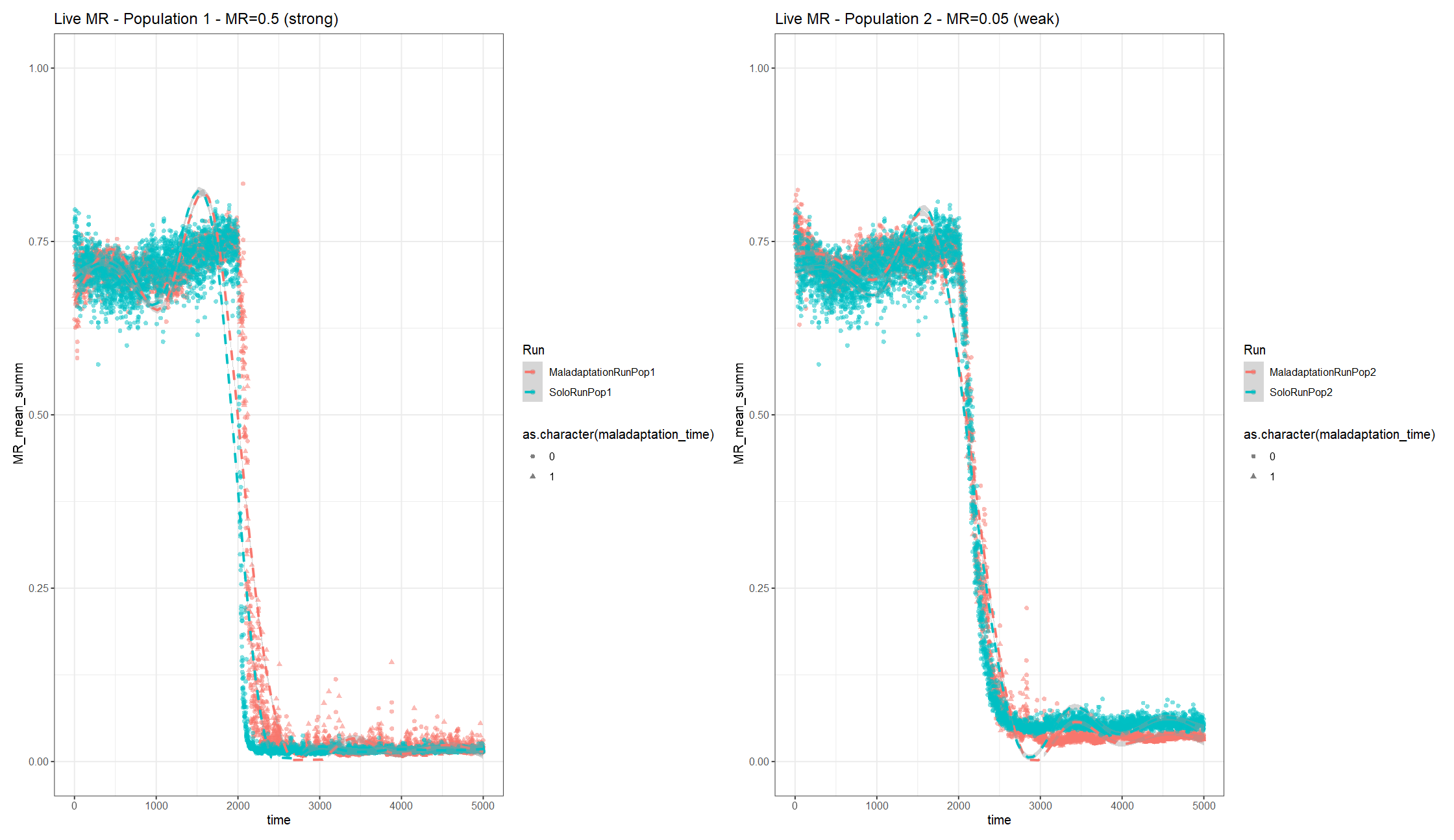
## Updated MR inheritance + competition + MR scale (removed initial rescale, converted all to 0-1) – Recruitment 0.003

|  |  |  |
| --- | --- | --- |
|  | | |
| age\_impact = 1.0  MR\_death\_impact = F  MR\_lateintro = F  recruitment\_const = 0.003  comp\_impact = 0.9 |  |  |
| age\_impact = 1.0  MR\_death\_impact = 0.05  MR\_lateintro = F  recruitment\_const = 0.003  comp\_impact = 0.9 |  |  |
|  |  |  |
| age\_impact = 1.0  MR\_death\_impact = 0.1  MR\_lateintro = F  recruitment\_const = 0.003  comp\_impact = 0.9 |  |  |
| age\_impact = 1.0  MR\_death\_impact = 0.1  MR\_lateintro = T - 2000  recruitment\_const = 0.003  comp\_impact = 0.9 |  |  |
| age\_impact = 1.0  MR\_death\_impact = 0.15  MR\_lateintro = F  recruitment\_const = 0.003  comp\_impact = 0.9 |  |  |
| age\_impact = 1.0  MR\_death\_impact = 0.2  MR\_lateintro = F  recruitment\_const = 0.003  comp\_impact = 0.9 |  |  |
| age\_impact = 1.0  MR\_death\_impact = 0.2  MR\_lateintro = T - 2000  recruitment\_const = 0.003  comp\_impact = 0.9 |  |  |
| age\_impact = 1.0  MR\_death\_impact = 0.5  MR\_lateintro = F  recruitment\_const = 0.003  comp\_impact = 0.9 |  |  |
| age\_impact = 1.0  MR\_death\_impact = 0.5  MR\_lateintro = T - 2000  recruitment\_const = 0.003  comp\_impact = 0.9 |  |  |

|  |  |  |
| --- | --- | --- |
| Pop 1  Age imp val = 1.0  MR imp val = 0.5  Pop 2  Age imp val = 1.0  MR imp val = 0.05 | Blue = runs without maladaptation events (running it solo)  Red = runs with maladaptation events (running both pops in conjunction)  Where for each side pop 1, maladapts with pop 2 (triangle events)  For the left side, pop 1, the maladapted pop is brought higher with the influence of pop2  For the right side, the population is |  |



