*The following supplements accompany the article*

# Environment and anthropogenic activities influence cetacean habitat use in Southeastern Brazil

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**Supplement 1.** Tardin et al. *What drives cetacean habitat use in Southeastern Brazil: environment or anthropic activities?* Biological conservation

Figures displaying the spatial characterization of each environmental variable at the study area.

Depth

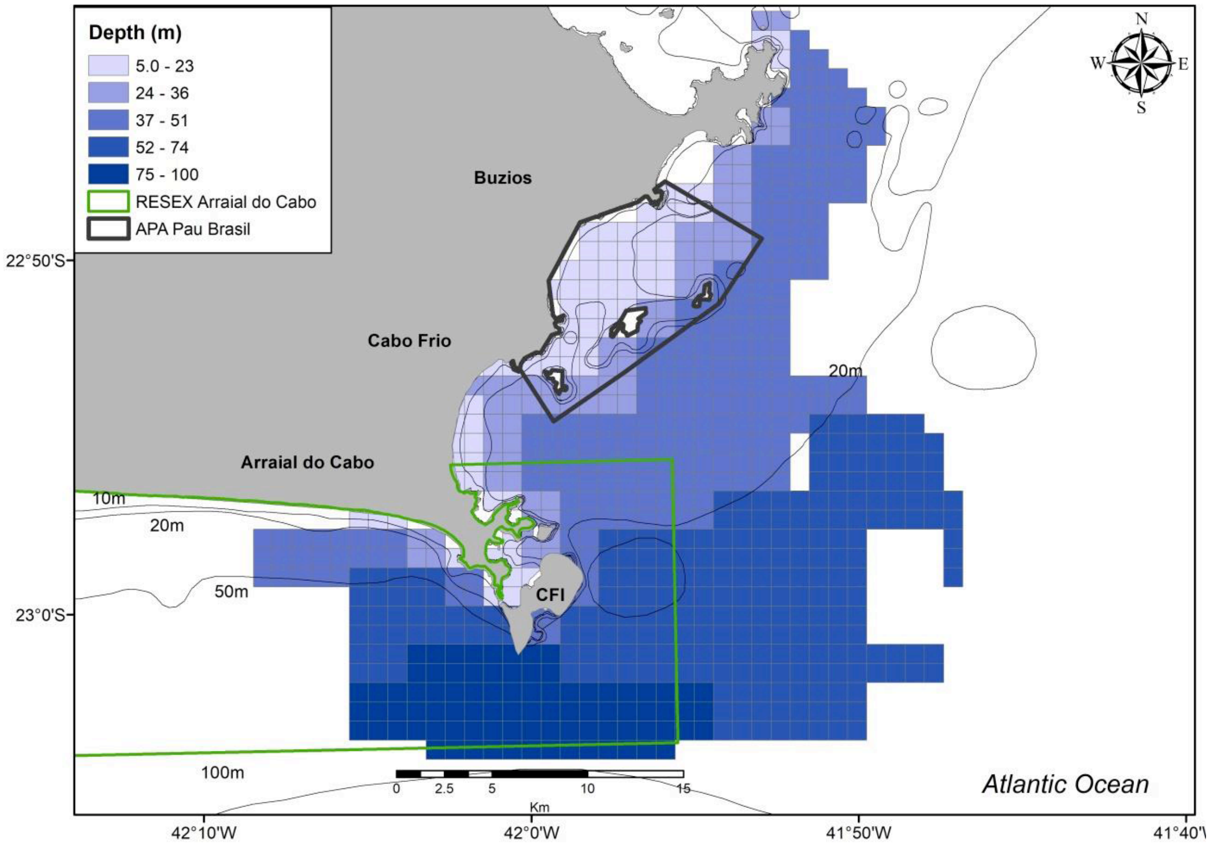



Figure S1. Spatial characterization indicating the values of Depth for each 1km2 in the region of Cabo Frio, RJ, Southeastern Brazil.

Distance to coast

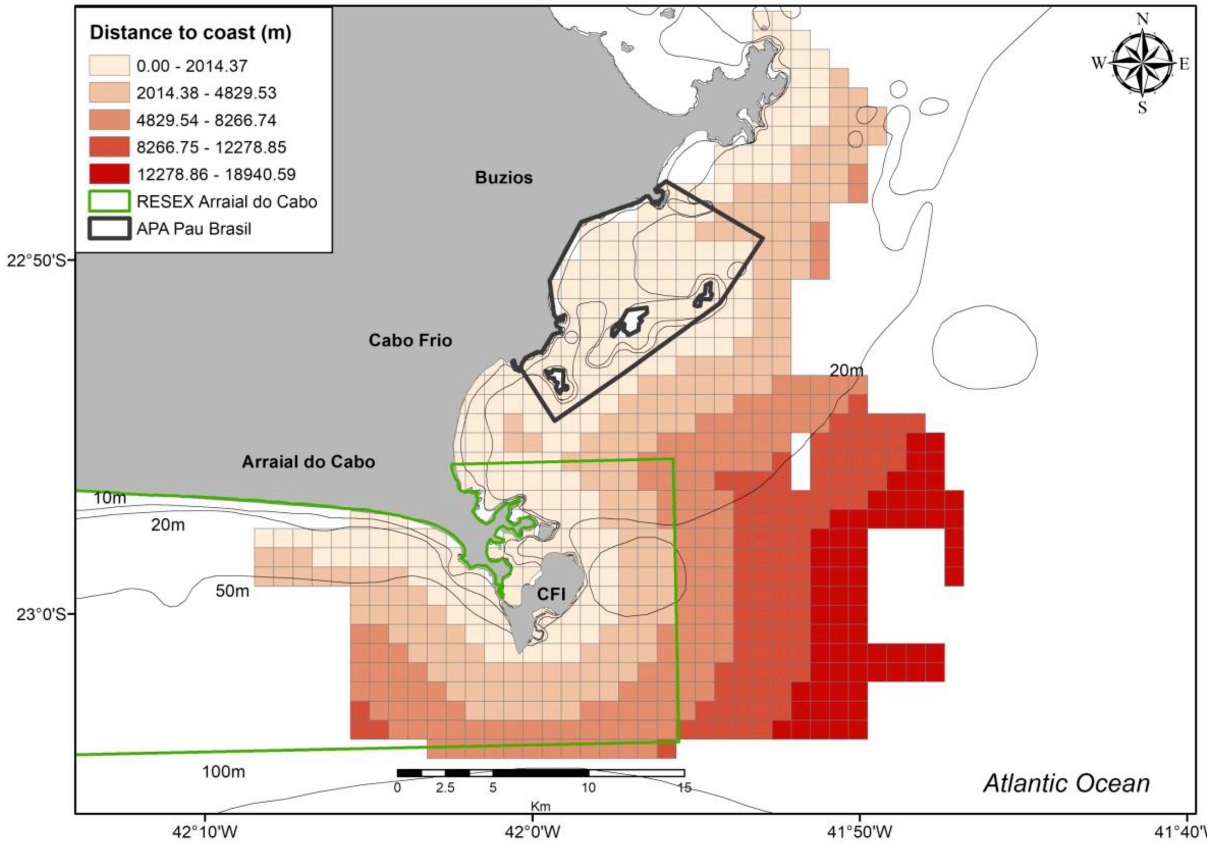



Figure S2. Spatial characterization indicating the values of Distance to coast for each 1km2 in the region of Cabo Frio, RJ, Southeastern Brazil.

Minimum SST

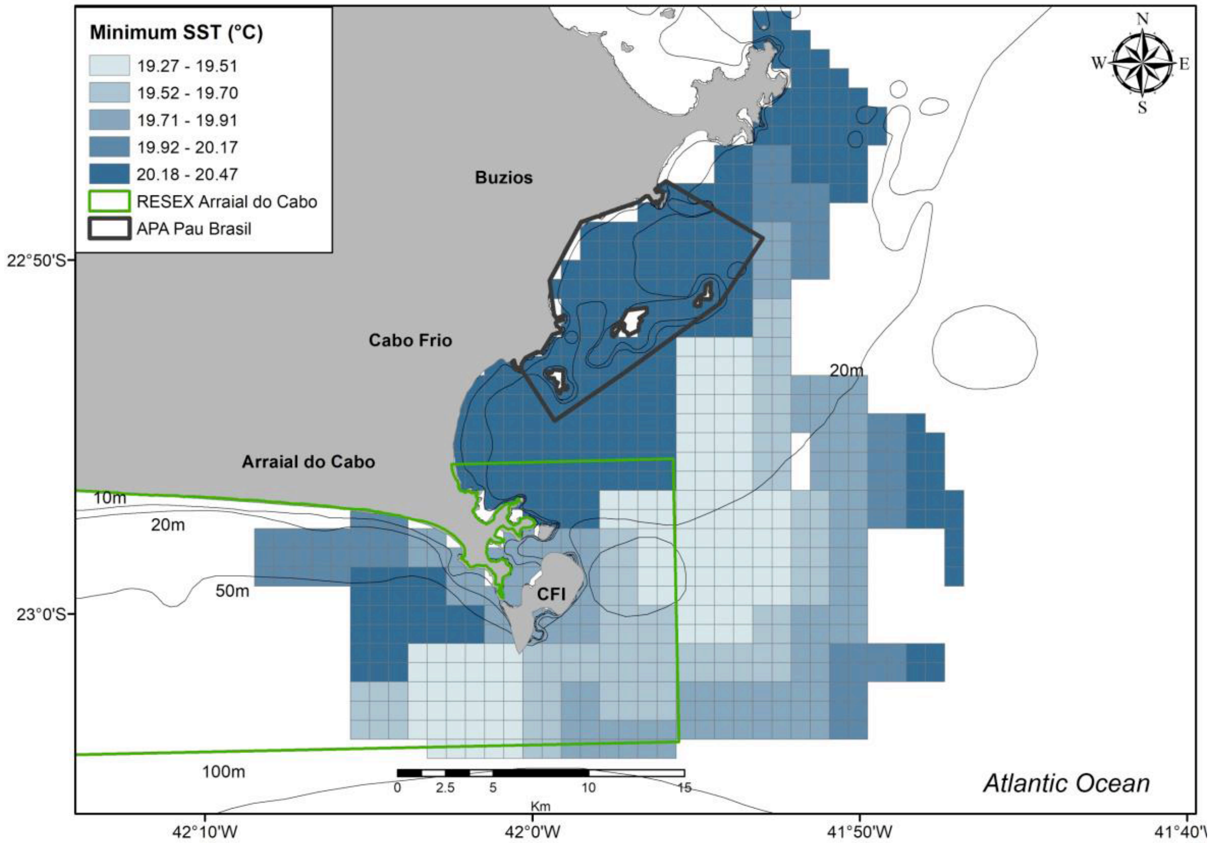



Figure S3. Spatial characterization indicating the values of Minimum SST for each 1km2 in the region of Cabo Frio, RJ, Southeastern Brazil.

Mean SST

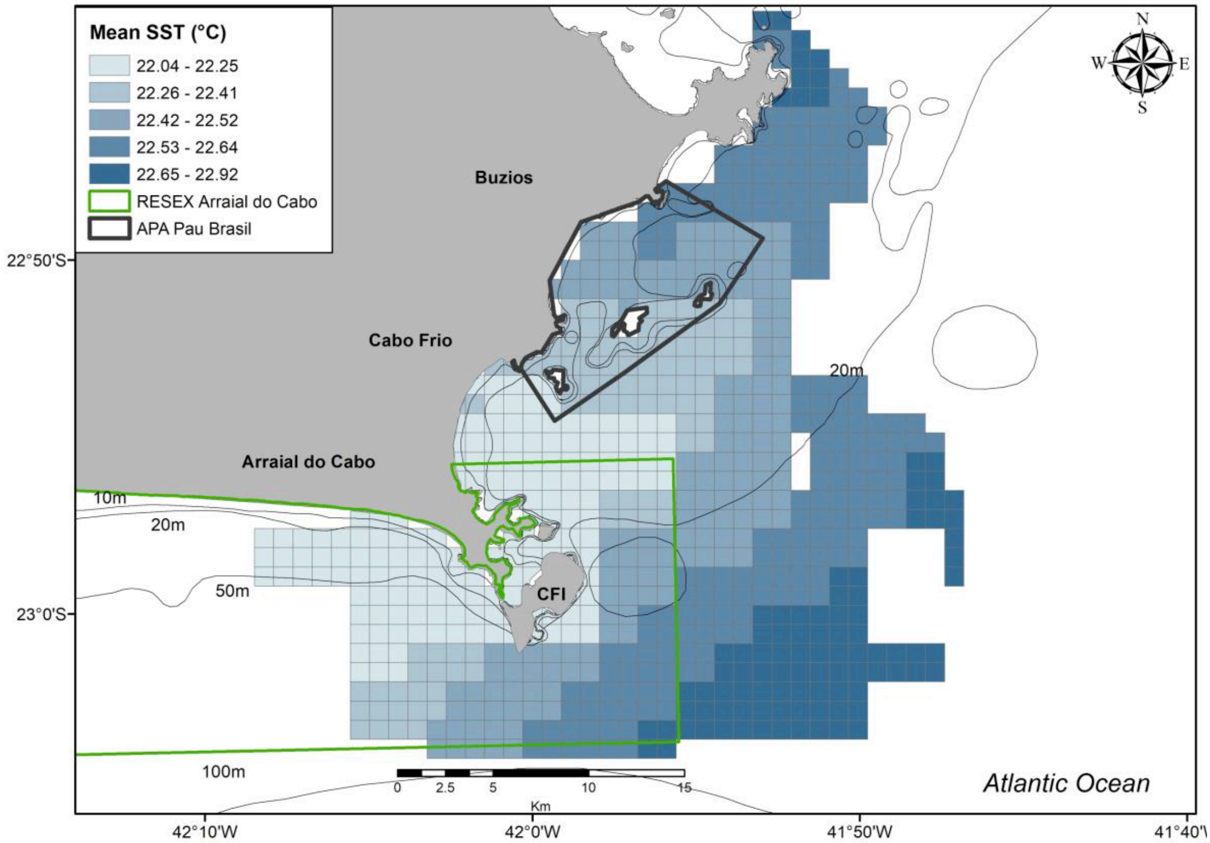



Figure S4. Spatial characterization indicating the values of Mean SST for each 1km2 in the region of Cabo Frio, RJ, Southeastern Brazil

