Scopoli's shearwaters movements

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Contents

1 Data exploration

1.1 Generalisation data set

% Table created by stargazer v.5.2.2 by Marek Hlavac, Harvard University. E-mail: hlavac at fas.harvard.edu
% Date and time: jeu., janv. 13, 2022 - 11:11:50

Table 1: Extrait du jeu de données du 28 juin 2011*

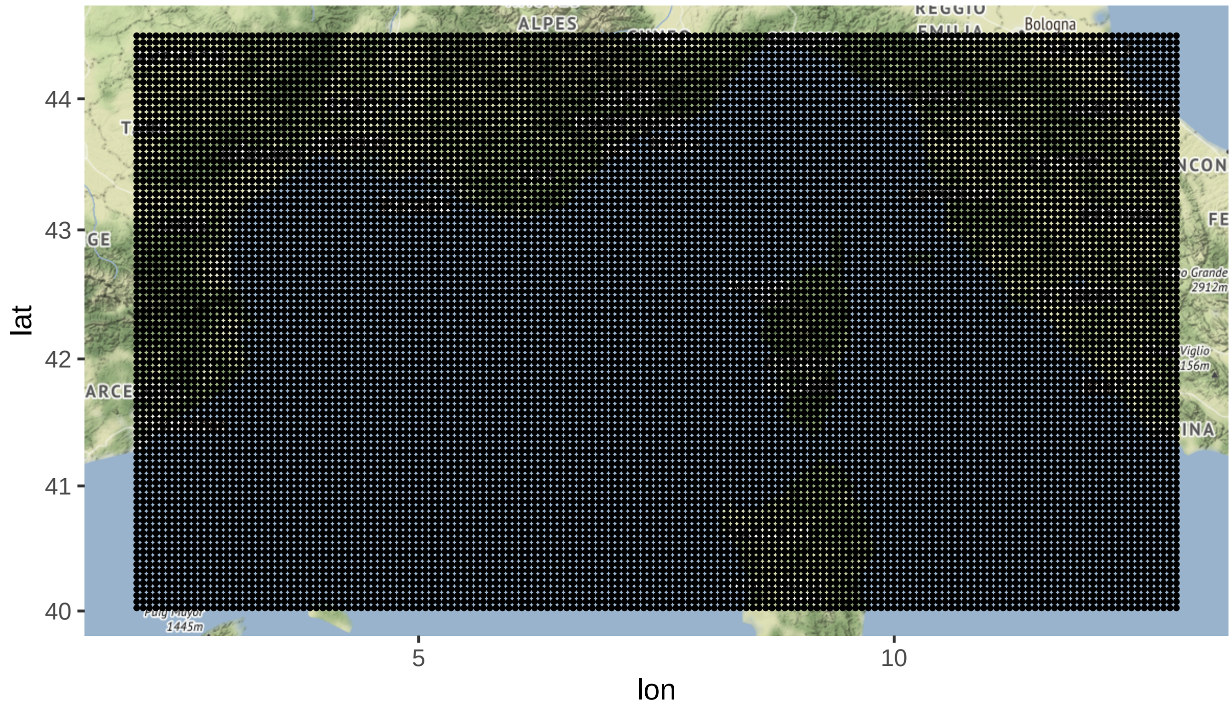
	Longitude	Latitude	Cell	Date	Day	year	month
2011-06-28.1	2.034	44.475	1	2011-06-28	2011-06-28	2011	06
2011-06-28.2	2.101	44.475	2	2011-06-28	2011-06-28	2011	06
2011-06-28.3	2.169	44.475	3	2011-06-28	2011-06-28	2011	06
2011-06-28.4	2.236	44.475	4	2011-06-28	2011-06-28	2011	06
2011-06-28.5	2.304	44.475	5	2011-06-28	2011-06-28	2011	06
2011-06-28.14666	12.699	40.025	14, 666	2011-06-28	2011-06-28	2011	06
2011-06-28.14667	12.766	40.025	14, 667	2011-06-28	2011-06-28	2011	06
2011-06-28.14668	12.834	40.025	14, 668	2011-06-28	2011-06-28	2011	06
2011-06-28.14669	12.901	40.025	14, 669	2011-06-28	2011-06-28	2011	06
2011-06-28.14670	12.969	40.025	14, 670	2011-06-28	2011-06-28	2011	06

*Six premières colonnes sur les 41 colonnes du jeu de données

Grid giving tempretures and bathymetry data for each one of the 95 days.