## Change MR recruitment to ^2 instead of ^4; adjust MR inheritance by -0.08

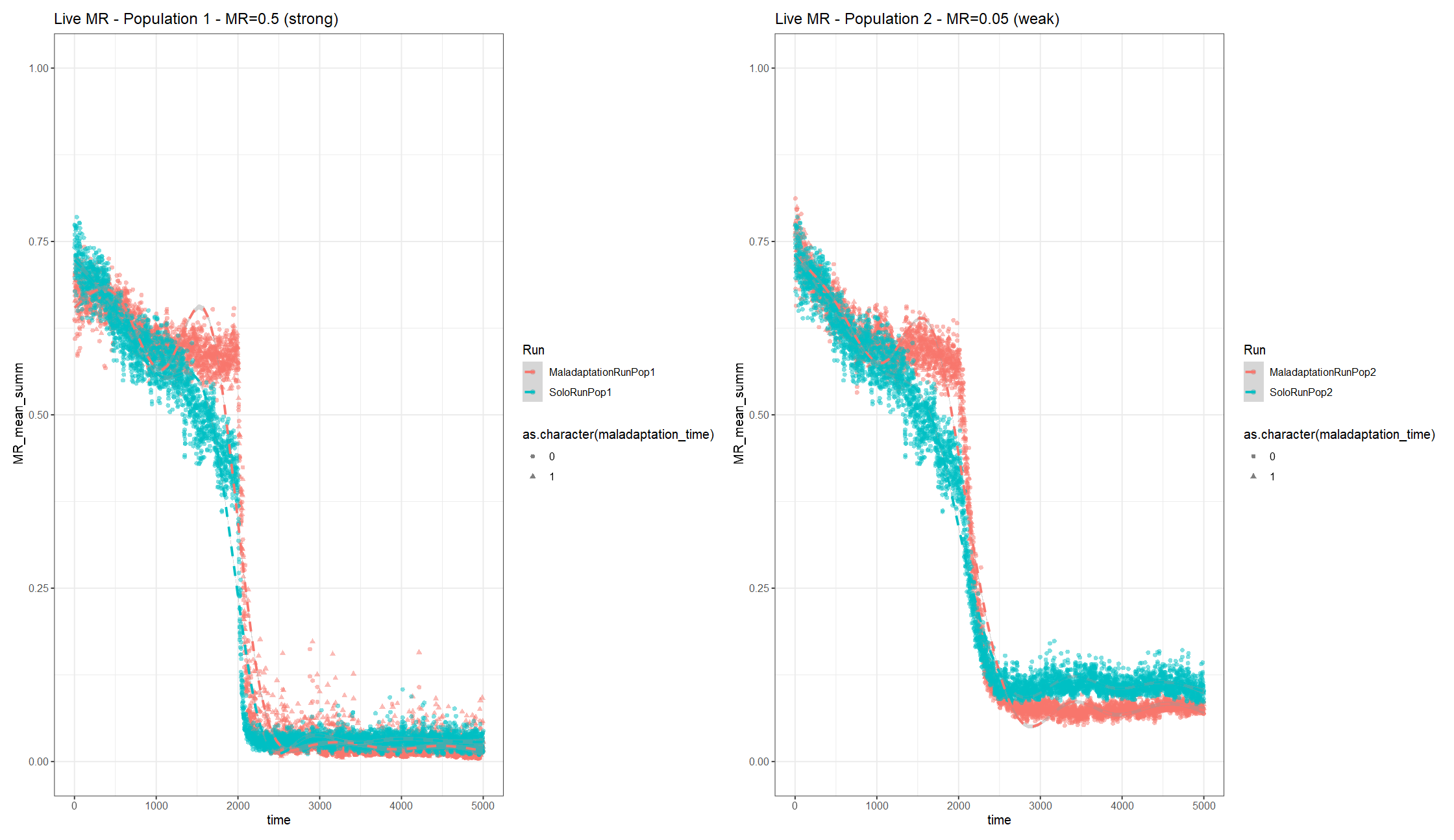
|  |  |  |
| --- | --- | --- |
| age\_impact = 1.0  MR\_death\_impact = F  MR\_lateintro = F  recruitment\_const = 0.003  comp\_impact = 0.9 | A graph of a graph of a person's size  AI-generated content may be incorrect. | A graph of time and time  AI-generated content may be incorrect. |
| age\_impact = 1.0  MR\_death\_impact = 0.1  MR\_lateintro = T - 1000  recruitment\_const = 0.003  comp\_impact = 0.9 |  | A graph of time and time  AI-generated content may be incorrect. |
| age\_impact = 1.0  MR\_death\_impact = 0.2  MR\_lateintro = T - 1000  recruitment\_const = 0.003  comp\_impact = 0.9 | A graph of a person's size  AI-generated content may be incorrect. | A graph of time and time  AI-generated content may be incorrect. |
| A graph with a number of boxes  AI-generated content may be incorrect. | A graph with a chart and text  AI-generated content may be incorrect. |
| T=2000 | A graph of different sizes and numbers  AI-generated content may be incorrect. |  |
| A graph of a chart  AI-generated content may be incorrect. | A graph with black lines  AI-generated content may be incorrect. |
| age\_impact = 1.0  MR\_death\_impact = 0.5  MR\_lateintro = F  recruitment\_const = 0.003  comp\_impact = 0.9 |  |  |
| age\_impact = 1.0  MR\_death\_impact = 0.5  MR\_lateintro = T - 1000  recruitment\_const = 0.003  comp\_impact = 0.9 | A graph of a graph of a person's size  AI-generated content may be incorrect. | A graph of time and time  AI-generated content may be incorrect. |
| age\_impact = 1.0  MR\_death\_impact = 0.75  MR\_lateintro = T - 1000  recruitment\_const = 0.003  comp\_impact = 0.9 | A graph of a graph of a person's size  AI-generated content may be incorrect. |  |
| age\_impact = 1.0  MR\_death\_impact = 0.8  MR\_lateintro = T - 2000  recruitment\_const = 0.003  comp\_impact = 0.9 | A graph of a graph of a person's body  AI-generated content may be incorrect. | A graph of time and time  AI-generated content may be incorrect. |
| age\_impact = 1.0  MR\_death\_impact = 1.0  MR\_lateintro = T - 1000  recruitment\_const = 0.003  comp\_impact = 0.9 | A graph of a graph of a person's size  AI-generated content may be incorrect. |  |
| A graph of a graph with numbers and a line of black and white  AI-generated content may be incorrect. | A graph of a number of objects  AI-generated content may be incorrect. |
| Pop 1  Age imp val = 1.0  MR imp val = 0.2  Pop 2  Age imp val = 1.0  MR imp val = 0.8 | Was run without maladaptation at the start to confirm initial pops overlapped  Q: Why does it drop at the start? |  |

A screenshot of a graph

AI-generated content may be incorrect.

## Change MR recruitment to ^2 instead of ^4

|  |  |  |
| --- | --- | --- |
| Pop 1  age\_impact = 1.0  MR\_death\_impact = 0.5  MR\_lateintro = T - 2000  recruitment\_const = 0.003  comp\_impact = 0.9 |  |  |
| Pop 2  age\_impact = 1.0  MR\_death\_impact = 0.05  MR\_lateintro = T - 2000  recruitment\_const = 0.003  comp\_impact = 0.9 |  |  |
| Pop 1  Age imp val = 1.0  MR imp val = 0.5  Pop 2  Age imp val = 1.0  MR imp val = 0.05 | Blue = runs without maladaptation events (running it solo)  Red = runs with maladaptation events (running both pops in conjunction)  Where for each side, red, pop 1, maladapts with pop 2 (triangle events):   * For the left side, pop 1, the maladapted pop is **pulled up** with the influence of pop2 (less resistant) * For the right side, pop 2 is **pulled** **down** with the influence of pop1 (more resistant) |  |



|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Impact \_ MR | 0.10 | 0.12 | 0.14 | 0.16 | 0.18 |
|  |  |  |  |  | A graph with lines and numbers  AI-generated content may be incorrect. |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

**Adjusted recruitment to account for MR and age**

|  |  |
| --- | --- |
|  |  |

### Intervention

Data\_sim\_3

Altered mortality – age of interception indivs \*4 until mortality\_age\_shift/4 (~35)

#### Base:

* Recruitment adjustment = 0 & ^2
* MR=0.12
* MR introduced at 1000

**A graph of a person's size

AI-generated content may be incorrect.A graph of time and time

AI-generated content may be incorrect.A graph with a row of rectangular objects

AI-generated content may be incorrect.A graph with black lines and white text

AI-generated content may be incorrect.**

#### Intervention\_100-0.15-0.1\_T1025:

* Population size = 1000
* Init pop MR mean= 0.787; MR sd=0. 385
* Recruitment adjustment = 0 & ^2
* MR=0.12
* MR introduced at 1000
* intercept\_timepoint = 1025
* Dropped mean MR from 0.4468093 -> 0.4385565
* intercept\_indiv = 100
* intercept\_MR\_mean = 0.15
* intercept\_MR\_sd = 0.1

# A tibble: 2 × 2

Run min\_pop\_size

*<chr>* *<dbl>*

1 Base 1362.

2 Resistance Intervention 1598.

A screenshot of a graph

AI-generated content may be incorrect.

