))+
  labs(y = "")+
  labs(x = "")+
  ggtitle("Adults")+
  theme(legend.position="")
```

7. Variation in trapping rate of young black rats according to habitats and seasons

```
# data selection and preparation
dataRrattus_TR_J_S<-dataRrattus_TR[which(dataRrattus_TR$Age =="J_S"),]
print(dataRrattus_TR_J_S)
```

```
##                     Site             Habitat Season Age n_capt effort
## 1    Gros_Morne_Deshaies  Semi_deciduous_dry    wet J_S     11     78
## 3    Gros_Morne_Deshaies  Semi_deciduous_dry    dry J_S      0    119
## 5        Barre_de_Cadoue  Semi_deciduous_dry    wet J_S     12     51
## 7        Barre_de_Cadoue  Semi_deciduous_dry    dry J_S      0    176
## 9      Piton_Sainte_Rose  Seasonal_evergreen    wet J_S     11     42
## 11     Piton_Sainte_Rose  Seasonal_evergreen    dry J_S      0     60
## 13             Esperance  Seasonal_evergreen    wet J_S     12     37
## 15             Esperance  Seasonal_evergreen    dry J_S      0     72
## 17      Col_des_Mamelles Mountain_rainforest    wet J_S      5     29
## 19      Col_des_Mamelles Mountain_rainforest    dry J_S      0     62
## 21            Bras_David Mountain_rainforest    wet J_S      8     30
## 23            Bras_David Mountain_rainforest    dry J_S      0     60
## 25 Maison_de_la_mangrove        Swamp_forest    wet J_S      6     60
## 27 Maison_de_la_mangrove        Swamp_forest    dry J_S      2     42
##    night t_effort sprung t_effort_corr obs_rate
## 1      2      156      1           155    0.071
## 3      3      357     28           329    0.000
## 5      1       51      9            42    0.286
## 7      5      880     12           868    0.000
## 9      2       84     12            72    0.153
## 11     2      120     15           105    0.000
## 13     1       37      9            28    0.429
## 15     2      144     15           129    0.000
## 17     1       29      7            22    0.227
## 19     2      124     13           111    0.000
## 21     1       30      4            26    0.308
## 23     2      120     19           101    0.000
## 25     2      120      8           112    0.054
## 27     2       84      7            77    0.026
```

7.1. Bayesian generalized linear mixed model with betabbinomial error

```
# Binomial error with logit
modTR_JS_binom <- brm(n_capt|trials(t_effort_corr) ~ (Habitat+Season)^2,
                  prior = set_prior('normal(0, 10)'),
                  data = dataRrattus_TR_J_S, family = binomial(),
                  iter = 20000, chains = 3, thin=10, refresh = 0)
# check dispersion
residTR_JS_binom <- residuals(modTR_JS_binom, type='pearson', summary=FALSE)
SSresidTR_JS_binom <- apply(residTR_JS_binom^2,1,sum)
dfTR_JS_binnom <- nrow(dataRrattus_TR_J_S) - 5 # number of model coefficients
DispTR_JS_binom <- SSresidTR_JS_binom/dfTR_JS_binnom
data.frame(Mean=round(mean(DispTR_JS_binom),2),
           SE=round(sd(DispTR_JS_binom)/dfTR_JS_binnom,2))
```

