SUPPLEMENTARY ELECTRONIC MATERIAL

ARDEOLA 71 (2)

FACTORS AFFECTING TIME ACTIVITY BUDGETS OF BREEDING WHITE STORKS *CICONIA CICONIA* ASSESSED USING BIO-LOGGING

FACTORES QUE AFFECTAN A LOS PRESUPUESTOS DE ACTIVIDAD TEMPORAL DE LAS CIGÜEÑAS BLANCAS *CICONIA CICONIA* REPRODUCTORAS EVALUADOS MEDIANTE BIO-LOGGING

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TABLE A1

Results of the GAMM model explaining the proportion of time spent walking in White Storks. *n* = 762 observations (i.e. bird.days), *n* = 9 individuals. The proportion of deviance explained by the model was 39.3%. edf, smoother estimated degree of freedom. For random effects, estimates are the variance components. Phi1 and Phi2 indicate the parameters of the selected ARMA(2,1) structure.

[Resultados del modelo GAMM que explica la proporción de tiempo dedicado a caminar de las cigüeñas blancas. n = 762 observaciones (es decir, ave.día), n = 9 individuos. La proporción de desviación explicada por el modelo fue del 39.3%. edf, grado de libertad estimado más suave. Para los efectos aleatorios, las estimaciones son los componentes de la varianza. Phi1 y phi2 indican los parámetros de la estructura ARMA(2,1) seleccionada.]

Variable	**Estimate (SE)**	***z*-value**	***P*-value**	**edf**	**F-test**	***P*-value**
Intercept	0.421 (0.059)	7.19	<0.001			
Site (Loire)	0.171 (0.064)	2.66	0.008			
Sex (M)	-0.041 (0.048)	-0.86	0.389			
2 fledglings	0.088 (0.053)	1.66	0.098			
3 fledglings	0.014 (0.076)	0.18	0.858			
s(Time)				4.27	8.26	<0.001
Individual (random)	0.00002					
Residual	0.138					
Phi1	1.109					
Phi2	-0.156					

TABLE A2

Results of the GAMM model explaining the proportion of time spent resting outside the nest area in White Storks. *n* = 762 observations, *n* = 9 individuals. The proportion of deviance explained by the model was 66.2%. edf, smoother estimated degree of freedom. For random effects, estimates are the variance components. Phi1, Phi2 and Phi3 indicate the parameters of the selected ARMA(3,1) structure.

[Resultados del modelo GAMM que explica la proporción de tiempo pasado descansando fuera del área de nidificación en cigüeñas blancas. n = 762 observaciones, n = 9 individuos. La proporción de desviación explicada por el modelo fue del 66.2%. edf, grado de libertad estimado más suave. Para los efectos aleatorios, las estimaciones son los componentes de la varianza. Phi1, phi2 y phi3 indican los parámetros de la estructura ARMA(3,1) seleccionada.]

Variable	**Estimate (SE)**	***z*-value**	***P*-value**	**edf**	***F*-test**	***P*-value**
Intercept	0.310 (0.058)	5.32	<0.001			
Site (Loire)	-0.105 (0.064)	-1.64	0.102			
Sex (M)	0.010 (0.047)	0.20	0.839			
2 fledglings	-0.095 (0.053)	-1.79	0.074			
3 fledglings	-0.036 (0.076)	-0.472	0.637			
s(Time)				3.33	40.0	<0.001
Individual (random)	0.00001					
Residual	0.132					
Phi1	1.122					
Phi2	-0.224					
Phi3	0.054					

TABLE A3

Results of the GAMM model explaining the proportion of time spent flying in White Storks. *n* = 762 observations, *n* = 9 individuals. The proportion of deviance explained by the model was 8.4%. edf, smoother estimated degree of freedom. For random effects, estimates are the variance components. Phi1 indicates the parameter of the selected ARMA(1,1) structure.

[Resultados del modelo GAMM que explica la proporción de tiempo de vuelo en cigüeñas blancas. n = 762 observaciones, n = 9 individuos. La proporción de desviación explicada por el modelo fue del 8,4%. edf, grado de libertad estimado más suave. Para los efectos aleatorios, las estimaciones son los componentes de la varianza. Phi1 indica el parámetro de la estructura ARMA(1,1) seleccionada.]

Variable	**Estimate (SE)**	***z*-value**	***P*-value**	**edf**	***F* test**	***P*-value**
Intercept	0.014 (0.049)	0.29	0.775			
Site (Loire)	-0.003 (0.053)	-0.07	0.948			
Sex (M)	0.032 (0.040)	0.81	0.418			
2 fledglings	0.022 (0.044)	0.49	0.622			
3 fledglings	0.053 (0.063)	0.84	0.399			
s(Time)				1.19	0.726	0.340
Individual (random)	0.037					
Residual	0.060					
Phi1	0.917					

TABLE A4

Results of the GAMM model explaining the proportion of time spent at the nest in White Storks. *n* = 762 observations, *n* = 9 individuals. The proportion of deviance explained by the model was 74.6%. edf, smoother estimated degree of freedom. For random effects, estimates are the variance components. Phi1 indicates the parameter of the selected ARMA(1,2) structure.