A comparison of a graph

AI-generated content may be incorrect.

#### Intervention\_300-0.15-0.1\_T1025:

* Population size = 1000
* Init pop MR mean= 0.787; MR sd=0. 385
* Recruitment adjustment = 0 & ^2
* MR=0.12
* MR introduced at 1000
* intercept\_timepoint = 1025
  + Dropped mean MR from 0.4468093 -> 0.4235052
* intercept\_indiv = 300
* intercept\_MR\_mean = 0.15
* intercept\_MR\_sd = 0.1

# A tibble: 2 × 2

Run min\_pop\_size

*<chr>* *<dbl>*

1 Base 1362.

2 Resistance Intervention 1222.

A graph of a graph

AI-generated content may be incorrect.A comparison of a graph

AI-generated content may be incorrect.

#### Intervention\_300-0.10-0.05\_T1025:

* Population size = 1000
* Init pop MR mean= 0.787; MR sd=0. 385
* Recruitment adjustment = 0 & ^2
* MR=0.12
* MR introduced at 1000
* intercept\_timepoint = 1025
  + Dropped mean MR from 0.499 -> 0.4718
* intercept\_indiv = 300
* intercept\_MR\_mean = 0.10
* intercept\_MR\_sd = 0.05

# A tibble: 2 × 2

Run min\_pop\_size

*<chr>* *<dbl>*

1 Base 1362.

2 Resistance Intervention 1470.

A graph of a graph of a graph

AI-generated content may be incorrect.

A comparison of a graph

AI-generated content may be incorrect.

#### Intervention\_300-0.15-0.10\_T1050:

* Population size = 1000
* Init pop MR mean= 0.787; MR sd=0. 385
* Recruitment adjustment = 0 & ^2
* MR=0.12
* MR introduced at 1000
* intercept\_timepoint = 1050
  + Dropped mean MR from 0.4458399 -> 0.4202595
* intercept\_indiv = 300
* intercept\_MR\_mean = 0.15
* intercept\_MR\_sd = 0.10

> live\_size\_wind\_mean %>%

+ group\_by(Run) %>%

+ summarise(min\_pop\_size = min(mean\_wind\_size))

# A tibble: 2 × 2

Run min\_pop\_size

*<chr>* *<dbl>*

1 Base 1362.

2 Resistance Intervention 1367.

A screenshot of a graph

AI-generated content may be incorrect.

A comparison of a graph

AI-generated content may be incorrect.

#### Intervention\_300-0.15-0.10\_T1025:

* Population size = 1000
* Init pop MR mean= 0.787; MR sd=0. 385
* Recruitment adjustment = 0 & ^2
* MR=0.12
* MR introduced at 1000
* intercept\_timepoint = 1025
  + Dropped mean MR from 0.4468093 -> 0.4235052
* intercept\_indiv = 300
* intercept\_MR\_mean = 0.15
* intercept\_MR\_sd = 0.1

# A tibble: 2 × 2

Run min\_pop\_size

*<chr>* *<dbl>*

1 Base 1362.

2 Resistance Intervention 1192.

A screenshot of a graph

AI-generated content may be incorrect.

A comparison of a graph

AI-generated content may be incorrect.

#### Intervention\_500-0.15-0.10\_T1025:

* Population size = 1000
* Init pop MR mean= 0.787; MR sd=0. 385
* Recruitment adjustment = 0 & ^2
* MR=0.12
* MR introduced at 1000
* intercept\_timepoint = 1025
  + Dropped mean MR from 0.4468093 -> 0.4102694
* intercept\_indiv = 500
  + After addition (*N =* 4035)
* intercept\_MR\_mean = 0.15
* intercept\_MR\_sd = 0.1

# A tibble: 2 × 2

Run min\_pop\_size

*<chr>* *<dbl>*

1 Base 1362.

2 Resistance Intervention 1635.

A graph of a graph

AI-generated content may be incorrect.

A comparison of a graph

AI-generated content may be incorrect.

#### Intervention\_1000-0.15-0.1\_T1025:

* Population size = 1000
* Init pop MR mean= 0.787; MR sd=0. 385
* Recruitment adjustment = 0 & ^2
* MR=0.12
* MR introduced at 1000
* intercept\_timepoint = 1025
  + Dropped mean MR from 0.4468093 -> 0.3825454
* intercept\_indiv = 1000
  + After addition (*N =* 4535)
* intercept\_MR\_mean = 0.15
* intercept\_MR\_sd = 0.1

# A tibble: 2 × 2

Run min\_pop\_size

*<chr>* *<dbl>*

1 Base 1362.

2 Resistance Intervention 1845.

A graph of a graph of a graph

AI-generated content may be incorrect.

A comparison of a graph

AI-generated content may be incorrect.

#### Intervention\_300-0.15-0.1\_T1025\_PopSize4000:

* Population size = 4000
* Init pop MR mean= 0.787; MR sd=0. 385
* Recruitment adjustment = 0 & ^2
* MR=0.12
* MR introduced at 1000
* intercept\_timepoint = 1025
  + Dropped mean MR from 0.4468093 -> 0.3825454
* intercept\_indiv = 300
* intercept\_MR\_mean = 0.15
* intercept\_MR\_sd = 0.1

# A tibble: 2 × 2

Run min\_pop\_size

*<chr>* *<dbl>*

1 Base 6280.

2 Resistance Intervention 7039.

A graph of a graph

AI-generated content may be incorrect.

A comparison of a graph

AI-generated content may be incorrect.

**Reducing recruitment: to 0.0025 from 0.003**

A graph of a graph of a graph

AI-generated content may be incorrect.

#### Intervention\_300-0.15-0.1\_T1025 \_ResistInitMR:

* Population size = 1000
* Init pop MR mean= 0.25; MR sd=0. 1
* Recruitment adjustment = 0 & ^2
* MR=0.12
* MR introduced at 1000
* intercept\_timepoint = 1025
  + Dropped mean MR from 0.243588 -> 0.2376324
* intercept\_indiv = 300
* intercept\_MR\_mean = 0.15
* intercept\_MR\_sd = 0.1

> live\_size\_wind\_mean %>%

+ group\_by(Run) %>%

+ summarise(min\_pop\_size = min(mean\_wind\_size))

