Fitted Models

Loïc Pages

2025-06-25

Seedlings survival

Models selected by AIC

```
ASurvglm11 <- fitme(Survie ~ 1+ bs(SizeOMars,df=4,degree=2) + (SizeOMars|year),
                    family=binomial,
                    data=survdata1,
                    method="PQL/L")

ASurvglm12 <- fitme(Survie ~ 1+ bs(SizeOMars,df=4,degree=2) + (SizeOMars|year)+ (1|Pop),
                    family=binomial,
                    data=survdata1,
                    method="PQL/L")

ASurvglm13 <- fitme(Survie ~ 1+ bs(SizeOMars,df=4,degree=2) + (1|year) + (1|Pop),
                    family=binomial,
                    data=survdata1,
                    method="PQL/L")

ASurvglm14 <- fitme(Survie ~ 1+ bs(SizeOMars,df=4,degree=2) + (1|year),
                    family=binomial,
                    data=survdata1,
                    method="PQL/L")

ASurvglm15 <- fitme(Survie ~ 1+ bs(SizeOMars,df=5,degree=3) + (SizeOMars|year),
                    family=binomial,
                    data=survdata1,
                    method="PQL/L")
```

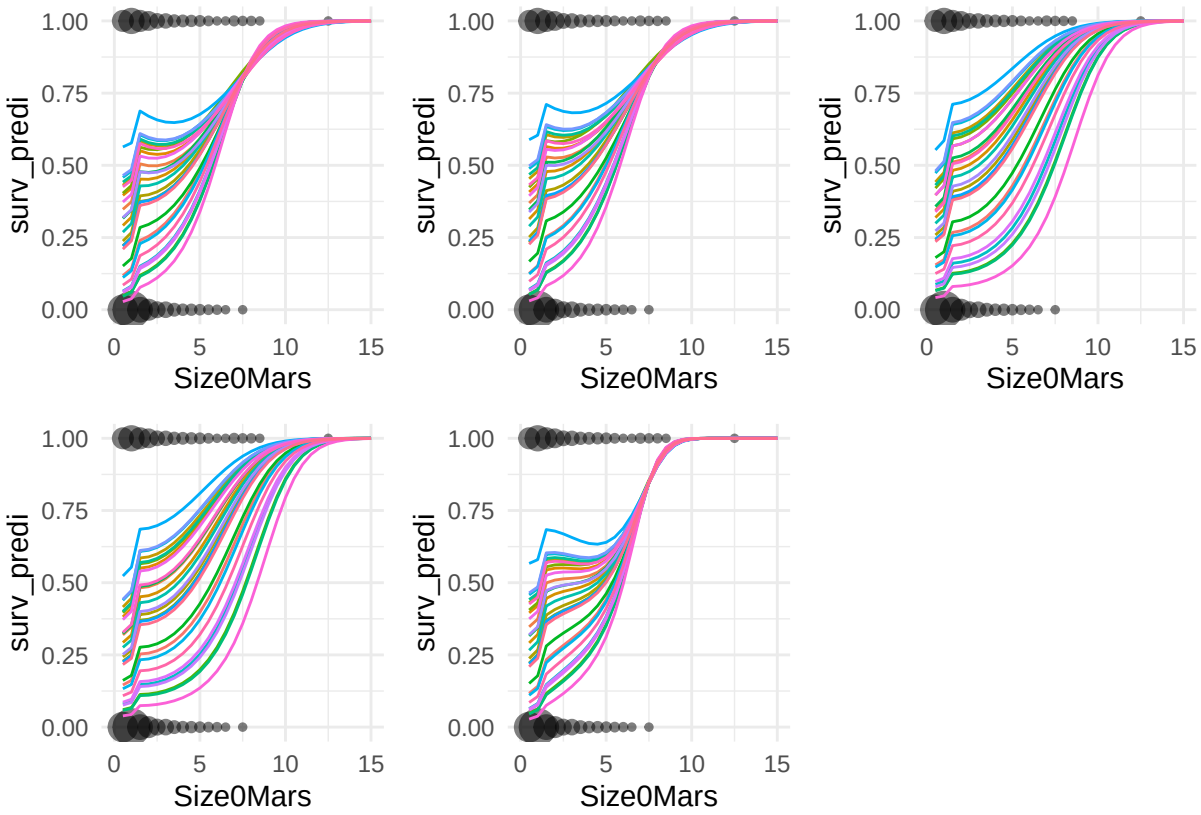
Models selected by BIC

```
BSurvglm11 <- fitme(Survie ~ 1+ SizeOMars + (1|year) + (1|Pop),
                    family=binomial,
                    data=survdata1,
                    method="PQL/L")

BSurvglm12 <- fitme(Survie ~ 1+ SizeOMars + (1|year),
                    family=binomial,
                    data=survdata1,
                    method="PQL/L")
```

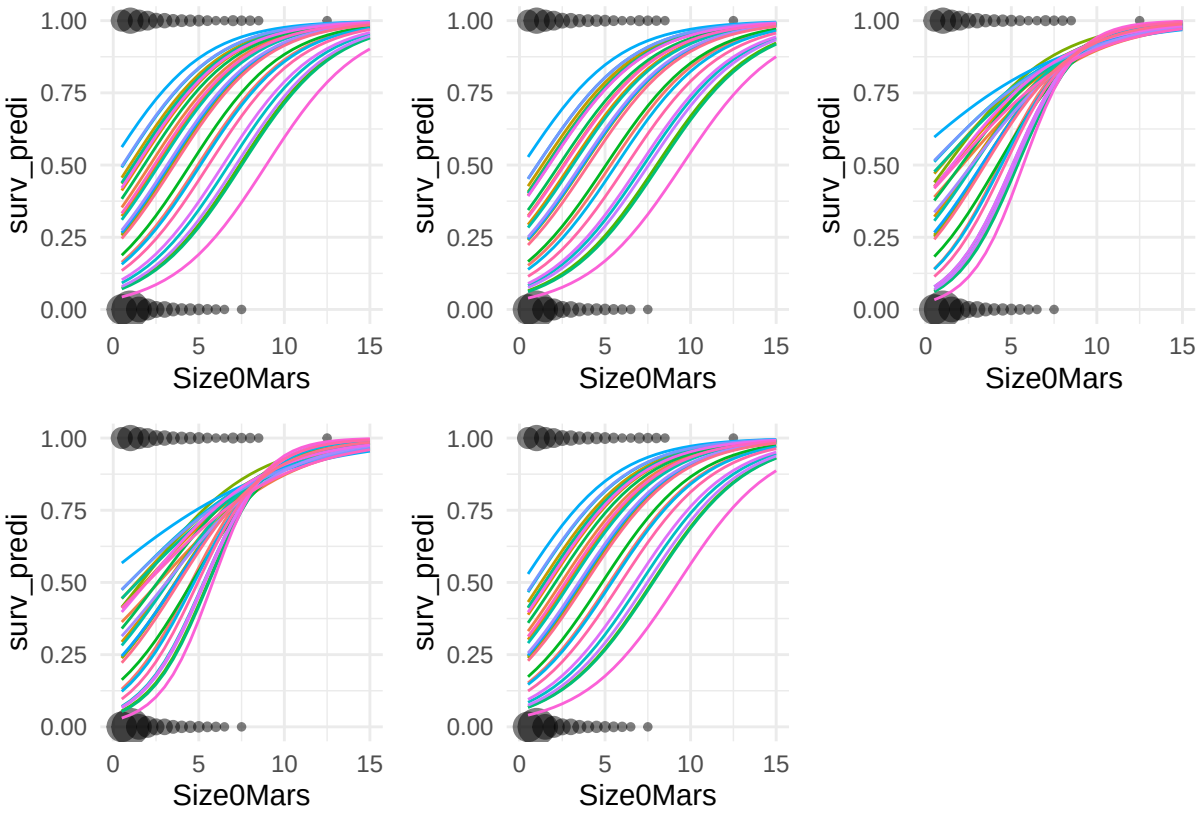
```
BSurvglm13 <- fitme(Survie ~ 1 + Size0Mars + (Size0Mars|year) + (1|Pop),
                   family=binomial,
                   data=survdata1,
                   method="PQL/L")

BSurvglm14 <- fitme(Survie ~ 1+ Size0Mars + (Size0Mars|year),
                   family=binomial,
                   data=survdata1,
                   method="PQL/L")

BSurvglm15 <- fitme(Survie ~ 1+ Size0Mars + (1|year) + (Size0Mars|Pop),
                   family=binomial,
                   data=survdata1,
                   method="PQL/L")
```

As a function of size

See year effect (population fixed)

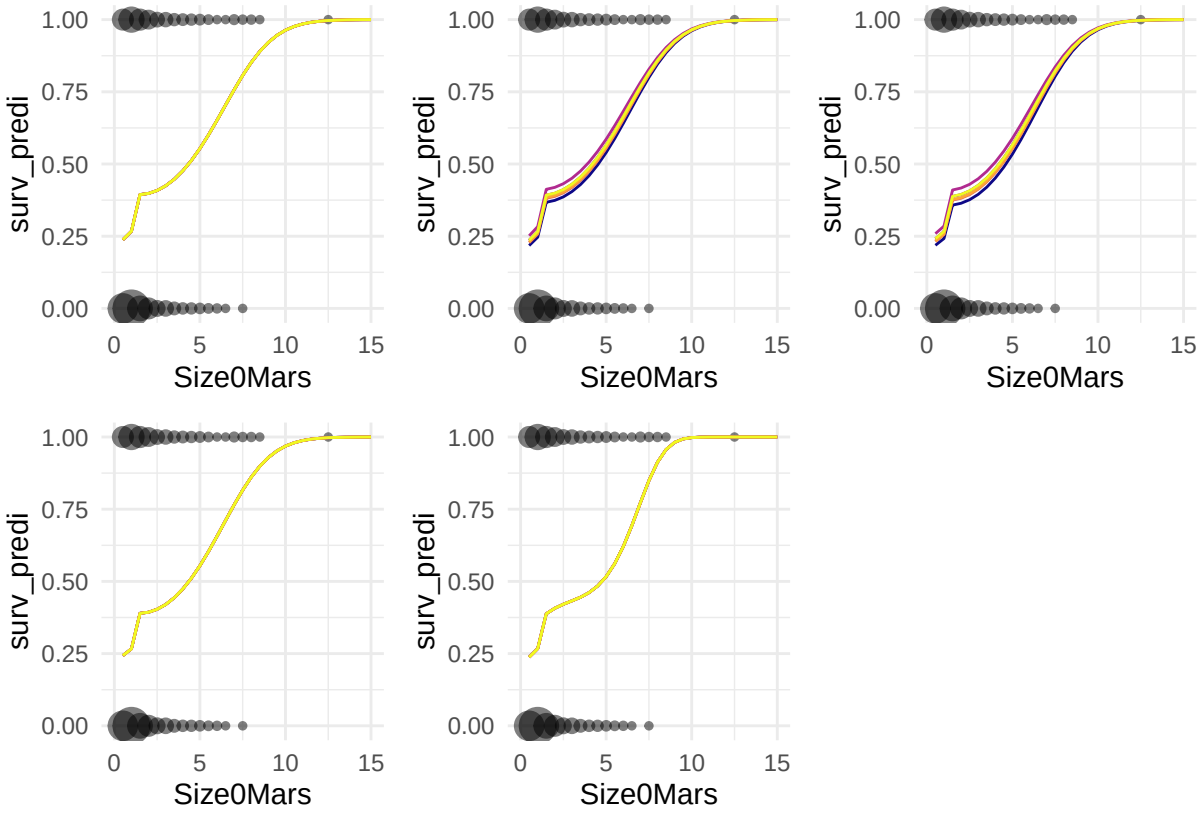


AIC

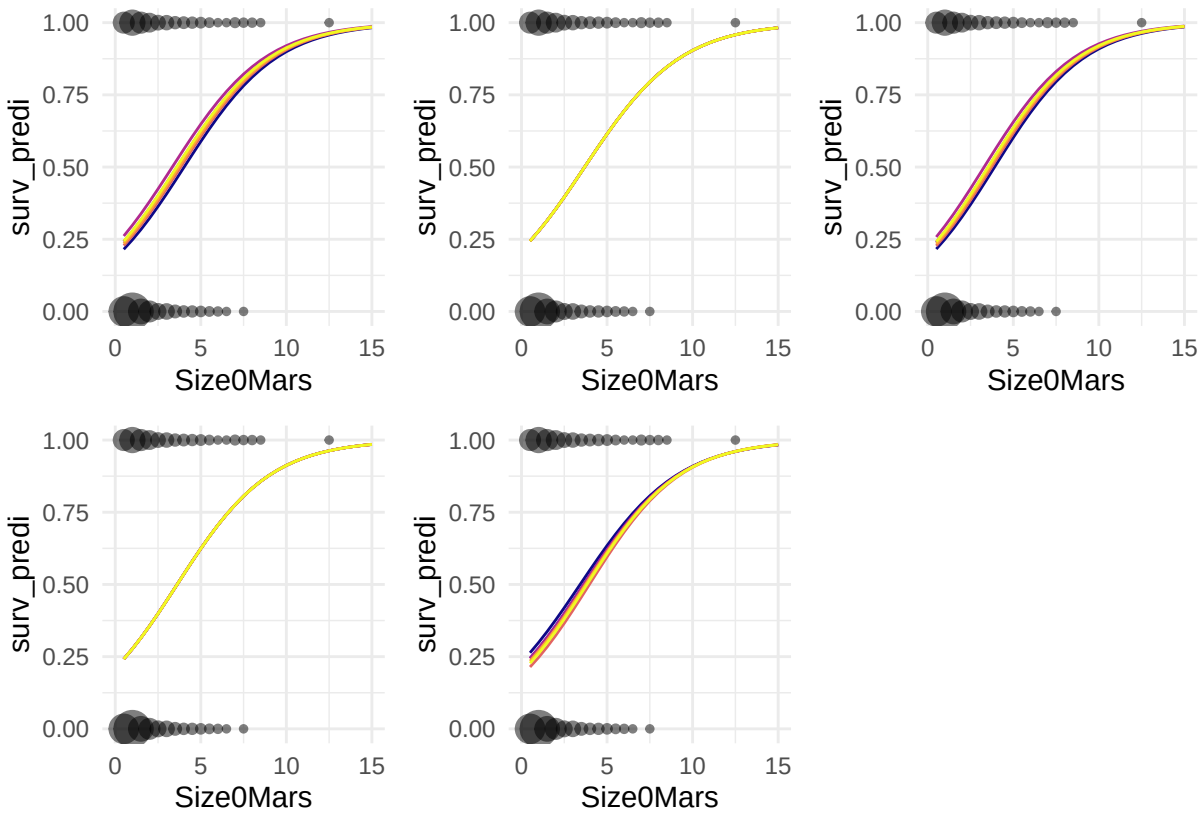


BIC

See population effect (year fixed)



AIC



BIC

Rosette survival

AIC

```
ASurvglm21 <- fitme(Survie ~ 1+ bs(Size0Mars,df=3,degree=2) +
                        bs(Age,degree=3,knots=6.5) + (Age|year) + (1|Pop),
                    family=binomial,
                    data=survdata2,
                    method="PQL/L")

ASurvglm22 <- fitme(Survie ~ 1+  bs(Size0Mars,df=3,degree=2) +
                        bs(Age,degree=3,knots=6.5) + (1|year) + (1|Pop),
                    family=binomial,
                    data=survdata2,
                    method="PQL/L")

ASurvglm23 <- fitme(Survie ~ 1+ bs(Size0Mars,df=4,degree=2) +
                        bs(Age,degree=3,knots=6.5) + (Age|year) + (1|Pop),
                    family=binomial,
                    data=survdata2,
                    method="PQL/L")

ASurvglm24 <- fitme(Survie ~ 1 + poly(Size0Mars,4) + bs(Age,degree=3,knots=6.5)
                      + (Age|year) + (1|Pop),
```