Maximum SST

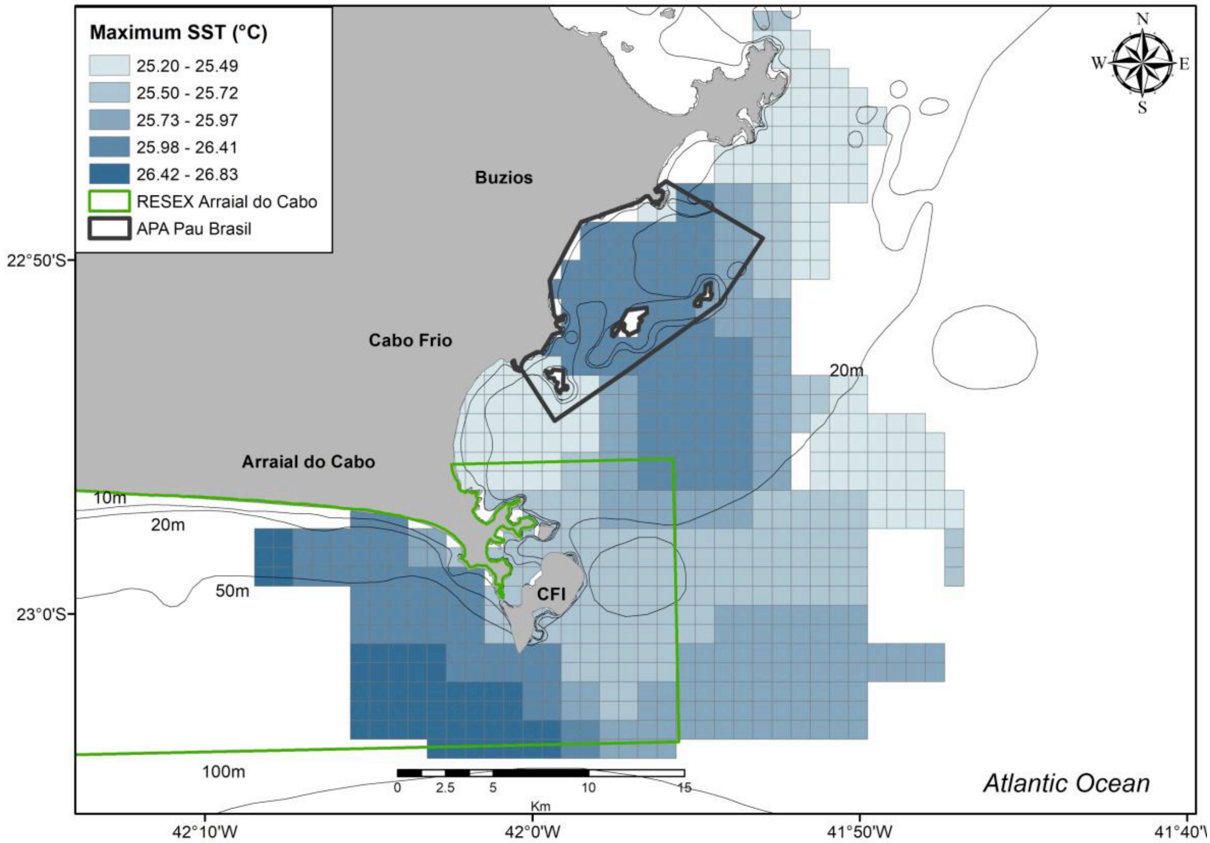



Figure S5. Spatial characterization indicating the values of Maximum SST for each 1km2 in the region of Cabo Frio, RJ, Southeastern Brazil.

Standard Deviation SST

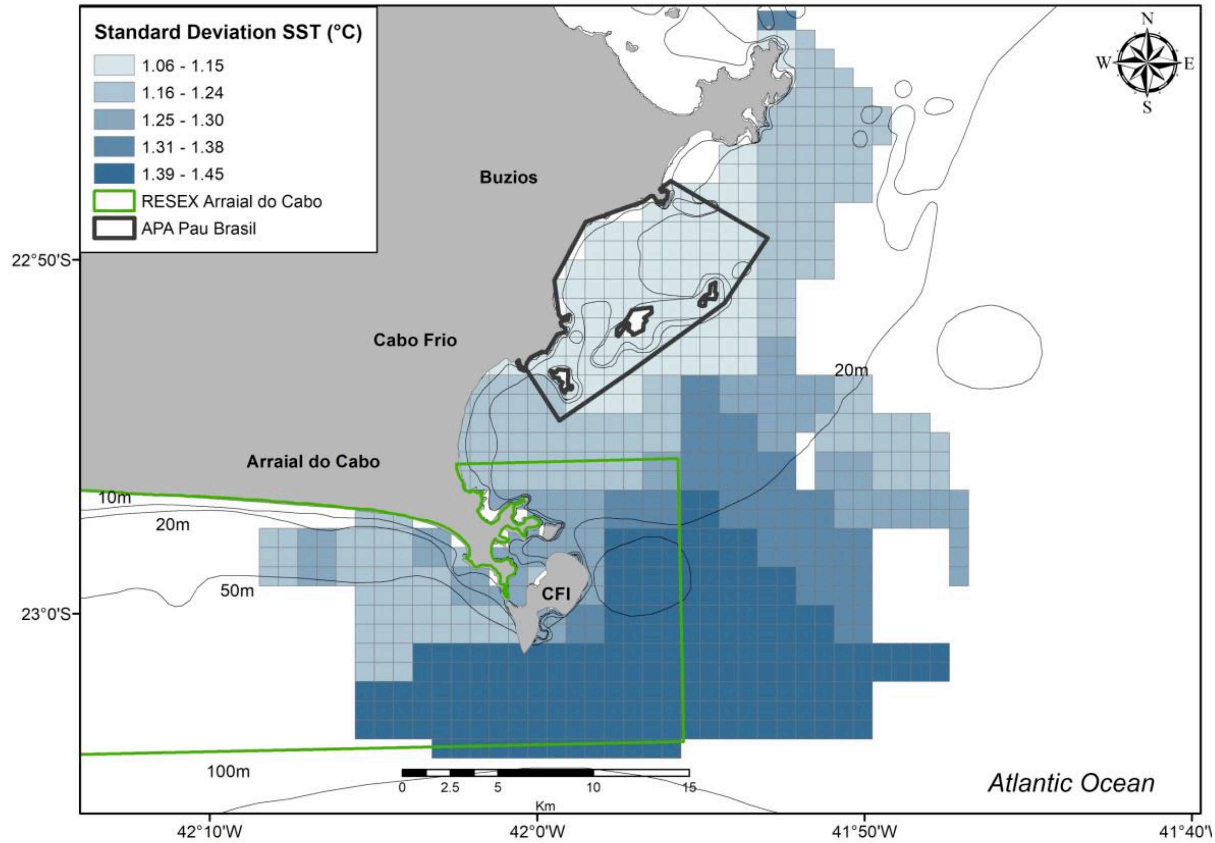



Figure S6. Spatial characterization indicating the values of Standard Deviation SST for each 1km2 in the region of Cabo Frio, RJ, Southeastern Brazil.

Minimum Chlorophyll-a concentration (mg m-3 km-1)

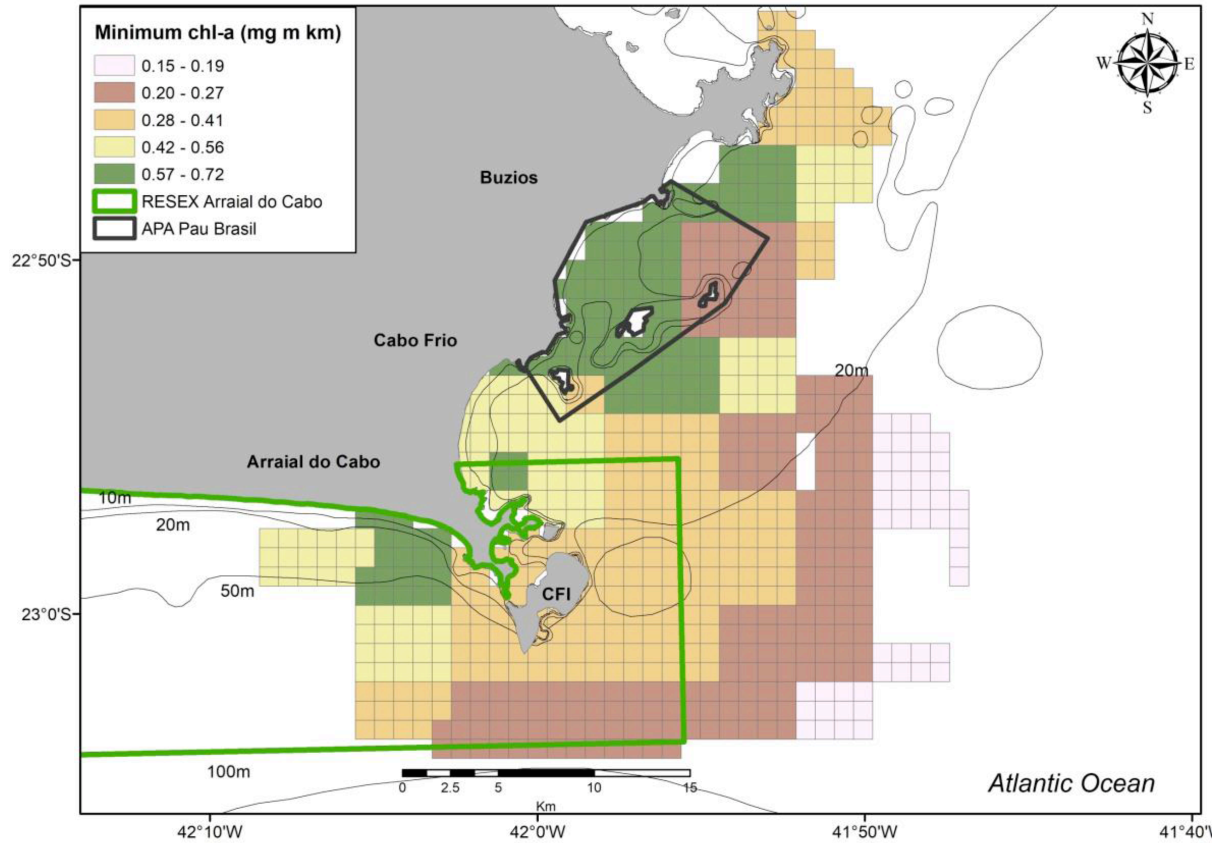



Figure S7. Spatial characterization indicating the values of Minimum Chlorophyl-a concentration for each 1km2 in the region of Cabo Frio, RJ, Southeastern Brazil.

Mean Chlorophyll-a concentration (mg m-3 km-1)

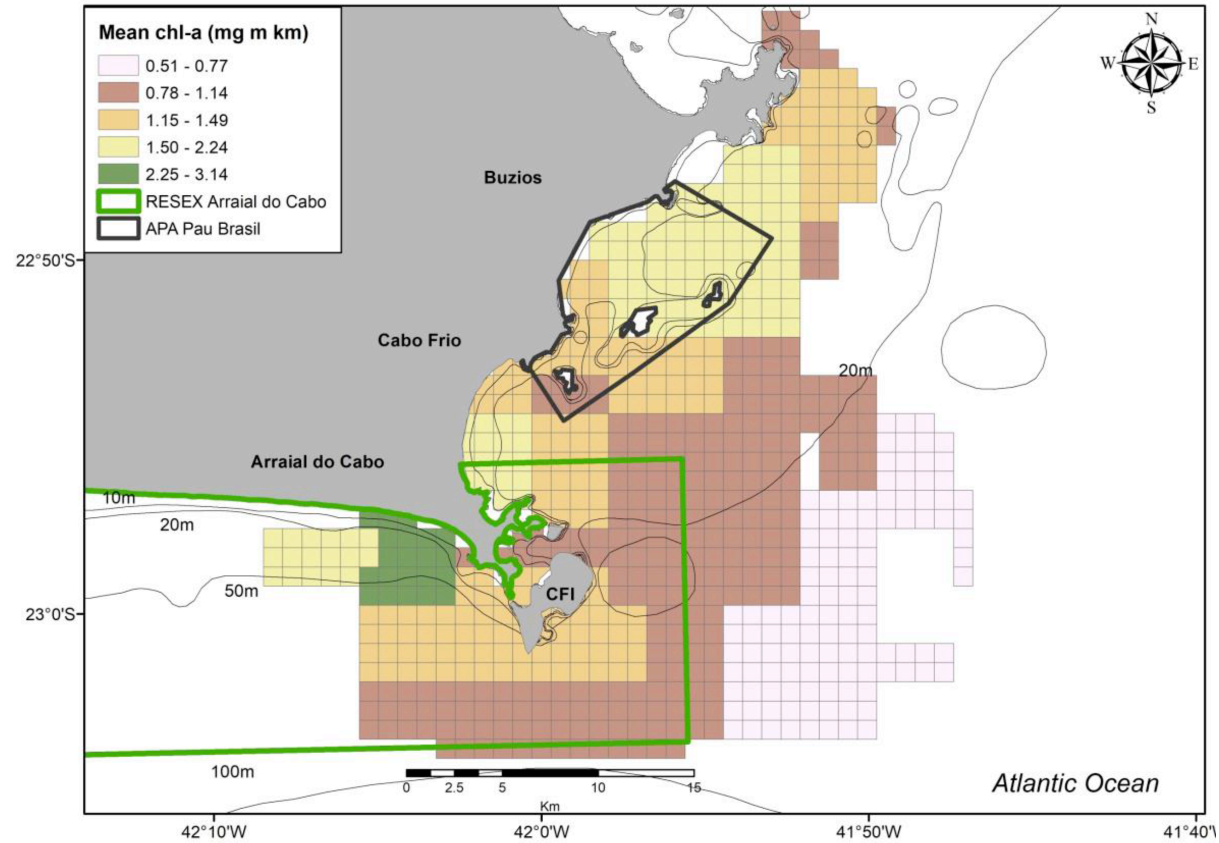



Figure S8. Spatial characterization indicating the values of Mean Chlorophyll-a concentration for each 1km2 in the region of Cabo Frio, RJ, Southeastern Brazil.

Maximum Chlorophyll-a concentration (mg m-3 km-1)

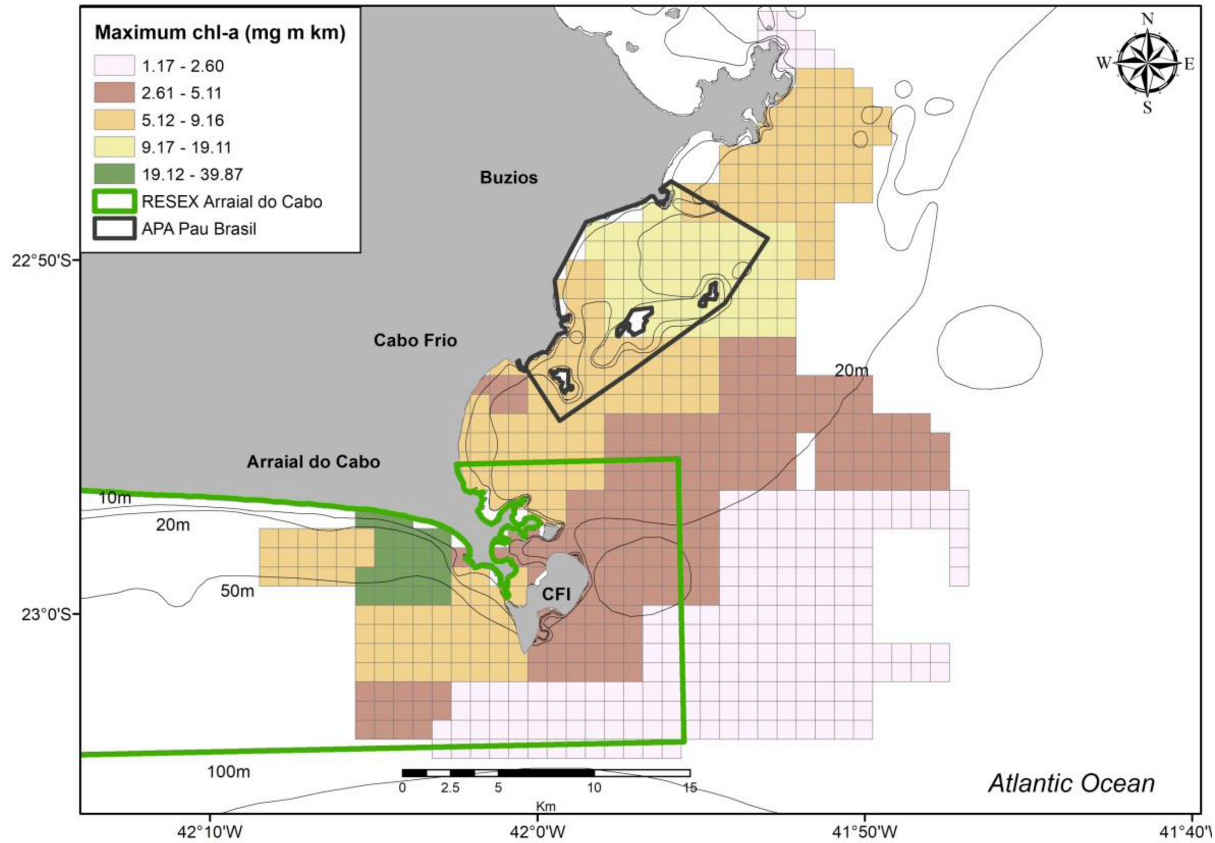



Figure S9. Spatial characterization indicating the values of Maximum Chlorophyll-a concentration for each 1km2 in the region of Cabo Frio, RJ, Southeastern Brazil.