# A tibble: 2 × 2

Run min\_pop\_size

*<chr>* *<dbl>*

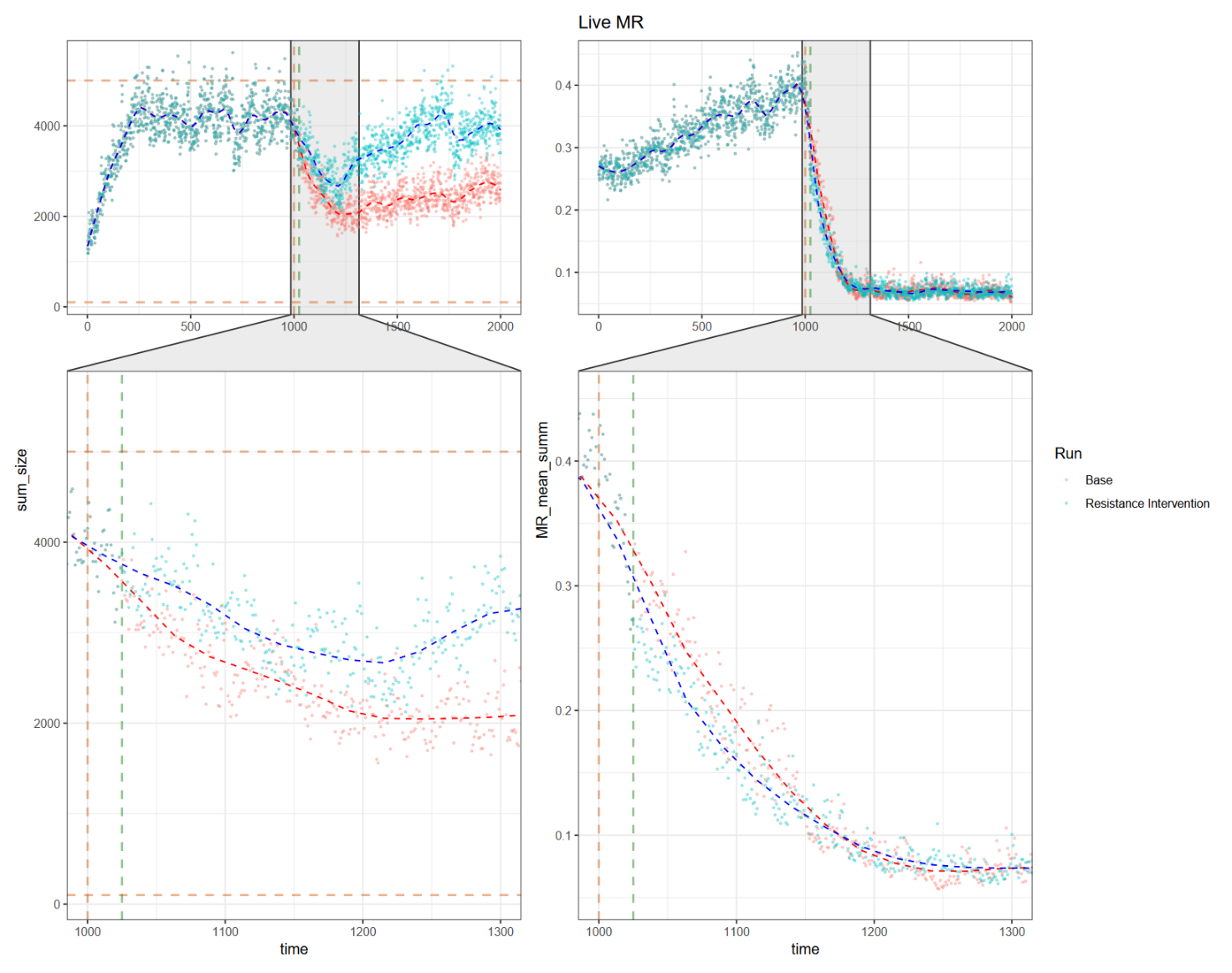
1 Base 2011.

2 Resistance Intervention 2485.

E.g., 0.3 recruit

A graph of a number of objects

AI-generated content may be incorrect.

**A comparison of a graph

AI-generated content may be incorrect.**

#### Intervention\_300-0.15-0.1\_T1025\_Rm mortality reduction\_ ResistInitMR:

* Population size = 1000
* Init pop MR mean= 0.25; MR sd=0. 1
* Recruitment adjustment = 0 & ^2
* MR=0.12
* MR introduced at 1000
* intercept\_timepoint = 1025
  + Dropped mean MR from 0.2764773 -> 0.2684228
* intercept\_indiv = 300
* intercept\_MR\_mean = 0.15
* intercept\_MR\_sd = 0.1
* intercept\_reducMort = F

# A tibble: 2 × 2

Run min\_pop\_size

*<chr>* *<dbl>*

1 Base 1362.

2 Resistance Intervention 1845.

A screenshot of a graph

AI-generated content may be incorrect.

A comparison of a window size chart

AI-generated content may be incorrect.

#### Intervention\_300-0.8-0.1\_T1050:

* Population size = 1000
* Init pop MR mean= 0.787; MR sd=0. 385
* Recruitment adjustment = 0 & ^2
* MR=0.12
* MR introduced at 1000
* intercept\_timepoint = 1050
  + Mean MR from 0.4468093 -> 0.4741063
* intercept\_indiv = 300
* intercept\_MR\_mean = 0.80
* intercept\_MR\_sd = 0.10
* intercept\_reducMort = F

> live\_size\_wind\_mean %>%

+ group\_by(Run) %>%

+ summarise(min\_pop\_size = min(mean\_wind\_size))

# A tibble: 2 × 2

Run min\_pop\_size

*<chr>* *<dbl>*

1 Base 1362.

2 Resistance Intervention 1330.

A graph of a graph

AI-generated content may be incorrect.

A comparison of a graph

AI-generated content may be incorrect.

A graph of a person with histogram

AI-generated content may be incorrect.