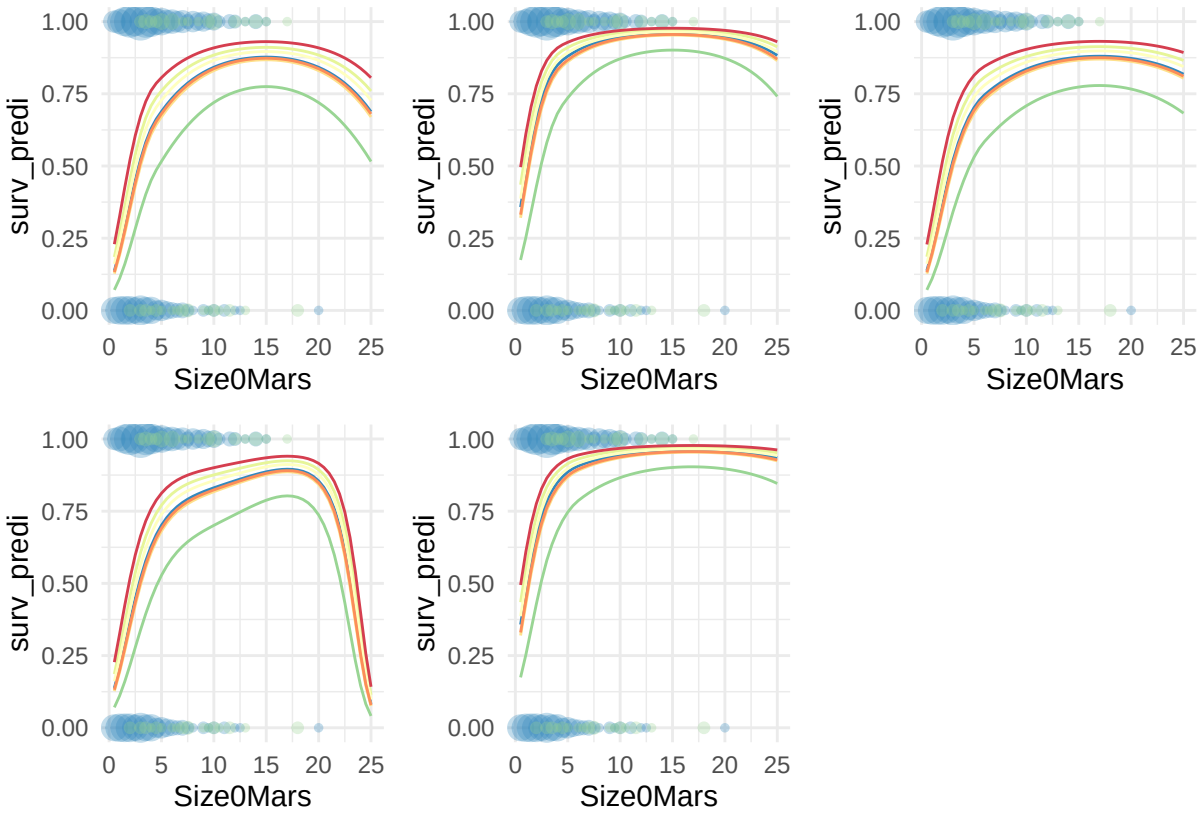
```
                  family=binomial,
                  data=survdata2,
                  method="PQL/L")

ASurvglm25 <- fitme(Survie ~ 1+ bs(SizeOMars,df=4,degree=2) +
                      bs(Age,degree=3,knots=6.5) + (1|year) + (1|Pop),
                  family=binomial,
                  data=survdata2,
                  method="PQL/L")
```

BIC

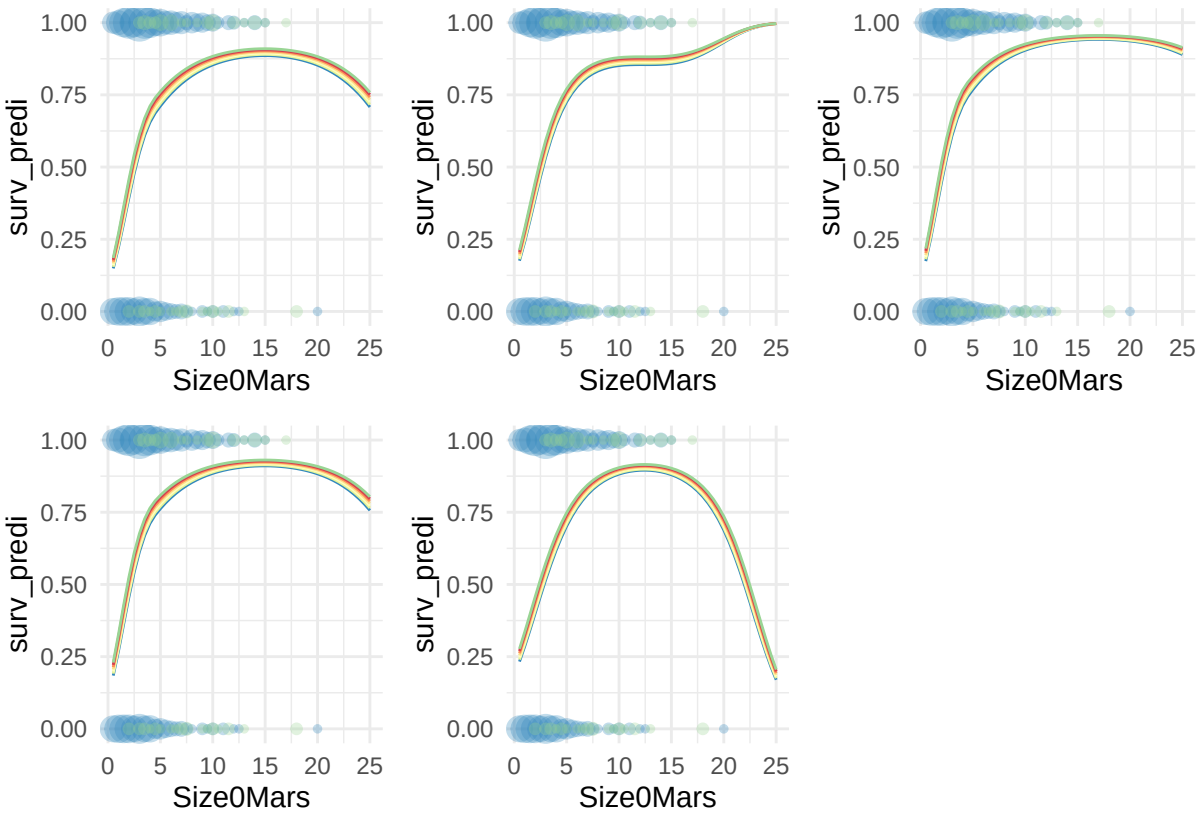
```
BSurvglm21 <- fitme(Survie ~ 1+ bs(SizeOMars,df=3,degree=2) + (Age|year) +
                      (1|Pop),
                  family=binomial,
                  data=survdata2,
                  method="PQL/L")

BSurvglm22 <- fitme(Survie ~ 1+ poly(SizeOMars,3) + (Age|year) + (1|Pop),
                  family=binomial,
                  data=survdata2,
                  method="PQL/L")

BSurvglm23 <- fitme(Survie ~ 1 + bs(SizeOMars,df=3,degree=2) + (Age|year) +
                      (SizeOMars|Pop),
                  family=binomial,
                  data=survdata2,
                  method="PQL/L")

BSurvglm24 <- fitme(Survie ~ 1+ bs(SizeOMars,df=3,degree=2) + (Age|year) +
                      (Age|Pop),
                  family=binomial,
                  data=survdata2,
                  method="PQL/L")

BSurvglm25 <- fitme(Survie ~ 1+ poly(SizeOMars,2) + (Age|year) + (1|Pop),
                  family=binomial,
                  data=survdata2,
                  method="PQL/L")
```

As a function of size

See effect of age (population and year fixed)

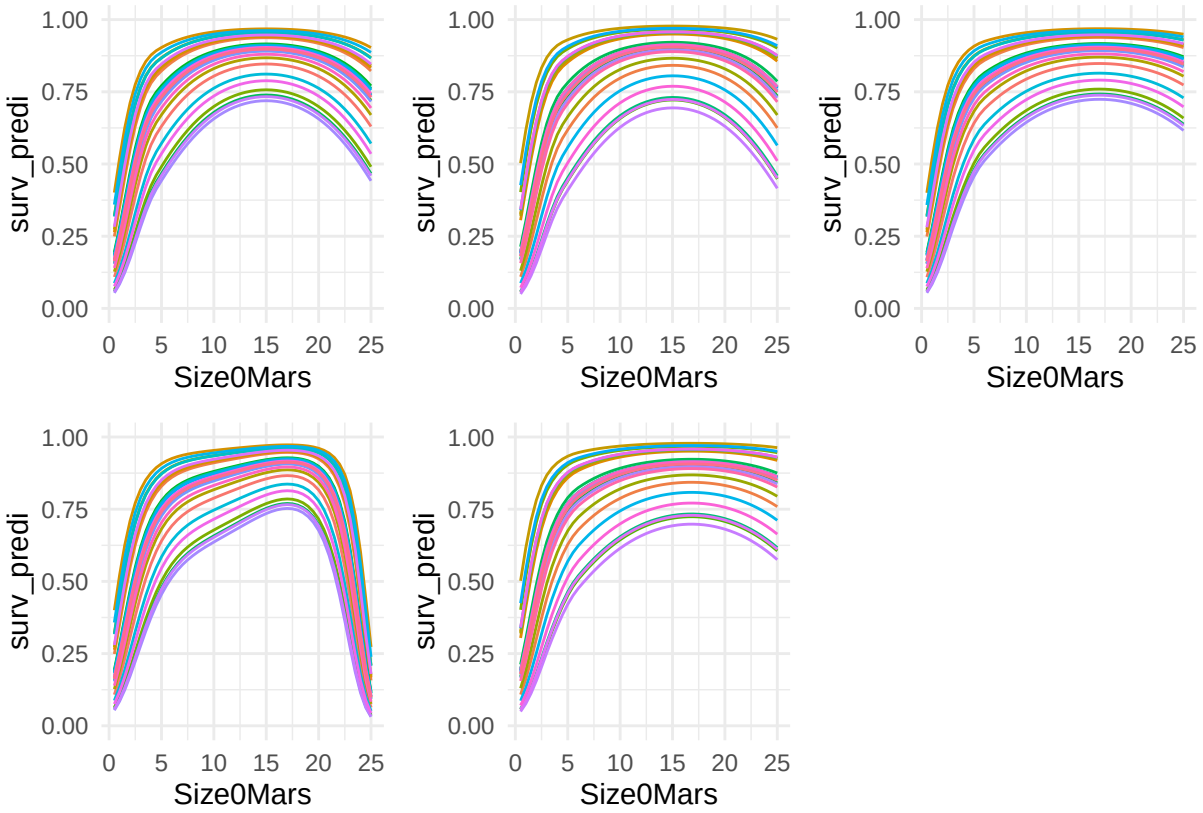


AIC

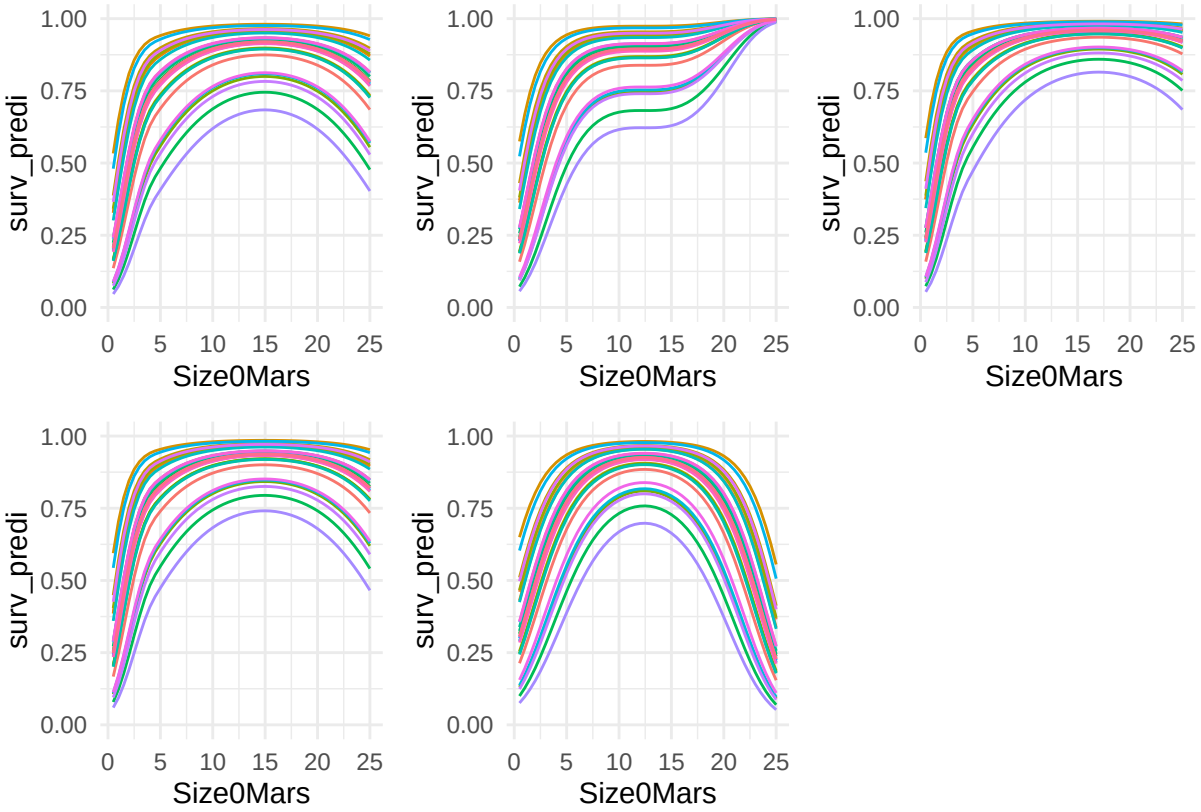


BIC

See year effect (population fixed and age=5)

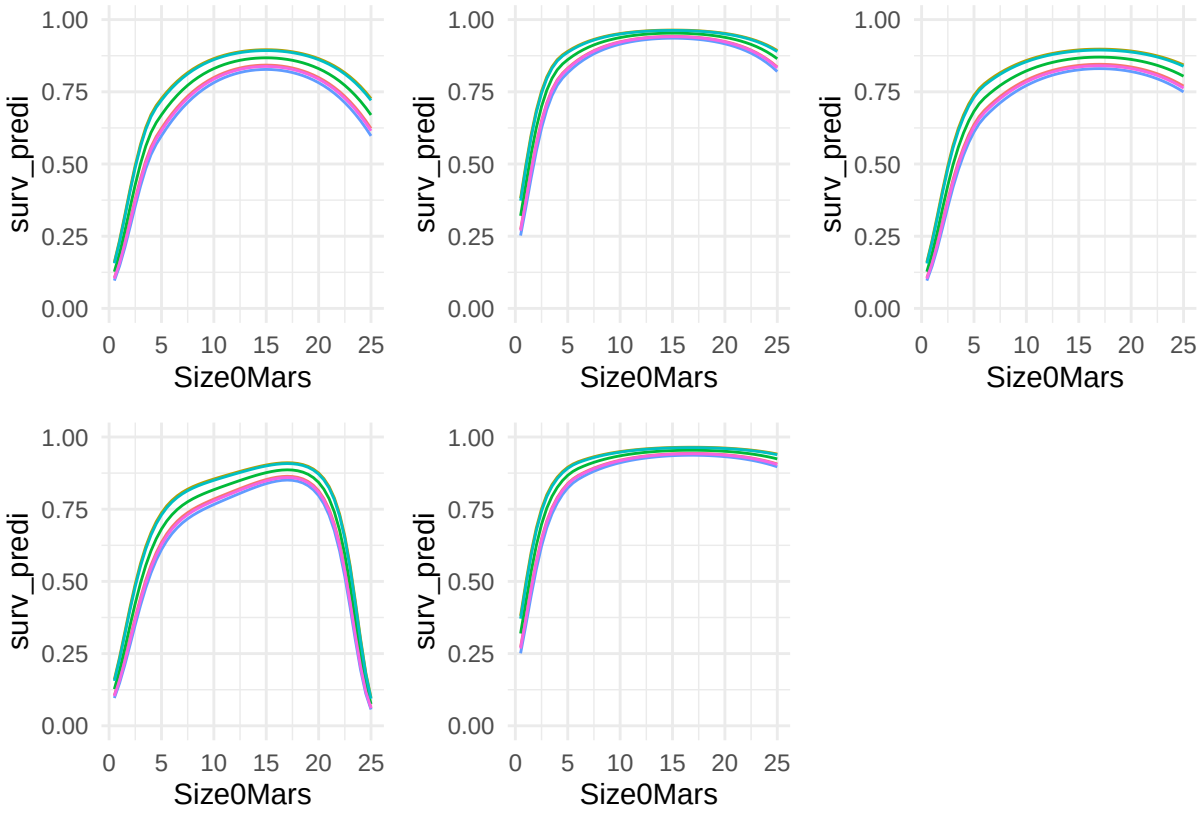


AIC

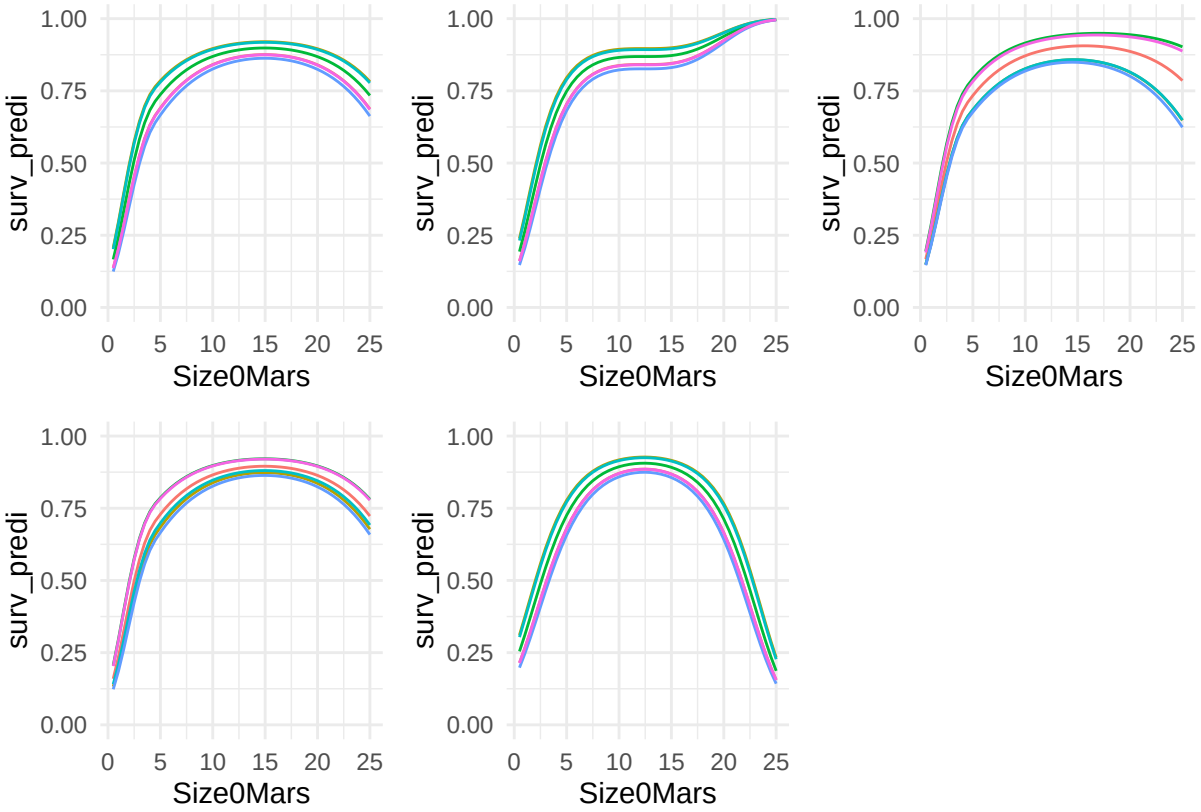


BIC

See population effect (year fixed and age=5)



