Contents

Fitness and Standardization

Load Data

```
library(MASS) # MASS clashes with dplyr... so always load first
library(pander) # pander clashes with dplyr... so always load first
```

```
##
## Attaching package: 'pander'
##
## The following object is masked from 'package:knitr':
##
##     pandoc
```

```
library(dplyr)
```

```
##
## Attaching package: 'dplyr'
##
## The following object is masked from 'package:MASS':
##
##     select
##
## The following objects are masked from 'package:stats':
##
##     filter, lag
##
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
set.alignment('right', row.names = 'left')
load("data/analyses_data/raneffs_blups.RData")
# load("data/analyses_data/pca.RData")
fitness <- read.table(file = "data/fitness+competition.csv", sep = ',',
  header = TRUE, stringsAsFactors = FALSE)
fitness <- tbl_df(fitness)
```

Merge fitness with blups

```
fitness$ID <- as.character(fitness$ID)
fit_raneff_data <- inner_join(fitness, raneffs_blups, by = "ID")
fit_raneff_data
```

```
## Source: local data frame [296,296 x 15]
##
##    Year Grid  ID    Sex kprod ars_all age year grid_year competition itt
## 1  2003   SU 370 female     3       2   5 2003    SU2003       4.667   1
## 2  2003   SU 370 female     3       2   5 2003    SU2003       4.667   2
## 3  2003   SU 370 female     3       2   5 2003    SU2003       4.667   3
## 4  2003   SU 370 female     3       2   5 2003    SU2003       4.667   4
## 5  2003   SU 370 female     3       2   5 2003    SU2003       4.667   5
## 6  2003   SU 370 female     3       2   5 2003    SU2003       4.667   6
## 7  2003   SU 370 female     3       2   5 2003    SU2003       4.667   7
## 8  2003   SU 370 female     3       2   5 2003    SU2003       4.667   8
## 9  2003   SU 370 female     3       2   5 2003    SU2003       4.667   9
## 10 2003   SU 370 female     3       2   5 2003    SU2003       4.667  10
## ..  ...  ... ...    ...   ...     ... ...  ...       ...         ... ...
## Variables not shown: type (chr), docility (dbl), aggression (dbl),
##   activity (dbl)
```

Merge fitness with pca & docility repeated mesures data

```
load("data/analyses_data/pca.RData")
pca_to_merge <- pca_data %>%
  filter(Sex == "F") %>%
  select(ID, Year, Grid, julian, Obs, docility = docil, handlevent_year,
    trial_life, trial_year, aggression = misPC1, activity = ofPC1)

## Can't use dplyr join because need outer join
fit_behav_data <- merge(pca_to_merge, fitness %>%
  select(-Sex), by = c("ID", "Year", "Grid"), all = TRUE)
fit_behav_data <- tbl_df(fit_behav_data)
```

Relative Fitness

Calculate relative fitness for each year & population combination. Two populations (Grids). Three measures of fitness:

1. ars_all = Annual reproductive success over all litters (no. pups that survived overwinter)
2. kprod = Fecundity (kids produced)
3. prop = Offpsring overwinter survival (proportion of pups produced that survived overwinter)

```
# Calculate offspring overwitner survival
fit_raneff_data <- fit_raneff_data %>% mutate(prop = ars_all/kprod)
```

```
fit_raneff_data <- fit_raneff_data %>%
  group_by(Grid, Year, itt) %>%
  mutate(rel_ars = ars_all / mean(ars_all),
   rel_kpd = kprod / mean(kprod),
   rel_ows = prop / mean(prop)
   )

fit_behav_data <- fit_behav_data %>% mutate(prop = ars_all/kprod)
fit_behav_data <- fit_behav_data %>%
  group_by(Grid, Year) %>%
  mutate(rel_ars = ars_all / mean(ars_all),
   rel_kpd = kprod / mean(kprod),
   rel_ows = prop / mean(prop)
   )
```

Now:

- rel_ars = relative ARS
- rel_kpd = relative fecunidty
- felOWS = relative offspring overwinter survival