[Resultados del modelo GAMM que explica la proporción de tiempo pasado en el nido en cigüeñas blancas. n = 762 observaciones, n = 9 individuos. La proporción de desviación explicada por el modelo fue del 74.6%. edf, grado de libertad estimado más suave. Para los efectos aleatorios, las estimaciones son los componentes de la varianza. Phi1 indica el parámetro de la estructura ARMA(1,2) seleccionada.]

Variable	**Estimate (SE)**	***z*-value**	***P*-value**	**edf**	***F*-test**	***P*-value**
Intercept	0.251 (0.059)	4.27	<0.001			
Site (Loire)	-0.061 (0.065)	-0.95	0.343			
Sex (M)	0.001 (0.048)	0.03	0.978			
2 fledglings	-0.013 (0.054)	-0.24	0.807			
3 fledglings	-0.029 (0.077)	-0.37	0.708			
s(Time)				4.17	31.9	<0.001
Individual (random)	0.00001					
Residual	0.116					
Phi1	0.950					

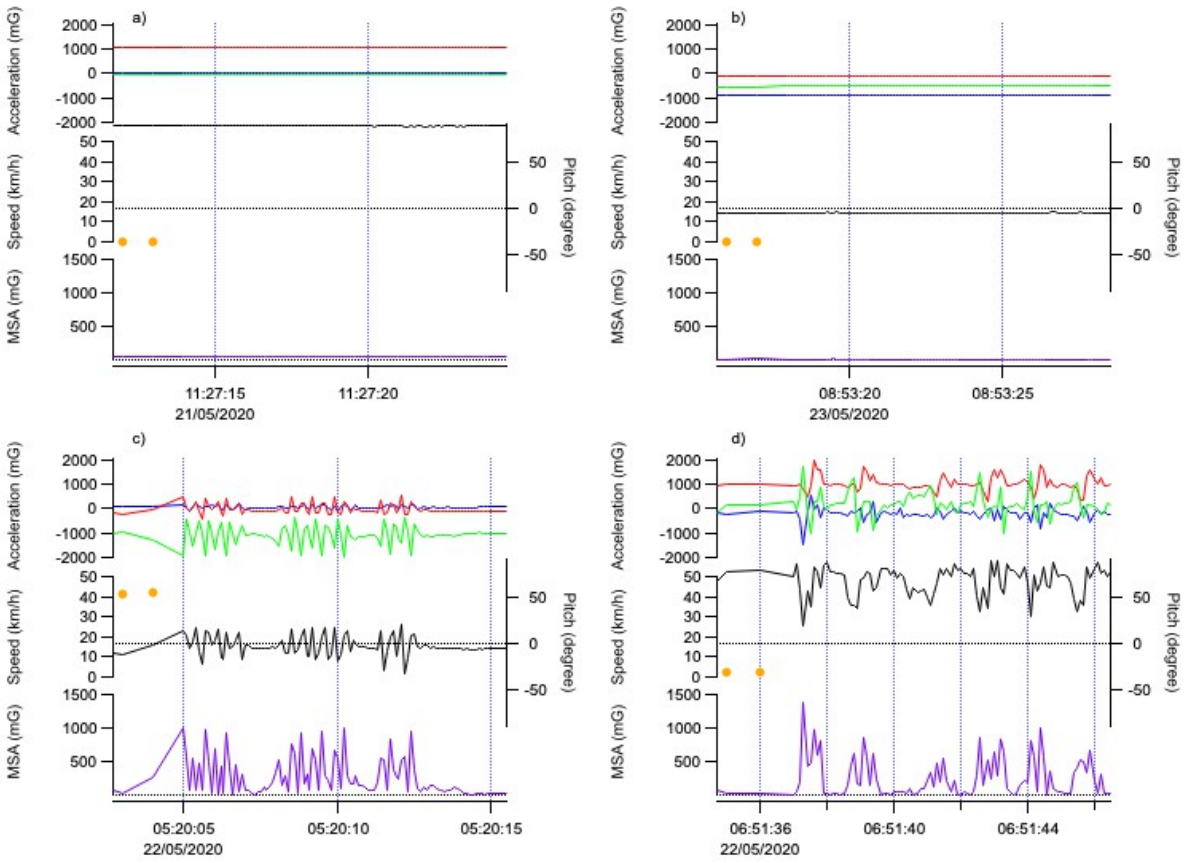

FIG. A1._The typical accelerations (Acc_x in blue, Acc_y in red, Acc_z in green), pitch (black), minimum specific acceleration (MSA, purple) and speed (orange dot) during a) standing with straight legs, b) standing on one leg or sitting, c) flight, and d) walking/foraging.