## Change MR recruitment to adjust for MR and age; MR recruited return back to ^4

**Base**

|  |  |  |
| --- | --- | --- |
| ## Input parameters for high MR pressure sites  ## Population parameters  population\_size = 1000  population\_carrying\_capacity = population\_size\*5  population\_minimum\_size = population\_size/10  MR\_mean = 0.787 # From actual genotype data  MR\_sd = 0.385  disturbance\_impact\_val=5 # impacts base age & MR death factor and recruitment constant  ## Mortality parameters  age\_impact = 1.0 # scaled age inflicted increase - from 0 to 1, should add to 1 with MR impact val  mortality\_age\_shift = 150 # at what age does increases in age increase chance of death  MR\_imp = T # toggle on/off for MR inflicted death increase  MR\_death\_impact = 0.20 # linear scaled MR inflicted death increase - from 0 to 1, should add to 1 with age impact val  MR\_age\_impact = 20 # scaled impact of age (ages / MR\_age\_impact\_val) on MR inflicted death increase  MR\_lateintro = T  MR\_timepoint = 1000 # time point when MR is introduced  ## Recruitment parameters  recruitment\_const = 0.003 # base constant for chance of recruitment  recruitment\_age = 7 # age to begin recruiting  recruitment\_mean = 100 # mean for PDF of normal distribution for number of recruited individuals  recruitment\_sd = recruitment\_mean/2 # standard deviation of number of recruited individuals  age\_rec\_toggle = TRUE # Takes the complimentary of the age fraction to reduce recruitment mean according to size (larger = closer to 1)  age\_recruit\_impact\_value = 0.5 # Range from 0.01-1. Takes the exponential of this value, the higher this value, the steeper the penalisation  rec\_age\_shift = 100 # age shift, lower than this age recruitment for the individual is penalised  MR\_rec\_toggle = F # toggle on/off of MR affect on recruitment  MR\_recruit\_impact = 0.5 # impact of MR on recruitment, a multiplier of the individual MR to reduce recruitment chance  MR\_rec\_adj = 0 # Shift mean of MR status of recruited individuals  ## Intervention parameters  intercept\_togg = F |  |  |
| ## Input parameters for high MR pressure sites  ## Population parameters  population\_size = 1000  population\_carrying\_capacity = population\_size\*5  population\_minimum\_size = population\_size/10  MR\_mean = 0.787 # From actual genotype data  MR\_sd = 0.385  disturbance\_impact\_val=5 # impacts base age & MR death factor and recruitment constant  ## Mortality parameters  age\_impact = 1.0 # scaled age inflicted increase - from 0 to 1, should add to 1 with MR impact val  mortality\_age\_shift = 150 # at what age does increases in age increase chance of death  MR\_imp = T # toggle on/off for MR inflicted death increase  MR\_death\_impact = 0.12 # linear scaled MR inflicted death increase - from 0 to 1, should add to 1 with age impact val  MR\_age\_impact = 20 # scaled impact of age (ages / MR\_age\_impact\_val) on MR inflicted death increase  MR\_lateintro = T  MR\_timepoint = 1000 # time point when MR is introduced  ## Recruitment parameters  recruitment\_const = 0.003 # base constant for chance of recruitment  recruitment\_age = 7 # age to begin recruiting  recruitment\_mean = 100 # mean for PDF of normal distribution for number of recruited individuals  recruitment\_sd = recruitment\_mean/2 # standard deviation of number of recruited individuals  age\_rec\_toggle = TRUE # Takes the complimentary of the age fraction to reduce recruitment mean according to size (larger = closer to 1)  age\_recruit\_impact\_value = 0.5 # Range from 0.01-1. Takes the exponential of this value, the higher this value, the steeper the penalisation  rec\_age\_shift = 100 # age shift, lower than this age recruitment for the individual is penalised  MR\_rec\_toggle = F # toggle on/off of MR affect on recruitment  MR\_recruit\_impact = 0.5 # impact of MR on recruitment, a multiplier of the individual MR to reduce recruitment chance  MR\_rec\_adj = 0 # Shift mean of MR status of recruited individuals  ## Intervention parameters  intercept\_togg = F |  |  |
| ## Input parameters for high MR pressure sites  ## Population parameters  population\_size = 1000  population\_carrying\_capacity = population\_size\*5  population\_minimum\_size = population\_size/10  MR\_mean = 0.787 # From actual genotype data  MR\_sd = 0.385  disturbance\_impact\_val=5 # impacts base age & MR death factor and recruitment constant  ## Mortality parameters  age\_impact = 1.0 # scaled age inflicted increase - from 0 to 1, should add to 1 with MR impact val  mortality\_age\_shift = 150 # at what age does increases in age increase chance of death  MR\_imp = T # toggle on/off for MR inflicted death increase  MR\_death\_impact = 0.12 # linear scaled MR inflicted death increase - from 0 to 1, should add to 1 with age impact val  MR\_age\_impact = 20 # scaled impact of age (ages / MR\_age\_impact\_val) on MR inflicted death increase  MR\_lateintro = T  MR\_timepoint = 1000 # time point when MR is introduced  ## Recruitment parameters  recruitment\_const = 0.003 # base constant for chance of recruitment  recruitment\_age = 7 # age to begin recruiting  recruitment\_mean = 100 # mean for PDF of normal distribution for number of recruited individuals  recruitment\_sd = recruitment\_mean/2 # standard deviation of number of recruited individuals  age\_rec\_toggle = TRUE # Takes the complimentary of the age fraction to reduce recruitment mean according to size (larger = closer to 1)  age\_recruit\_impact\_value = 0.5 # Range from 0.01-1. Takes the exponential of this value, the higher this value, the steeper the penalisation  rec\_age\_shift = 100 # age shift, lower than this age recruitment for the individual is penalised  MR\_rec\_toggle = F # toggle on/off of MR affect on recruitment  MR\_recruit\_impact = 0.5 # impact of MR on recruitment, a multiplier of the individual MR to reduce recruitment chance  MR\_rec\_adj = 0 # Shift mean of MR status of recruited individuals  ## Intervention parameters  intercept\_togg = F  ## Disturbance parameters (ranges from super small to big impacts)  **dist\_imp = F # Turn on and off disturbance presence** |  |  |
| ## Input parameters for high MR pressure sites  ## Population parameters  population\_size = 1000  population\_carrying\_capacity = population\_size\*5  population\_minimum\_size = population\_size/10  MR\_mean = 0.787 # From actual genotype data  MR\_sd = 0.385  disturbance\_impact\_val=5 # impacts base age & MR death factor and recruitment constant  ## Mortality parameters  age\_impact = 1.0 # scaled age inflicted increase - from 0 to 1, should add to 1 with MR impact val  mortality\_age\_shift = 150 # at what age does increases in age increase chance of death  MR\_imp = T # toggle on/off for MR inflicted death increase  MR\_death\_impact = 0.12 # linear scaled MR inflicted death increase - from 0 to 1, should add to 1 with age impact val  MR\_age\_impact = 20 # scaled impact of age (ages / MR\_age\_impact\_val) on MR inflicted death increase  MR\_lateintro = T  MR\_timepoint = 1000 # time point when MR is introduced  ## Recruitment parameters  recruitment\_const = 0.003 # base constant for chance of recruitment  recruitment\_age = 7 # age to begin recruiting  recruitment\_mean = 100 # mean for PDF of normal distribution for number of recruited individuals  recruitment\_sd = recruitment\_mean/2 # standard deviation of number of recruited individuals  age\_rec\_toggle = TRUE # Takes the complimentary of the age fraction to reduce recruitment mean according to size (larger = closer to 1)  age\_recruit\_impact\_value = 0.5 # Range from 0.01-1. Takes the exponential of this value, the higher this value, the steeper the penalisation  rec\_age\_shift = 100 # age shift, lower than this age recruitment for the individual is penalised  MR\_rec\_toggle = F # toggle on/off of MR affect on recruitment  **MR\_recruit\_impact = 0.75 # impact of MR on** recruitment, a multiplier of the individual MR to reduce recruitment chance  MR\_rec\_adj = 0 # Shift mean of MR status of recruited individuals  ## Intervention parameters  intercept\_togg = F  ## Disturbance parameters (ranges from super small to big impacts)  dist\_imp = F # Turn on and off disturbance presence  ^4 -> ^2 MR inheritance |  |  |