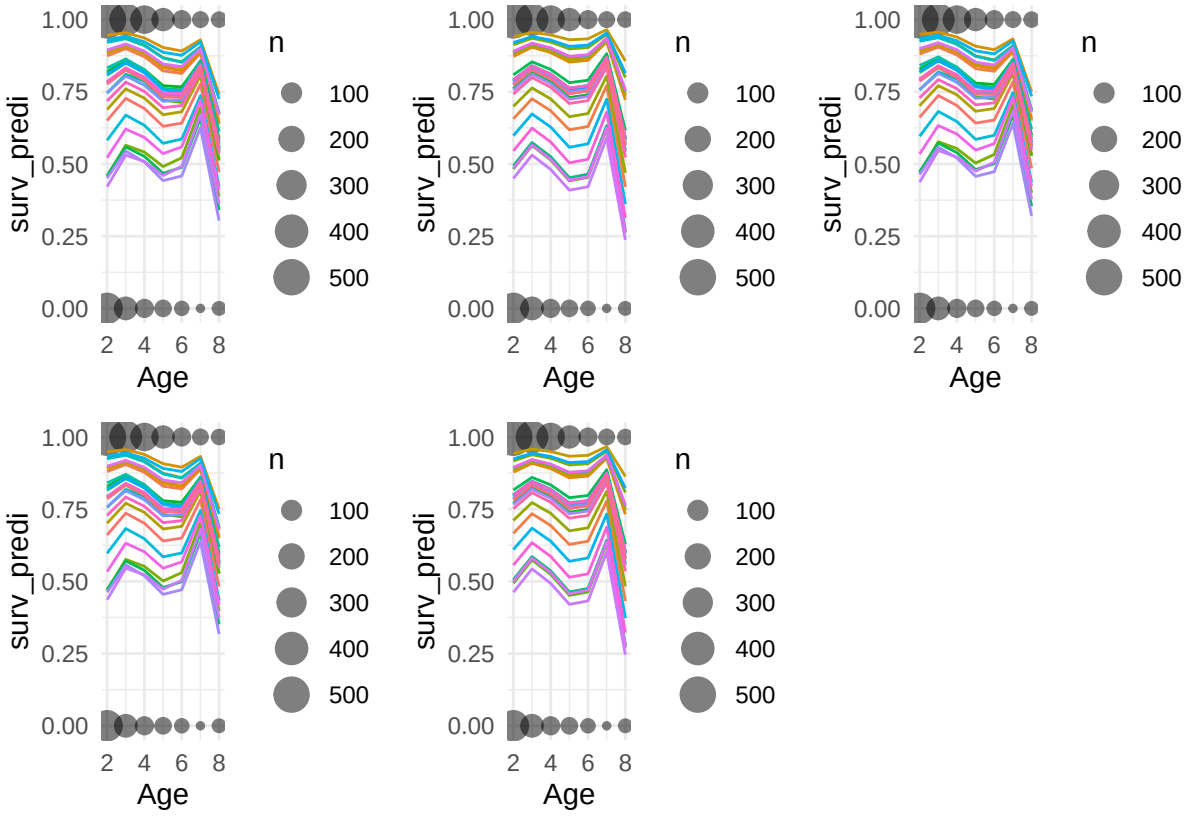
AIC



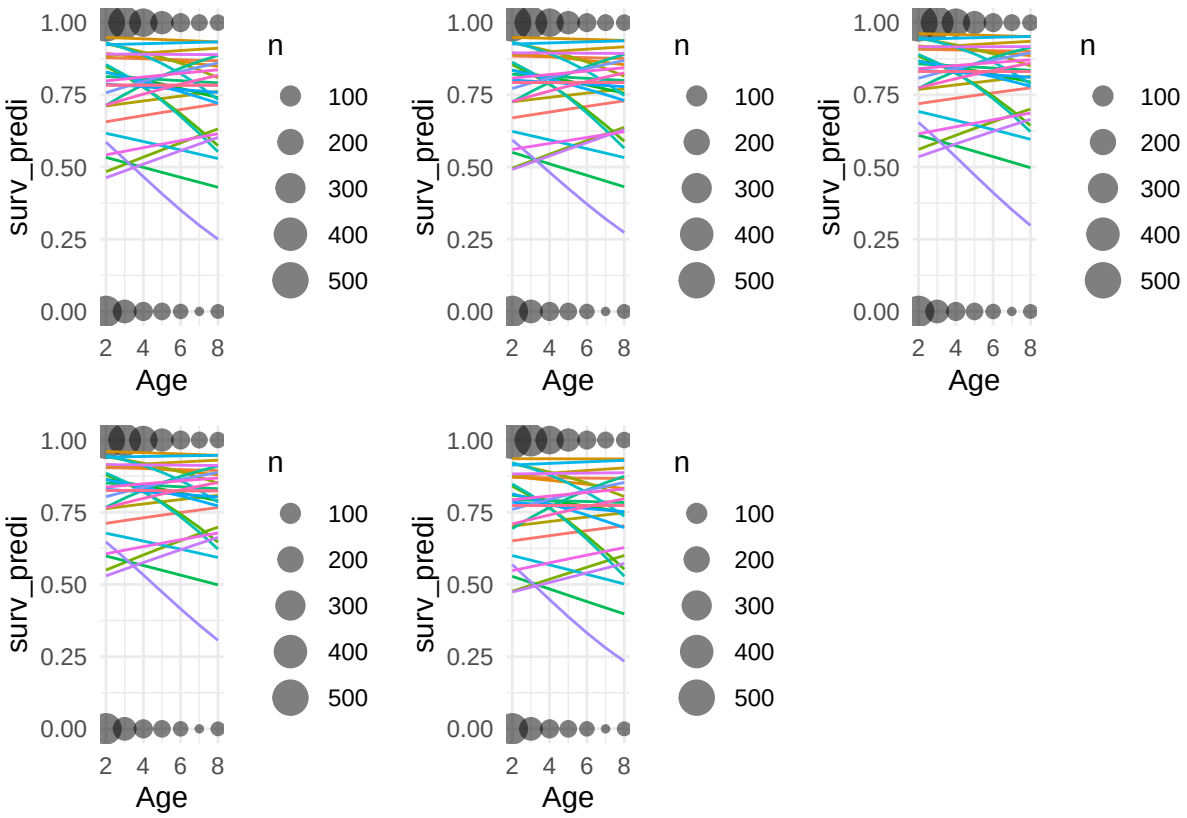
BIC

As a function of age (size=5)

See year effect (population fixed)



AIC



BIC

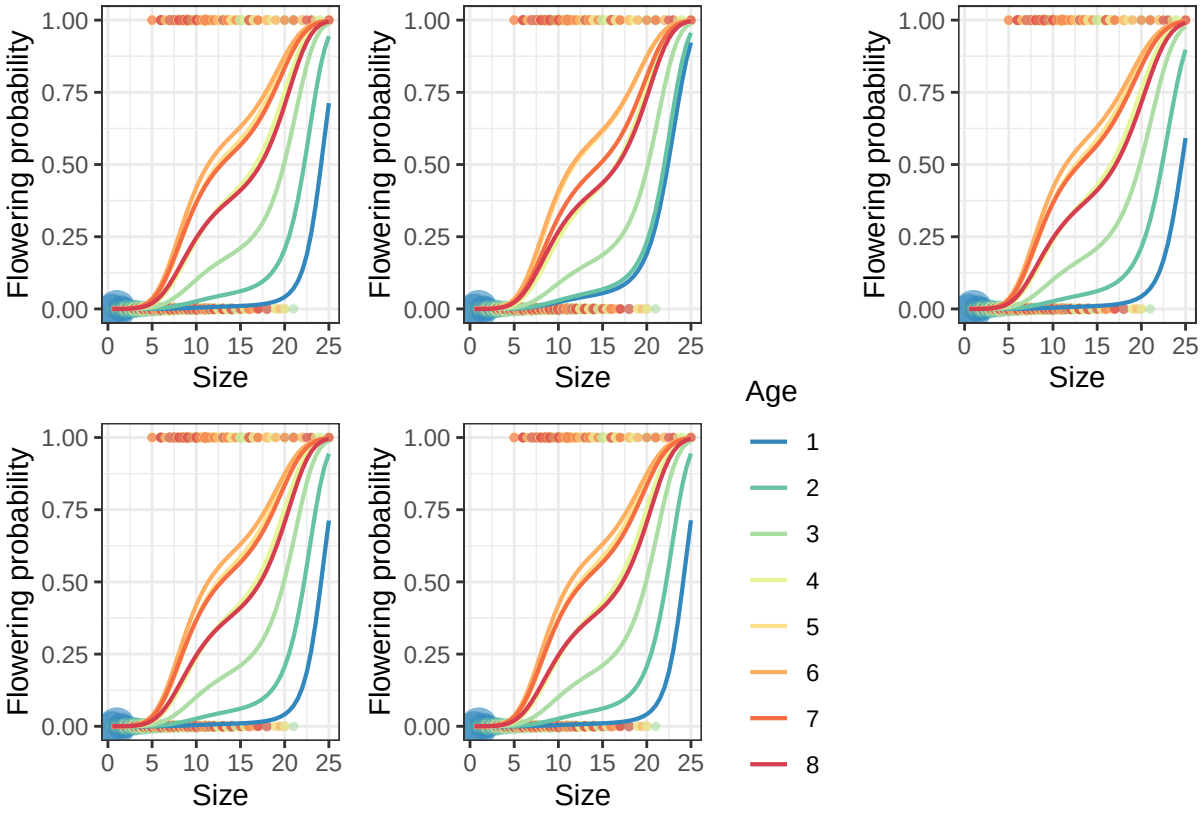
Flowering probability

AIC

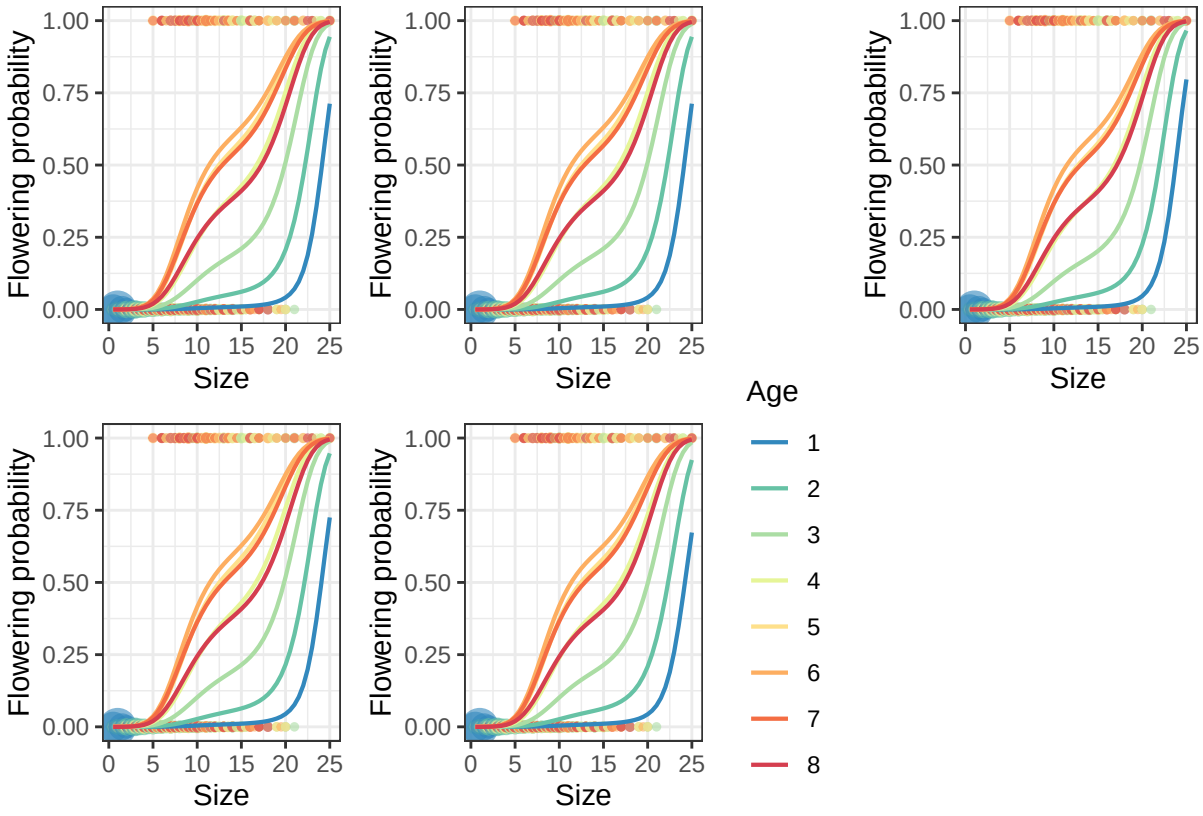
BIC

As a function of size

See effect of age



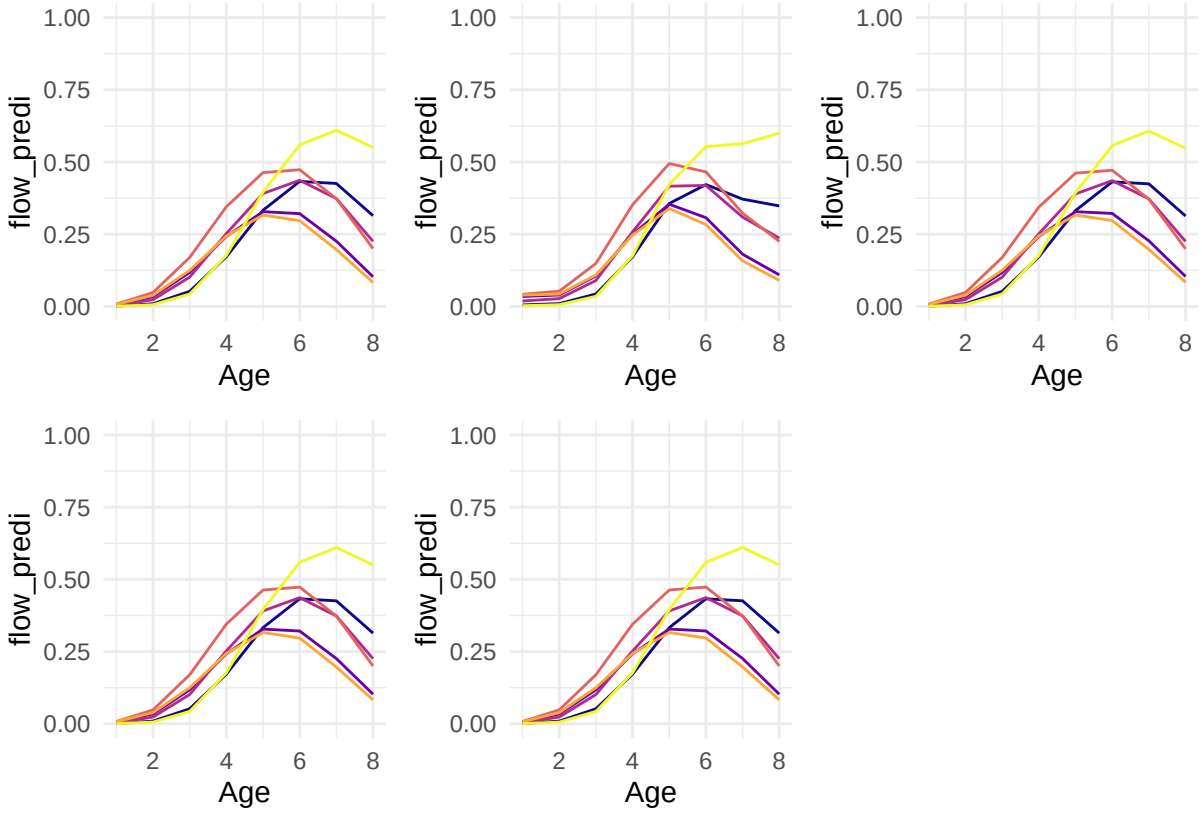
AIC


Flowering probability
1.00
0.75
0.50
0.25
0.00
0 5 10 15 20 25
Size
Age
1
2
3
4
5
6
7
8