[Las aceleraciones típicas (Acc_x en azul, Acc_y en rojo, Acc_z en verde), cabeceo (negro), aceleración específica mínima (MSA, púrpura) y velocidad (punto naranja) durante a) bipedestación con pata recta, b) bipedestación con pata flexionada o sentada, c) vuelo, y d) caminar/forrajeo.]

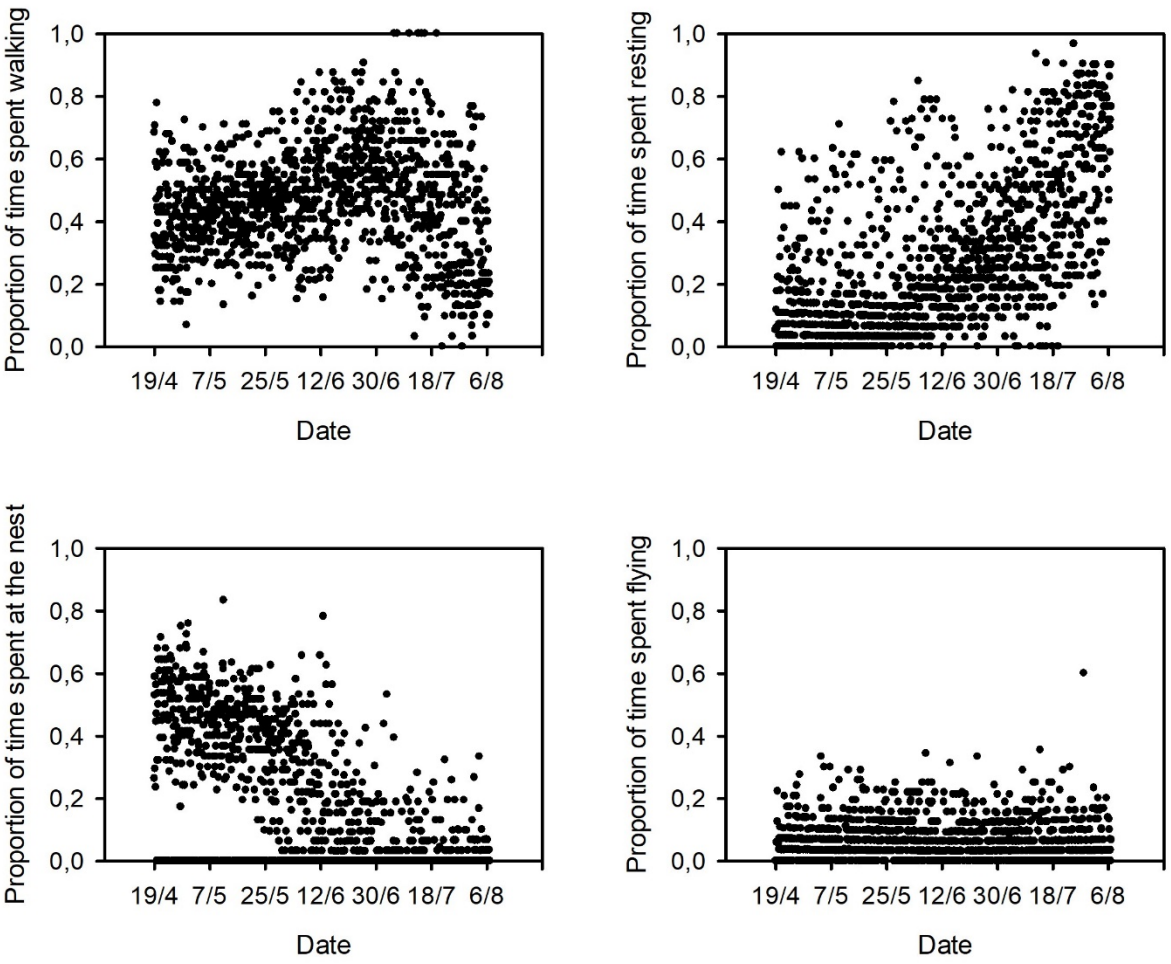

FIG. A2._Observed proportion of time spent walking, resting, at the nest and flying as a function of time during the breeding period from April 19th to August 7th.

[Proporción observada de tiempo pasado caminando, descansando, en el nido y volando en función del tiempo durante el periodo reproductor del 19 de abril al 7 de agosto.]