| ## Input parameters for high MR pressure sites  ## Population parameters  population\_size = 1000  population\_carrying\_capacity = population\_size\*5  population\_minimum\_size = population\_size/10  MR\_mean = 0.787 # From actual genotype data  MR\_sd = 0.385  disturbance\_impact\_val=5 # impacts base age & MR death factor and recruitment constant  ## Mortality parameters  age\_impact = 1.0 # scaled age inflicted increase - from 0 to 1, should add to 1 with MR impact val  mortality\_age\_shift = 150 # at what age does increases in age increase chance of death  MR\_imp = T # toggle on/off for MR inflicted death increase  MR\_death\_impact = 0.15 # linear scaled MR inflicted death increase - from 0 to 1, should add to 1 with age impact val  MR\_age\_impact = 20 # scaled impact of age (ages / MR\_age\_impact\_val) on MR inflicted death increase  MR\_lateintro = T  MR\_timepoint = 1000 # time point when MR is introduced  ## Recruitment parameters  recruitment\_const = 0.003 # base constant for chance of recruitment  recruitment\_age = 7 # age to begin recruiting  recruitment\_mean = 100 # mean for PDF of normal distribution for number of recruited individuals  recruitment\_sd = recruitment\_mean/2 # standard deviation of number of recruited individuals  age\_rec\_toggle = TRUE # Takes the complimentary of the age fraction to reduce recruitment mean according to size (larger = closer to 1)  age\_recruit\_impact\_value = 0.5 # Range from 0.01-1. Takes the exponential of this value, the higher this value, the steeper the penalisation  rec\_age\_shift = 100 # age shift, lower than this age recruitment for the individual is penalised  MR\_rec\_toggle = F # toggle on/off of MR affect on recruitment  **MR\_recruit\_impact = 0.75 # impact of MR on** recruitment, a multiplier of the individual MR to reduce recruitment chance  MR\_rec\_adj = 0 # Shift mean of MR status of recruited individuals  ## Intervention parameters  intercept\_togg = F  ## Disturbance parameters (ranges from super small to big impacts)  dist\_imp = F # Turn on and off disturbance presence  ^4 -> ^2 MR inheritance |  |  |
| ## Input parameters for high MR pressure sites  ## Population parameters  population\_size = 1000  population\_carrying\_capacity = population\_size\*5  population\_minimum\_size = population\_size/10  MR\_mean = 0.787 # From actual genotype data  MR\_sd = 0.385  disturbance\_impact\_val=5 # impacts base age & MR death factor and recruitment constant  ## Mortality parameters  age\_impact = 1.0 # scaled age inflicted increase - from 0 to 1, should add to 1 with MR impact val  mortality\_age\_shift = 150 # at what age does increases in age increase chance of death  MR\_imp = T # toggle on/off for MR inflicted death increase  MR\_death\_impact = 0.20 # linear scaled MR inflicted death increase - from 0 to 1, should add to 1 with age impact val  MR\_age\_impact = 20 # scaled impact of age (ages / MR\_age\_impact\_val) on MR inflicted death increase  MR\_lateintro = T  MR\_timepoint = 1000 # time point when MR is introduced  ## Recruitment parameters  recruitment\_const = 0.003 # base constant for chance of recruitment  recruitment\_age = 7 # age to begin recruiting  recruitment\_mean = 100 # mean for PDF of normal distribution for number of recruited individuals  recruitment\_sd = recruitment\_mean/2 # standard deviation of number of recruited individuals  age\_rec\_toggle = TRUE # Takes the complimentary of the age fraction to reduce recruitment mean according to size (larger = closer to 1)  age\_recruit\_impact\_value = 0.5 # Range from 0.01-1. Takes the exponential of this value, the higher this value, the steeper the penalisation  rec\_age\_shift = 100 # age shift, lower than this age recruitment for the individual is penalised  MR\_rec\_toggle = F # toggle on/off of MR affect on recruitment  **MR\_recruit\_impact = 0.75 # impact of MR on** recruitment, a multiplier of the individual MR to reduce recruitment chance  MR\_rec\_adj = 0 # Shift mean of MR status of recruited individuals  ## Intervention parameters  intercept\_togg = F  ## Disturbance parameters (ranges from super small to big impacts)  dist\_imp = F # Turn on and off disturbance presence  ^4 -> ^2 MR inheritance |  |  |
| ## Input parameters for high MR pressure sites  ## Population parameters  population\_size = 1000  population\_carrying\_capacity = population\_size\*5  population\_minimum\_size = population\_size/10  MR\_mean = 0.787 # From actual genotype data  MR\_sd = 0.385  disturbance\_impact\_val=5 # impacts base age & MR death factor and recruitment constant  ## Mortality parameters  age\_impact = 1.0 # scaled age inflicted increase - from 0 to 1, should add to 1 with MR impact val  mortality\_age\_shift = 150 # at what age does increases in age increase chance of death  MR\_imp = T # toggle on/off for MR inflicted death increase  MR\_death\_impact = 0.20 # linear scaled MR inflicted death increase - from 0 to 1, should add to 1 with age impact val  MR\_age\_impact = 20 # scaled impact of age (ages / MR\_age\_impact\_val) on MR inflicted death increase  MR\_lateintro = T  MR\_timepoint = 1000 # time point when MR is introduced  ## Recruitment parameters  recruitment\_const = 0.003 # base constant for chance of recruitment  recruitment\_age = 7 # age to begin recruiting  recruitment\_mean = 100 # mean for PDF of normal distribution for number of recruited individuals  recruitment\_sd = recruitment\_mean/2 # standard deviation of number of recruited individuals  age\_rec\_toggle = TRUE # Takes the complimentary of the age fraction to reduce recruitment mean according to size (larger = closer to 1)  age\_recruit\_impact\_value = 0.5 # Range from 0.01-1. Takes the exponential of this value, the higher this value, the steeper the penalisation  rec\_age\_shift = 100 # age shift, lower than this age recruitment for the individual is penalised  MR\_rec\_toggle = F # toggle on/off of MR affect on recruitment  **MR\_recruit\_impact = 0.75 # impact of MR on** recruitment, a multiplier of the individual MR to reduce recruitment chance  MR\_rec\_adj = 0 # Shift mean of MR status of recruited individuals  ## Intervention parameters  intercept\_togg = F  ## Disturbance parameters (ranges from super small to big impacts)  dist\_imp = F # Turn on and off disturbance presence  ^4 -> ^2 MR inheritance |  |  |