```
##   Mean  SE
## 1 2.59 0.1
```

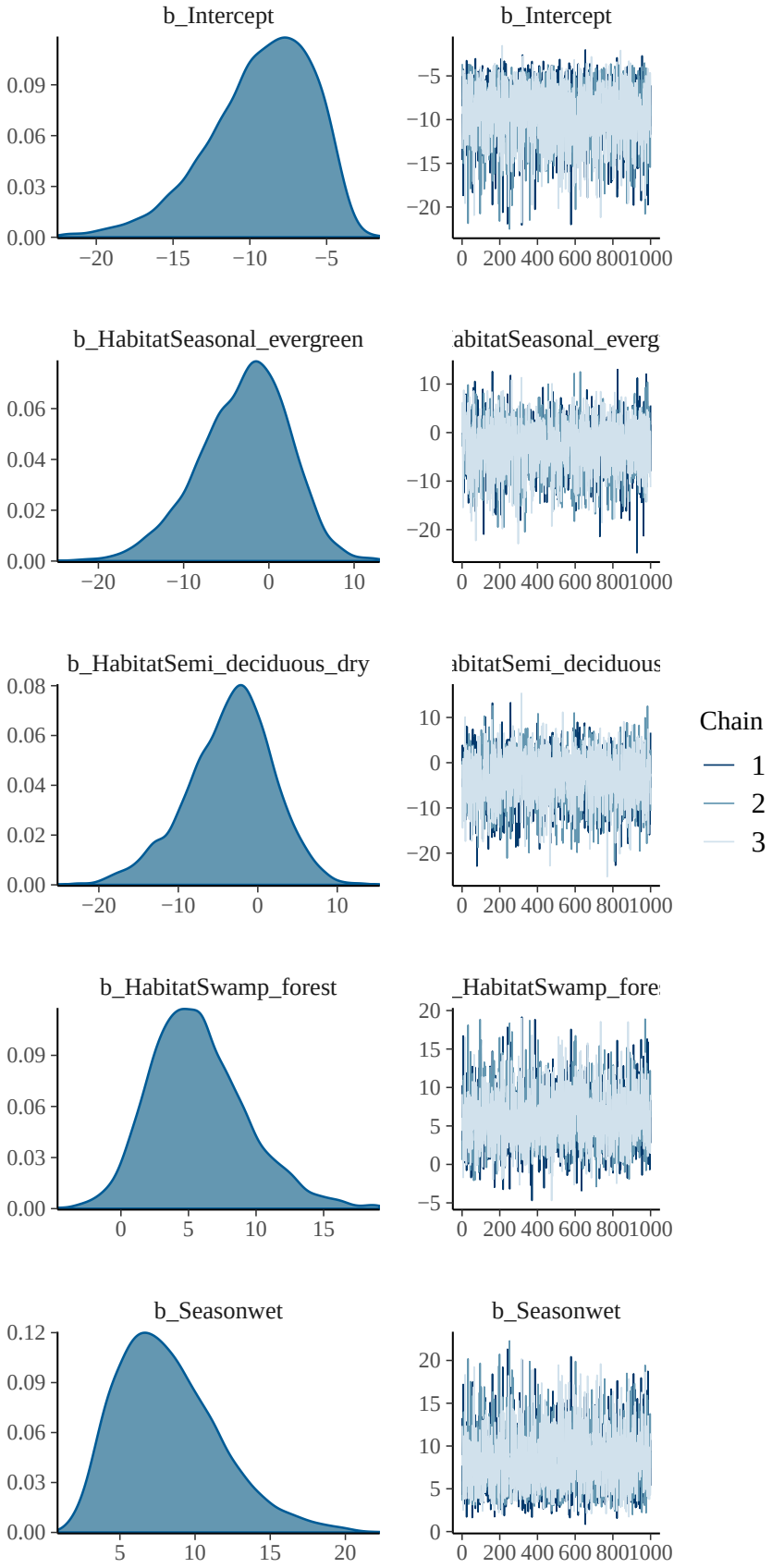
There is overdispersion with the binomial model, the dispersion parameter being > 2.00

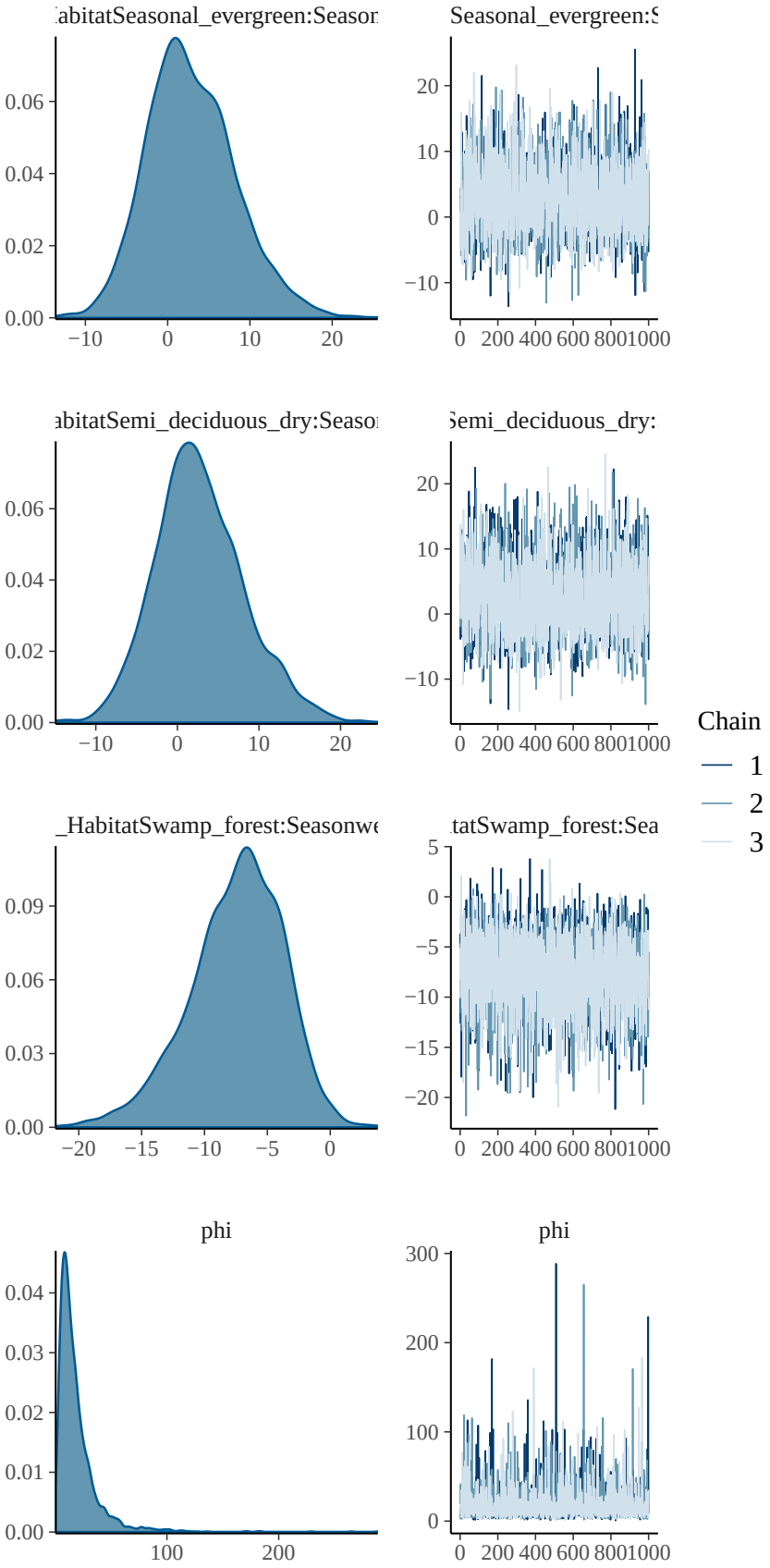
```
# Betabinomial error with logit
modTR_JS_Bbinom <- brm(n_capt|vint(t_effort_corr) ~ (Habitat+Season)^2,
                       prior = set_prior('normal(0, 10)'),
                       data = dataRrattus_TR_J_S, family = beta_binomial2,
                       stanvars = stanvars, iter = 20000, chains = 3,
                       thin=10, refresh = 0)
```

7.2. Model checking

7.2.1. Bayesian convergence