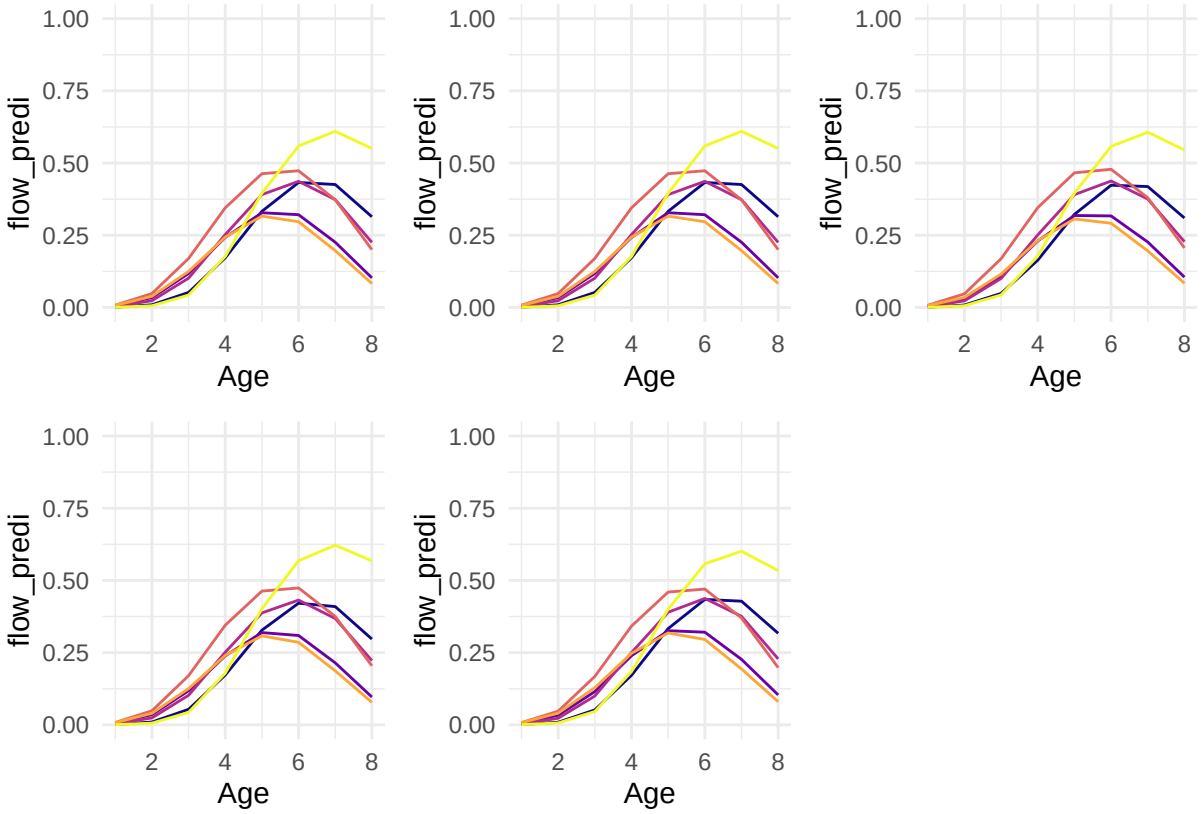
BIC

As a function of age (size fixed)

See population effect (mean over the years)

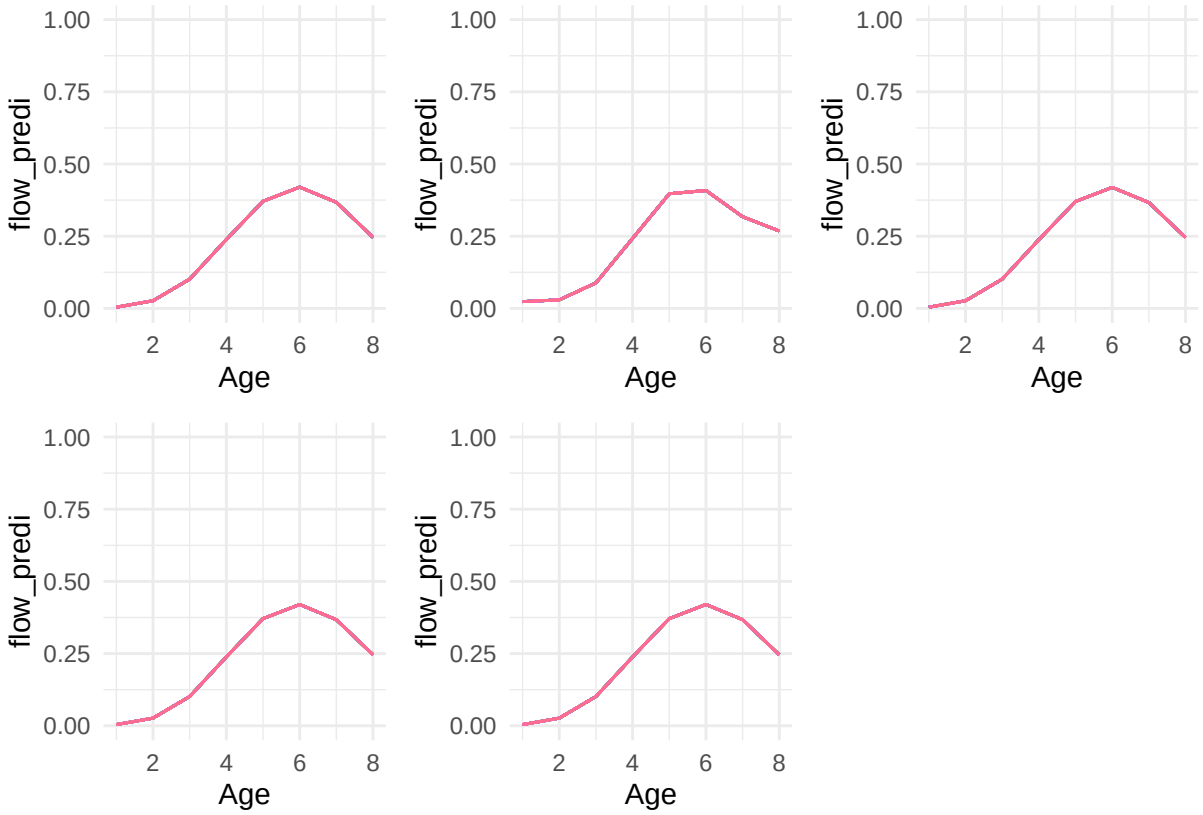


AIC

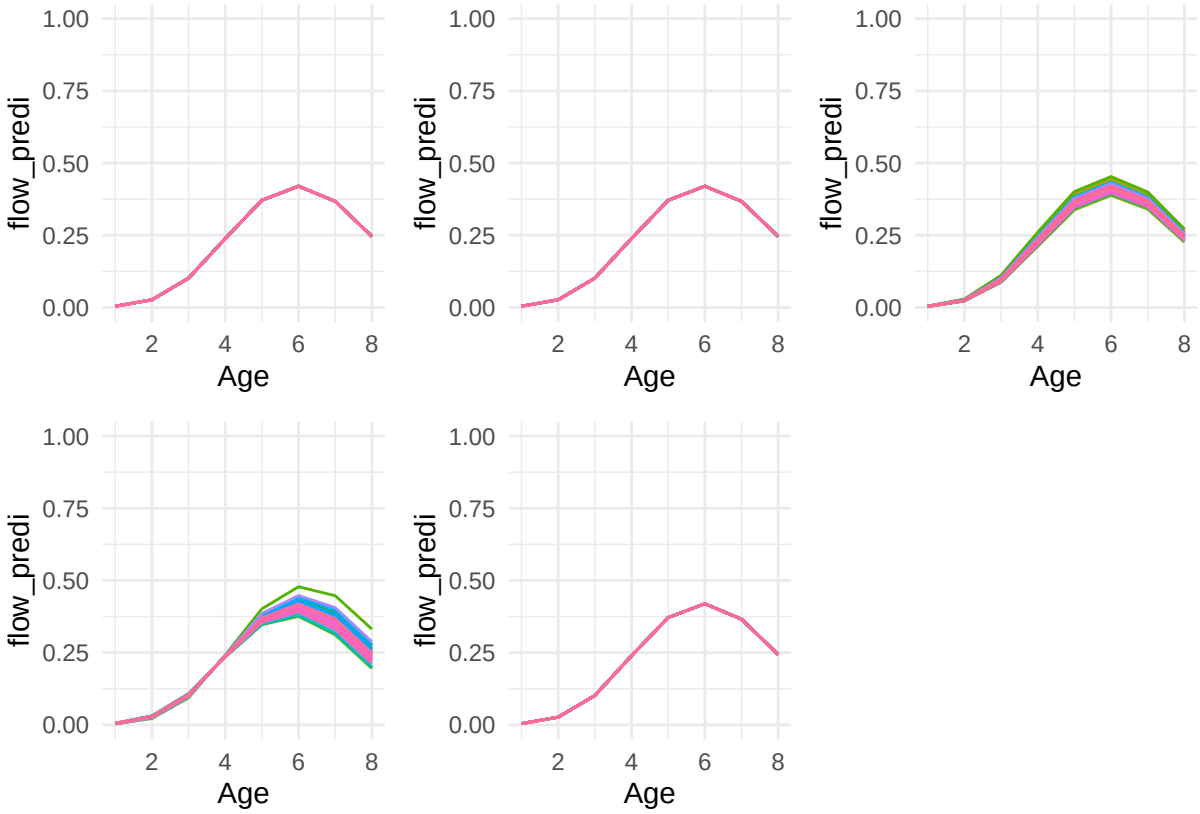


BIC

See year effect (mean over the populations)



AIC



BIC

Growth

AIC

```
AGrowthglm1 <- fitme(Size1Mars ~ 1 + poly(SizeOMars,3) +
                       bs(Age,degree=2,knots=6.5) + (SizeOMars+Age|year) +
                       (1|Pop),
                     resid.model = ~ log(SizeOMars)+log(Age),
                     data=growthdata)

AGrowthglm2 <- fitme(Size1Mars ~ 1 + poly(SizeOMars,3) +
                       bs(Age,degree=2,knots=6.5) + (SizeOMars+Age|year) +
                       (SizeOMars|Pop),
                     resid.model = ~ log(SizeOMars)+log(Age),
                     data=growthdata)

AGrowthglm3 <- fitme(Size1Mars ~ 1 + poly(SizeOMars,3) +
                       bs(Age,degree=2,knots=6.5) + (SizeOMars+Age|year) +
                       (SizeOMars+Age|Pop),
                     resid.model = ~ log(SizeOMars)+log(Age),
                     data=growthdata)

AGrowthglm4 <- fitme(Size1Mars ~ 1 + bs(SizeOMars,df=5,degree=3) +
                       bs(Age,degree=2,knots=6.5) + (SizeOMars+Age|year) +
```

```
                      (1|Pop),
                    resid.model = ~ log(SizeOMars)+log(Age),
                    data=growthdata)

AGrowthglm5 <- fitme(Size1Mars ~ 1 + bs(SizeOMars,df=5,degree=3) +
                      bs(Age,degree=2,knots=6.5) + (SizeOMars+Age|year) +
                      (SizeOMars|Pop),
                    resid.model = ~ log(SizeOMars)+log(Age),
                    data=growthdata)
```

BIC

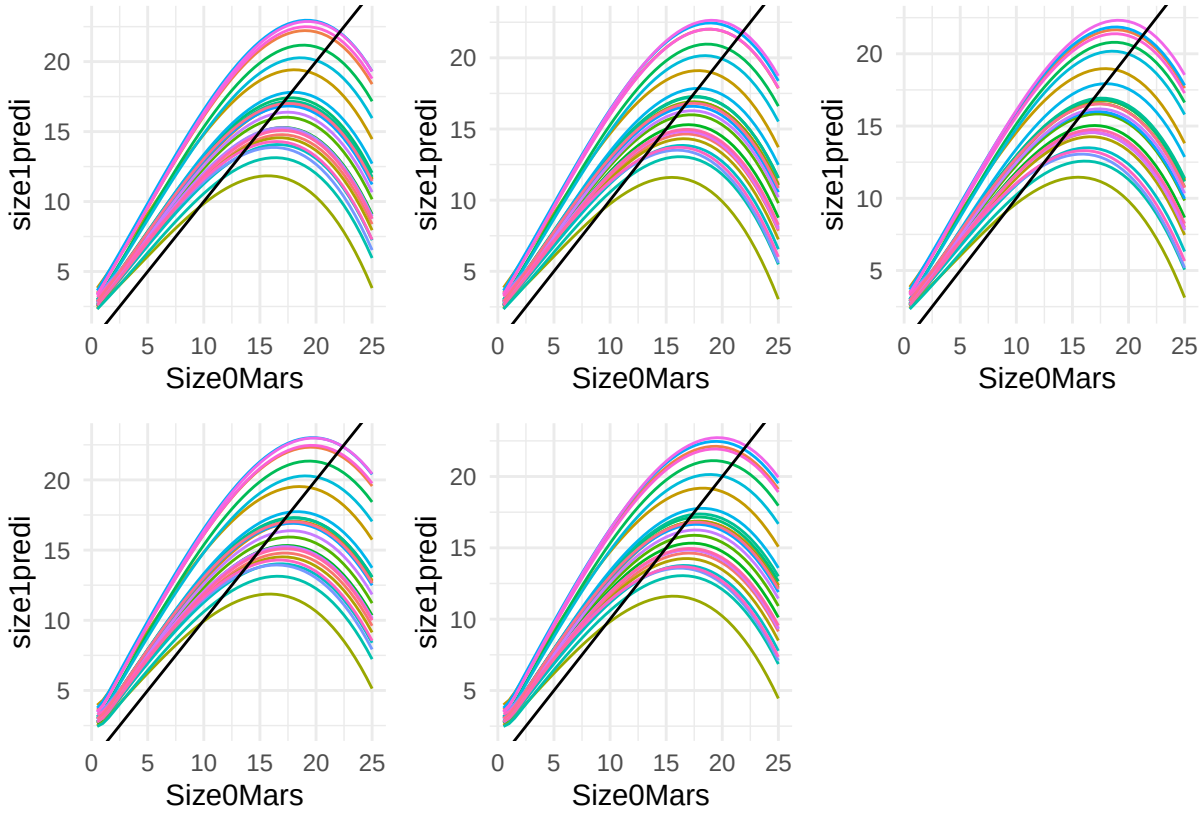
```
BGrowthglm1 <- fitme(Size1Mars ~ 1 + poly(SizeOMars,3) + poly(Age,2) +
                      (SizeOMars+Age|year) + (1|Pop),
                    resid.model = ~ log(SizeOMars)+log(Age),
                    data=growthdata)

BGrowthglm2 <- fitme(Size1Mars ~ 1 + poly(SizeOMars,3) + poly(Age,2) +
                      (SizeOMars+Age|year) + (SizeOMars+Age|Pop),
                    resid.model = ~ log(SizeOMars)+log(Age),
                    data=growthdata)

BGrowthglm3 <- fitme(Size1Mars ~ 1 + bs(SizeOMars,df=3,degree=2) + poly(Age,2) +
                      (SizeOMars+Age|year) + (1|Pop),
                    resid.model = ~ log(SizeOMars)+log(Age),
                    data=growthdata)

BGrowthglm4 <- fitme(Size1Mars ~ 1 + bs(SizeOMars,df=3,degree=2) + poly(Age,2) +
                      (SizeOMars+Age|year) + (SizeOMars|Pop),
                    resid.model = ~ log(SizeOMars)+log(Age),
                    data=growthdata)

BGrowthglm5 <- fitme(Size1Mars ~ 1 + bs(SizeOMars,df=3,degree=2) + poly(Age,2) +
                      (SizeOMars+Age|year) + (SizeOMars+Age|Pop),
                    resid.model = ~ log(SizeOMars)+log(Age),
                    data=growthdata)
```

```
plot_growth1 <- function(data = fake_data, prediction, var, c1, c2, valc1=1, fact) {
  data %>%
    mutate(size1predi = prediction) %>%
    group_by(!!sym(var),!!sym(fact)) %>%
    filter(!!sym(c1) == valc1) %>%
    summarise(size1predi = mean(size1predi),
            .groups = "drop") %>%
    ggplot(aes(x = .data[[var]], y = size1predi)) +
    geom_line(aes(color = as.factor(.data[[fact]])),show.legend = FALSE) +
    geom_abline()+
    theme_minimal()
}

plot_growth2 <- function(data = fake_data, prediction, var, c1, c2, valc1=1, fact) {
  data %>%
    mutate(size1predi = prediction) %>%
```