**Intervention**

|  |  |
| --- | --- |
| ## Input parameters for high MR pressure sites  ## Population parameters  population\_size = 1000  population\_carrying\_capacity = population\_size\*5  population\_minimum\_size = population\_size/10  MR\_mean = 0.787 # From actual genotype data  MR\_sd = 0.385  disturbance\_impact\_val=5 # impacts base age & MR death factor and recruitment constant  ## Mortality parameters  age\_impact = 1.0 # scaled age inflicted increase - from 0 to 1, should add to 1 with MR impact val  mortality\_age\_shift = 150 # at what age does increases in age increase chance of death  MR\_imp = T # toggle on/off for MR inflicted death increase  MR\_death\_impact = 0.12 # linear scaled MR inflicted death increase - from 0 to 1, should add to 1 with age impact val  MR\_age\_impact = 20 # scaled impact of age (ages / MR\_age\_impact\_val) on MR inflicted death increase  MR\_lateintro = T  MR\_timepoint = 1000 # time point when MR is introduced  ## Recruitment parameters  recruitment\_const = 0.003 # base constant for chance of recruitment  recruitment\_age = 7 # age to begin recruiting  recruitment\_mean = 100 # mean for PDF of normal distribution for number of recruited individuals  recruitment\_sd = recruitment\_mean/2 # standard deviation of number of recruited individuals  age\_rec\_toggle = TRUE # Takes the complimentary of the age fraction to reduce recruitment mean according to size (larger = closer to 1)  age\_recruit\_impact\_value = 0.5 # Range from 0.01-1. Takes the exponential of this value, the higher this value, the steeper the penalisation  rec\_age\_shift = 100 # age shift, lower than this age recruitment for the individual is penalised  MR\_rec\_toggle = F # toggle on/off of MR affect on recruitment  MR\_recruit\_impact = 0.5 # impact of MR on recruitment, a multiplier of the individual MR to reduce recruitment chance  MR\_rec\_adj = 0 # Shift mean of MR status of recruited individuals  ## Intervention parameters  intercept\_togg = T  intercept\_timepoint = 1025  intercept\_indiv = 300  intercept\_MR\_mean = 0.15 # (bottom third)  intercept\_MR\_sd = 0.1  intercept\_reducMort = T | MR mean 0.6943643 -> 0.6597317  # A tibble: 2 × 2  Run min\_pop\_size  <chr> <dbl>  1 Base 1447.  2 Resistance Intervention 1383. |
| ## Intervention parameters  intercept\_togg = T  intercept\_timepoint = 1025  intercept\_indiv = 300  intercept\_MR\_mean = 0.75 # (top quarter)  intercept\_MR\_sd = 0.1  intercept\_reducMort = T | MR 0.567441 -> 0.5811666 |
| ## Input parameters for high MR pressure sites  ## Population parameters  population\_size = 1000  population\_carrying\_capacity = population\_size\*5  population\_minimum\_size = population\_size/10  MR\_mean = 0.787 # From actual genotype data  MR\_sd = 0.385  disturbance\_impact\_val=5 # impacts base age & MR death factor and recruitment constant  ## Mortality parameters  age\_impact = 1.0 # scaled age inflicted increase - from 0 to 1, should add to 1 with MR impact val  mortality\_age\_shift = 150 # at what age does increases in age increase chance of death  MR\_imp = T # toggle on/off for MR inflicted death increase  MR\_death\_impact = 0.12 # linear scaled MR inflicted death increase - from 0 to 1, should add to 1 with age impact val  MR\_age\_impact = 20 # scaled impact of age (ages / MR\_age\_impact\_val) on MR inflicted death increase  MR\_lateintro = T  MR\_timepoint = 1000 # time point when MR is introduced  ## Recruitment parameters  recruitment\_const = 0.003 # base constant for chance of recruitment  recruitment\_age = 7 # age to begin recruiting  recruitment\_mean = 100 # mean for PDF of normal distribution for number of recruited individuals  recruitment\_sd = recruitment\_mean/2 # standard deviation of number of recruited individuals  age\_rec\_toggle = TRUE # Takes the complimentary of the age fraction to reduce recruitment mean according to size (larger = closer to 1)  age\_recruit\_impact\_value = 0.5 # Range from 0.01-1. Takes the exponential of this value, the higher this value, the steeper the penalisation  rec\_age\_shift = 100 # age shift, lower than this age recruitment for the individual is penalised  MR\_rec\_toggle = F # toggle on/off of MR affect on recruitment  **MR\_recruit\_impact = 0.75 # impact of MR on** recruitment, a multiplier of the individual MR to reduce recruitment chance  MR\_rec\_adj = 0 # Shift mean of MR status of recruited individuals  ## Intervention parameters  intercept\_togg = T  intercept\_timepoint = 1025  intercept\_indiv = 300  intercept\_MR\_mean = 0.15  intercept\_MR\_sd = 0.1  intercept\_reducMort = T  ## Disturbance parameters (ranges from super small to big impacts)  dist\_imp = F # Turn on and off disturbance presence  ^4 -> ^2 MR inheritance | MR 0.4649687 -> 0.4439846  # A tibble: 2 × 2  Run min\_pop\_size  <chr> <dbl>  1 Base 1683.  2 Resistance Intervention 2055. |
| ## Input parameters for high MR pressure sites  ## Population parameters  population\_size = 1000  population\_carrying\_capacity = population\_size\*5  population\_minimum\_size = population\_size/10  MR\_mean = 0.787 # From actual genotype data  MR\_sd = 0.385  disturbance\_impact\_val=5 # impacts base age & MR death factor and recruitment constant  ## Mortality parameters  age\_impact = 1.0 # scaled age inflicted increase - from 0 to 1, should add to 1 with MR impact val  mortality\_age\_shift = 150 # at what age does increases in age increase chance of death  MR\_imp = T # toggle on/off for MR inflicted death increase  **MR\_death\_impact = 0.20 # linear scaled MR inflicted death** increase - from 0 to 1, should add to 1 with age impact val  MR\_age\_impact = 20 # scaled impact of age (ages / MR\_age\_impact\_val) on MR inflicted death increase  MR\_lateintro = T  MR\_timepoint = 1000 # time point when MR is introduced  ## Recruitment parameters  recruitment\_const = 0.003 # base constant for chance of recruitment  recruitment\_age = 7 # age to begin recruiting  recruitment\_mean = 100 # mean for PDF of normal distribution for number of recruited individuals  recruitment\_sd = recruitment\_mean/2 # standard deviation of number of recruited individuals  age\_rec\_toggle = TRUE # Takes the complimentary of the age fraction to reduce recruitment mean according to size (larger = closer to 1)  age\_recruit\_impact\_value = 0.5 # Range from 0.01-1. Takes the exponential of this value, the higher this value, the steeper the penalisation  rec\_age\_shift = 100 # age shift, lower than this age recruitment for the individual is penalised  MR\_rec\_toggle = F # toggle on/off of MR affect on recruitment  MR\_recruit\_impact = 0.75 # impact of MR on recruitment, a multiplier of the individual MR to reduce recruitment chance  MR\_rec\_adj = 0 # Shift mean of MR status of recruited individuals  ## Intervention parameters  intercept\_togg = T  intercept\_timepoint = 1025  intercept\_indiv = 300  intercept\_MR\_mean = 0.15  intercept\_MR\_sd = 0.1  intercept\_reducMort = T  ## Disturbance parameters (ranges from super small to big impacts)  dist\_imp = F # Turn on and off disturbance presence  ^4 -> ^2 MR inheritance | MR 0. 0.4254523 -> 0. 0.4070457  # A tibble: 2 × 2  Run min\_pop\_size  <chr> <dbl>  1 Base 1290.  2 Resistance Intervention 2013. |
| ## Input parameters for high MR pressure sites  ## Population parameters  population\_size = 1000  population\_carrying\_capacity = population\_size\*5  population\_minimum\_size = population\_size/10  MR\_mean = 0.787 # From actual genotype data  MR\_sd = 0.385  disturbance\_impact\_val=5 # impacts base age & MR death factor and recruitment constant  ## Mortality parameters  age\_impact = 1.0 # scaled age inflicted increase - from 0 to 1, should add to 1 with MR impact val  mortality\_age\_shift = 150 # at what age does increases in age increase chance of death  MR\_imp = T # toggle on/off for MR inflicted death increase  **MR\_death\_impact = 0.20 # linear scaled MR inflicted death** increase - from 0 to 1, should add to 1 with age impact val  MR\_age\_impact = 20 # scaled impact of age (ages / MR\_age\_impact\_val) on MR inflicted death increase  MR\_lateintro = T  MR\_timepoint = 1000 # time point when MR is introduced  ## Recruitment parameters  recruitment\_const = 0.003 # base constant for chance of recruitment  recruitment\_age = 7 # age to begin recruiting  recruitment\_mean = 100 # mean for PDF of normal distribution for number of recruited individuals  recruitment\_sd = recruitment\_mean/2 # standard deviation of number of recruited individuals  age\_rec\_toggle = TRUE # Takes the complimentary of the age fraction to reduce recruitment mean according to size (larger = closer to 1)  age\_recruit\_impact\_value = 0.5 # Range from 0.01-1. Takes the exponential of this value, the higher this value, the steeper the penalisation  rec\_age\_shift = 100 # age shift, lower than this age recruitment for the individual is penalised  MR\_rec\_toggle = F # toggle on/off of MR affect on recruitment  MR\_recruit\_impact = 0.75 # impact of MR on recruitment, a multiplier of the individual MR to reduce recruitment chance  MR\_rec\_adj = 0 # Shift mean of MR status of recruited individuals  ## Intervention parameters  intercept\_togg = T  intercept\_timepoint = 1025  intercept\_indiv = 300  intercept\_MR\_mean = 0.15  intercept\_MR\_sd = 0.1  intercept\_reducMort = T  ## Disturbance parameters (ranges from super small to big impacts)  dist\_imp = F # Turn on and off disturbance presence  ^4 -> ^2 MR inheritance | MR 0.4462213 -> 0.421469  # A tibble: 2 × 2  Run min\_pop\_size  <chr> <dbl>  1 Base 996.  2 Resistance Intervention 1371. |

# Changed recruitment to Hills + changed to density dependent recruitment

|  |  |  |
| --- | --- | --- |
| recruitment\_const = 0.005  MR\_death\_impact = 0.5  ## Intervention parameters  intercept\_togg = F  intercept\_timepoint = 1025  intercept\_indiv = 300  intercept\_MR\_mean = 0.15  intercept\_MR\_sd = 0.1  intercept\_reducMort = T |  |  |
| intercept\_togg = T  intercept\_timepoint = 1025  intercept\_indiv = 300  intercept\_MR\_mean = 0.15  intercept\_MR\_sd = 0.1  intercept\_reducMort = T  ## Lower impact given recruitment is mediated by density |  |  |
|  |  |  |