Standard Deviation Chlorophyll-a concentration (mg m-3 km-1)

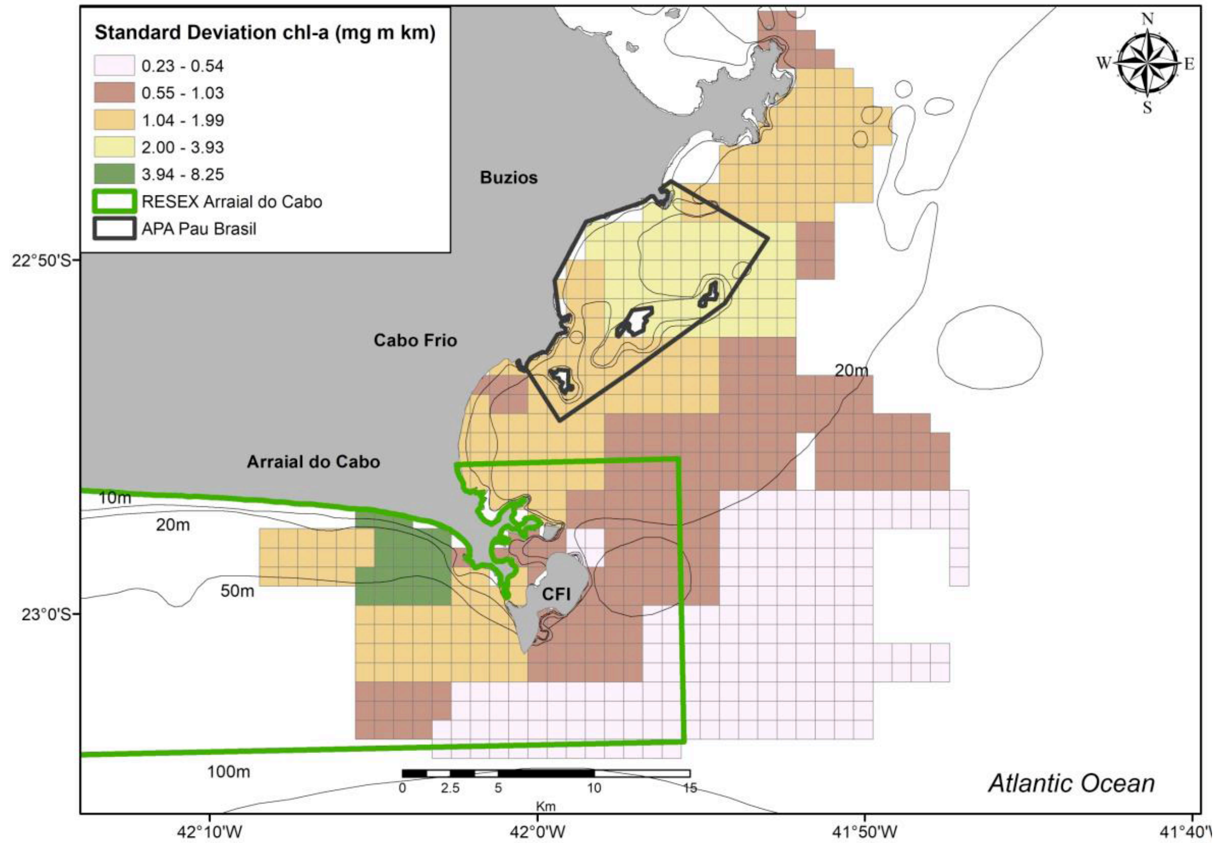



Figure S10. Spatial characterization indicating the values of Standard Deviation Chlorophyl-a concentration for each 1km2 in the region of Cabo Frio, RJ, Southeastern Brazil.

## Supplement 2

R script from Tardin et al. What drives cetacean habitat use in Southeastern Brazil: environment or anthropic activities?

```
##Getting libraries
library(spdep)
library(ggplot2)
library(car)
library(maptools)
library(hier.part)
library(MuMIn)
library(bbmle)
library(boot)
library(AER)
library(rgdal)
library(xtable)
#######################################################################################
########
```

```
### Getting data ############
#######################################################################################
########
mist=readOGR("C:/Users/Rodrigo Tardin/Dropbox/ArcGIS projects/Caps 1 e
2","Fishnet_cap3_fishing3")
names(mist)
#######################################################################################
###########
```

```
#### Cetacean modeling ########
##############################################################################
###########
################# Data Exploration #######################
#Visual inspection to include or not a polynomial term
depth=mist$DEPTH
Cetacean=mist$OCC_CET
plot(depth,Cetacean)
#Curvilinear
distcoast=mist$DISTCOAST
plot(distcoast,Cetacean)
#Linear
sstsd=mist$SST_SD_1
plot(sstsd,Cetacean)
#Curvilinear
sstmean=mist$SST_MEAN_1
plot(sstmean,Cetacean)
#Curvilinear
sstmin=mist$SST_MIN_1
plot(sstmin,Cetacean)
#Curvilinear
```

```
sstmax=mist$SST_MAX_1
plot(sstmax,Cetacean)
#Curvilinear
chlormean=mist$CHLOR_ME_1
plot(chlormean,Cetacean)
#Linear
chlormin=mist$CHLOR_MI_1
plot(chlormin,Cetacean)
#linear
tour=mist$TOUR
plot(tour,Cetacean)
#Linear
dive=mist$DIVE
plot(dive,Cetacean)
#Linear
fshgrd=mist$FISHGRD
plot(fshgrd,Cetacean)
#Curvilinear
fshrt=mist$FISHROUTE
plot(fshrt,Cetacean)
#Linear
```

```
####################################################################
####### Cetacean GLM #####
####################################################################
dispersiontest(glmist.cete)
dispersiontest(glmist.ceta)
dispersiontest(glmist.cetea)
#Environmental hypothesis
glmist.cete <- glm(OCC_CET~ DEPTH +I(DEPTH^2)+
DISTCOAST+SST_SD+I(SST_SD^2)+SST_MEAN+
I(SST_MEAN^2)+SST_MIN+I(SST_MIN^2)+SST_MAX+CHLOR_MEAN+CHLOR_MIN,
data=mist, offset=log(RT_KM),family=poisson,maxit=100)
#Anthropic hypothesis
glmist.ceta <- glm(OCC_CET~ FISHGRD+I(FISHGRD^2)+FISHROUTE+DIVE + TOUR,
data=mist, offset=log(RT_KM),family="poisson",maxit=100)
#Synergy hypothesis
glmist.cetea <- glm(OCC_CET~
FISHGRD+I(FISHGRD^2)+FISHROUTE+DIVE+TOUR+DEPTH+I(DEPTH^2) +
DISTCOAST+SST_SD+I(SST_SD^2)+SST_MEAN+
I(SST_MEAN^2)+SST_MIN+I(SST_MIN^2)+SST_MAX+CHLOR_MEAN+CHLOR_MIN,
data=mist, offset=log(RT_KM),family="poisson",maxit=100)
AIC(glmist.cete,glmist.ceta,glmist.cetea)
summary(glmist.cetea)
vifcet=vif(glmist.cetea)
xtable(vifcet)
```

```
################################################################################
# Mysticetes SEV-GLM modelling ##
################################################################################
##Neighbourhood with Queen specification
mist.nb.q <- poly2nb(mist, queen=TRUE)
mist.lw.q <- nb2listw(mist.nb.q, style="W")
##Moran Test for spatial autocorrelation
moran.test(mist$OCC_CET,nb2listw(mist.nb.q, style="W"))
# Spatial Filtering with Moran Eigenvectors
#Environmental hypothesis
eigmist.ecet <- ME(OCC_CET ~ DEPTH +I(DEPTH^2)+
DISTCOAST+SST_SD+I(SST_SD^2)+SST_MEAN+
I(SST_MEAN^2)+SST_MIN+I(SST_MIN^2)+SST_MAX+CHLOR_MEAN+CHLOR_MIN,
data=mist, family="poisson", listw=mist.lw.q,offset=log(RT_KM), alpha=0.05, verbose=TRUE)
#Anthropic hypothesis
eigmist.acet <- ME(OCC_CET ~ FISHGRD+I(FISHGRD^2)+FISHROUTE+DIVE+TOUR,
data=mist, family="poisson", listw=mist.lw.q,offset=log(RT_KM), alpha=0.05, verbose=TRUE)
#Synergy hypothesis
eigmist.eacet <- ME(OCC_CET ~
FISHGRD+I(FISHGRD^2)+FISHROUTE+DIVE+TOUR+DEPTH +I(DEPTH^2)+
```

```
DISTCOAST+SST_SD+I(SST_SD^2)+SST_MEAN+
I(SST_MEAN^2)+SST_MIN+I(SST_MIN^2)+SST_MAX+CHLOR_MEAN+CHLOR_MIN,
data=mist, family="poisson", listw=mist.lw.q,offset=log(RT_KM), alpha=0.05, verbose=TRUE)
## SEV-GLM
#Environmental hypothesis
sevglmist.ecet <- glm(OCC_CET ~ DEPTH +
DISTCOAST+SST_SD+I(SST_SD^2)+SST_MEAN+
I(SST_MEAN^2)+SST_MIN+I(SST_MIN^2)+SST_MAX+CHLOR_MEAN+CHLOR_MIN+fitt
ed(eigmist.ecet), data=mist, family=poisson, offset=log(RT_KM),)
#Anthropic hypothesis
sevglmist.acet <- glm(OCC_CET ~
FISHGRD+I(FISHGRD^2)+FISHROUTE+DIVE+TOUR+fitted(eigmist.acet), data=mist,
family=poisson, offset=log(RT_KM))
#Synergy hypothesis
sevglmist.eacet <- glm(OCC_CET ~ FISHGRD+I(FISHGRD^2)+FISHROUTE+DEPTH
+I(DEPTH^2)+ DISTCOAST+SST_SD+I(SST_SD^2)+SST_MEAN+
I(SST_MEAN^2)+SST_MIN+I(SST_MIN^2)+SST_MAX+CHLOR_MEAN+CHLOR_MIN+fitt
ed(eigmist.eacet), data=mist, family=poisson, offset=log(RT_KM))
#Model Selection
AIC(sevglmist.ecet,sevglmist.acet,sevglmist.eacet)
summary(sevglmist.eacet)
############Hierarchical partitioning analysis #########
```

```
envimiscet=c(fshgrd,fshrt,depth,sstmean,sstsd,sstmax,chlormin,chlormean)
envimis2cet=as.data.frame(envimiscet)
hier.part(mist$OCC_CET,envimis2cet,family=poisson)
## test if the fitted values explain the observed value
glmMEC <- glm(mist$OCC_CET ~ fitted(sevglmist.eacet), family="poisson")
anova(glmMEC, test="Chisq")
# Test if SEVGLM is best than GLM
ln.lrcet <- -2*(logLik(glmist.cetea)[1]-logLik(sevglmist.eacet)[1])
1-pchisq(ln.lrcet, df=4)
#PseudoR
psd.r21cet <- lm(mist$OCC_CET~ fitted(sevglmist.eacet))
summary(psd.r21cet)$r.square
################################################################################
######################
## Spatially predicting Mysticetes habitat use ##
################################################################################
cetpredglm1=predict.glm(glmist.cetea,type="response")
write.csv(cetpredglm1,file="mistipred1.csv")
cetpredsevglm1=predict.glm(sevglmist.eacet,type="response")
write.csv(cetpredsevglm1,file="mistipredsevglm1.csv")
```

```
#Residuals mapping
#GLM residuals
rescetglm <- residuals.glm(glmist.cetea, type="pearson")
write.csv(rescetglm,file="residualscetglm.csv")
#SEV-GLM residuals
rescetsevglm <- residuals.glm(sevglmist.eacet, type="pearson")
write.csv(rescetsevglm,file="residualsmistsevglm.csv")
#############################################################################
#####################
## Eigenvector Mapping ##
#############################################################################
#####################
betacet <- matrix(coefficients(sevglmist.eacet)[17:19])
xcet<-as.matrix(fitted(eigmist.eacet))
sfcet <- xcet%*%betacet
write.csv(sfmist,file="spatialfiltercet.csv")
##############################################################################
###########
##############################################################################
###########
#### Mysticetes modeling ######
```

```
###############################################################################
###########
##############################################################
# Data exploration ####
##############################################################
#Visual inspection to include or not a polynomial term
depth=mist$DEPTH
Mysticetes=mist$OCC_CET
plot(depth,Mysticetes)
#Curvilinear
distcoast=mist$DISTCOAST
plot(distcoast,Mysticetes)
#Linear
sstsd=mist$SST_SD_1
plot(sstsd,Mysticetes)
#Curvilinear
sstmean=mist$SST_MEAN_1
plot(sstmean,Mysticetes)
#Curvilinear
sstmin=mist$SST_MIN_1
plot(sstmin,Mysticetes)
#Curvilinear
```

```
sstmax=mist$SST_MAX_1
plot(sstmax,Mysticetes)
#Curvilinear
chlormean=mist$CHLOR_ME_1
plot(chlormean,Mysticetes)
#Linear
chlormin=mist$CHLOR_MI_1
plot(chlormin,Mysticetes)
#linear
tour=mist$TOUR
plot(tour,Mysticetes)
#Linear
dive=mist$DIVE
plot(dive,Mysticetes)
#Linear
fshgrd=mist$FISHGRD
plot(fshgrd,Mysticetes)
#Curvilinear
fshrt=mist$FISHROUTE
plot(fshrt,Mysticetes)
```

```
#Linear
#############################################################################
## Mysticetes GLM modelling ##
#############################################################################
dispersiontest(glmist.e)
dispersiontest(glmist.a)
dispersiontest(glmist.ea)
#Environmental hypothesis
glmist.e <- glm(OCC_MISTI~ DEPTH +I(DEPTH^2)+
DISTCOAST+SST_SD+I(SST_SD^2)+SST_MEAN+
I(SST_MEAN^2)+SST_MIN+I(SST_MIN^2)+SST_MAX+CHLOR_MEAN+CHLOR_MIN,
data=mist, offset=log(RT_KM),family=poisson,maxit=100)
#Anthropic hypothesis
glmist.a <- glm(OCC_MISTI~ FISHGRD+I(FISHGRD^2)+FISHROUTE+DIVE + TOUR,
data=mist, offset=log(RT_KM),family="poisson",maxit=100)
#Synergy hypothesis
glmist.ea <- glm(OCC_MISTI~
FISHGRD+I(FISHGRD^2)+FISHROUTE+DIVE+TOUR+DEPTH+I(DEPTH^2) +
DISTCOAST+SST_SD+I(SST_SD^2)+SST_MEAN+
I(SST_MEAN^2)+SST_MIN+I(SST_MIN^2)+SST_MAX+CHLOR_MEAN+CHLOR_MIN,
data=mist, offset=log(RT_KM),family="poisson",maxit=100)
AIC(glmist.e,glmist.a,glmist.ea)
summary(glmist.ea)
```

```
vif(glmist.ea)
################################################################################
# Mysticetes SEV-GLM modelling ##
################################################################################
##Neighbourhood with Queen specification
mist.nb.q <- poly2nb(mist, queen=TRUE)
mist.lw.q <- nb2listw(mist.nb.q, style="W")
##Moran Test for spatial autocorrelation
moran.test(mist$OCC_MISTI,nb2listw(mist.nb.q, style="W"))
# Spatial Filtering with Moran Eigenvectors
#Environmental hypothesis
eigmist.e <- ME(OCC_MISTI ~ DEPTH +I(DEPTH^2)+
DISTCOAST+SST_SD+I(SST_SD^2)+SST_MEAN+
I(SST_MEAN^2)+SST_MIN+I(SST_MIN^2)+SST_MAX+CHLOR_MEAN+CHLOR_MIN,
data=mist, family="quasipoisson", listw=mist.lw.q,offset=log(RT_KM), alpha=0.05,
verbose=TRUE)
#Anthropic hypothesis
eigmist.a <- ME(OCC_MISTI ~ FISHGRD+I(FISHGRD^2)+FISHROUTE+DIVE+TOUR,
data=mist, family="quasipoisson", listw=mist.lw.q,offset=log(RT_KM), alpha=0.05,
verbose=TRUE)
```

```
#Synergy hypothesis
eigmist.ea <- ME(OCC_MISTI ~
FISHGRD+I(FISHGRD^2)+FISHROUTE+DIVE+TOUR+DEPTH +I(DEPTH^2)+
DISTCOAST+SST_SD+I(SST_SD^2)+SST_MEAN+
I(SST_MEAN^2)+SST_MIN+I(SST_MIN^2)+SST_MAX+CHLOR_MEAN+CHLOR_MIN,
data=mist, family="quasipoisson", listw=mist.lw.q,offset=log(RT_KM), alpha=0.05,
verbose=TRUE)
## SEV-GLM
#Environmental hypothesis
sevglmist.e <- glm(OCC_MISTI ~ DEPTH +
DISTCOAST+SST_SD+I(SST_SD^2)+SST_MEAN+
I(SST_MEAN^2)+SST_MIN+I(SST_MIN^2)+SST_MAX+CHLOR_MEAN+CHLOR_MIN+fitt
ed(eigmist.e), data=mist, family=poisson, offset=log(RT_KM),)
#Anthropic hypothesis
sevglmist.a <- glm(OCC_MISTI ~
FISHGRD+I(FISHGRD^2)+FISHROUTE+DIVE+TOUR+fitted(eigmist.a), data=mist,
family=poisson, offset=log(RT_KM))
#Synergy hypothesis
sevglmist.ea <- glm(OCC_MISTI ~ FISHGRD+I(FISHGRD^2)+FISHROUTE+DEPTH
+I(DEPTH^2)+ DISTCOAST+SST_SD+I(SST_SD^2)+SST_MEAN+
I(SST_MEAN^2)+SST_MIN+I(SST_MIN^2)+SST_MAX+CHLOR_MEAN+CHLOR_MIN+fitt
ed(eigmist.ea), data=mist, family=poisson, offset=log(RT_KM))
#Model Selection
AIC(sevglmist.e,sevglmist.a,sevglmist.ea)
summary(sevglmist.a)
```

```
#Hierarchical partitioning analysis
envimis=c(fishgrd,fishrt,dive,tour)
envimis2=as.data.frame(envimis)
hier.part(mist$OCC_MISTI,envimis2,family=poisson)
## test if the fitted values explain the observed value
glmMEM <- glm(mist$OCC_MISTI ~ fitted(sevglmist.a), family="poisson")
anova(glmMEM, test="Chisq")
# Test if SEVGLM is best than GLM
ln.lr <- -2*(logLik(glmist.a)[1]-logLik(sevglmist.a)[1])
1-pchisq(ln.lr, df=4)
#PseudoR
psd.r21 <- lm(mist$OCC_MISTI~ fitted(sevglmist.a))
summary(psd.r21)$r.square
#############################################################################
######################
## Spatially predicting Mysticetes habitat use ##
#############################################################################
mistipredglm1=predict.glm(glmist.a,type="response")
write.csv(mistipred1,file="mistipred1.csv")
```

```
mistipredsevglm1=predict.glm(sevglmist.a,type="response")
write.csv(mistipredsevglm1,file="mistipredsevglm1.csv")
#Residuals mapping
#GLM residuals
resmistglm <- residuals.glm(glmist.a, type="pearson")
write.csv(resmistglm,file="residualsmistglm.csv")
#SEV-GLM residuals
resmistsevglm <- residuals.glm(sevglmist.a, type="pearson")
write.csv(resmistsevglm,file="residualsmistsevglm.csv")
################################################################################
######################
## Eigenvector Mapping ##
################################################################################
######################
betamist <- matrix(coefficients(sevglmist.a)[7:15])
xmist<-as.matrix(fitted(eigmist.a))
sfmist <- xmist%*%betamist
write.csv(sfmist,file="spatialfiltermist.csv")
#################################################################################
####################
```

```
########## Odontocetes modeling #######
##############################################################################
###################
####################################################
### Data exploration #####
####################################################
depth=mist$DEPTH
Odontocetes=mist$OCC_ODO
plot(depth,Odontocetes)
#Linear
distcoast=mist$DISTCOAST
plot(distcoast,Odontocetes)
#Linear
sstsd=mist$SST_SD_1
plot(sstsd,Odontocetes)
#Linear
plot(sstmean,Odontocetes)
#Linear
plot(sstmin,Odontocetes)
#Curvilinear
plot(sstmax,Odontocetes)
```

```
#Linear
plot(chlormean,Odontocetes)
#Curvilinear
chlormin=mist$CHLOR_MI_1
plot(chlormin,Odontocetes)
#Linear
plot(tour,Odontocetes)
#Linear
plot(dive,Odontocetes)
#Linear
plot(fshgrd,Odontocetes)
#Linear
plot(fshrt,Odontocetes)
#Linear
########################################################################
#### Odontocetes GLM ####
########################################################################
names(mist)
#Environmental hypothesis
```

```
glmodo.e <- glm(OCC_ODO~ DEPTH +
DISTCOAST+SST_SD+SST_MEAN+SST_MIN+I(SST_MIN^2)+SST_MAX+CHLOR_MEA
N+I(+CHLOR_MEAN^2)+CHLOR_MIN+I(CHLOR_MIN^2), data=mist,
offset=log(RT_KM),family="poisson",maxit=100)
#Anthropic hypothesis
glmodo.a <- glm(OCC_ODO~ FISHGRD+I(FISHGRD^2)+FISHROUTE++DIVE + TOUR,
data=mist, offset=log(RT_KM),family="poisson",maxit=100)
#Synergy hypothesis
glmodo.ea <- glm(OCC_ODO~
FISHGRD+I(FISHGRD^2)+FISHROUTE+DIVE+TOUR+DEPTH +
DISTCOAST+SST_SD+SST_MEAN+SST_MIN+SST_MAX+CHLOR_MEAN+CHLOR_MIN,
data=mist, offset=log(RT_KM),family="poisson",maxit=100)
dispersiontest(glmodo.e)
dispersiontest(glmodo.a)
dispersiontest(glmodo.ea)
#Model selection
AIC(glmodo.e,glmodo.a,glmodo.ea)
summary(glmodo.ea)
################################################################################
##### Odontocetes SEV-GLM ######
################################################################################
moran.test(mist$OCC_ODO,nb2listw(mist.nb.q, style="W"))
############ Moran Eigenvectors #############
```