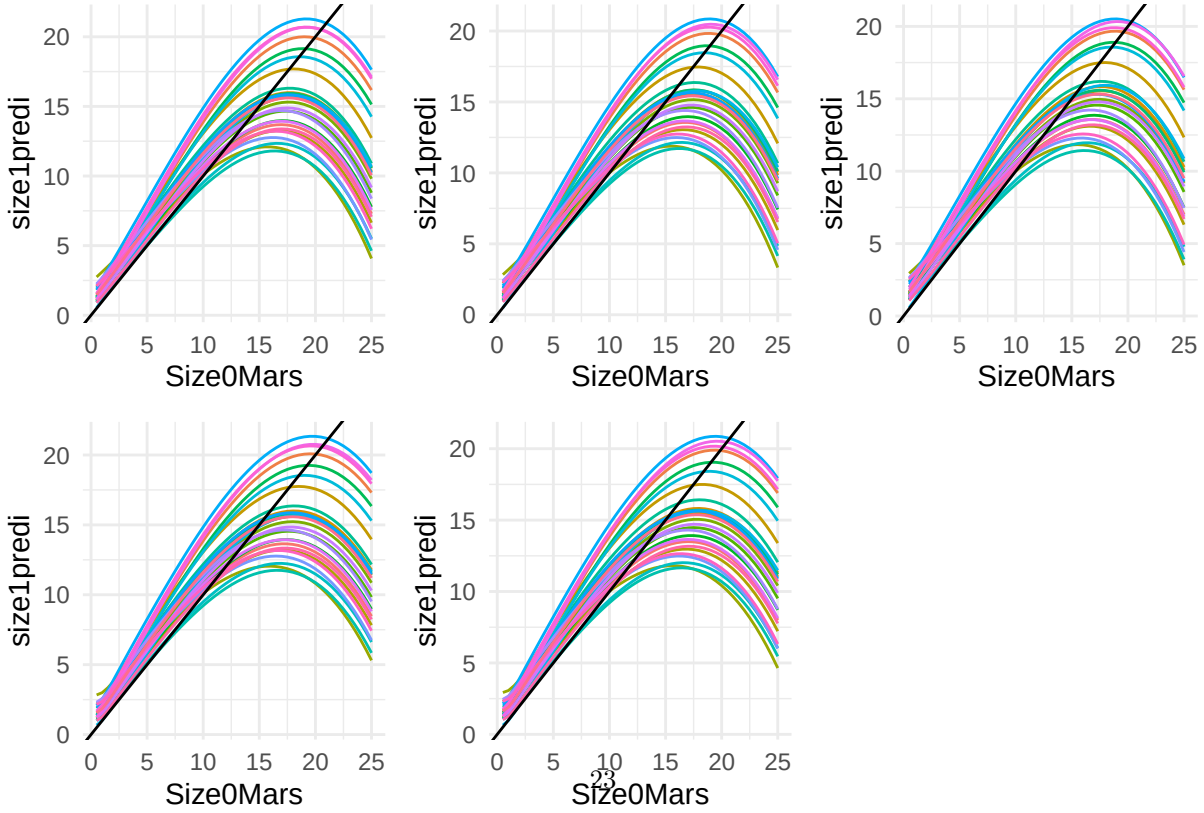
```
    group_by(!!sym(var),!!sym(fact)) %>%
    filter(!!sym(c1) == valc1) %>%
    summarise(size1predi = mean(size1predi),
            .groups = "drop") %>%
    ggplot(aes(x = .data[[var]], y = size1predi)) +
    geom_line(aes(color = as.factor(.data[[fact]])),show.legend = FALSE) +
    geom_abline()+
    theme_minimal()+
    scale_color_viridis_d(option = "plasma")
}

plot_growth3 <- function(data = fake_data, prediction, var, c1, c2, valc1=1, fact) {
  data %>% mutate(sdgrow = prediction) %>%
  group_by(SizeOMars, Age) %>%
  summarise(sd_predi = mean(sdgrow),
            .groups = "drop") %>%
  ggplot(aes(x = SizeOMars, y = sd_predi)) +
  geom_line(aes(color = as.factor(Age))) +
  theme_bw()+
  labs(x = "Size(t)",
      y = "Growth residual variance",
      fill = "Age",
      color = "Age")+
    scale_color_brewer(palette = "Spectral", direction = -1)
}
```

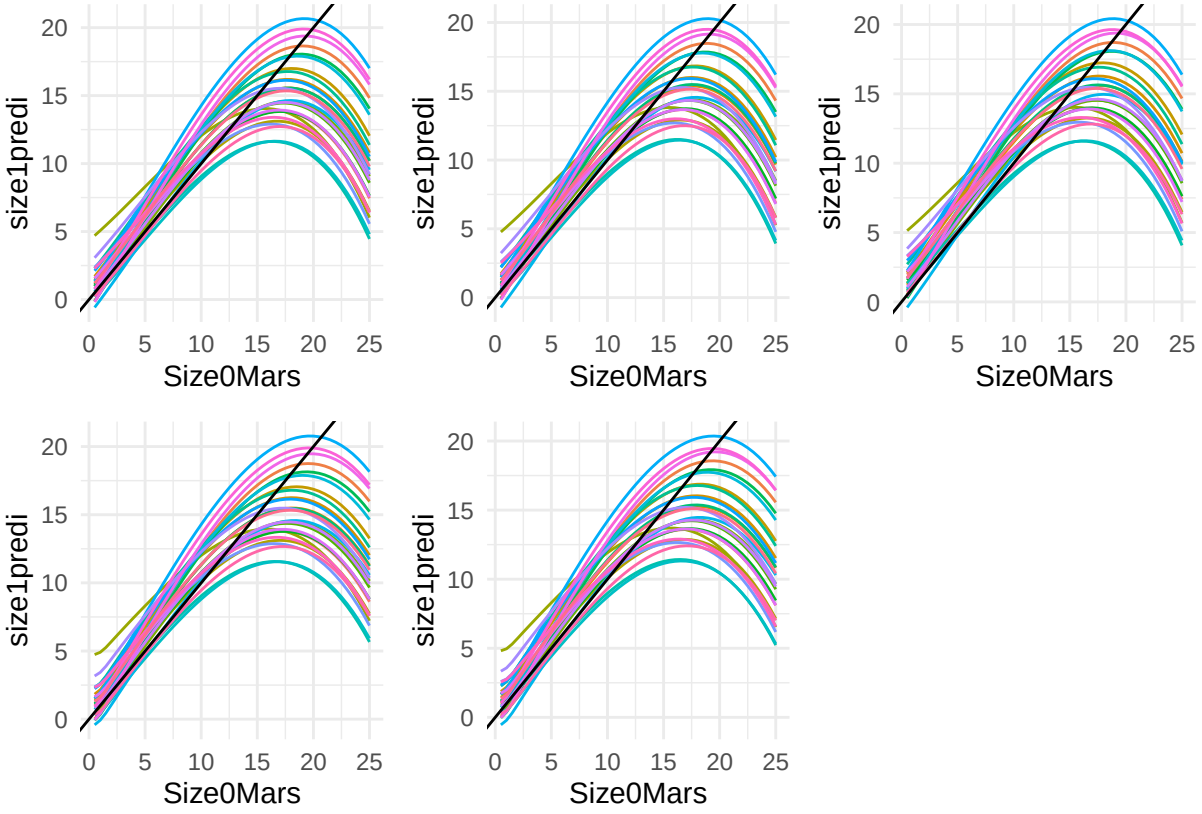
Size at t+1 as a function of size at t (age 1, 4, 8)

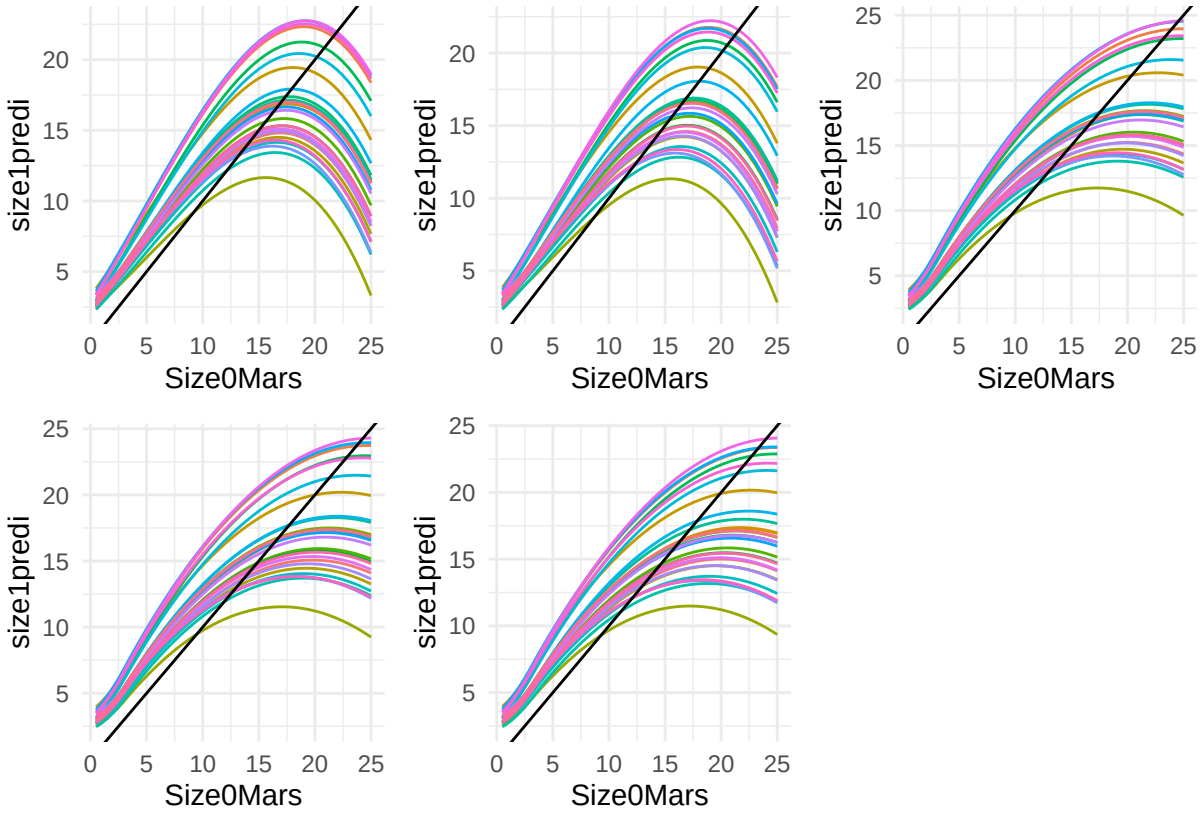
See year effect (population fixed)