# Final:

## Weak MR pres

## Input parameters for high MR pressure sites

## Population parameters

population\_size = 1000

population\_carrying\_capacity = population\_size\*5 # If population creeps above this value, comp is used to punish the population size by increasing the minimum probability of death based on how much higher population size is than the carrying capacity

population\_minimum\_size = population\_size/10 # If population falls below this value, there is a 10x increased chance of recruitment

MR\_mean = 0.787 # From actual genotype data

MR\_sd = 0.385

## Mortality parameters

age\_impact = 1.0 # scaled age inflicted increase - from 0 to 1

mortality\_age\_shift = 150 # at what age does increases in age increase chance of death

MR\_imp = T # toggle on/off for MR inflicted death increase

MR\_death\_impact = 0.12 # linear scaled MR inflicted death increase - from 0 to 1

MR\_age\_impact = 10 # scaled impact of age (ages / MR\_age\_impact\_val) on MR inflicted death increase

MR\_lateintro = T

MR\_timepoint = 1000 # time point when MR is introduced

comp\_imp = T # toggle on/off for competition due to carrying capacity

comp\_impact = 0.9 # impact of competition due to carrying capacity (1.x multiplier of a scaled competition influence)

## Recruitment parameters

recruitment\_const = 0.003 # base constant for chance of recruitment

recruitment\_age = 7 # age to begin recruiting

recruitment\_mean = 100 # mean for PDF of normal distribution for number of recruited individuals

recruitment\_sd = recruitment\_mean/2 # standard deviation of number of recruited individuals

density\_recruit\_toggle = FALSE # Reduces density recruitment by the proportion of individuals in pop vs maximum carrying capacity

age\_rec\_toggle = TRUE # Takes the complimentary of the age fraction to reduce recruitment mean according to size (larger = closer to 1)

age\_recruit\_impact\_value = 0.5 # Range from 0.01-1. Takes the exponential of this value, the higher this value, the steeper the penalisation

#age\_scaled <- recruitment\_indivs\_ages / rec\_age\_shiftch; age\_scaled[age\_scaled>1]=1

#age\_impact <- age\_scaled ^ age\_recruit\_impact\_val

rec\_age\_shift = 100 # age shift, lower than this age recruitment for the individual is penalised

MR\_rec\_toggle = TRUE # toggle on/off of MR affect on recruitment

MR\_recruit\_impact = 0.75 # impact of MR on recruitment, a multiplier of the individual MR to reduce recruitment chance; MR\_impact <- 1 - recruitment\_indivs\_MR ^ MR\_recruit\_impact\_val

MR\_rec\_adj = 0 # Shift mean of MR status of recruited individuals

## Intervention parameters

intercept\_togg = T

intercept\_timepoint = 1025

intercept\_indiv = 300

intercept\_MR\_mean = 0.15

intercept\_MR\_sd = 0.1

intercept\_reducMort = T

## Disturbance parameters (ranges from super small to big impacts)

dist\_imp = F # Turn on and off disturbance presence

disturbance\_age\_struct\_type = "complex" # Impact value flat or varied by age [complex/flat]

dist\_impact = 5 # Level of impact (multiplier)

dist\_age\_impact = 10 # Impact of age on disturbance 1/(1 + exp((age-val) / 10))

## Simulation parameters

time\_max = 2000 # how long to run sim for

output\_timept = time\_max/5 # How often to report visual statistics

#timepoint\_pop\_grab = c(750:1250)

timepoint\_pop\_grab = c(seq(from=1010, to=1020), seq(from=1030, to=1050)) # Saves population at the end of the timepoints (post-recruitment + mortality events) - note time will be +1 than indicated as it is past incident events - saved in object pop\_timepoints (list of lists)

## Strong MR pres

## Input parameters for high MR pressure sites

## Population parameters

population\_size = 1000

population\_carrying\_capacity = population\_size\*5 # If population creeps above this value, comp is used to punish the population size by increasing the minimum probability of death based on how much higher population size is than the carrying capacity

population\_minimum\_size = population\_size/10 # If population falls below this value, there is a 10x increased chance of recruitment

MR\_mean = 0.787 # From actual genotype data

MR\_sd = 0.385

## Mortality parameters

age\_impact = 1.0 # scaled age inflicted increase - from 0 to 1

mortality\_age\_shift = 150 # at what age does increases in age increase chance of death

MR\_imp = T # toggle on/off for MR inflicted death increase

MR\_death\_impact = 0.20 # linear scaled MR inflicted death increase - from 0 to 1

MR\_age\_impact = 10 # scaled impact of age (ages / MR\_age\_impact\_val) on MR inflicted death increase

MR\_lateintro = T

MR\_timepoint = 1000 # time point when MR is introduced

comp\_imp = T # toggle on/off for competition due to carrying capacity

comp\_impact = 0.9 # impact of competition due to carrying capacity (1.x multiplier of a scaled competition influence)

## Recruitment parameters

recruitment\_const = 0.003 # base constant for chance of recruitment

recruitment\_age = 7 # age to begin recruiting

recruitment\_mean = 100 # mean for PDF of normal distribution for number of recruited individuals

recruitment\_sd = recruitment\_mean/2 # standard deviation of number of recruited individuals

density\_recruit\_toggle = FALSE # Reduces density recruitment by the proportion of individuals in pop vs maximum carrying capacity

age\_rec\_toggle = TRUE # Takes the complimentary of the age fraction to reduce recruitment mean according to size (larger = closer to 1)

age\_recruit\_impact\_value = 0.5 # Range from 0.01-1. Takes the exponential of this value, the higher this value, the steeper the penalisation

#age\_scaled <- recruitment\_indivs\_ages / rec\_age\_shiftch; age\_scaled[age\_scaled>1]=1

#age\_impact <- age\_scaled ^ age\_recruit\_impact\_val

rec\_age\_shift = 100 # age shift, lower than this age recruitment for the individual is penalised

MR\_rec\_toggle = TRUE # toggle on/off of MR affect on recruitment

MR\_recruit\_impact = 0.75 # impact of MR on recruitment, a multiplier of the individual MR to reduce recruitment chance; MR\_impact <- 1 - recruitment\_indivs\_MR ^ MR\_recruit\_impact\_val

MR\_rec\_adj = 0 # Shift mean of MR status of recruited individuals

## Intervention parameters

intercept\_togg = T

intercept\_timepoint = 1025

intercept\_indiv = 300

intercept\_MR\_mean = 0.15

intercept\_MR\_sd = 0.1

intercept\_reducMort = T

## Disturbance parameters (ranges from super small to big impacts)

dist\_imp = F # Turn on and off disturbance presence

disturbance\_age\_struct\_type = "complex" # Impact value flat or varied by age [complex/flat]

dist\_impact = 5 # Level of impact (multiplier)

dist\_age\_impact = 10 # Impact of age on disturbance 1/(1 + exp((age-val) / 10))

## Simulation parameters

time\_max = 2000 # how long to run sim for

output\_timept = time\_max/5 # How often to report visual statistics

#timepoint\_pop\_grab = c(750:1250)

timepoint\_pop\_grab = c(seq(from=1010, to=1020), seq(from=1030, to=1050)) # Saves population at the end of the timepoints (post-recruitment + mortality events) - note time will be +1 than indicated as it is past incident events - saved in object pop\_timepoints (list of lists)