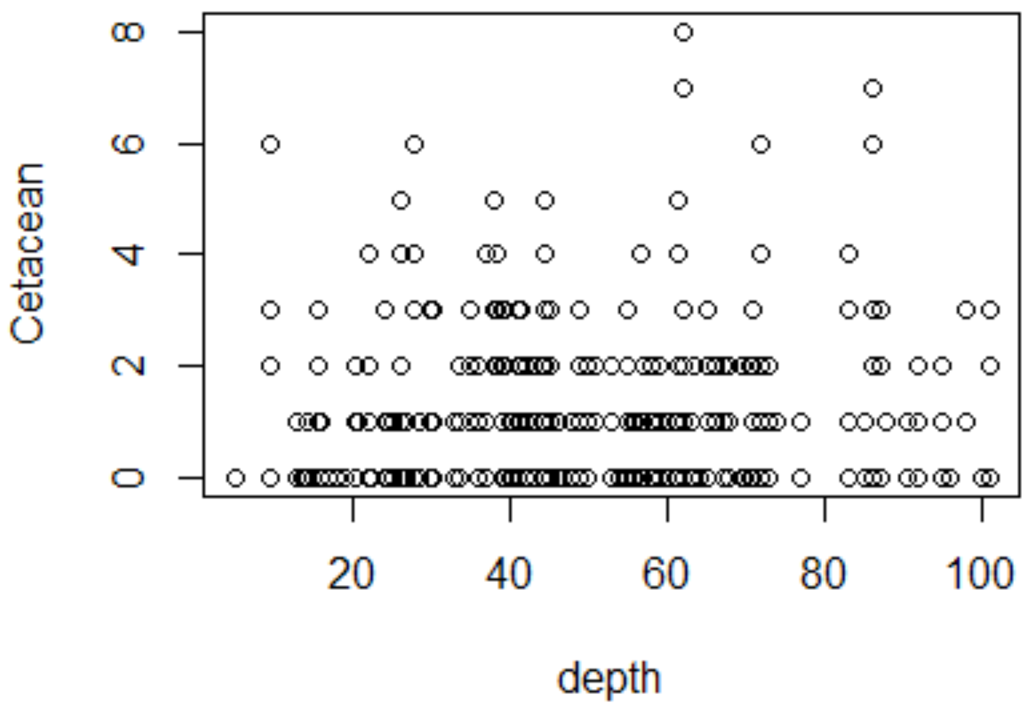
```
#Environmental hypothesis
eigodo.e <- ME(OCC_ODO ~ DEPTH +
DISTCOAST+SST_SD+SST_MEAN+SST_MIN+I(SST_MIN^2)+SST_MAX+CHLOR_MEA
N+I(+CHLOR_MEAN^2)+CHLOR_MIN+I(CHLOR_MIN^2), data=mist, family="poisson",
listw=mist.lw.q,offset=log(RT_KM), alpha=0.05, verbose=TRUE)
#Anthropic hypothesis
eigodo.a <- ME(OCC_ODO ~ FISHGRD+I(FISHGRD^2)+FISHROUTE+DIVE+TOUR,
data=mist, family="poisson", listw=mist.lw.q,offset=log(RT_KM), alpha=0.05, verbose=TRUE)
#Synergy hypothesis
eigodo.ea <- ME(OCC_ODO ~ FISHGRD+I(FISHGRD^2)+FISHROUTE+DIVE + TOUR+
DEPTH +
DISTCOAST+SST_SD+SST_MEAN+SST_MIN+I(SST_MIN^2)+SST_MAX+CHLOR_MEA
N+I(+CHLOR_MEAN^2)+CHLOR_MIN+I(CHLOR_MIN^2), data=mist, family="poisson",
listw=mist.lw.q,offset=log(RT_KM), alpha=0.05, verbose=TRUE)
############## SEV-GLM ###################
#Environmental hypothesis
sevglmodo.e <- glm(OCC_ODO ~ DEPTH +
DISTCOAST+SST_SD+SST_MEAN+SST_MIN+I(SST_MIN^2)+SST_MAX+CHLOR_MEA
N+I(+CHLOR_MEAN^2)+CHLOR_MIN+I(CHLOR_MIN^2)+fitted(eigodo.e), data=mist,
family="poisson", offset=log(RT_KM),)
#Anthropic hypothesis
sevglmodo.a <- glm(OCC_ODO ~
FISHGRD+I(FISHGRD^2)+FISHROUTE+DIVE+TOUR+fitted(eigodo.a), data=mist,
family="poisson", offset=log(RT_KM))
#Synergy hypothesis
sevglmodo.ea <- glm(OCC_ODO ~ DEPTH +
DISTCOAST+SST_SD+SST_MEAN+SST_MIN+I(SST_MIN^2)+SST_MAX+CHLOR_MEA
N+I(+CHLOR_MEAN^2)+CHLOR_MIN+I(CHLOR_MIN^2)+FISHGRD+I(FISHGRD^2)+FIS
HROUTE+DIVE+TOUR+fitted(eigodo.ea), data=mist, family="poisson", offset=log(RT))
```

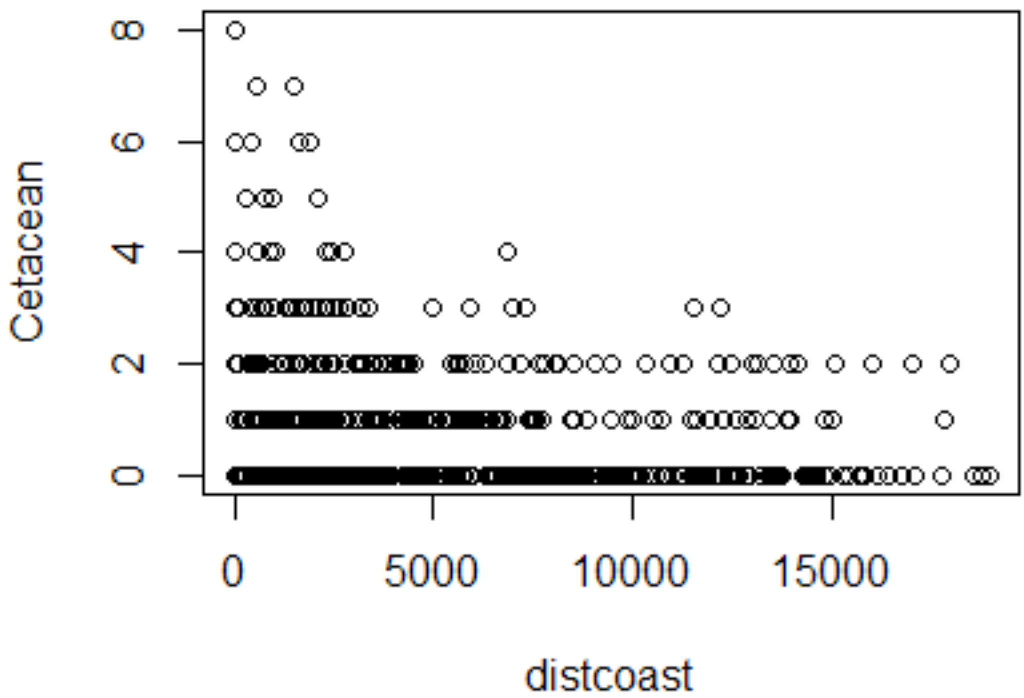
```
#Model Selection
AIC(sevglmodo.e,sevglmodo.a,sevglmodo.ea)
summary(sevglmodo.a)
############# Hierarchical partitioning analysis
envimisodo=c(fshgrd,dive, tour)
envimis2odo=as.data.frame(envimisodo)
hier.part(mist$OCC_ODO,envimis2odo,family=poisson)
### test if the fitted values explain the observed value
glmMEodo <- glm(mist$OCC_ODO ~ fitted(sevglmodo.a), family="poisson")
anova(glmMEodo, test="Chisq")
### Test if SEVGLM is best than GLM
ln.lr <- -2*(logLik(glmodo.a)[1]-logLik(sevglmodo.a)[1])
1-pchisq(ln.lr, df=4)
##PSeudoR
psd.r21odo <- lm(mist$OCC_ODO~ fitted(sevglmodo.a))
summary(psd.r21odo)$r.square
####################################################################
###### Spatially predicting odontocetes habitat use #######
####################################################################
odopredglm1=predict.glm(glmodo.a,type="response")
write.csv(odopredglm1,file="odopredglm1.csv")
```

```
odopred1=predict.glm(sevglmodo.a,type="response")
write.csv(odopred1,file="odopred1.csv")
```