```
plot(modTR_JS_Bbinom, N=5)
```


b_Intercept
b_Intercept
b_HabitatSeasonal_evergreen
abitatSeasonal_everg
b_HabitatSemi_deciduous_dry
abitatSemi_deciduous
b_HabitatSwamp_forest
_HabitatSwamp_fore
b_Seasonwet
b_Seasonwet
Chain
1
2
3


abitatSeasonal_evergreen:Seasor
Seasonal_evergreen:S
abitatSemi_deciduous_dry:Seaso
Semi_deciduous_dry:
_HabitatSwamp_forest:Seasonwe
tatSwamp_forest:Sea
phi
phi
Chain
1
2
3

7.2.2. Dispersion

```
# check dispersion - have to be run outside RMarkdown
#residTR_JS_Bbinom <- residuals(modTR_JS_Bbinom, type='pearson', summary=FALSE)
#SSresidTR_JS_Bbinom <- apply(residTR_JS_Bbinom^2,1,sum)
#dfTR_JS_Bbinnom <- nrow(dataRrattus_TR_J_S) - 5 # number of model coefficients
#DispTR_JS_Bbinom <- SSresidTR_JS_Bbinom/dfTR_JS_Bbinnom

#data.frame(Mean=round(mean(DispTR_JS_binom),2),
#SE=round(sd(DispTR_JS_binom)/dfTR_JS_binnom,2))
```

Dispersion calculated from a run of the model:

```
   Mean        SE
```

1 0.75 0.18

There is no overdispersion with the betabinomial error model.

7.3. Model results

7.3.1. Coefficients estimations

```
modTR_JS_Bbinom
```

```
##  Family: beta_binomial2
##   Links: mu = logit; phi = identity
## Formula: n_capt | vint(t_effort_corr) ~ (Habitat + Season)^2
##    Data: dataRrattus_TR_J_S (Number of observations: 14)
## Samples: 3 chains, each with iter = 20000; warmup = 10000; thin = 10;
##          total post-warmup samples = 3000
##
## Population-Level Effects:
##                                   Estimate Est.Error l-95% CI u-95% CI
## Intercept                            -9.27      3.40   -17.10    -4.13
## HabitatSeasonal_evergreen            -2.92      5.29   -14.26     6.28
## HabitatSemi_deciduous_dry            -3.47      5.42   -15.23     6.39
## HabitatSwamp_forest                   5.74      3.56    -0.20    13.70
## Seasonwet                             8.25      3.41     3.07    16.26
## HabitatSeasonal_evergreen:Seasonwet   2.90      5.34    -6.49    14.38
## HabitatSemi_deciduous_dry:Seasonwet   2.78      5.45    -6.96    14.58
## HabitatSwamp_forest:Seasonwet        -7.46      3.70   -15.66    -1.22
##                                   Rhat Bulk_ESS Tail_ESS
## Intercept                         1.00     2781     2769
## HabitatSeasonal_evergreen         1.00     2678     2408
## HabitatSemi_deciduous_dry         1.00     3161     2666
## HabitatSwamp_forest               1.00     2796     2865
## Seasonwet                         1.00     2749     2802
## HabitatSeasonal_evergreen:Seasonwet 1.00     2575     2735
## HabitatSemi_deciduous_dry:Seasonwet 1.00     3085     2752
## HabitatSwamp_forest:Seasonwet       1.00     2780     3022
##
## Family Specific Parameters:
##     Estimate Est.Error l-95% CI u-95% CI Rhat Bulk_ESS Tail_ESS
```

```
## phi    19.34     19.35     2.92    69.92 1.00     3046     3077
##
## Samples were drawn using sampling(NUTS). For each parameter, Eff.Sample
## is a crude measure of effective sample size, and Rhat is the potential
## scale reduction factor on split chains (at convergence, Rhat = 1).
```

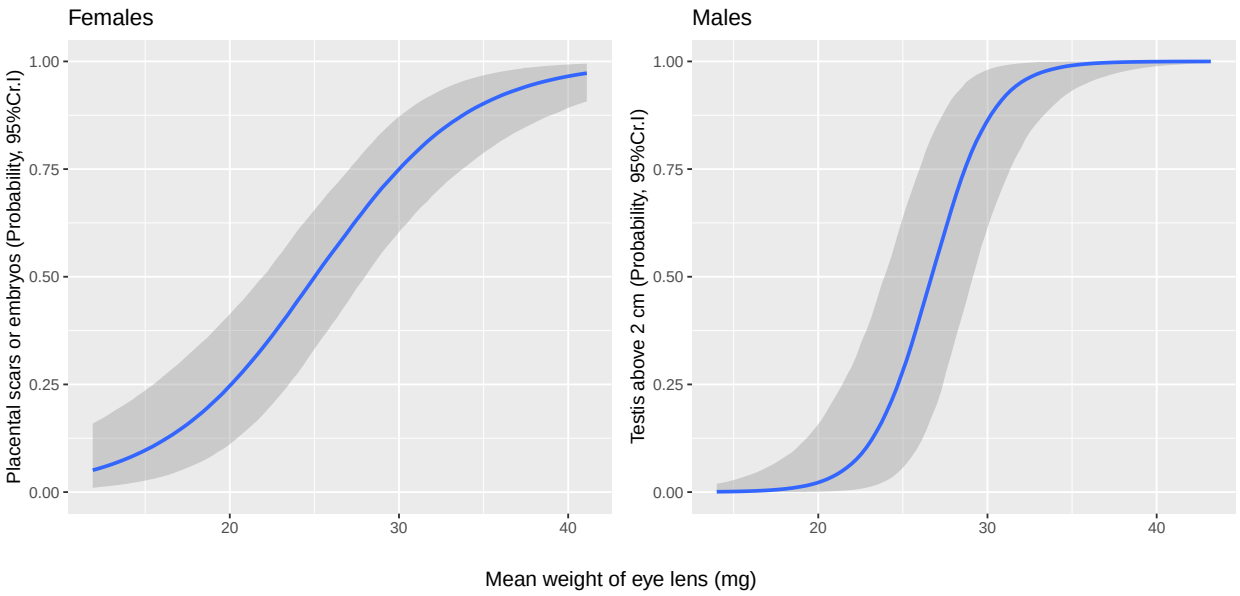
7.3.2. Graphical display