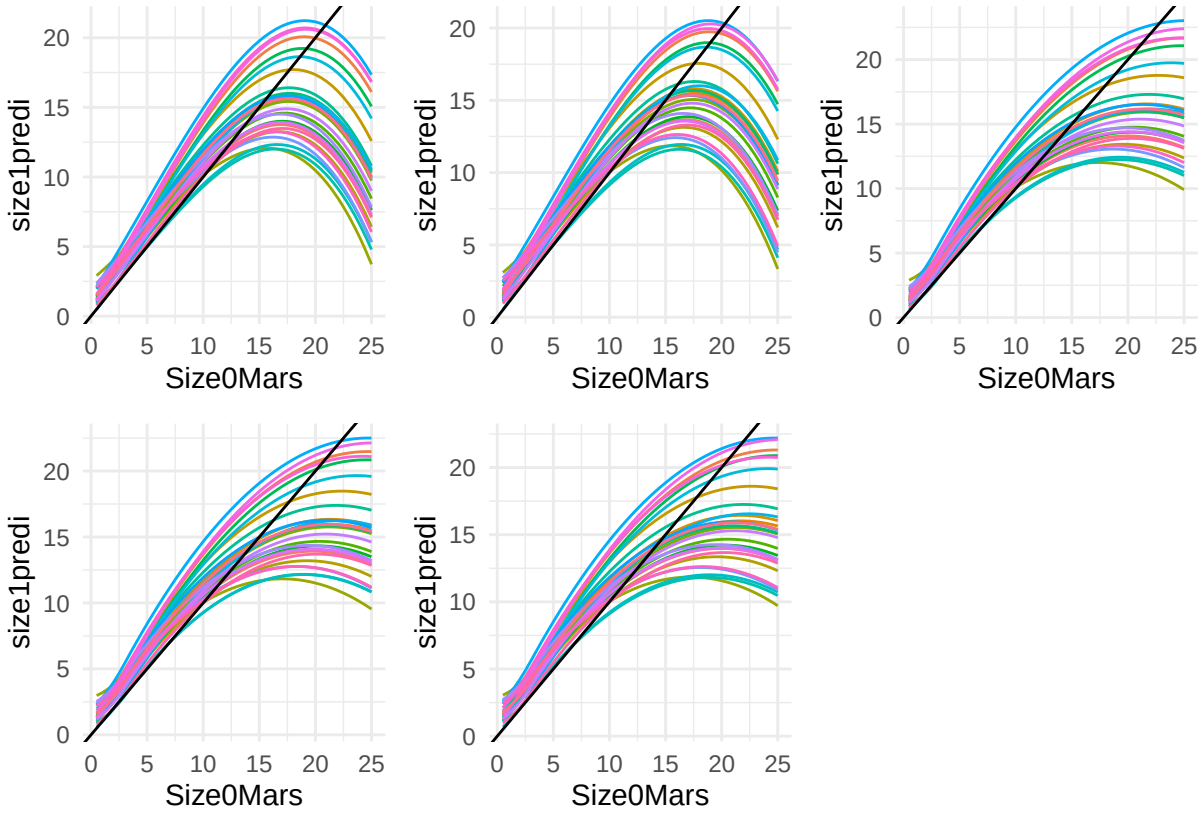
AIC

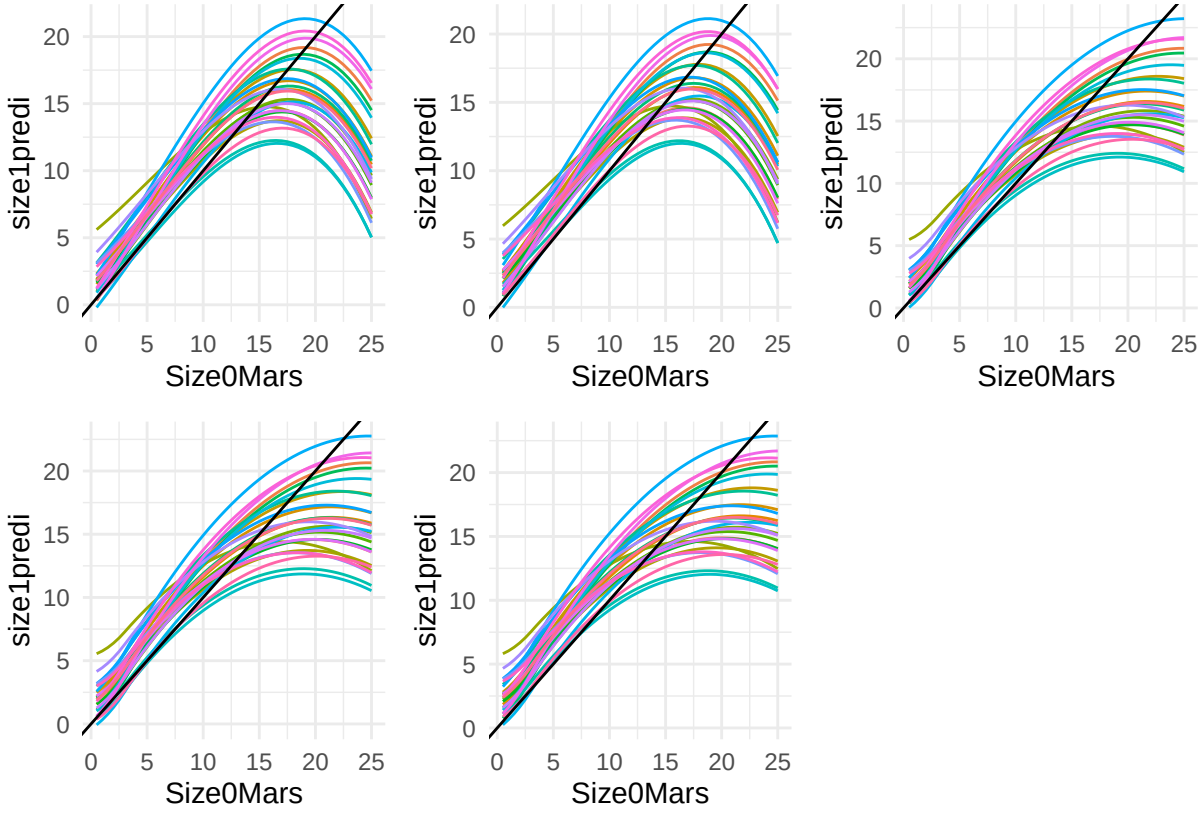


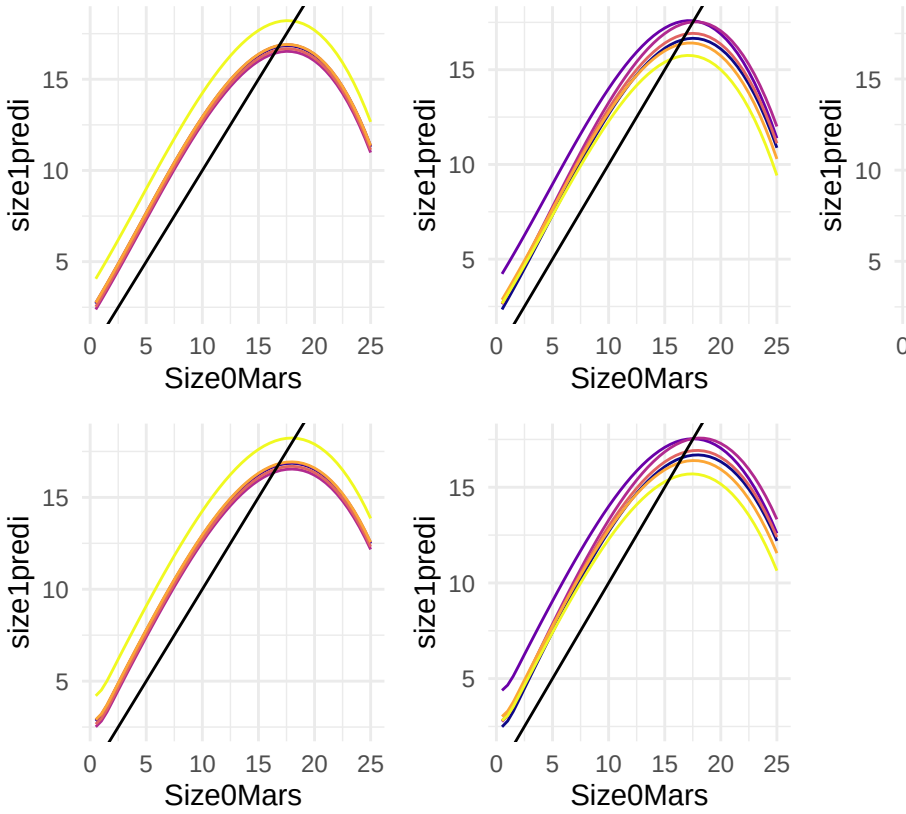

size1predi
Size0Mars
0
5
10
15
20
25



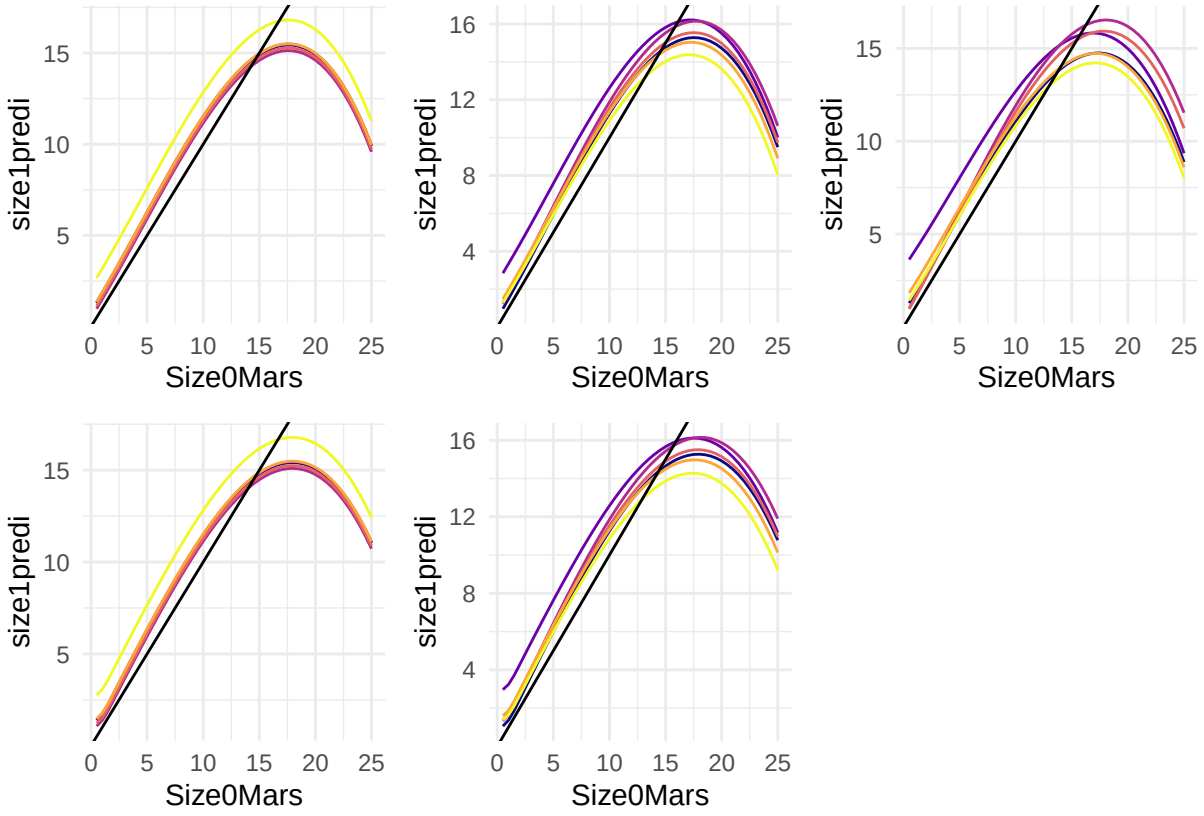
BIC

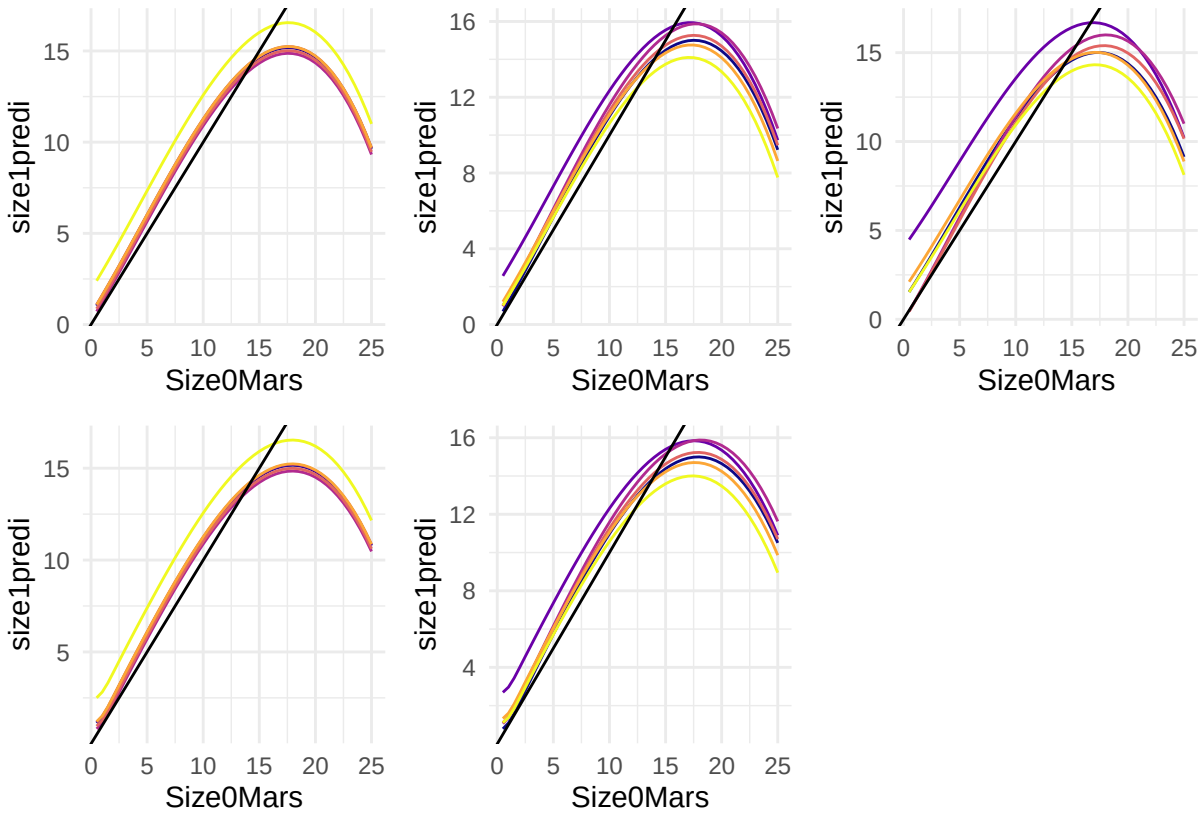

size1predi
Size0Mars
0
5
10
15
20
25

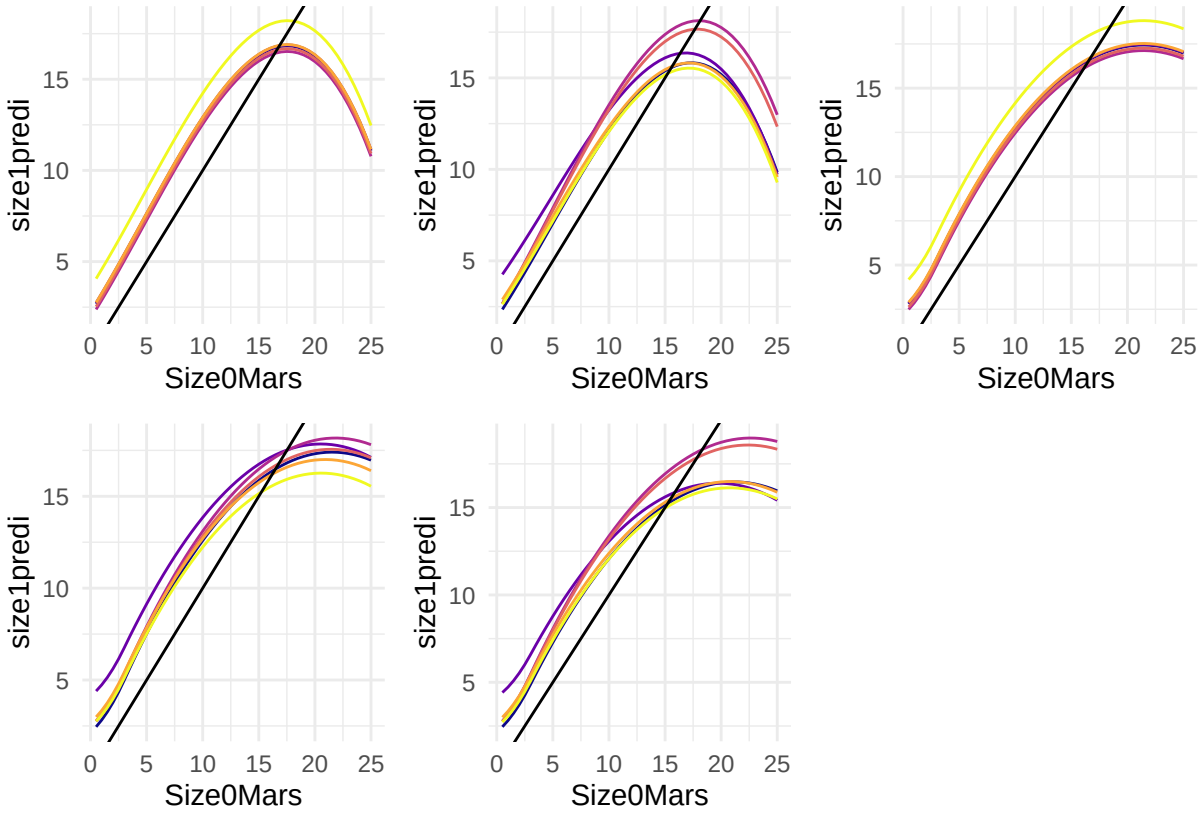

size1predi
Size0Mars
0
5
10
15
20
25



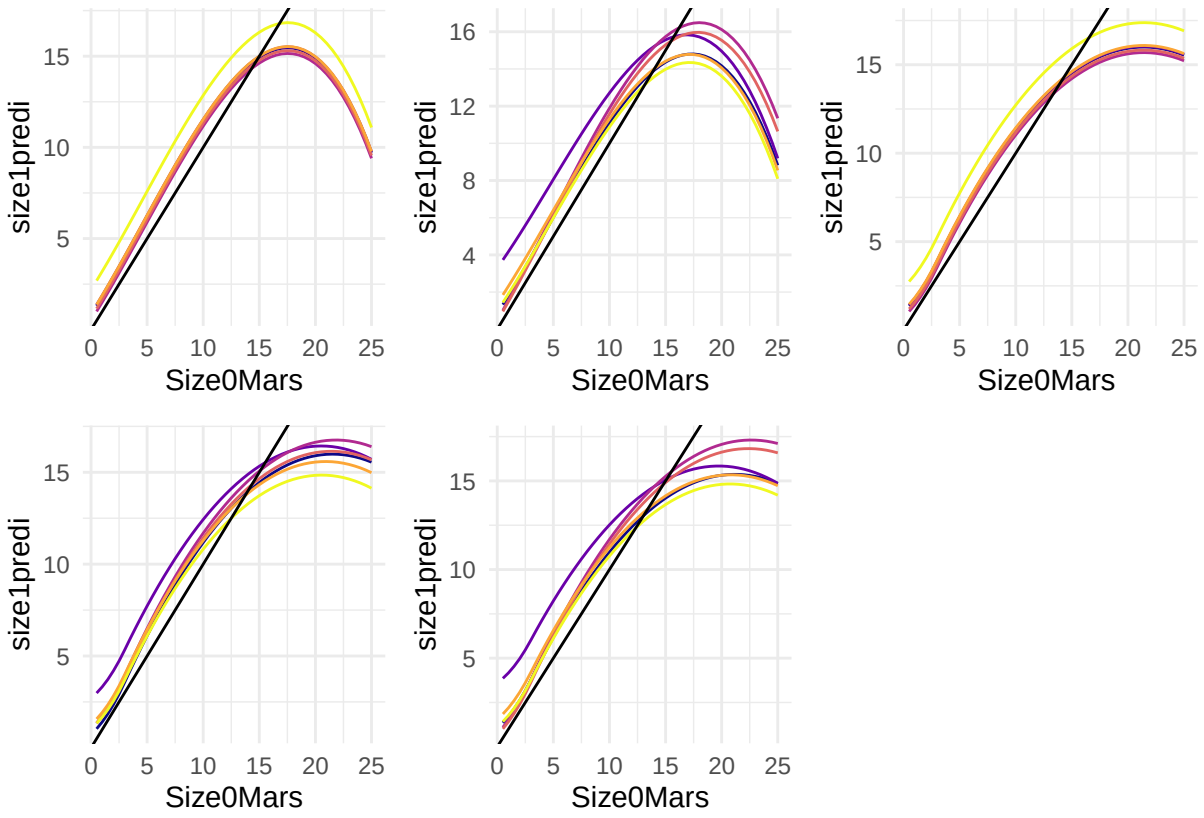
See population effect (year fixed) AIC

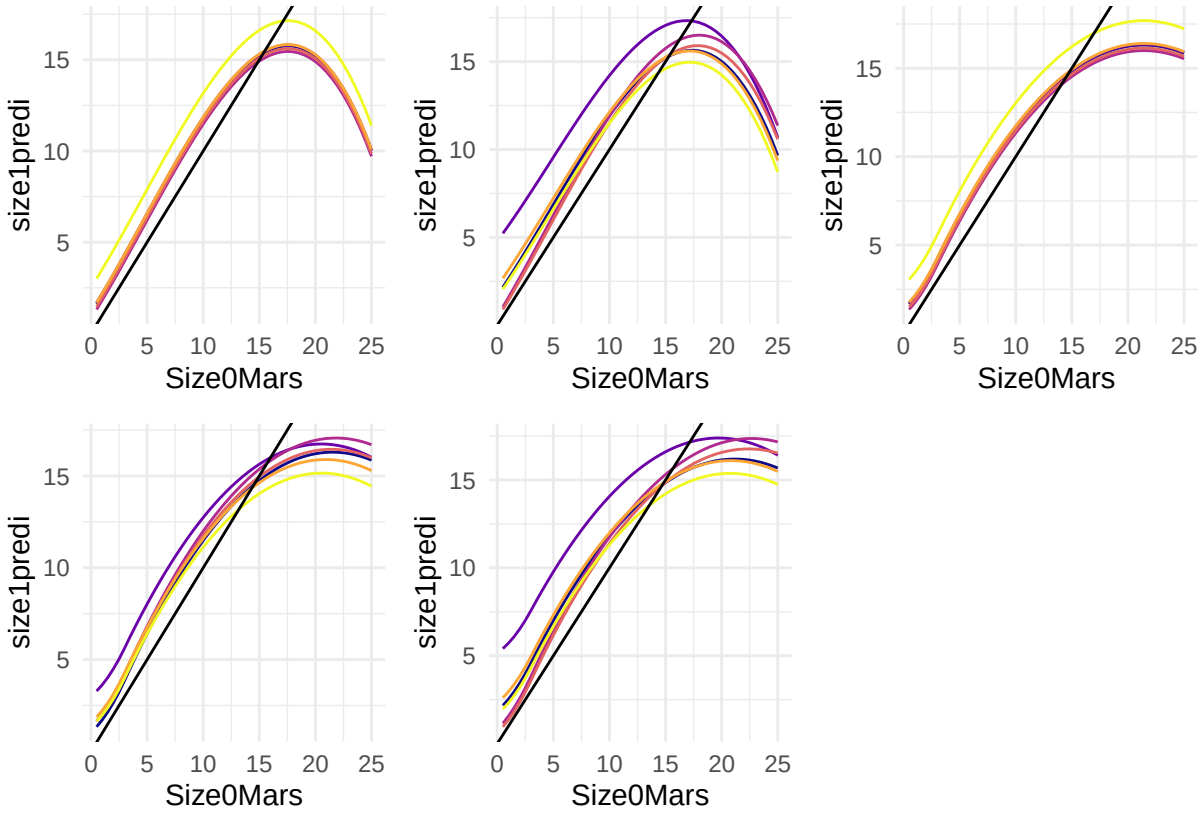



size1predi
Size0Mars
0
5
10
15
20
25
4
8
12
16

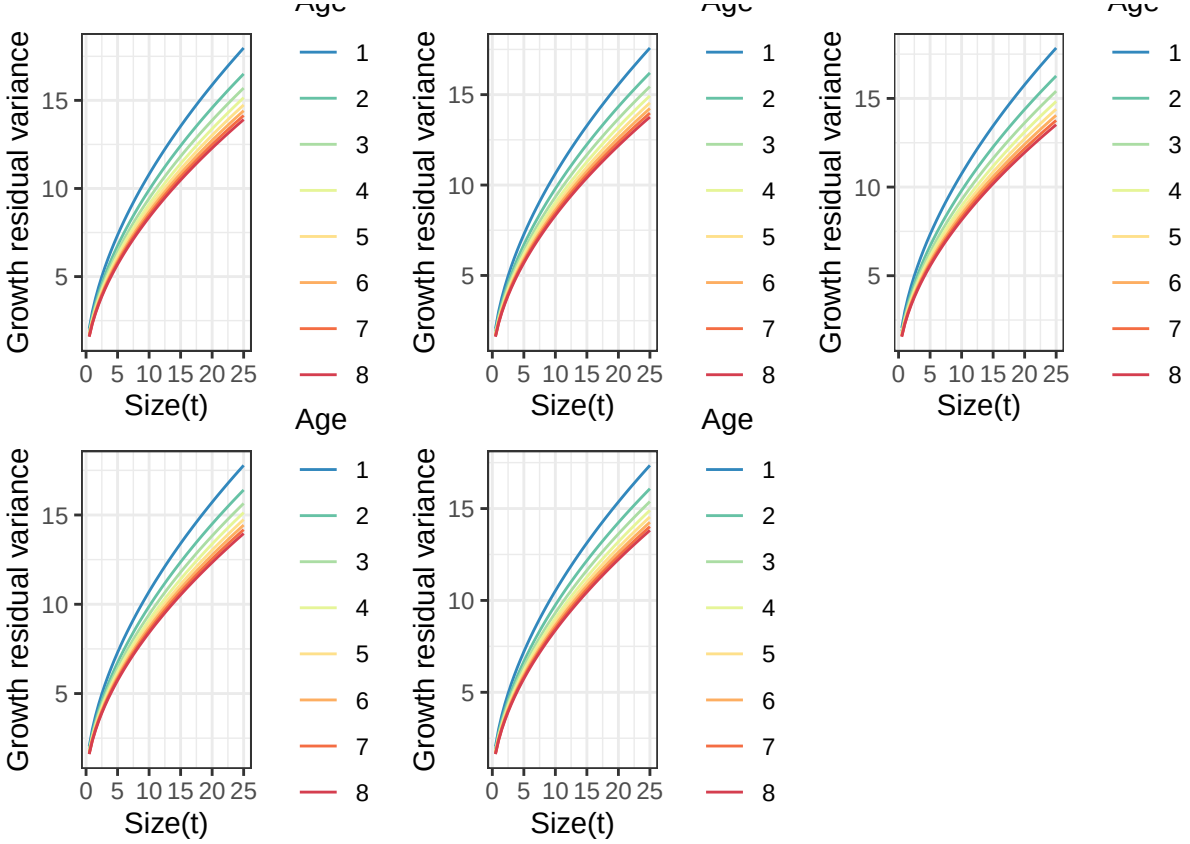


BIC

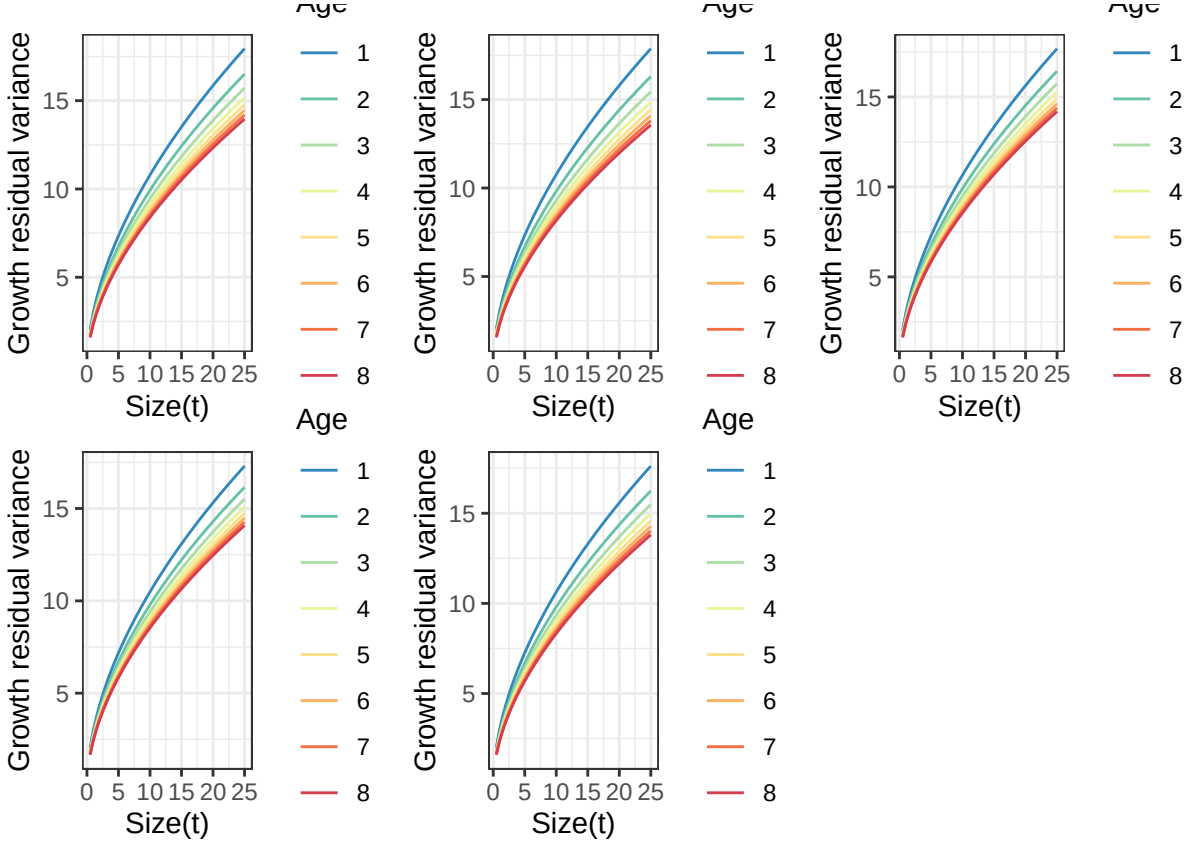

size1predi
Size0Mars
0
5
10
15
20
25
4
8
12
16


size1predi
Size0Mars
0
5
10
15
20
25

Residual variance



AIC



BIC

Number of capitula (fecundity)

AIC

```
ACptlglm1 <- fitme(log(Capitule) ~ 1 + SizeOMars + (Age|year),
                   data=cptldata)

ACptlglm2 <- fitme(log(Capitule) ~ 1 + SizeOMars + (Age|year) + (1|Pop),