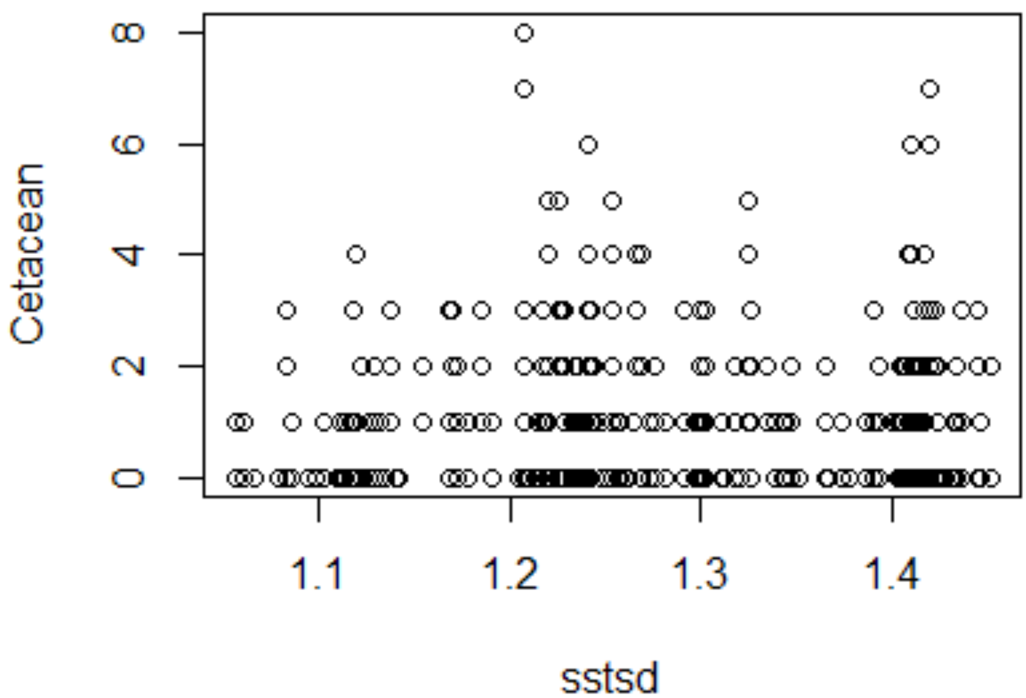
**Supplement 3**. What drives cetacean habitat use in Southeastern Brazil: environment or anthropic activities? – *Biological conservation*

Data exploration for linear or quadratic terms
Cetacean

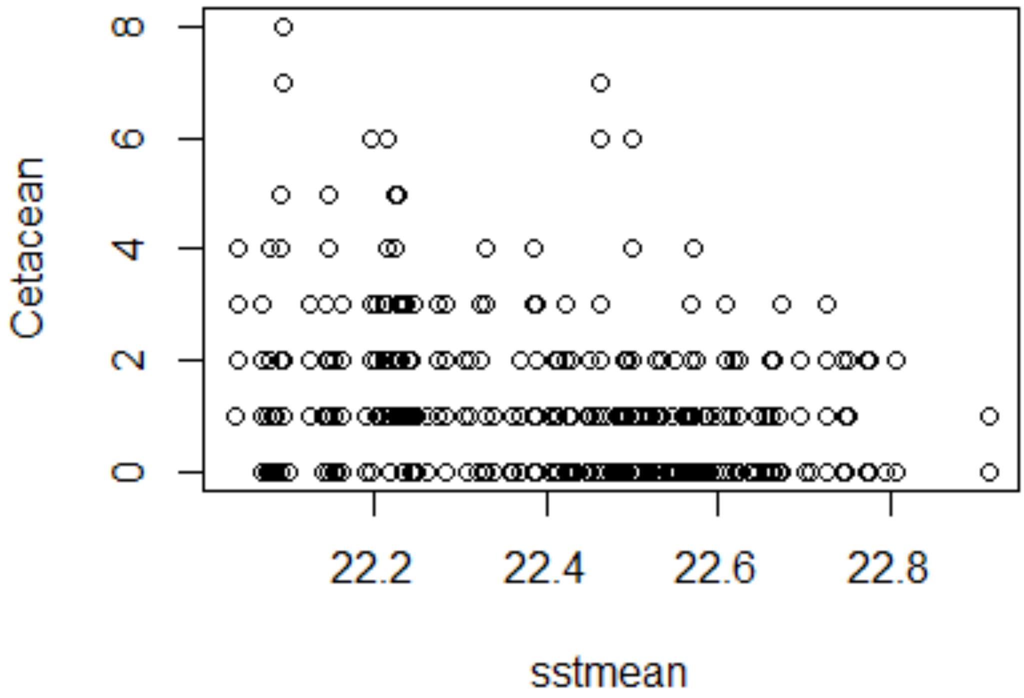


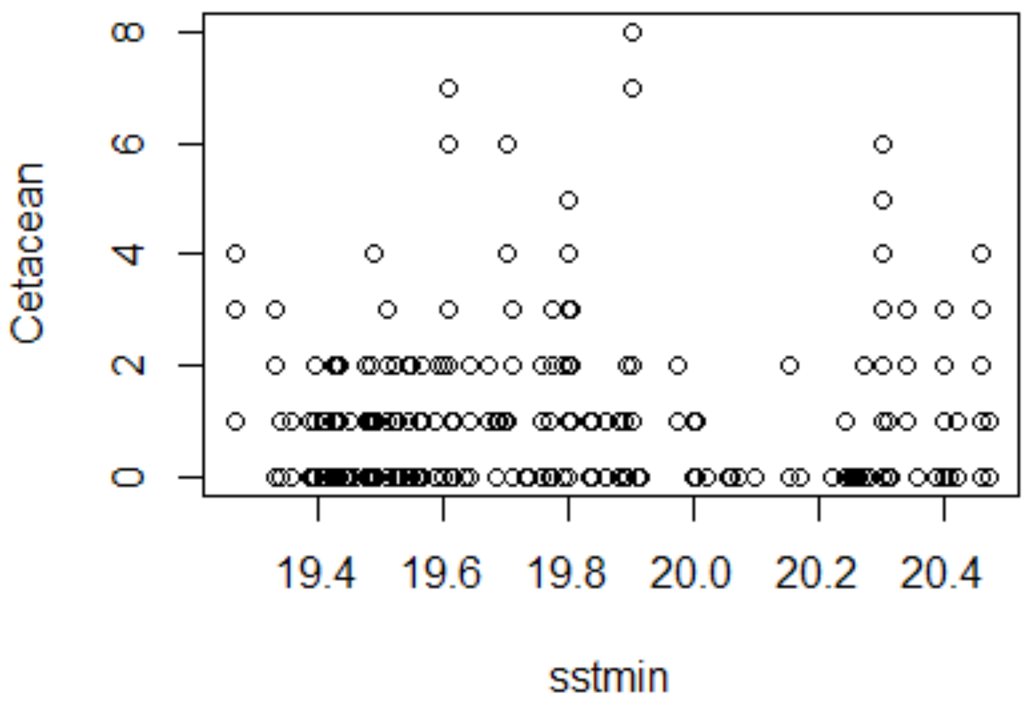


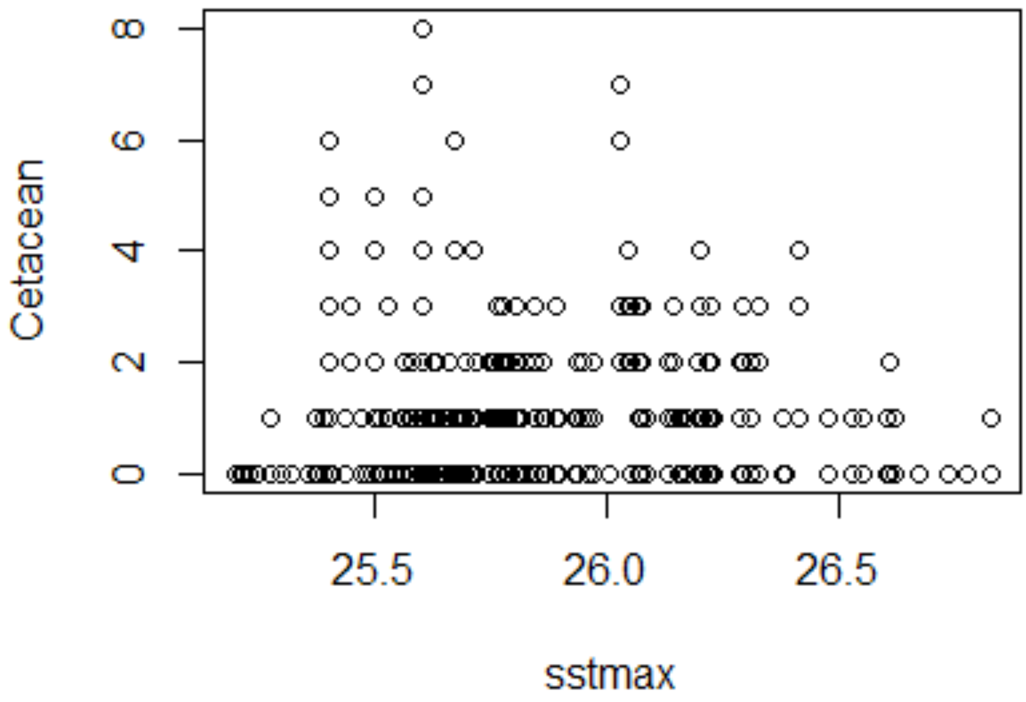
Cetacean
0
2
4
6
8
0
5000
10000
15000
distcoast

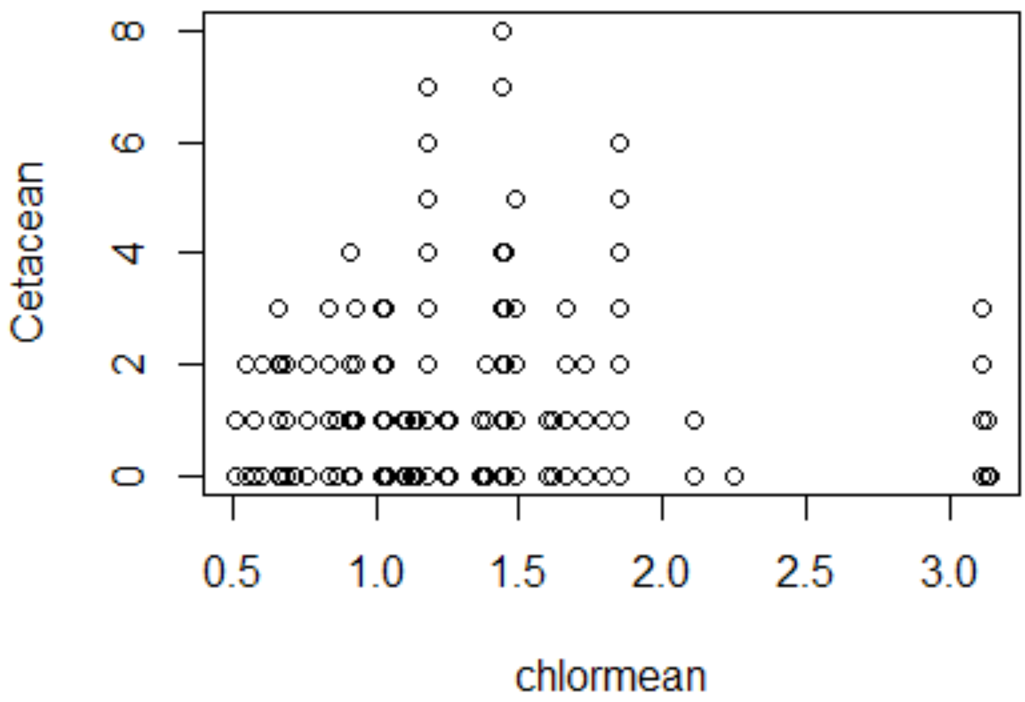



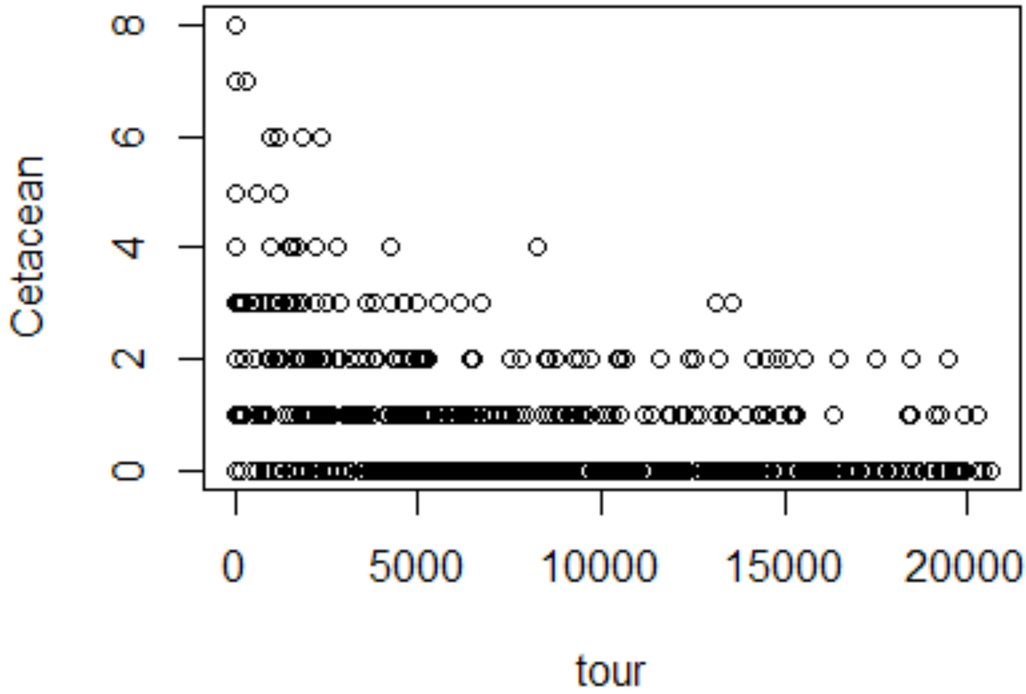
Cetacean
0
2
4
6
8
1.1
1.2
1.3
1.4
sstsd