```
TJS<-marginal_effects(modTR_JS_Bbinom, conditions = data.frame(t_effort_corr = 1),
                      effects="Habitat:Season")
Juveniles<-plot(TJS, plot = FALSE)[[1]] +
  theme(plot.title = element_text(size = 12,face="bold"),
        panel.background = element_blank(),
        axis.line = element_line(colour = "black"),
        axis.text.x = element_text(colour="black", size=7),
        axis.title.x = element_text(size=9))+
  ylim(c(0,0.6))+
  labs(y = "")+
  labs(x = "")+
  ggtitle("Young")+
  theme(legend.position=c(.9, .9))
```

8. Figure output for the article

8.1. Relative age of black rats - Figure 3

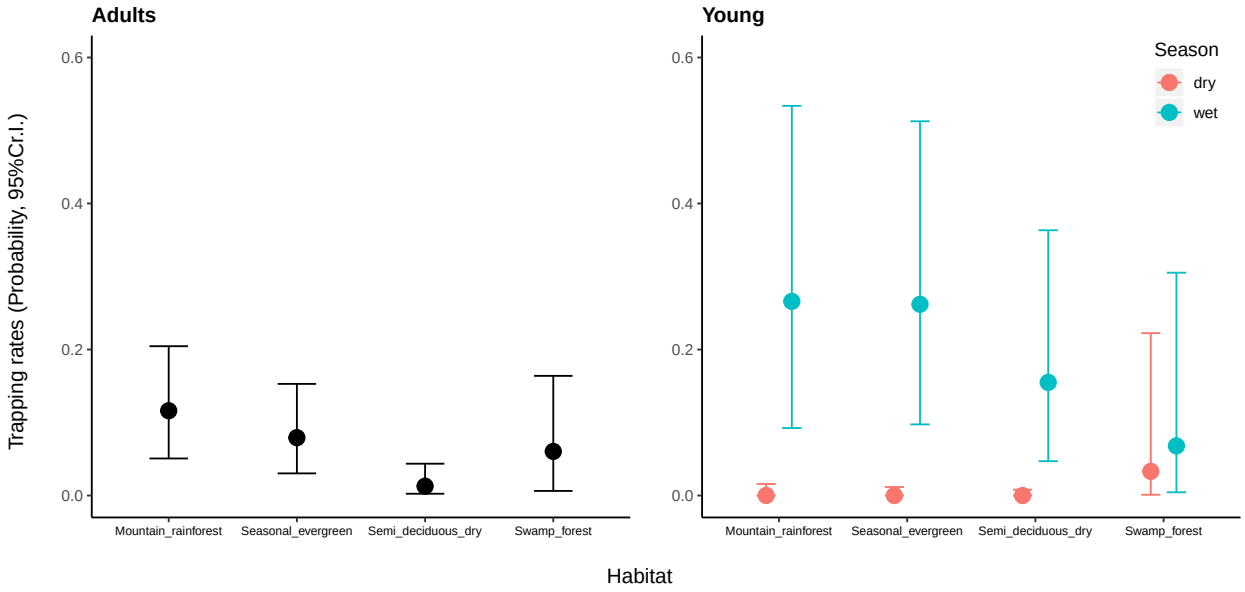
```
Fig_3<-grid.arrange(grobs = list(Female_age, Male_age),
                    nrow = 1, ncol = 2,
                    size = 9, top="",
                    bottom = textGrob("Mean weight of eye lens (mg)",
                                      vjust = 0.2, gp = gpar(cex = 1)))
```




```
#ggsave("Fig_3.tiff", width = 26, height = 13, units="cm", dpi=200, Fig_3)
```

8.2. Trapping rates of black rats - Figure 4