CODE USED FOR THE CLASSIFICATION OF WHITE STORK BEHAVIOURS

[CÓDIGO USADO PRA LA CLASIFICACIÓN DE LAS CONDUCTAS DE LAS CIGÜEÑAS BLANCAS]

```
##############################################
library(Rmixmod)

## Separation between Flying and Not Flying behaviours ##
dataF <- data[data$avSpeed>=5,]  # Flying Table
dataF$cluster <- 4
dataF$cluster <- as.factor(dataF$cluster)
dataF$Behavior<- "Flying"
dataN <- data[data$avSpeed<5,]  # Not Flying Table
numCluster <- 3                 # Number of Cluster
listID <- unique(dataN$ID)      # List of ID
imax <-length(listID)

### Classification LOOP  ###
    # /!\   In xem <- mixmodCluster (data_cluster[,c(10,9)], .... ) -->  c(10,9) Might need
to be changed
    # /!\   Here 10 & 9 represent the avPitch & avMSA column
for (i in 1:imax) {
 data_cluster <- dataN[dataN$ID==listID[i],]
 repeatN=0       # To count number of repeats
 system.time(
  repeat{       # Repeat until likelihood is not 0
    repeatN=repeatN+1
    xem <- mixmodCluster (data_cluster[,c(10,9)],numCluster, models =
mixmodGaussianModel (), criterion= c("BIC","ICL"),  # data_cluster[,c(10,9)]
corresponds to MSA & pitch. As to be change if not
            strategy = mixmodStrategy(algo = "EM", nbTry = 1,initMethod = "smallEM",
nbTryInInit = 50,
                                      nbIterationInInit = 5, nbIterationInAlgo = 200,
epsilonInInit = 0.001, epsilonInAlgo = 0.001, seed =NULL))
       if (xem@bestResult@likelihood!=0) {break}
  }
 )
 print("Number of repetitions for convergence :")
 print(repeatN)
 print("ID :")
 print(listID[i])
 summary (xem)
 plot(xem)
```

```
 title(listID[i])
 data_cluster$cluster <- (xem@bestResult@partition)
 data_cluster$cluster <- as.factor(data_cluster$cluster)

# To find the Walking cluster among the 3 Cluster
 WalkingCluster <- which.max(xem@bestResult@parameters@mean[,1])
  data_cluster$Behavior[data_cluster$cluster==WalkingCluster] <- "Walking"
 data_cluster$Behavior[data_cluster$cluster!=WalkingCluster] <- "Resting"
  dataN <- merge(dataN[dataN$ID!=listID[i],],data_cluster, all=T)
 }

### End of the LOOP ###
dataN <- as.data.frame(dataN)
dataF <- as.data.frame(dataF)
summary(dataN)
summary(dataF)

## Combination of the two tables dataN & dataF ##
data_Classi<- rbind(dataN,dataF)
data_Classi$Behavior <- as.factor(data_Classi$Behavior)

## Table reorganization ##
data_Classi <- data_Classi[order(data_Classi$Statut,data_Classi$ID,
data_Classi$Date_session),]  # Can be reorganized differently. For exemple just by:
order(data_Classi$ID, data_Classi$Date_session)
row.names(data_Classi) <- NULL  #â•‘ reset index
summary(data_Classi)

## Plot ##
      # All individuals combined
plot (dataN$avPitch~ dataN$avMSA, main= "avPitch ~ avMSA" )
points(dataN$avPitch[which(dataN$Behavior=="Resting")]~
dataN$avMSA[which(dataN$Behavior=="Resting")], pch = 1, col = "#FFCC33" )
points(dataF$avPitch[which(dataF$Behavior=="Flying")]~
dataF$avMSA[which(dataF$Behavior=="Flying")], pch = 1, col = "#0099FF" )
points(dataN$avPitch[which(dataN$Behavior=="Walking")]~
dataN$avMSA[which(dataN$Behavior=="Walking")], pch = 1, col = "#669900" )

## Remove unnecessary data ##
rm(dataF)
rm(dataN)
rm(data_cluster)

################################
```

```
######### Add Nesting #########
################################
      # Classify all the Resting behavior near the nest as Nesting
      # --> Correspond to a Nest and Juvenile monitoring behavior
levels(data_Classi$Behavior) <- c(levels(data_Classi$Behavior),"Nesting")    # Add
the Nesting level
data_Classi$Behavior[data_Classi$Behavior=="Resting" & data_Classi$Dist <= 17]
<- as.factor("Nesting")
      # The 17 meters value have been defined based on the Histogram segregation
method
summary(data_Classi)
```

MOVEBANK LINKS TO ACCESS TRACKING DATA

[ENLACES DE MOVEBANK PARA ACCEDER A LOS DATOS DE SEGUIMIENTO]

Gironde data :
https://www.movebank.org/cms/webapp?gwt_fragment=page=studies,path=study247772625

Loire data :
https://www.movebank.org/cms/webapp?gwt_fragment=page=studies,path=study1106241526