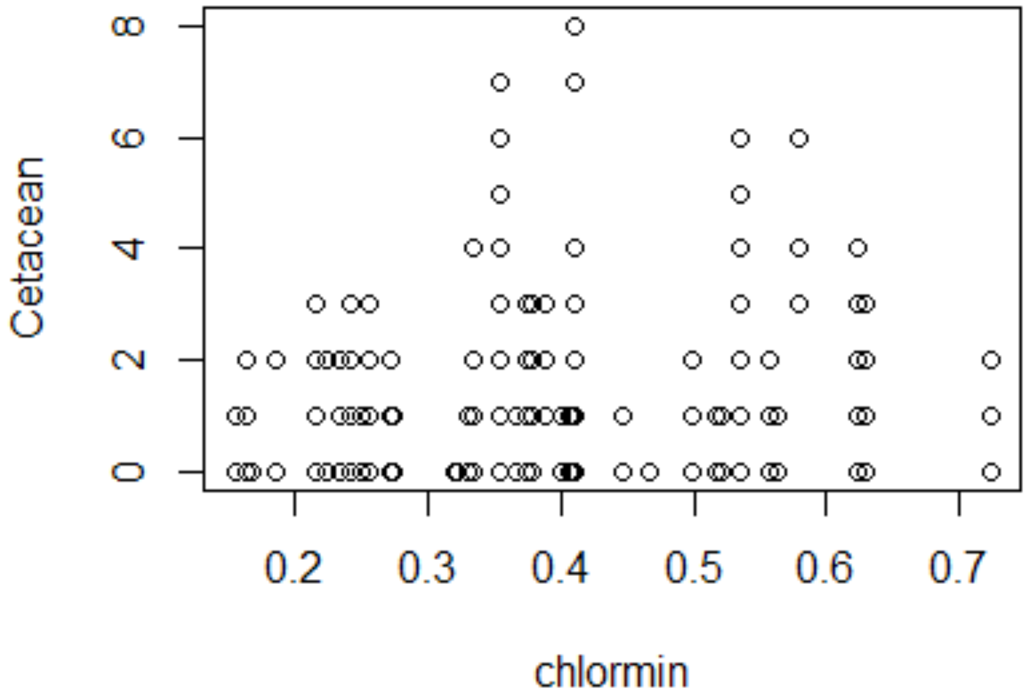

Cetacean
0
2
4
6
8
22.2
22.4
22.6
22.8
sstmean


Cetacean
0
2
4
6
8
19.4
19.6
19.8
20.0
20.2
20.4
sstmin


Cetacean
0
2
4
6
8
25.5
26.0
26.5
sstmax


Cetacean
0
2
4
6
8
0.5
1.0
1.5
2.0
2.5
3.0
chlormean


Cetacean
0
2
4
6
8
0
5000
10000
15000
20000
tour


Cetacean
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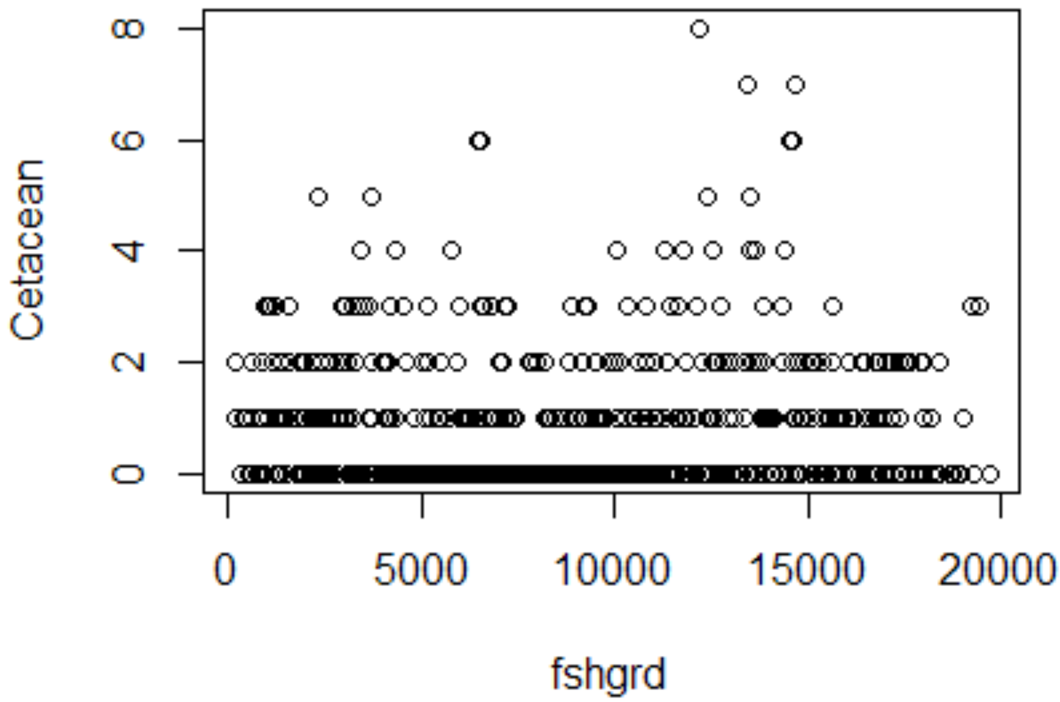
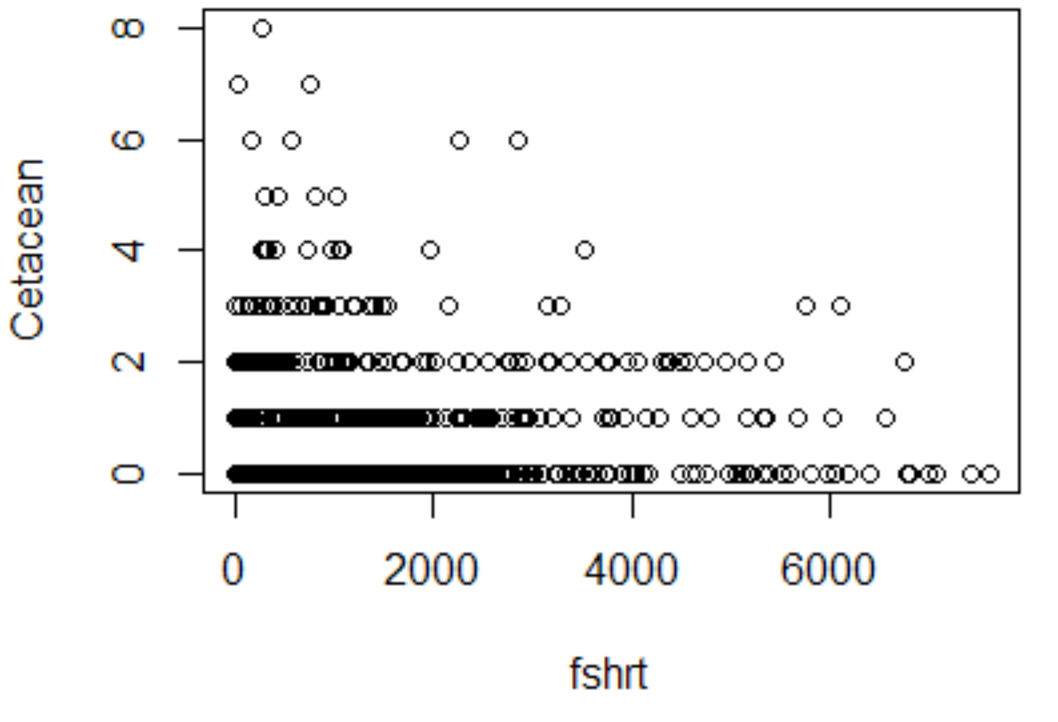
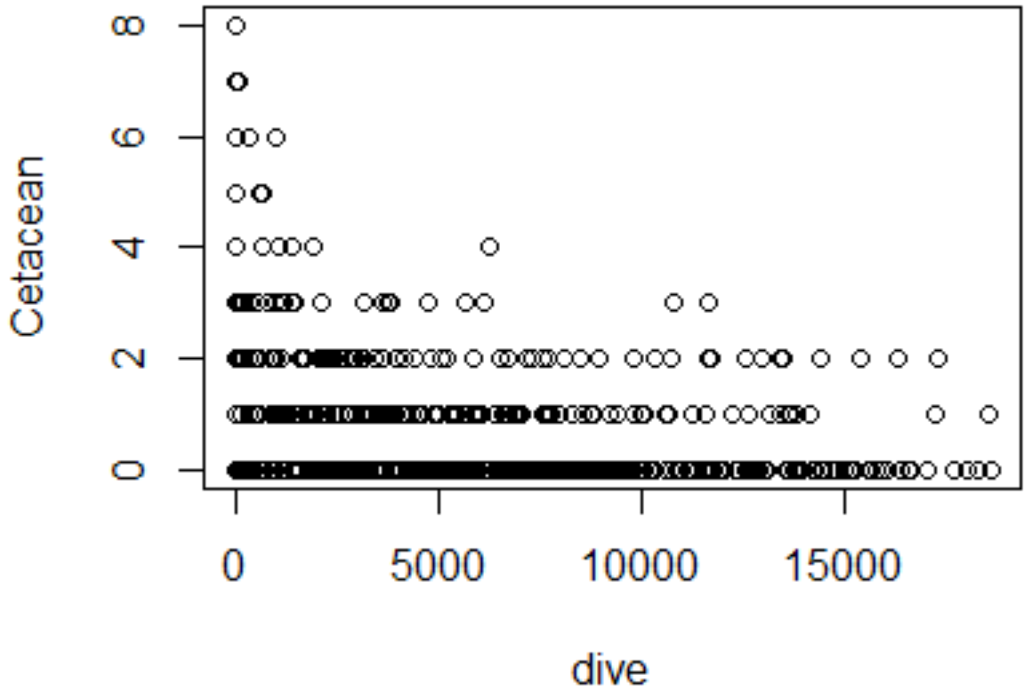
2
4
6
8
0.2
0.3
0.4
0.5
0.6
0.7
chlormin

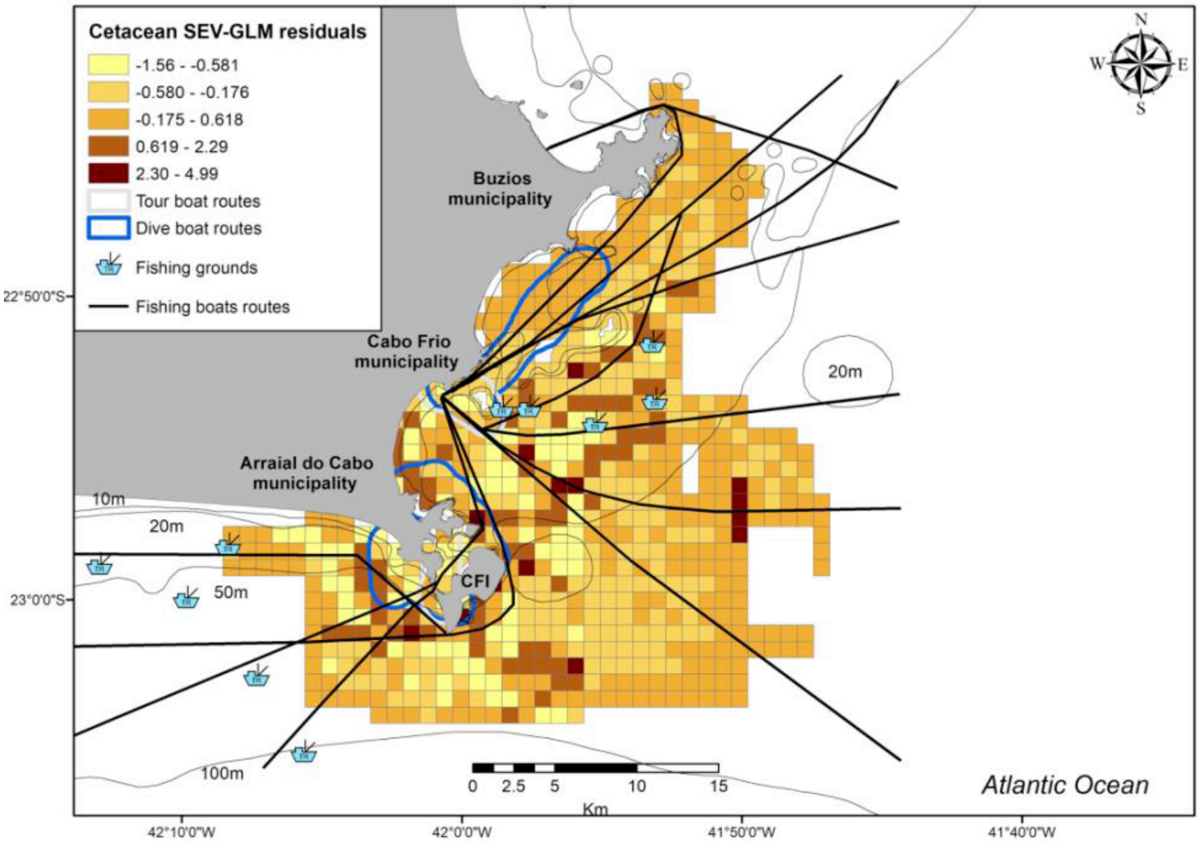

Cetacean
0
2
4
6
8
0
5000
10000
15000
20000
fshgrd


Cetacean
0
2
4
6
8
0
2000
4000
6000
fshrt



Cetacean
0
2
4
6
8
0
5000
10000
15000
dive

Data exploration for linear or quadratic terms
Mysticetes
Spatial patterns of Residuals



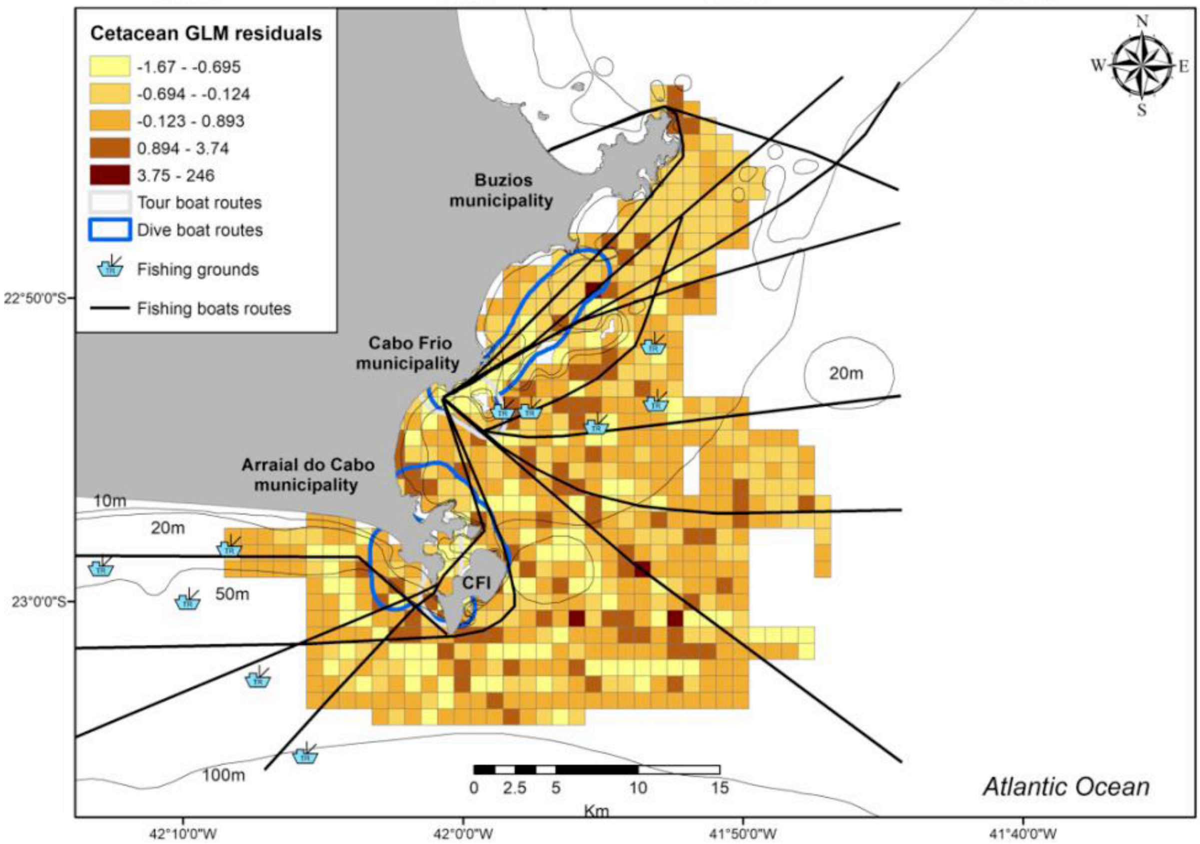



Fig S1. Cetacean species model residuals for each grid cell along the Cabo Frio Coast, Rio de Janeiro, Brazil, using Poisson GLMs accounting for spatial autocorrelation (Upper figure) and without accounting (Lower figure) CFI = Cabo Frio Island.