```
Fig_4<-grid.arrange(grobs = list(Adults, Juveniles),
                    nrow = 1, ncol = 2,
                    size = 9, top="",
                    left = textGrob(rot=90, "Trapping rates (Probability, 95%Cr.I.)",
                                    gp = gpar(cex = 1)),
                    bottom = textGrob("Habitat",
                                      vjust = 0.2, gp = gpar(cex = 1)))
```




```
#ggsave("Fig_4.tiff", width = 26, height = 13, units="cm", dpi=200, Fig_4)
```

SUPPLEMENTARY INFORMATION 3

Seasonal demography of different black rat (*Rattus rattus*) populations under contrasting natural habitats in Guadeloupe (Lesser Antilles, Caribbean)

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Table 2. Statistical tests concerning the relationship between the reproductive status of females and males with mean eye lens weight, eviscerated body mass of adults and corrected trapping rates by habitat and season for black rats (*Rattus rattus*) trapped between October 2017 and March 2018 on seven sites in Guadeloupe.

Sources of variation	$\beta \pm$ SE	95 % Cr. I.
REPRODUCTIVE STATUS OF FEMALES (BINOMIAL ERROR)		
Dispersion parameter	*1.01 ± 0.00*	-
Random part		
Intercept (Sites)	**0.47 ± 0.38**	**[0.02; 1.39]**
Fixed part		
Intercept	**-5.65 ± 1.26**	**[-8.32; -3.44]**
Mean eye lens weight	**0.23 ± 0.05**	**[0.14; 0.32]**
REPRODUCTIVE STATUS OF MALES (BINOMIAL ERROR)		
Dispersion parameter	*1.28 ± 0.00*	-
Random part		
Intercept (Sites)	**1.30 ± 1.06**	**[0.06; 4.05]**
Fixed part		
Intercept	**-15.62 ± 4.27**	**[-25.32; -8.84]**
Mean eye lens weight	**0.58 ± 0.15**	**[0.34; 0.93]**
EVISCERATED BODY MASS OF ADULT (GAUSSIAN ERROR)		
Random part		
Random intercept (Sites)	**4.17 ± 4.19**	**[0.12; 14.80]**
Residual	**17.00 ± 1.65**	**[14.22; 20.59]**
Fixed part		
Intercept	**115.35 ± 5.04**	**[105.61; 125.11]**
Sex Males *vs* Females	5.04 ± 4.35	[-3.71; 13.60]
Habitat Evergreen *vs* Mountain	10.86 ± 5.94	[-1.22; 21.84]
Habitat Deciduous *vs* Mountain	-7.75 ± 6.95	[-21.36; 5.71]
Habitat Swamp *vs* Mountain	1.49 ± 7.49	[-13.80; 16.40]
Season Wet *vs* Dry	-5.50 ± 4.72	[-14.52; 4.07]
CORRECTED TRAPPING RATES OF ADULTS (BETABINOMIAL ERROR)		
Dispersion parameter	*0.96 ± 0.05*	-
Intercept	**2.06 ± 0.39**	**[-2.93; -1.36]**
Habitat Evergreen *vs* Mountain	-0.43 ± 0.59	[-1.59; 0.74]
Habitat Deciduous *vs* Mountain	**-2.33 ± 0.59**	**[-4.03; -0.77]**
Habitat Swamp *vs* Mountain	-0.82 ± 0.94	[-3.04; 0.72]
Season Wet *vs* Dry	1.04 ± 0.56	[-0.08; 2.12]
CORRECTED TRAPPING RATES OF YOUNG (BETABINOMIAL ERROR)		
Dispersion parameter	*0.75 ± 0.18*	-
Intercept	**-9.27 ± 3.40**	**[-17.10; -4.13]**
Habitat Evergreen *vs* Mountain	-2.92 ± 5.29	[-14.26; 6.28]
Habitat Deciduous *vs* Mountain	-3.47 ± 5.42	[-15.23; 6.39]
Habitat Swamp *vs* Mountain	5.74 ± 3.56	[-0.20; 13.70]
Season Wet *vs* Dry	**8.25 ± 3.41**	**[3.07; 16.26]**
Habitat:Season Evergreen Wet *vs* Mountain Dry	2.90 ± 5.34	[-6.49; 14.38]
Habitat:Season Deciduous Wet *vs* Mountain Dry	2.78 ± 5.45	[-6.96; 14.58]
Habitat:Season Swamp Wet *vs* Mountain Dry	**-7.46 ± 3.70**	**[-15.66; -1.22]**