1.1.1 Visualisation of the grid

```
mediterranean  <- make_bbox(lat = Latitude, lon = Longitude, data = grid_day1)
map.day1 <- get_map(location = mediterranean) %>% ggmap()
map.day1 + geom_point(data = grid_day1, aes(x = Longitude, y = Latitude), size = 0.5)
```



1.2 "Training" data set (Puffin's movements)

```
difftime(max(ALL2012$Time), min(ALL2011$Time), units = "days")
dates_2011 <- ALL2011$Time %>% date() %>% unique()
dates_2012 <- ALL2012$Time %>% date() %>% unique()
nb_days <- length(dates_2011) + length(dates_2012)
paste("Period #1: from", min(dates_2011), "to", max(dates_2011),
      "(", difftime(max(dates_2011), min(dates_2011)), "days )")
paste("Period #2: from", min(dates_2012), "to", max(dates_2012),
      "(", difftime(max(dates_2012), min(dates_2012)), "days )")
```

Les données de traçage sont récoltées sur 62 jours, du 2011-08-02 au 2012-08-31.

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Get the grid dataframe corresponding to the first observed day

```
bool <- FALSE
i <- 0
while (!bool) {
  i <- i + 1
  if(grid_oceano[[i]]$Date[[1]] == dates_2011[1]) {
    bool <- TRUE
```

Table 2: Extrait du jeu de données*

	Site	trip_ID	Time	ID	Longitude	Latitude	Bathy
2011-08-02.129998	Riou	ID2R_1	2011-08-02 00:20:56	ID2R	5.330	43.166	95.950
2011-08-02.129999	Riou	ID2R_1	2011-08-02 00:22:56	ID2R	5.327	43.168	95.950
2011-08-02.130000	Riou	ID2R_1	2011-08-02 00:24:56	ID2R	5.326	43.168	95.950
2011-08-02.130001	Riou	ID2R_1	2011-08-02 00:26:56	ID2R	5.325	43.169	102.450
2011-08-02.130002	Riou	ID2R_1	2011-08-02 00:28:56	ID2R	5.325	43.169	102.450
2011-09-03.90287	Lavezzi	ID21L_1	2011-09-03 03:42:22	ID21L	8.751	41.008	58
2011-09-03.90288	Lavezzi	ID21L_1	2011-09-03 03:45:22	ID21L	8.752	41.008	58
2011-09-03.90289	Lavezzi	ID21L_1	2011-09-03 03:48:22	ID21L	8.752	41.008	58
2011-09-03.90290	Lavezzi	ID21L_1	2011-09-03 03:51:22	ID21L	8.752	41.008	58
2011-09-03.90291	Lavezzi	ID21L_1	2011-09-03 03:54:22	ID21L	8.752	41.008	58

*Dix premières colonnes sur les 25 colonnes du jeu de données

```
    grid_day1 <- grid_oceano[[i]]
  }
}

tab_extract.bird %>%
  left_join(grid_day1, by = c("Longitude", "Latitude")) %>%
  select(Site, Time, Date, ID, Longitude, Latitude, Bathy.x, Bathy.y)
```

1.2.1 Data visualisation

Number of individuals (doesn't match with the "breeding pairs" of Clara's paper)

```
bird1 <- ALL2011 %>%
  # filter(!is.na(Site)) %>%
  amt::select(x = Longitude, y = Latitude, t = Time, id = ID, Bathy = Bathy,
              SST1 = SST1, logCHLA1 = logCHLA1) %>%
  amt::filter(id == "ID1R")

track1 <- bird1 %>%
  amt::make_track(.x = x, .y = y, .t = t, crs = "epsg:2154", bathy = Bathy,
                  sst1 = SST1, logchla1 = logCHLA1, all_cols = FALSE)

summarize_sampling_rate(track1)

stps <- track1 %>%
  amt::track_resample(rate = minutes(10), tolerance = seconds(60)) %>%
  amt::filter_min_n_burst(min_n = 3) %>%
  amt::steps_by_burst(keep_col = 'both') %>%
  select(-c("burst__start", "burst__end"))  # removing these 2 auto created col.
  # amt::time_of_day(include.crepuscule = FALSE)
# str(stps)
```

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Get the grid dataframe corresponding to the observed day of stps dataframe

Table 3: Extrait des données de mouvements générées*

	burst_	x1_	x2_	y1_	y2_	sl_
1	1	5.3196583956044	5.31904454347826	43.1936886043956	43.192251923913	0.001562326867798
2	1	5.31904454347826	5.31857008695652	43.192251923913	43.1914647391304	0.000919113090414
3	1	5.31857008695652	5.3182886875	43.1914647391304	43.19137221875	0.000296218964484
4	1	5.3182886875	5.28038525	43.19137221875	43.18753025	0.03809765475973
5	1	5.28038525	5.25684440217391	43.18753025	43.1810203586956	0.02442437719095
6	2	5.11868041304348	5.1407792173913	43.2877600869565	43.2995260434783	0.02503587199352
7	2	5.1407792173913	5.17050696703297	43.2995260434783	43.2985096043956	0.02974512140110
8	2	5.17050696703297	5.22882837362637	43.2985096043956	43.2237628461538	0.09480751201614
9	2	5.22882837362637	5.2848227032967	43.2237628461538	43.2121182417582	0.05719232262078
10	2	5.2848227032967	5.29179266666667	43.2121182417582	43.187891	0.02520991139589