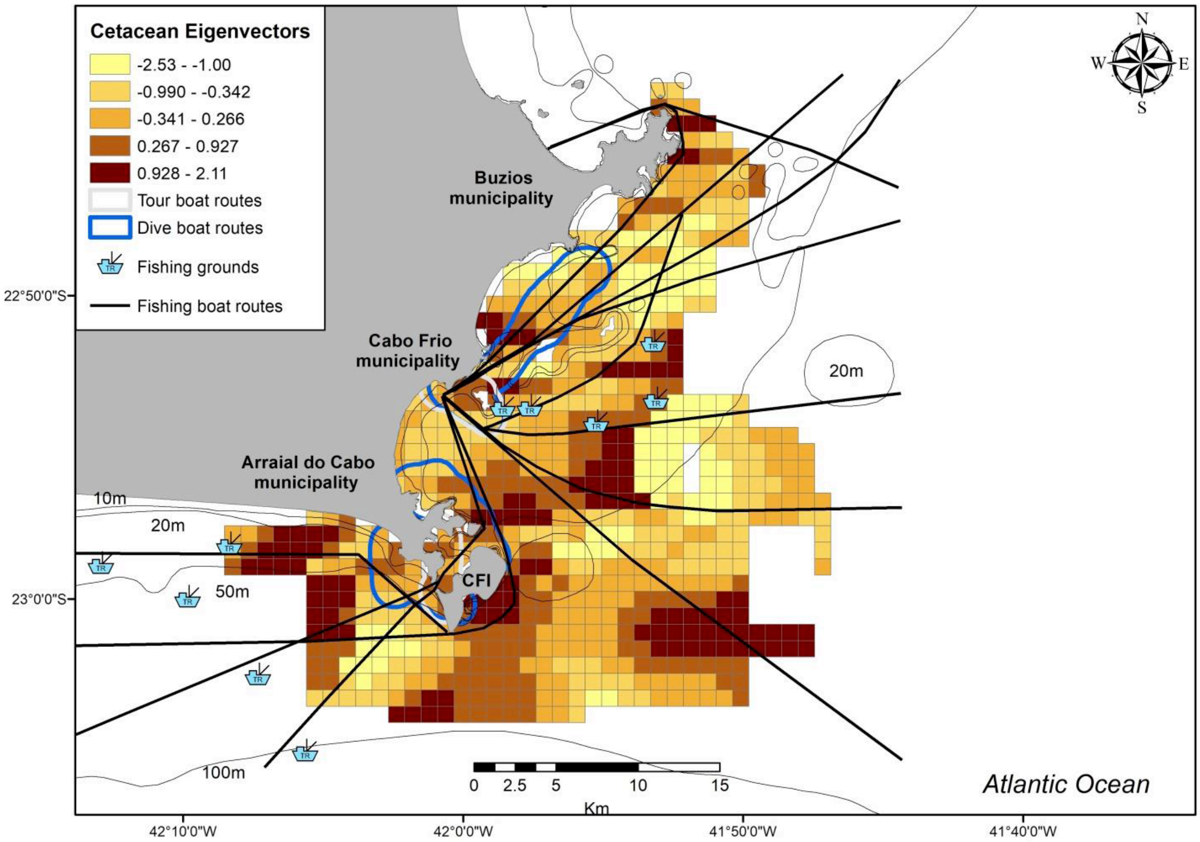
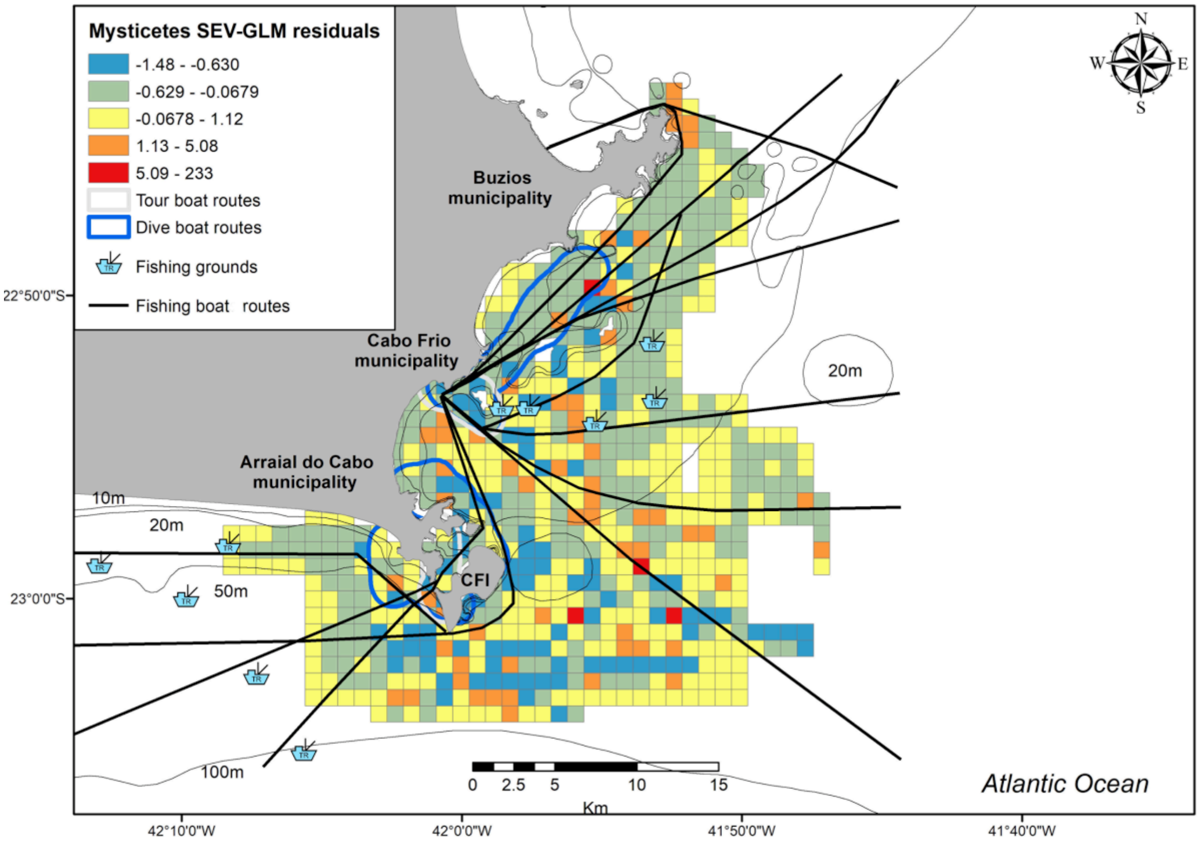


Fig S2. Spatial autocorrelation not explained by cetacean best Spatial Eigenvector GLM in Cabo Frio, Rio de Janeiro, Brazil. CFI = Cabo Frio Island.



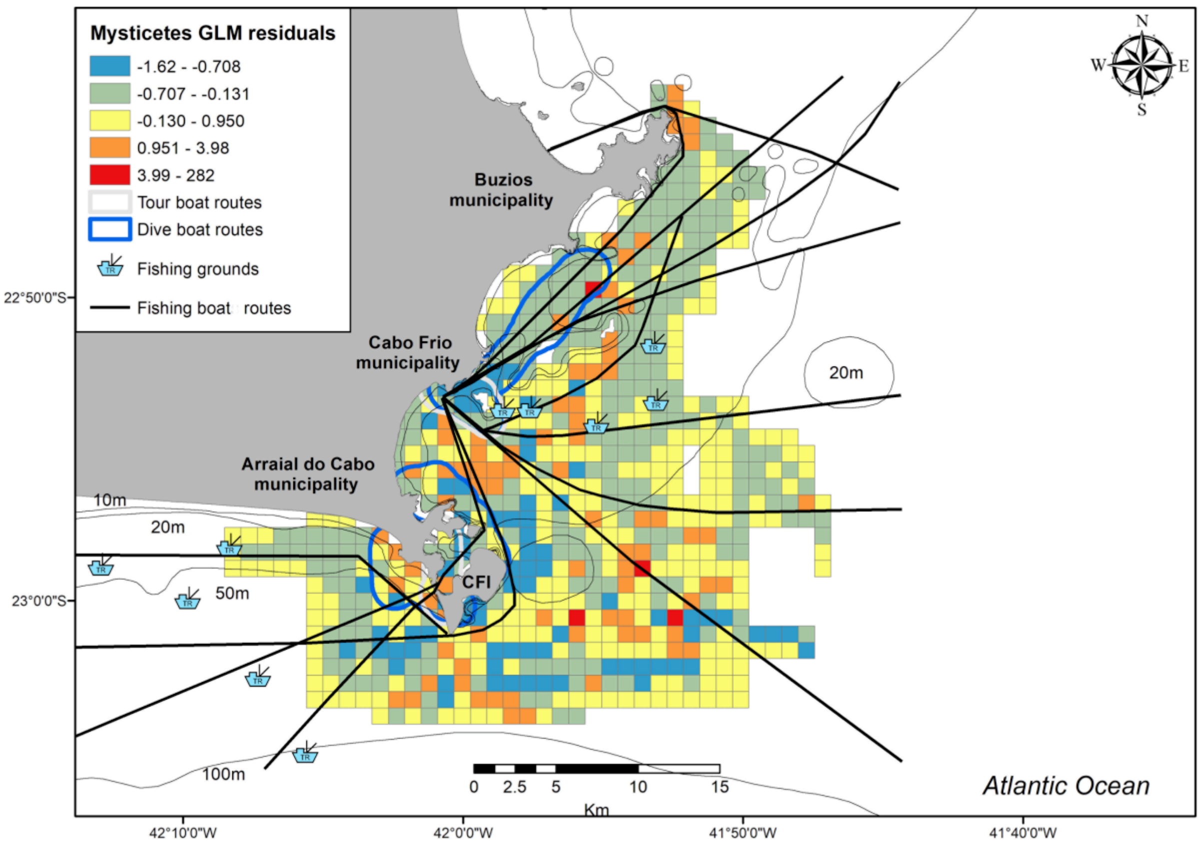



Fig S3. Mysticete species model residuals for each grid cell along the Cabo Frio Coast, Rio de Janeiro, Brazil, using Poisson GLMs accounting for spatial autocorrelation (Upper figure) and without accounting (Lower figure) CFI = Cabo Frio Island.

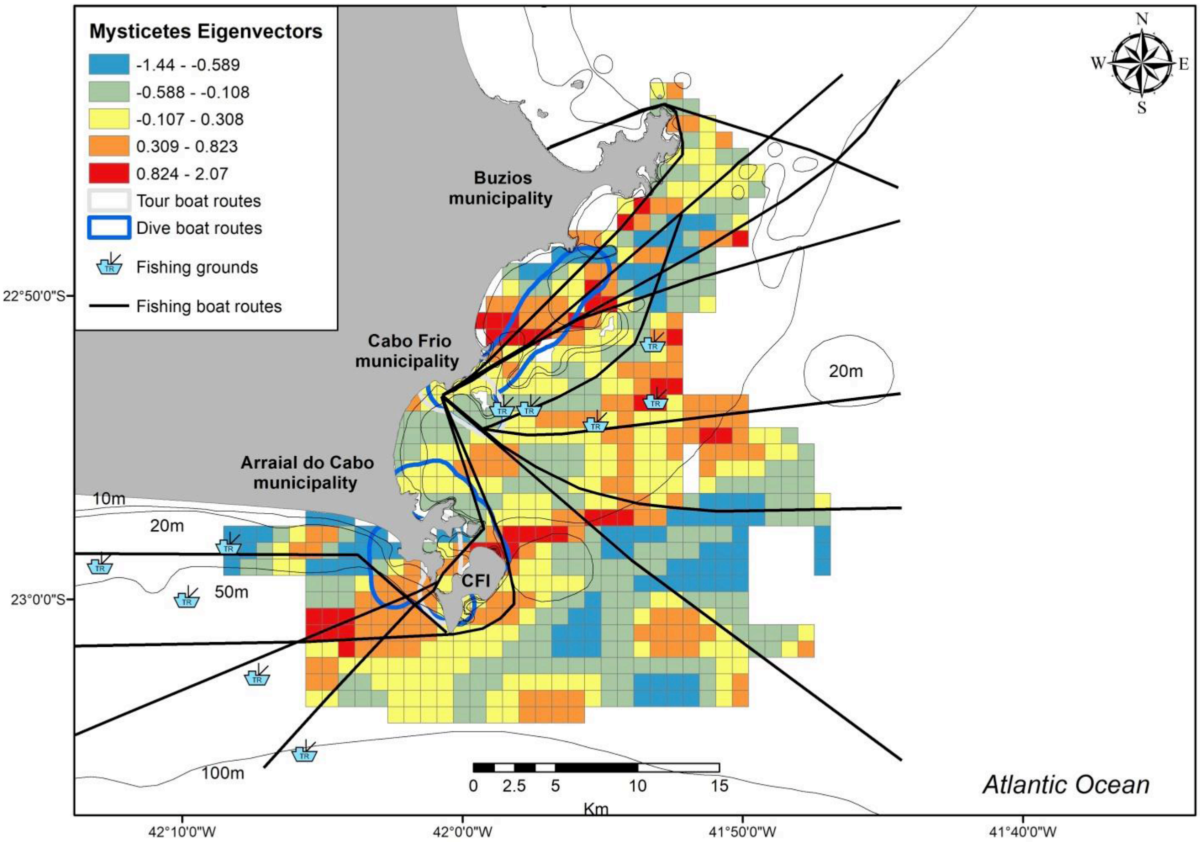



Fig S4.Spatial autocorrelation not explained by mysticetes best Spatial Eigenvector GLM in Cabo Frio, Rio de Janeiro, Brazil. CFI = Cabo Frio Island.

