April, 2021

AllocateMate: An R package for mate allocation

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### Contact

WorldFish Communications and Marketing Department, Jalan Batu Maung, Batu Maung, 11960 Bayan Lepas, Penang, Malaysia. Email: [fish@cgiar.org](mailto:fish@cgiar.org)

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# Table of contents

[1. Introduction 3](#_Toc69215286)

[2. AllocateMate package 3](#_Toc69215289)

[3. Installing AllocateMate 4](#_Toc69215290)

[References 5](#_Toc69215291)

[Annex 1. allocate.mate.ped function R help 6](#_Toc69215292)

[Annex 2. allocate.mate.H function R help 9](#_Toc69215293)

# 1. Introduction

WorldFish manages multiple family-based genetic improvement programs for tilapia and carp species (Charo-Karisa et al., 2020; Hamilton et al., 2019a; Hamilton et al., 2019b; Hamilton et al., 2021; Hamzah et al., 2014). In family-based genetic improvement programs, mate allocation is a process whereby selected parents (or in some cases families) are allocated to mating pairs prior to a spawning event. Mating pairs are then crossed to produce next-generation families of known pedigree.

2

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# 2. AllocateMate package

AllocateMate is a R package (R Core Team, 2020) comprised of two primary functions: *allocate.mate.ped* and *allocate.mate.H*. These functions allocate parents to mating pairs based on genetic relationships provided by the user in the form a pedigree file (*allocate.mate.ped*) or a relationship matrix (*allocate.mate.H*). These functions generate mating lists, using a linear programing approach (Berkelaar, 2020):

* to minimise the average Wright’s inbreeding coefficient (*F*; Wright, 1922) of offspring, by minimising the average coefficient of coancestry between parents in mating pairs; or
* according to assortative mating principles (Saura et al., 2017), by maximising the standard deviation of the parental mean EBVs of mating pairs.

Inputs, outputs and examples of use for the *allocate.mate.ped* and *allocate.mate.H* functionsare detailed in Annex 1 and Annex 2.

# 3. Application in tilapia

To ensure tilapia successfully spawn in a timely fashion, it is common practice to place multiple females with one male in a mating hapa/tank (Trong, 2013). To use AllocateMate in this circumstance, the following guidelines can be adopted.

If females in each mating hapa/tank are to be from a single full-sibling family:

* the *allocate.mate.ped* function should be used (Annex 1);
* female parental identifiers (i.e. ID’s present in the ‘parents’ data frame; Annex 1) should be modified so that there is only one female parental ID per mating hapa/tank, each representing multiple females from the same family; and
* N\_AS\_PARENT in the ‘parents’ data frame (Annex 1) should be specified as 1.

If females in each mating hapa/tank are to be from multiple families and the average Wright’s inbreeding coefficient is to be minimised (i.e. method = "min\_F"; Annex 1 and Annex 2):

* for males, N\_AS\_PARENT should be specified as the number of females to be placed in the hapa/tank with the male;
* for females, N\_AS\_PARENT should be specified as 1.

If females in each mating hapa/tank are to be from multiple families and assortative mating principles are to be applied (i.e. method = "assortative"; Annex 1 and Annex 2), to ensure that the female parents with the highest EBVs are not placed in the same mating hapa/tank:

* female parents should be sorted by their estimated breeding value (EBV; Annex 1 and Annex 2) and divided into groups – individuals with the highest EBVs should be grouped together, etc. The number of groups should equal the number of females in each mating hapa/tank and groups should be of equal size;
* N\_AS\_PARENT should be specified as 1; and
* *allocate.mate.ped* or *allocate.mate.H* should be run separately for each group of females with a common group of males; and
* the mating lists from all groups should be combined upon completion.

# 4. Installing AllocateMate

AllocateMate Version 1.0 is available at <https://github.com/mghamilton/AllocateMate> or for download as a .tar.gz **‘**source file**’** (provide link). To install the package from the .tar.gz source file:

* use the *install.packages* function **in R** – install.packages(*path****-****to****-****source****-file***, repos = NULL, type="source"); or
* within R studio, go to Tools -> Install Packages and then set ‘Install From’ to ‘Package Archive File (.zip; .tar.gz)’ before browsing to find the downloaded .tar.gz file.