                   data=cptldata)

ACptlglm3 <- fitme(log(Capitule) ~ 1 + poly(SizeOMars,2) + (Age|year),
                   data=cptldata)

ACptlglm4 <- fitme(log(Capitule) ~ 1 + SizeOMars + Age +(Age|year),
                   data=cptldata)

ACptlglm5 <- fitme(log(Capitule) ~ 1 + SizeOMars + (1|year),
                   data=cptldata)
```

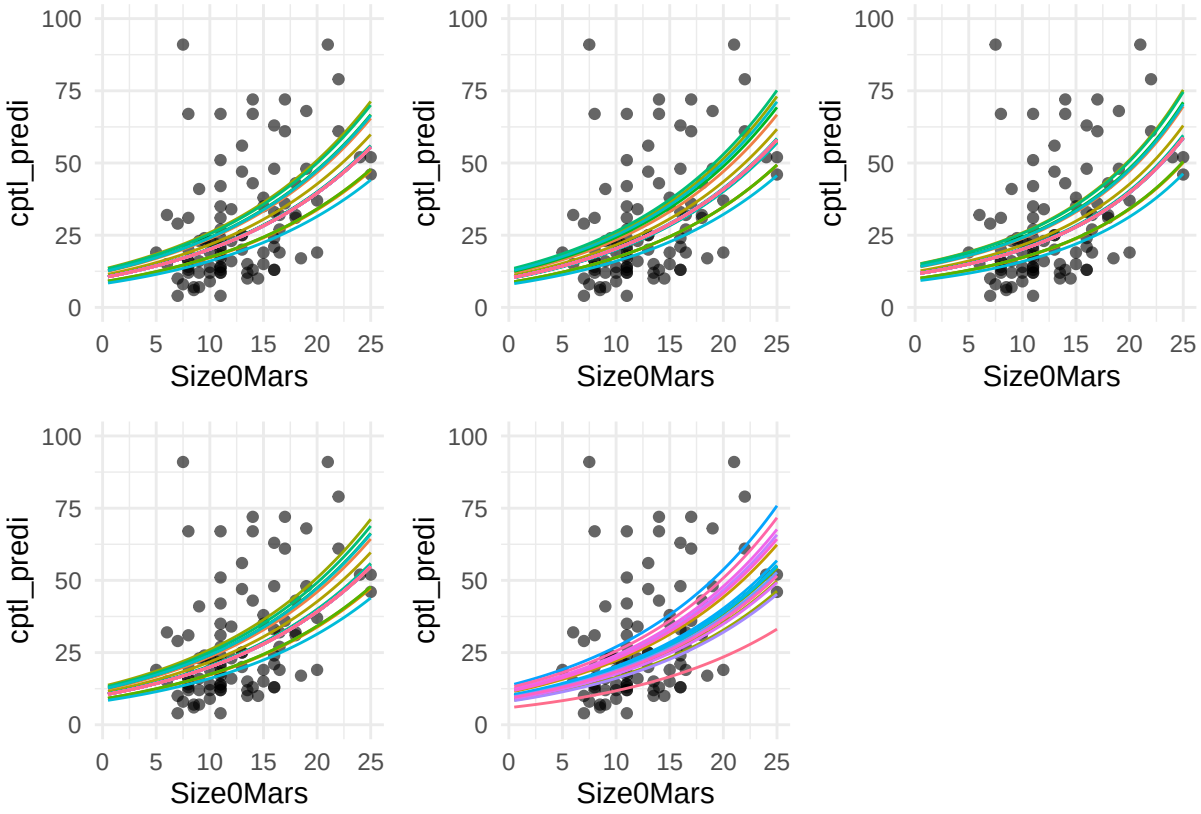
BIC

```
BCptlglm1 <- fitme(log(Capitule) ~ 1 + SizeOMars + (Age|year),
                   data=cptldata)
```

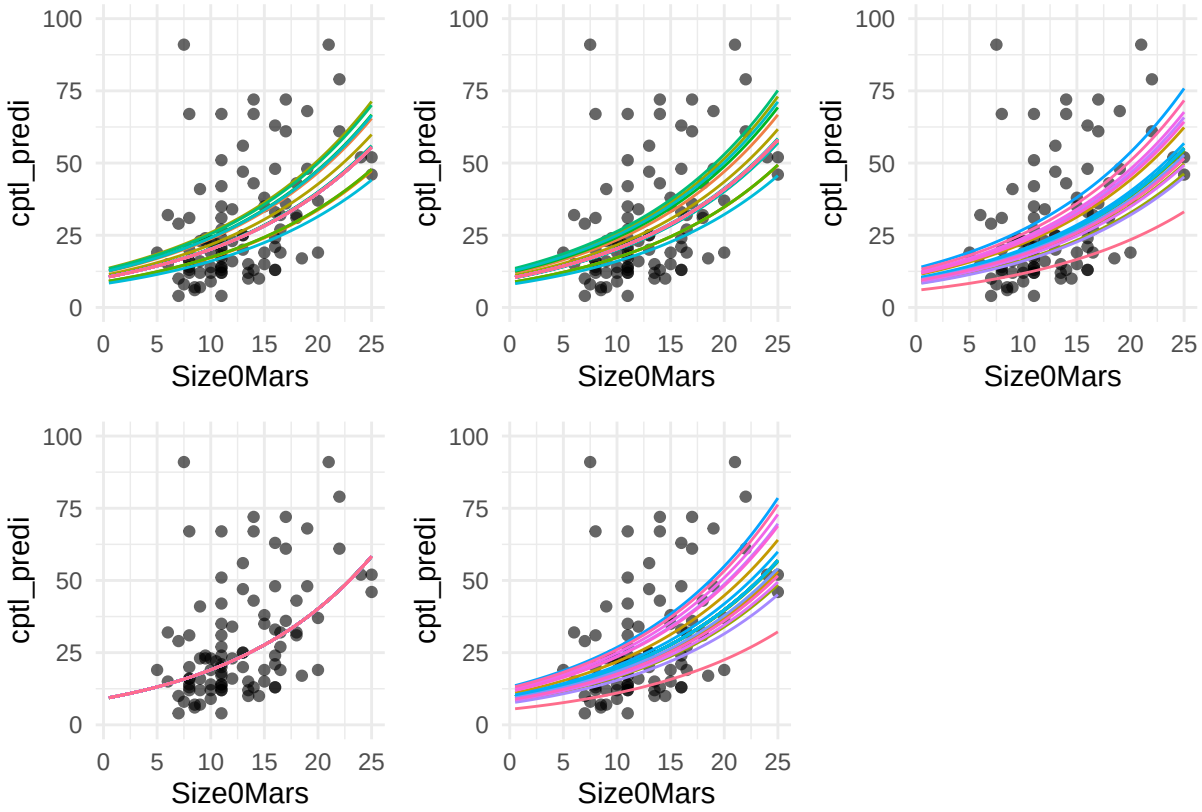
```
BCptlglm2 <- fitme(log(Capitule) ~ 1 +Size0Mars + (Age|year) + (1|Pop),
                  data=cptldata)

BCptlglm3 <- fitme(log(Capitule) ~ 1 + Size0Mars + (1|year),
                  data=cptldata)

BCptlglm4 <- fitme(log(Capitule) ~ 1 + Size0Mars,
                  data=cptldata)

BCptlglm5 <- fitme(log(Capitule) ~ 1 + Size0Mars + (1|year) + (1|Pop),
                  data=cptldata)
```