Standardize Variables

Standaradized to mean 0 and sd 1. Standardized variables renamed from xxx to xxx_s or xxx_sy (for standardized within year). Standardized within each BLUP itteration.

```
# Standardize within itteration and year
fit_raneff_data <- fit_raneff_data %>%
  group_by(itt, Year, add = FALSE) %>%
  mutate(
    aggression_sy  = (aggression  - mean(aggression, na.rm = TRUE))  /
      sd(aggression, na.rm = TRUE),
    activity_sy    = (activity    - mean(activity, na.rm = TRUE))    /
      sd(activity, na.rm = TRUE),
    docility_sy    = (docility    - mean(docility, na.rm = TRUE))    /
      sd(docility, na.rm = TRUE),
    competition_sy = (competition - mean(competition, na.rm = TRUE)) /
      sd(competition, na.rm = TRUE)
      )
# Standardize within itteration
fit_raneff_data <- fit_raneff_data %>%
  group_by(itt, add = FALSE) %>%
  mutate(
    aggression_s  = (aggression  - mean(aggression, na.rm = TRUE))  /
      sd(aggression, na.rm = TRUE),
    activity_s    = (activity    - mean(activity, na.rm = TRUE))    /
      sd(activity, na.rm = TRUE),
    docility_s    = (docility    - mean(docility, na.rm = TRUE))    /
      sd(docility, na.rm = TRUE),
```

```
    competition_s = (competition - mean(competition, na.rm = TRUE)) /
      sd(competition, na.rm = TRUE)
      )

fit_raneff_data %>%
  group_by(itt, add = FALSE) %>%
  summarise(
    v_agg = var(aggression_s, na.rm = TRUE),
    v_act = var(activity_s, na.rm = TRUE),
    v_doc = var(docility_s, na.rm = TRUE)
    ) %>%
  head(.,n=10) %>%
  pandoc.table(.)
```

itt	v_agg	v_act	v_doc
0	1	1	1
1	1	1	1
2	1	1	1
3	1	1	1
4	1	1	1
5	1	1	1
6	1	1	1
7	1	1	1
8	1	1	1
9	1	1	1

```
fit_raneff_data %>%
  group_by(itt, Year, add = FALSE) %>%
  summarise(
    v_agg = var(aggression_sy, na.rm = TRUE),
    v_act = var(activity_sy, na.rm = TRUE),
    v_doc = var(docility_sy, na.rm = TRUE)
    ) %>%
  head(.,n=10) %>%
  pandoc.table(.)
```

itt	Year	v_agg	v_act	v_doc
0	2003	1	1	1
0	2004	1	1	1
0	2005	1	1	1
0	2006	1	1	1
0	2007	1	1	1

itt	Year	v_agg	v_act	v_doc
0	2008	1	1	1
0	2009	1	1	1
0	2010	1	1	1
1	2003	1	1	1
1	2004	1	1	1

```
## Fill NAs with mean trait values (in the case of the standardized traits, the
## mean is zero)
#fit_raneff_data$aggression_s[is.na(fit_raneff_data$aggression_s)]   <- 0
#fit_raneff_data$activity_s[is.na(fit_raneff_data$activity_s)]       <- 0
#fit_raneff_data$docility_s[is.na(fit_raneff_data$docility_s)]       <- 0
#fit_raneff_data$aggression_sy[is.na(fit_raneff_data$aggression_sy)] <- 0
#fit_raneff_data$activity_sy[is.na(fit_raneff_data$activity_sy)]     <- 0
#fit_raneff_data$docility_sy[is.na(fit_raneff_data$docility_sy)]     <- 0


# Trickier for non-standardized data
fit_raneff_data <- fit_raneff_data %>%
group_by(itt, Year, add = FALSE) %>%
mutate(
  aggression_f = ifelse(
    is.na(aggression),
    mean(aggression, na.rm = TRUE),
    aggression),
  activity_f = ifelse(
    is.na(activity),
    mean(activity, na.rm = TRUE),
    activity)
    ,
  docility_f = ifelse(
    is.na(docility),
    mean(docility, na.rm = TRUE),
    docility)
  )
```

Sample Sizes

```
fit_raneff_data %>%
  filter(itt == "1") %>%
  group_by(Grid, Year, add = FALSE) %>%
  summarise(n()) %>%
  pandoc.table(.)
```

Grid	Year	n()
KL	2003	4
KL	2004	8
KL	2005	19
KL	2006	24
KL	2007	21
KL	2008	29
KL	2009	24
KL	2010	22
SU	2003	14
SU	2004	18
SU	2005	31
SU	2006	24
SU	2007	19
SU	2008	16
SU	2009	11
SU	2010	12

```
fit_raneff_data %>%
  filter(itt == "1") %>%
  group_by(Year, add = FALSE) %>%
  summarise(n()) %>%
  pandoc.table(.)
```

Year	n()
2003	18
2004	26
2005	50
2006	48
2007	40
2008	45
2009	35
2010	34

```
save(fit_raneff_data, file = "data/analyses_data/fit_raneff_data.RData")
```