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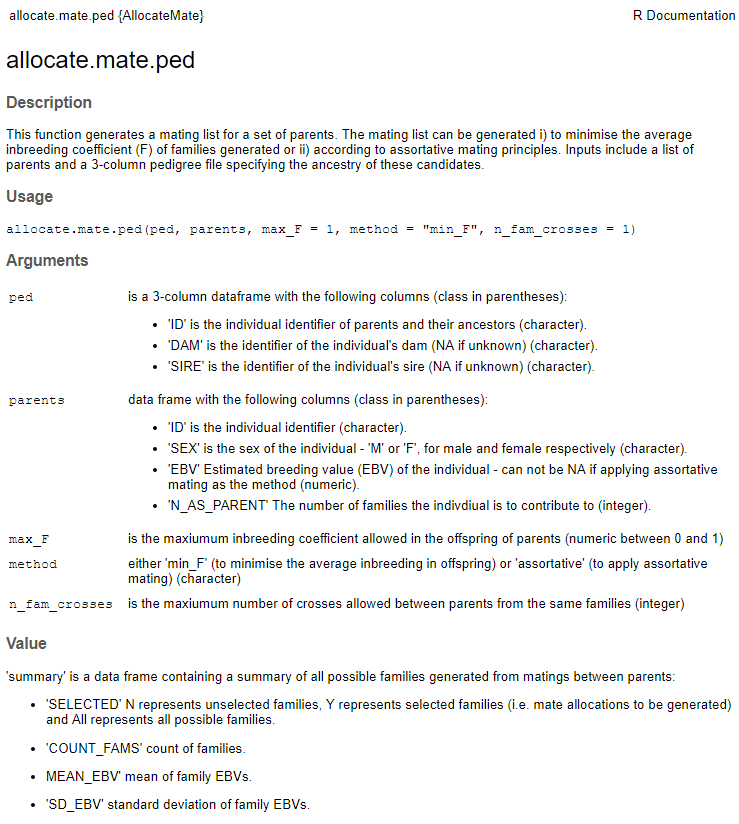
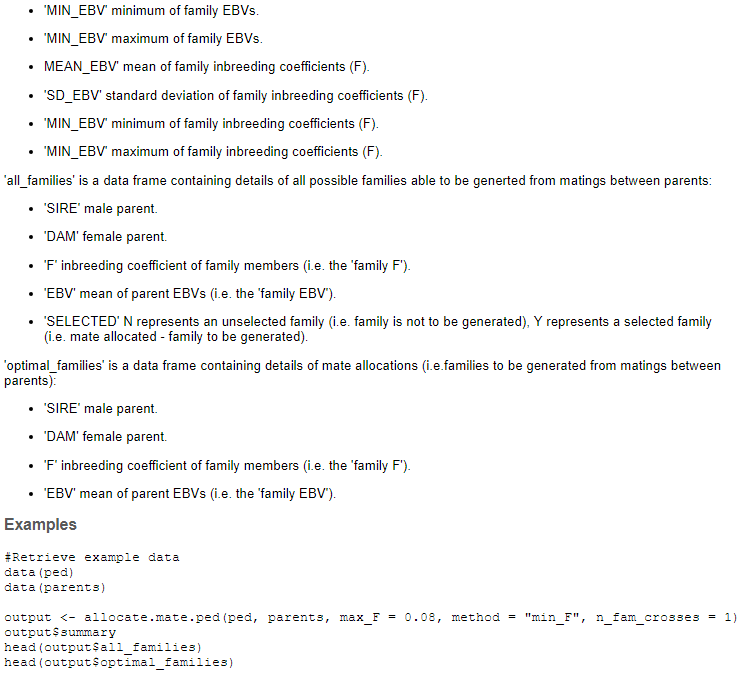
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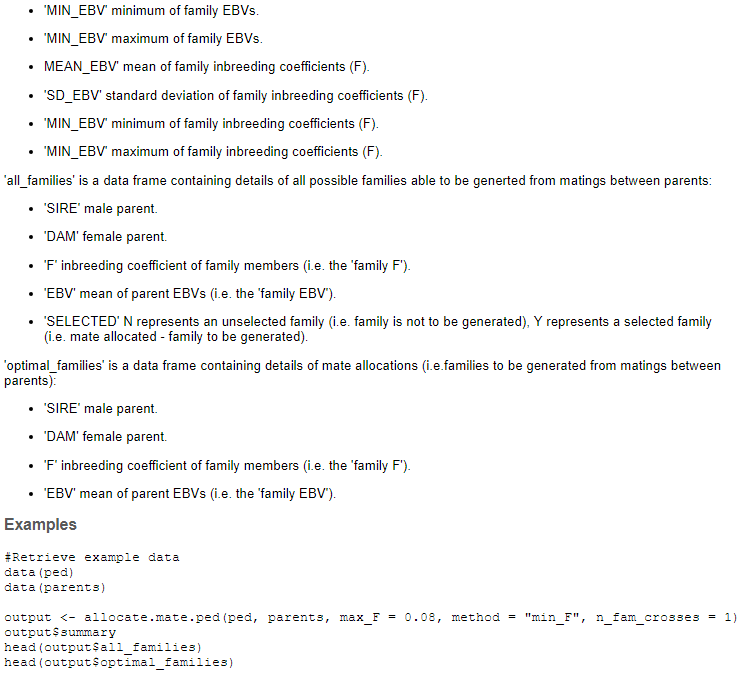
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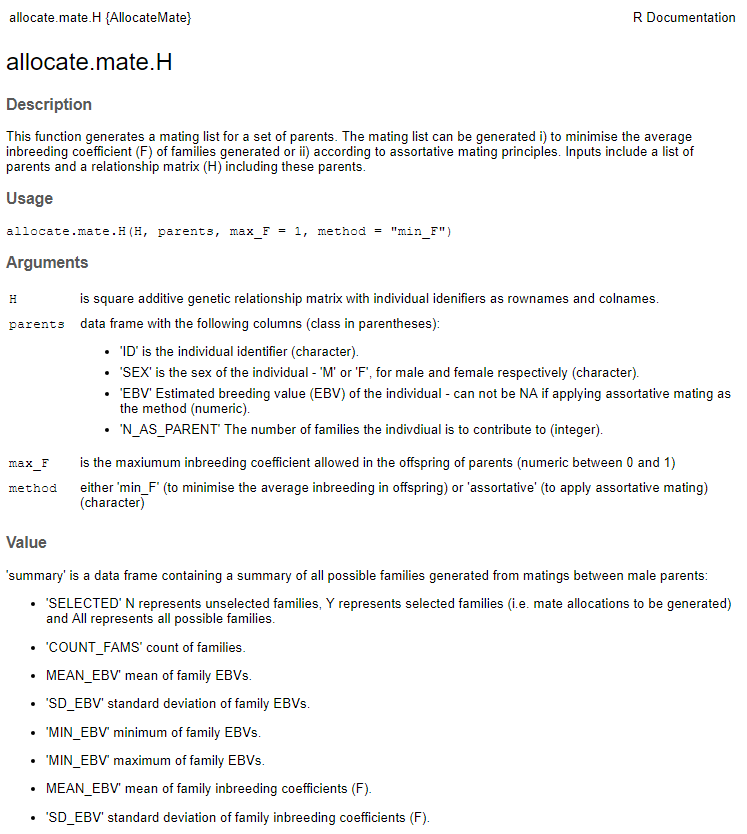