*observed steps

```
# bool <- FALSE
# i <- 0
# while (!bool) {
#   i <- i + 1
#   if(grid_oceano[[i]]$Date[[1]] == date(stps$t1_)[1]) {
#     bool <- TRUE
#     grid_day1_bird1 <- grid_oceano[[i]]
#   }
# }
```

closest starting point to existing grid points

```
# point1 <- stps[1, c("x2_", "y2_")]
# names(point1) <- c("Longitude", "Latitude")
# matrx <- grid_day1_bird1[, c("Longitude", "Latitude")] %>% as.matrix()
# nearest_pt <- Rfast::dista(point1, matrx, k = 1, index = TRUE)
# grid_day1_bird1[nearest_pt,]
# stps[1,]
```

adding random steps

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```
get_habitat <- function(step, mutate_var = "bathy_end", covariate = "Bathy", output){
  # get 1 habitat covariate for a random ENDGING point (default Bathy)
  grid_day <- grid_oceano[[which(grid_Oceano_Date == date(step$t2_))]]
  matrx <- grid_day[, c("Longitude", "Latitude")] %>% as.matrix()
  nearest_id <- Rfast::dista(step[,c("x2_", "y2_")], matrx, k = 1, index = TRUE)
  step[, mutate_var] <- grid_day[nearest_id, covariate]
  return(step)
}
```

```
for (i in 1:nrow(rdm_stps)){
  if (rdm_stps[i, "case_"] == FALSE){
    rdm_stps[i,] <- get_habitat(rdm_stps[i,],
```

Table 4: Extrait des données de mouvements aléatoires générées*

	burst_	x1_	x2_	y1_	y2_	sl_
1	1	5.31904454347826	5.31857008695652	43.192251923913	43.1914647391304	0.00091911309041450
2	1	5.31904454347826	5.32702638410633	43.192251923913	43.1907216063212	0.0081272167279902
3	1	5.31904454347826	5.32416896844003	43.192251923913	43.1902153966654	0.005514270071289
4	1	5.31904454347826	5.31745743573299	43.192251923913	43.1892734946752	0.0033749002532656
5	1	5.31904454347826	5.30836293449869	43.192251923913	43.1682550624209	0.0262668256907
6	2	5.2848227032967	5.28486038513963	43.2121182417582	43.2121261207569	3.84967519031979e-0
7	2	5.2848227032967	5.32199227284001	43.2121182417582	43.2263010709105	0.039783533563484
8	2	5.2848227032967	5.28496782684468	43.2121182417582	43.2121556645877	0.00014987098566675
9	2	5.2848227032967	5.28816110605142	43.2121182417582	43.2116614196375	0.0033695132293418
10	2	5.2848227032967	5.28530895678268	43.2121182417582	43.2030931112311	0.0090382201501840

*observed and random steps

```
                                mutate_var = "bathy_end", covariate = "Bathy")
    rdm_stps[i,] <- get_habitat(rdm_stps[i,],
                                mutate_var = "sst1_end", covariate = "SST1")
    rdm_stps[i,] <- get_habitat(rdm_stps[i,],
                                mutate_var = "logchla1_end", covariate = "logCHLA1")
  }
}

# rdm_stps[rdm_stps$case_==FALSE,]
```

amt::iSS function to run survival::clogit function usable in pipe workflow

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% Date and time: jeu., janv. 13, 2022 - 11:12:06

Table 5: Résumé du modèle de régression logistique conditionnel*

	Dependent variable:
	rep(1, 1890)
sl_	−0.195
	(4.107)
ta_	0.088
	(0.102)
log_sl	−0.004
	(0.075)
bathy_end	−0.026***
	(0.006)
sst1_end	−1.324**
	(0.567)
logchla1_end	−2.328***
	(0.715)
Observations	1,864
R^2	0.018
Max. Possible R^2	0.369
Log Likelihood	−412.116
Wald Test	27.240*** (df = 6)
LR Test	34.373*** (df = 6)
Score (Logrank) Test	25.734*** (df = 6)
Note:	*p<0.1; **p<0.05; ***p<0.01