As a function of size

See year effect

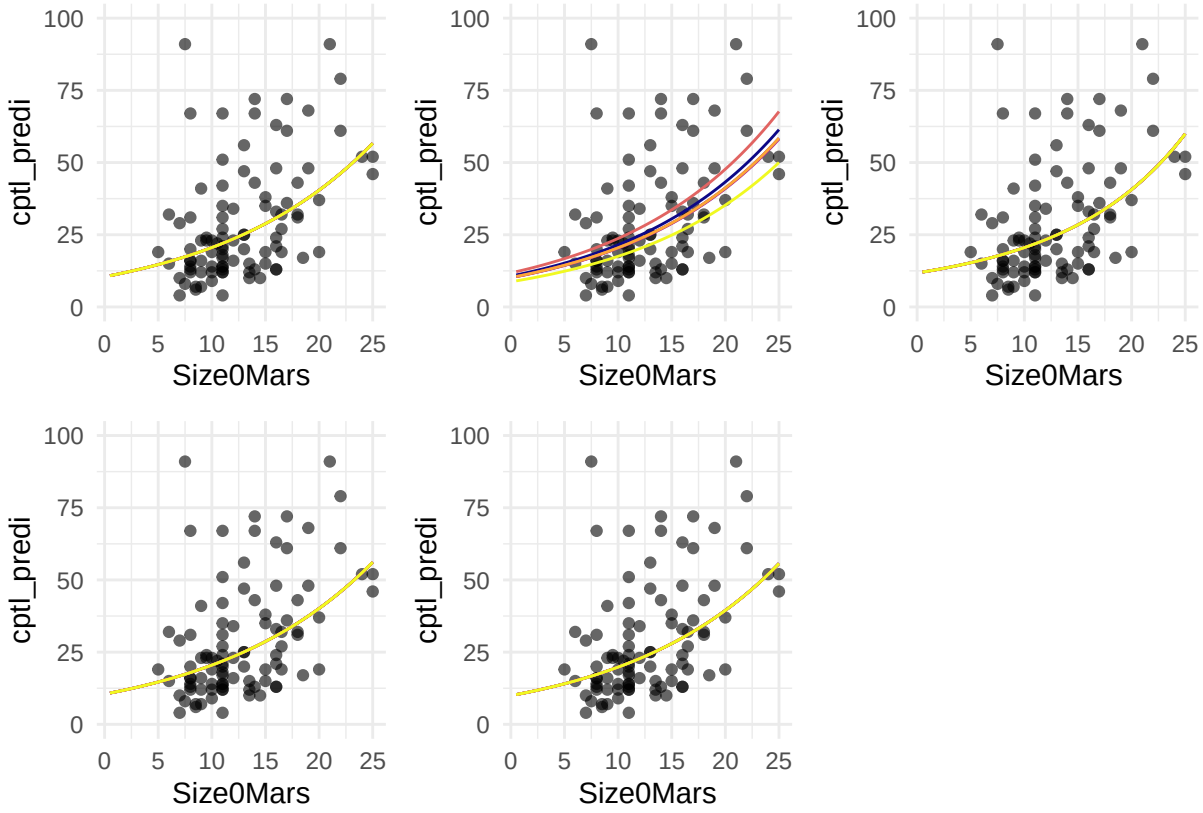


AIC

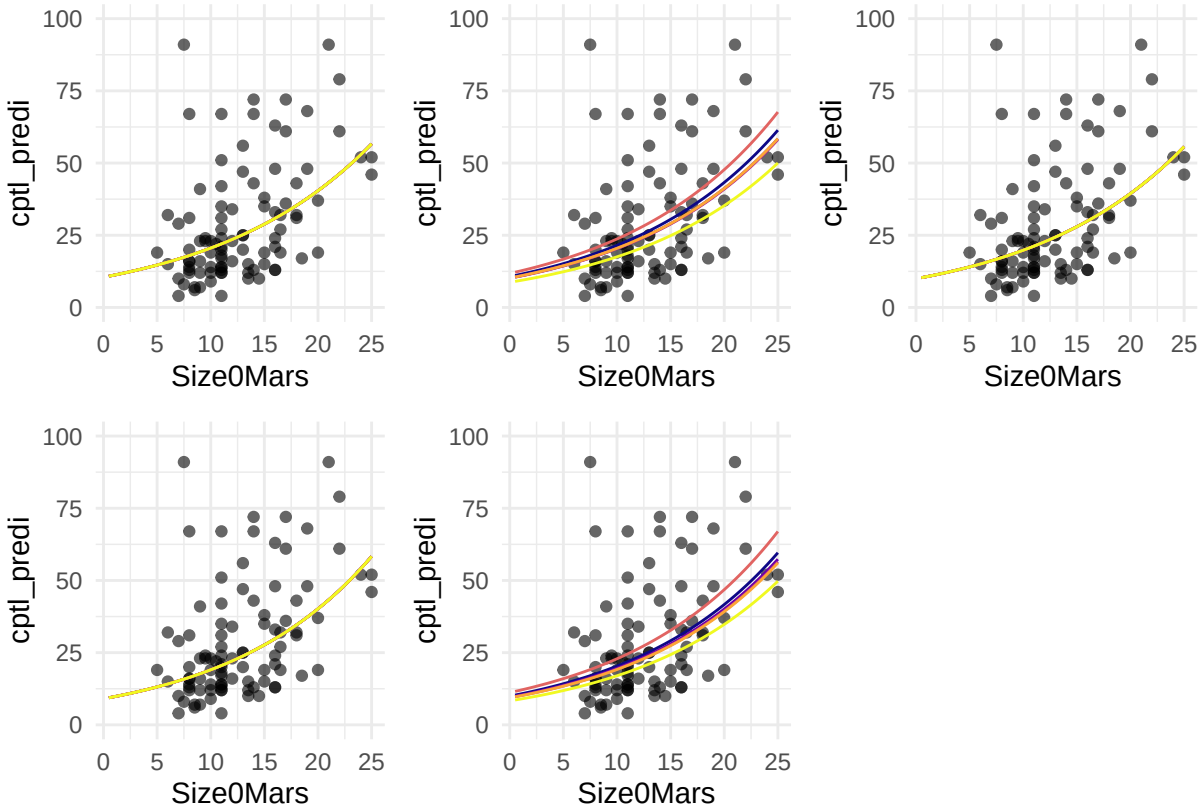


BIC

See population effect



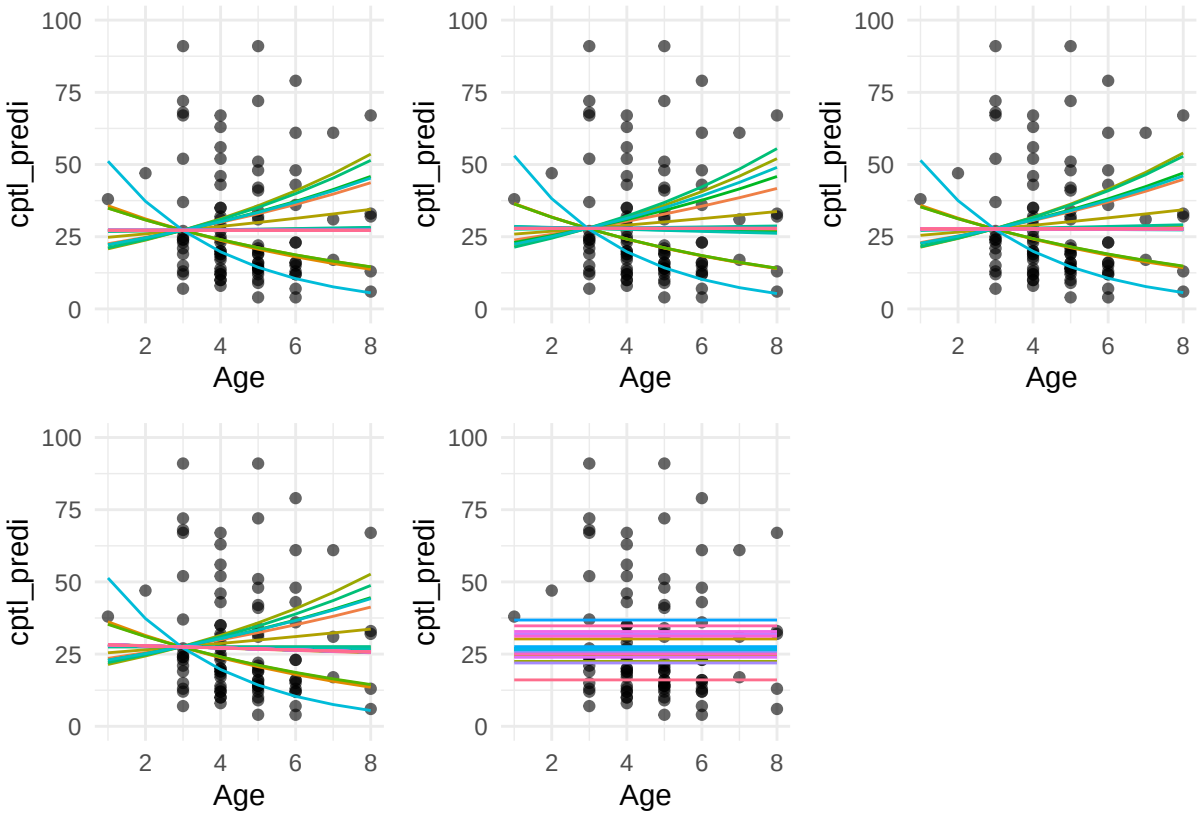
AIC



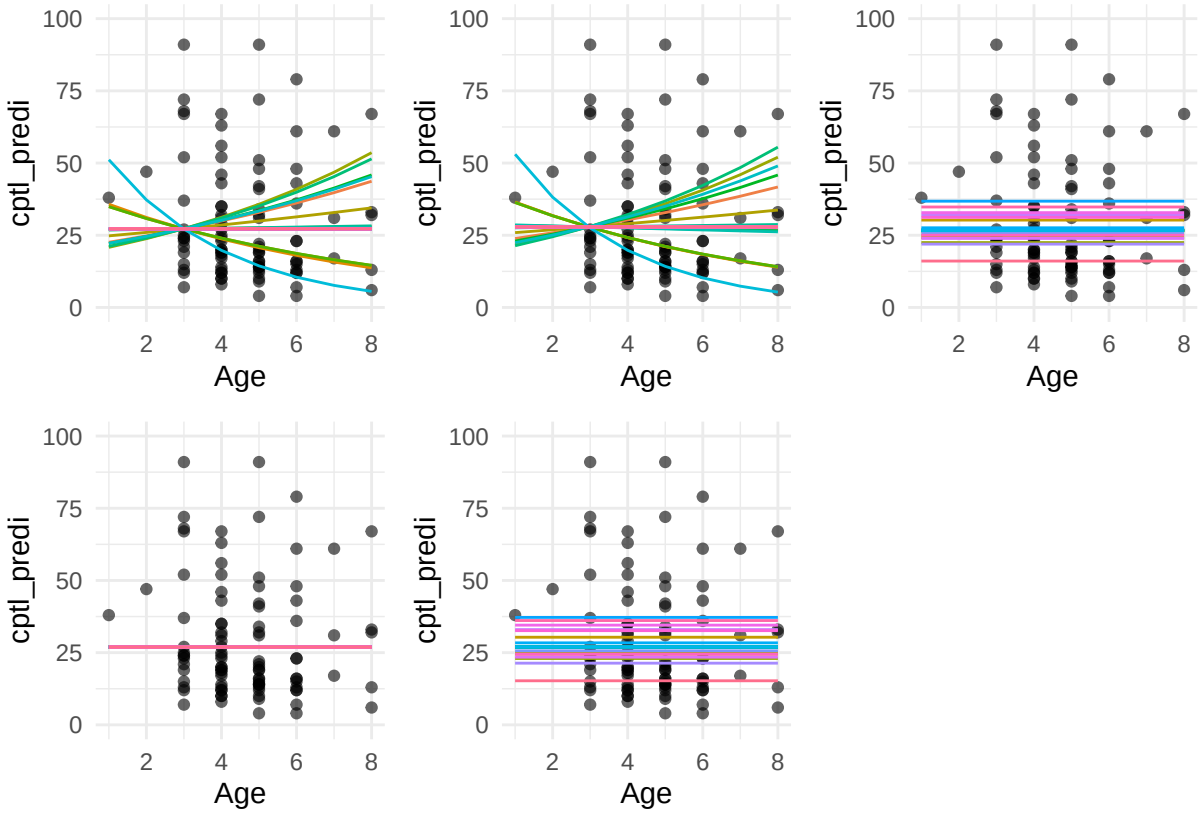
BIC

As a function of age

See year effect



AIC

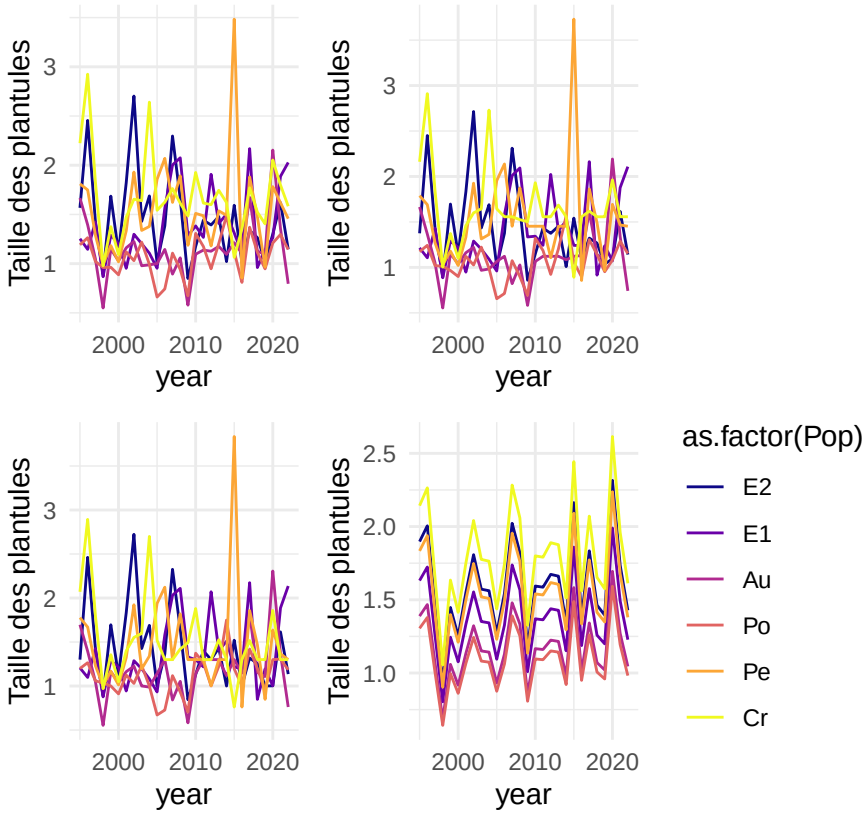


BIC

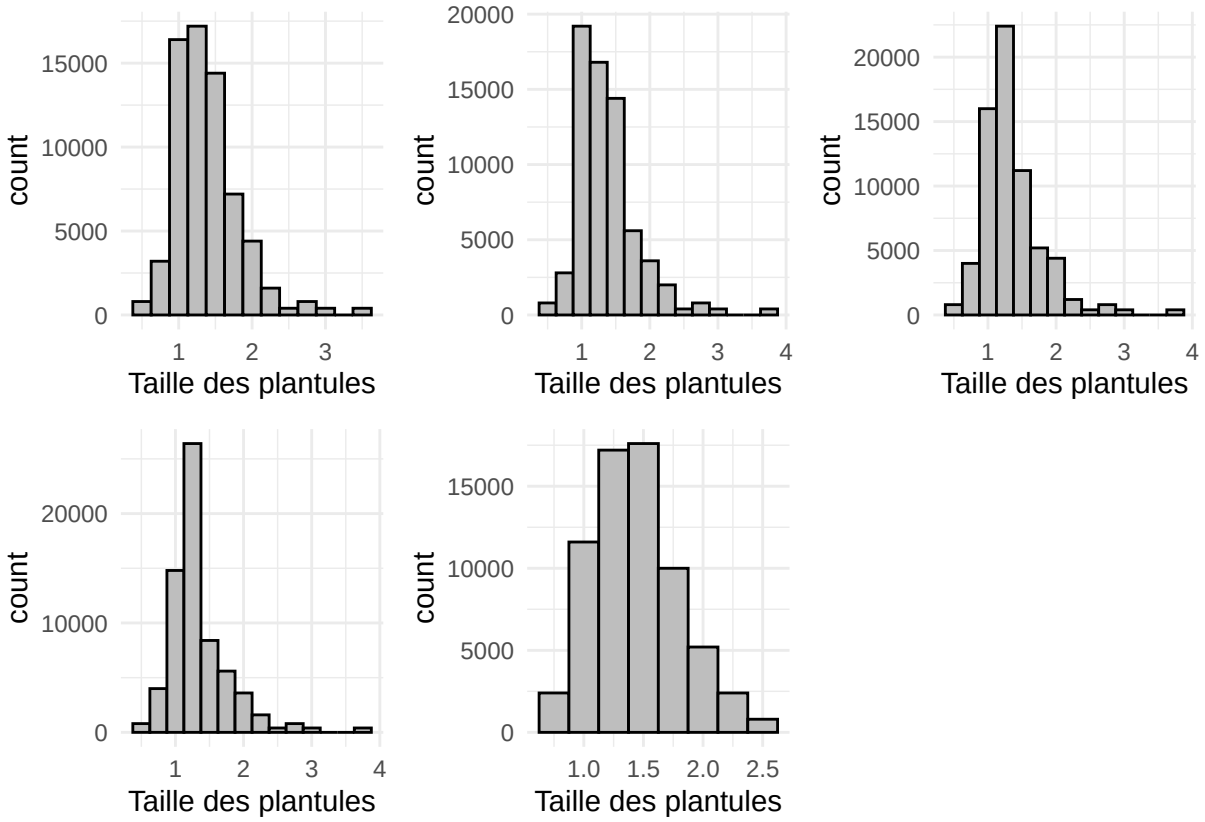
Seedling size

Same with AIC and BIC

As a function of year



Density


count
Taille des plantules
0
5000
10000
15000
20000
1
2
3
4
1.0
1.5
2.0
2.5