Reproducible analysis for: Individual flexibility in group foraging behaviour of reef manta rays (Mobula alfredi)

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Table of contents

0.1 Rationale

TODO

0.2 Packages and data import

Make sure to have these packages installed before runnig the code in this report

```
library(tidyverse); library(here); library(easystats); library(kableExtra)
library(lme4); library(marginaleffects); library(ggeffects);
library(rptR); library(gtsummary); library(tidybayes)
library(ggthemes); library(patchwork)
```

Import complete dataset

```
df = read.csv(here("data/data-clean/Manta Data_Annie.csv"),
              header=TRUE, sep=",", na.strings="NA", dec=".", strip.white=TRUE)
```

Import group foraging dataset

```
df.group = read.csv(here("data/data-clean/group_rp.csv"),
              header=TRUE, sep=",", na.strings="NA", dec=".", strip.white=TRUE)
str(df.group)
```

```
'data.frame':    1762 obs. of  48 variables:
 $ npid         : chr  "P19" "P19" "P33" "P33" ...
 $ id           : int  19 19 33 33 33 33 33 33 33 33 ...
 $ obs_nb       : int  1 2 1 2 3 4 5 6 7 8 ...
 $ rep_tot      : int  2 2 17 17 17 17 17 17 17 17 ...
 $ day          : int  155 155 153 155 184 184 184 184 214 215 ...
 $ year         : int  2016 2016 2016 2016 2016 2016 2016 2016 2016 2016 ...
 $ nyear        : chr  "year3" "year3" "year3" "year3" ...
 $ site         : int  1 1 1 1 1 1 1 1 1 1 ...
 $ clips        : int  46 46 16 46 25 25 25 25 8 1 ...
 $ sex          : int  1 1 2 2 2 2 2 2 2 2 ...
 $ size         : int  4 4 3 3 3 3 3 3 3 3 ...
 $ maturity     : int  2 2 2 2 2 2 2 2 2 2 ...
 $ group_ID     : chr  "G400" "G401" "G391" "G423" ...
 $ group_size   : int  5 5 4 5 4 2 3 4 2 2 ...
 $ position     : int  5 5 2 1 4 1 1 4 1 2 ...
 $ seconds      : int  12 12 17 28 22 19 24 29 6 8 ...
 $ time         : chr  "10:05" "10:05" "11:00" "11:55" ...
 $ time_ht      : int  118 118 49 8 112 104 98 40 60 118 ...
 $ high_tide    : chr  "12:03" "12:03" "10:11" "12:03" ...
 $ no_mantas    : int  5 6 4 6 4 5 5 8 2 2 ...
 $ manta_trans  : num  0.699 0.778 0.602 0.778 0.602 ...
 $ group        : int  1 1 1 1 1 1 1 1 1 1 ...
 $ leader       : int  0 0 0 1 0 1 1 0 1 0 ...
 $ follower     : int  1 1 1 0 1 0 0 1 0 1 ...
 $ dg           : int  0 0 0 0 0 0 0 0 0 0 ...
 $ hb           : int  1 1 1 1 1 1 1 1 1 1 ...
 $ hf           : int  0 0 0 0 0 0 0 0 0 0 ...
 $ rb           : int  0 0 0 0 0 0 0 0 0 0 ...
 $ v            : int  0 0 0 0 0 0 0 0 0 0 ...
 $ bt           : int  0 0 0 0 0 0 0 0 0 0 ...
 $ strategy     : int  6 6 6 2 6 2 2 2 2 2 ...
```

```
 $ feeding      : int  2 2 2 2 2 2 2 2 2 2 ...
 $ no_people    : int  23 23 13 23 9 9 9 9 73 43 ...
 $ people_trans : chr  "1.361727836" "1.361727836" "1.113943352" "1.361727836" ...
 $ plankton     : int  2 2 1 2 2 2 2 2 1 1 ...
 $ copepods     : int  1 1 1 1 1 1 1 1 1 1 ...
 $ arrow        : int  0 0 0 0 1 1 1 1 1 0 ...
 $ mysid        : int  0 0 0 0 0 0 0 0 0 0 ...
 $ jelly        : int  0 0 0 0 1 1 1 1 0 0 ...
 $ phyto        : int  0 0 0 0 0 0 0 0 0 0 ...
 $ lunar        : chr  "NM-4" "NM-4" "NM-4" "NM-4" ...
 $ l_code       : int  4 4 4 4 4 4 4 4 4 5 ...
 $ current.VU.AO: int  2 2 2 2 2 2 2 2 2 1 2 ...
 $ clip         : chr  "H03June06" "H03June36" "H01June11" "H03June24" ...
 $ injury       : int  0 0 1 1 1 1 1 1 1 1 1 ...
 $ shark_bite   : int  0 0 1 1 1 1 1 1 1 1 1 ...
 $ anthropogenic: int  0 0 0 0 0 0 0 0 0 0 ...
 $ pregnant     : int  0 0 0 0 0 0 0 0 0 0 ...
```

```r
df.group$id = as.factor(df.group$id)
df.group$site = as.factor(df.group$site)
df.group$sex_f = as.factor(ifelse(df.group$sex=="1","F","M"))
df.group$size = as.factor(df.group$size)
df.group$maturity = as.factor(df.group$maturity)
df.group$plankton = as.factor(df.group$plankton)
df.group$shark_bite = as.factor(df.group$shark_bite)
df.group$anthropogenic = as.factor(df.group$anthropogenic)
df.group$Id = df.group$id

# Transform Time columns centered aroun 12:00pm expressed in hours
df.group$time_cen = hm(df.group$time)
df.group$time_cen = as.numeric(df.group$time_cen-hours(12))/3600

# subset with only individuals within groups
df.group = df.group[df.group$group==1,]
df.group=df.group[complete.cases(df.group$position),]
head(df.group) %>% kable()
```

npid	obse	play	ctary	site	clip	sex	size	matr	grp	gtp	IDvo	rtion	high	tidal	staf	flldh	bhf	rb	v	bt	strfe	tckng	rgp	ptom	mss	lyto	rcod
P19	91	2	155	2016	ar	346	1	4	2	G45	005	1210	:05	25	30.6	9807	000	1	0	0	0	6	2	231.3	61727	836	0	0	NM-	H0

npid	obse...	...year...	...clip	sex	siz	...mag	...grou...ID...	...heigh...	...data...	...h	f	rb	v	bt	str...	...rop...nr...sib	h	v	tn	a	codi...
P19 92	2	15 2016 ar 346	1	4	2	G40 15	12 10:05 8 2 630.7780 5120	1	0	0	0	0	6	2	231.351720836	0	0	NM-2	H00 4
P33 31	17 15 2016 ar 316	2	3	2	G39 12	17 11:00 0 4 110.6020600 0	1	0	0	0	0	6	2	131.11394035 2	0	0	NM-2	H01 4
P33 32	17 15 2016 ar 346	2	3	2	G42 31	28 11:55 12 630.7781 5020	1	0	0	0	0	2	2	231.351720836	0	0	NM-2	H01 4
P33 33	17 18 2016 ar 325	2	3	2	G47 34	22 10:10 2 1 4 520.6020600 0	1	0	0	0	0	6	2	9 0.95412250 9	1	0	NM-2	H01 4
P33 34	17 18 2016 ar 325	2	3	2	G42 51	19 10:08 4 15 520.6989700 0	1	0	0	0	0	2	2	9 0.95412250 9	1	0	NM-2	H01 4

0.3 Group vs. solo foraging

0.4 What explains variation in group leadership ?

0.5 Individual differences in group leadership compared between sexes, age and injury status