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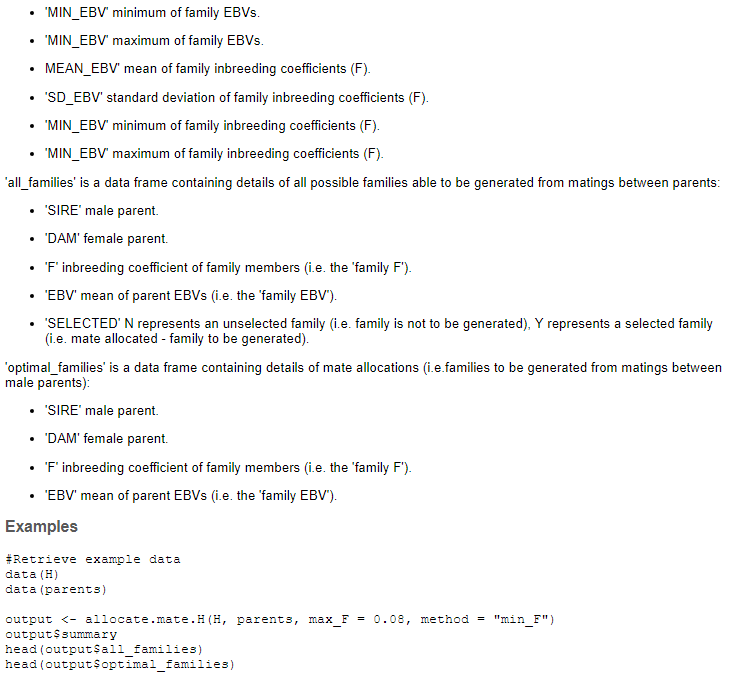
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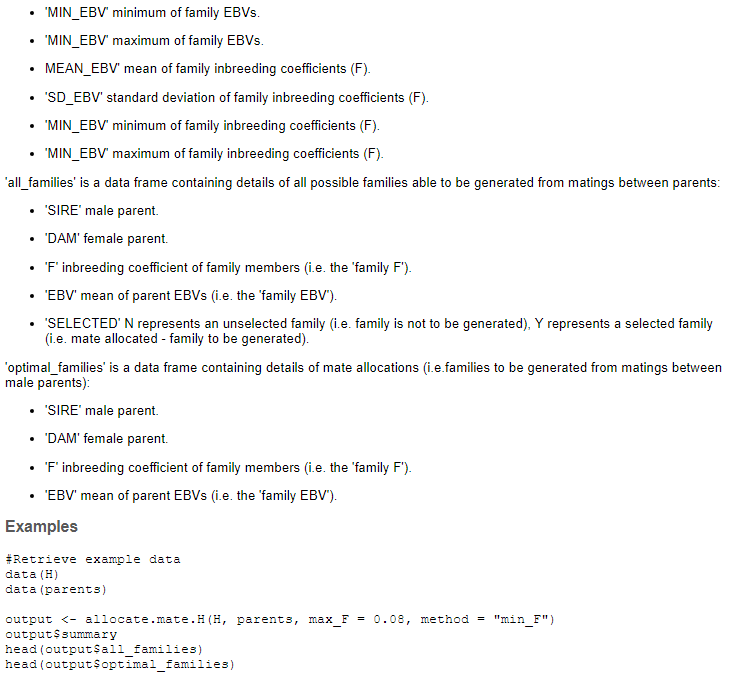
 



# Annex 2. allocate.mate.H function R help









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