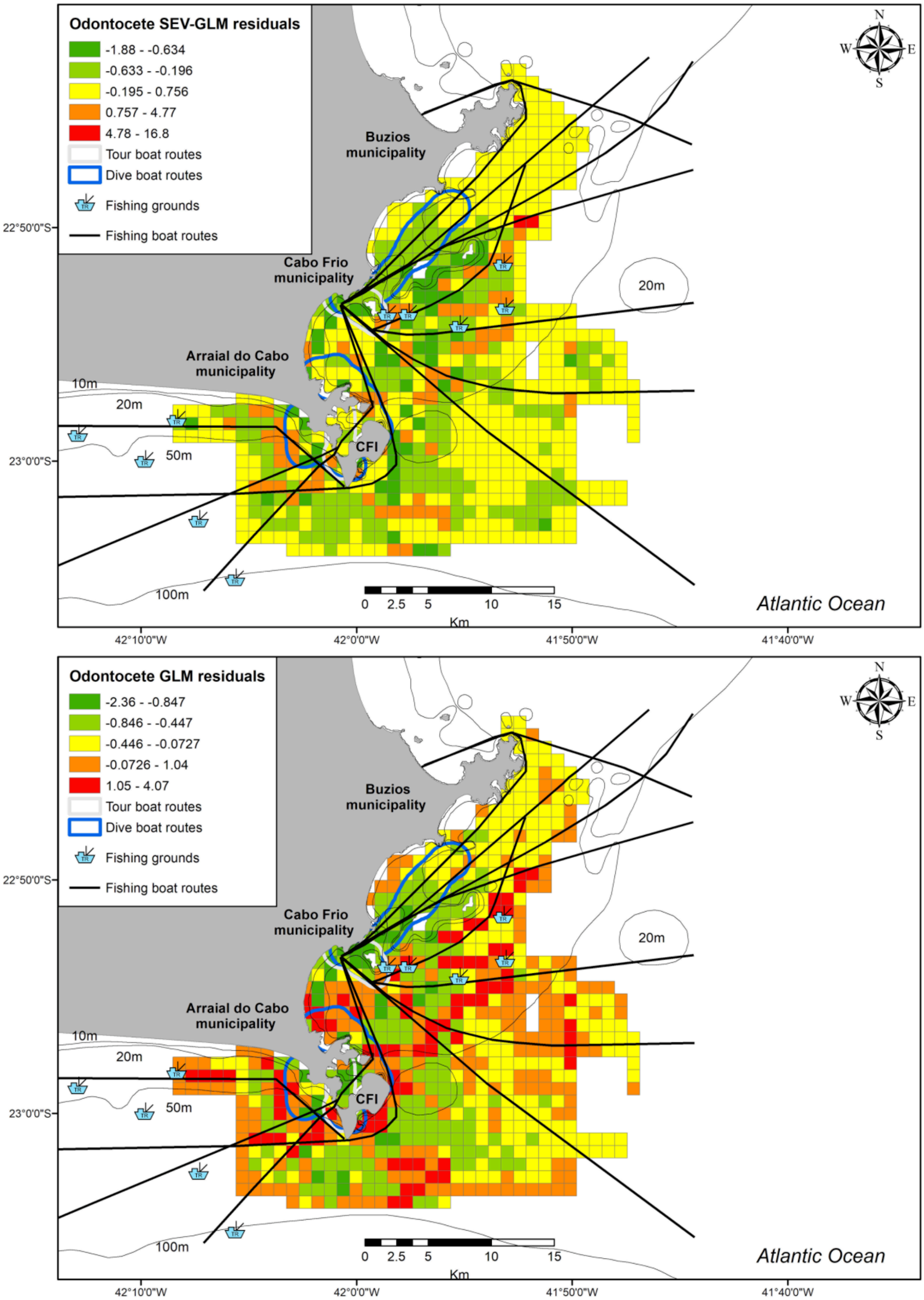



Fig S5. Odontocetes species model residuals for each grid cell along the Cabo Frio Coast, Rio de Janeiro, Brazil, using Poisson GLMs accounting for spatial autocorrelation (Upper figure) and without accounting (Lower figure) CFI = Cabo Frio Island.

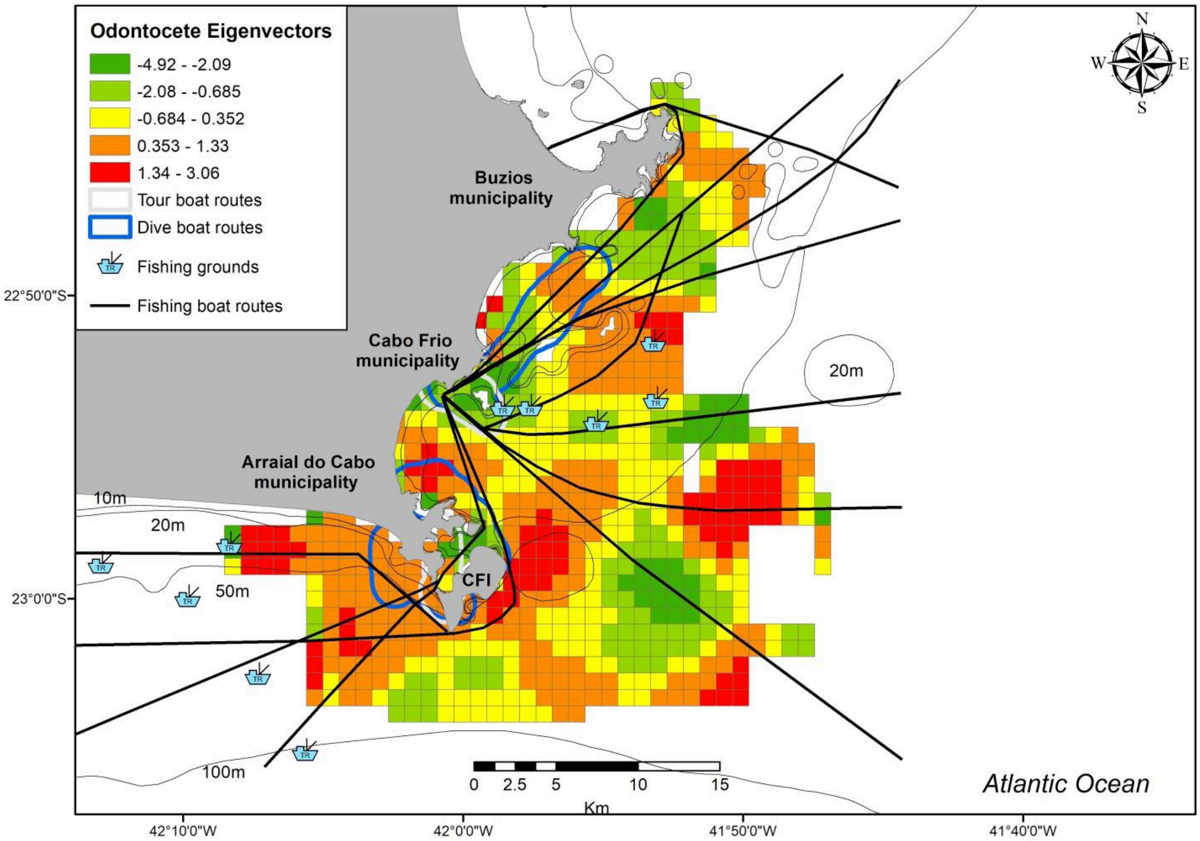



Fig S6. Spatial autocorrelation not explained by odontocetes best Spatial Eigenvector GLM in Cabo Frio, Rio de Janeiro, Brazil. CFI = Cabo Frio Island.

**Supplement 4.** Environment and anthropogenic activities influence cetacean habitat use in Southeastern Brazil – *Marine Ecology Progress Series*

Stepwise multiple selection procedure with backward elimination within a set of three pre-defined models to find the best combination of variables that explain the most variation in the data.

Migrant cetaceans
Seventeen different model combinations
Environmental models = 4
Anthropogenic models = 3
Synergy models = 10

Environmental model combinations = 4
Start: AIC=624.8
OCC_HUMP ~ DEPTH + DISTCOAST + SST_SD + SST_MEAN + I(SSTMEAN_CM^2) + SST_MIN + I(SSTMIN_CM^2) + SST_MAX + CHLOR_MEAN + CHLOR_MIN + I(CHLMIN_CM^2) + CHLOR_SD_1

Step: AIC = 623.0

OCC_HUMP ~ DEPTH + DISTCOAST + SST_SD + SST_MEAN + I(SSTMEAN_CM^2) + SST_MIN + I(SSTMIN_CM^2) + SST_MAX + CHLOR_MEAN + CHLOR_MIN + CHLOR_SD_1

Step: AIC = 621.7
OCC_HUMP ~ DEPTH + DISTCOAST + SST_SD + SST_MEAN + I(SSTMEAN_CM^2) + SST_MIN + I(SSTMIN_CM^2) + SST_MAX + CHLOR_MEAN + CHLOR_MIN 621.7

**Step: AIC = 620.4**
**OCC_HUMP ~ DEPTH + DISTCOAST + SST_SD + SST_MEAN + SST_MIN + I(SSTMIN_CM^2) + SST_MAX + CHLOR_MEAN + CHLOR_MIN**

Anthropogenic model combinations = 3
Start: AIC = 641.5
OCC_HUMP ~ FISHGRD + I(FISHGRD_CM^2) + FISHROUTE + DIVE + TOUR

Step: AIC = 639.5
OCC_HUMP ~ FISHGRD + I(FISHGRD_CM^2) + DIVE + TOUR

**Step: AIC = 638.6**
**OCC_HUMP ~ FISHGRD + I(FISHGRD_CM^2) + DIVE**

Synergy model combinations = 10
Start: AIC = 609.9
OCC_HUMP ~ FISHGRD + I(FISHGRD_CM^2) + FISHROUTE + DIVE + TOUR + DEPTH + DISTCOAST + SST_SD + SST_MEAN + I(SSTMEAN_CM^2) + SST_MIN + I(SSTMIN_CM^2) + SST_MAX + CHLOR_MEAN + CHLOR_MIN + I(CHLMIN_CM^2) + CHLOR_SD_1 609.9

Step: AIC = 600.5
OCC_HUMP ~ FISHGRD + I(FISHGRD_CM^2) + FISHROUTE + DIVE + TOUR + DEPTH + DISTCOAST + SST_SD + SST_MEAN + I(SSTMEAN_CM^2) + SST_MIN + I(SSTMIN_CM^2) + SST_MAX + CHLOR_MEAN + CHLOR_MIN + CHLOR_SD_1

Step: AIC = 598.7
OCC_HUMP ~ FISHGRD + I(FISHGRD_CM^2) + FISHROUTE + DIVE + TOUR + DEPTH + DISTCOAST + SST_MEAN + I(SSTMEAN_CM^2) + SST_MIN + I(SSTMIN_CM^2) + SST_MAX + CHLOR_MEAN + CHLOR_MIN + CHLOR_SD_1

Step: AIC = 597.0
OCC_HUMP ~ FISHGRD + I(FISHGRD_CM^2) + FISHROUTE + DIVE + TOUR + DEPTH + DISTCOAST + SST_MEAN + I(SSTMEAN_CM^2) + SST_MIN + I(SSTMIN_CM^2) + SST_MAX + CHLOR_MIN + CHLOR_SD_1

Step: AIC = 595.1
OCC_HUMP ~ FISHGRD + I(FISHGRD_CM^2) + FISHROUTE + DIVE + TOUR + DEPTH + DISTCOAST + SST_MEAN + I(SSTMEAN_CM^2) + SST_MIN + I(SSTMIN_CM^2) + SST_MAX + CHLOR_SD_1

Step: AIC = 593.4
OCC_HUMP ~ FISHGRD + I(FISHGRD_CM^2) + FISHROUTE + DIVE + TOUR + DEPTH + DISTCOAST + SST_MEAN + SST_MIN + I(SSTMIN_CM^2) + SST_MAX + CHLOR_SD_1

Step: AIC = 591.8
OCC_HUMP ~ FISHGRD + I(FISHGRD_CM^2) + DIVE + TOUR + DEPTH + DISTCOAST + SST_MEAN + SST_MIN + I(SSTMIN_CM^2) + SST_MAX +
CHLOR_SD_1

Step: AIC = 591.4
OCC_HUMP ~ FISHGRD + I(FISHGRD_CM^2) + DIVE + DEPTH + DISTCOAST + SST_MEAN + SST_MIN + I(SSTMIN_CM^2) + SST_MAX + CHLOR_SD_1

Step: AIC = 590.8
OCC_HUMP ~ FISHGRD + I(FISHGRD_CM^2) + DIVE + DEPTH + DISTCOAST + SST_MEAN + SST_MIN + SST_MAX + CHLOR_SD_1

**Step: AIC = 590.6**
**OCC_HUMP ~ FISHGRD + I(FISHGRD_CM^2) + DIVE + DEPTH + DISTCOAST + SST_MIN + SST_MAX + CHLOR_SD_1**

Non-Migrant cetaceans
Twenty-one different model combinations
Environmental models = 9
Anthropogenic = 3
Synergy = 9

Environmental model combinations = 9
Start: AIC=1024.43
OCC_FUNCT ~ DEPTH + I(DEPTH_CM^2) + DISTCOAST + SST_SD + I(SSTSD_CM^2) + SST_MEAN + I(SSTMEAN_CM^2) + SST_MIN + I(SSTMIN_CM^2) + SST_MAX + I(SSTMAX_CM^2) + CHLOR_MEAN + I(CHLMEAN_CM^2) + CHLOR_MIN + I(CHLMIN_CM^2) + fitted(eigfun.e)

Step: AIC=1022.44
OCC_FUNCT ~ DEPTH + DISTCOAST + SST_SD + I(SSTSD_CM^2) + SST_MEAN + I(SSTMEAN_CM^2) + SST_MIN + I(SSTMIN_CM^2) + SST_MAX + I(SSTMAX_CM^2) + CHLOR_MEAN + I(CHLMEAN_CM^2) + CHLOR_MIN + I(CHLMIN_CM^2) + fitted(eigfun.e)

Step: AIC=1020.45
OCC_FUNCT ~ DEPTH + DISTCOAST + I(SSTSD_CM^2) + SST_MEAN + I(SSTMEAN_CM^2) + SST_MIN + I(SSTMIN_CM^2) + SST_MAX + I(SSTMAX_CM^2) + CHLOR_MEAN + I(CHLMEAN_CM^2) + CHLOR_MIN + I(CHLMIN_CM^2) + fitted(eigfun.e)

Step: AIC=1018.46
OCC_FUNCT ~ DEPTH + DISTCOAST + I(SSTSD_CM^2) + SST_MEAN + I(SSTMEAN_CM^2) + SST_MIN + I(SSTMIN_CM^2) + SST_MAX + I(SSTMAX_CM^2) + CHLOR_MEAN + CHLOR_MIN + I(CHLMIN_CM^2) + fitted(eigfun.e)

Step:  AIC=1016.99
OCC_FUNCT ~ DEPTH + DISTCOAST + I(SSTSD_CM^2) + SST_MEAN + SST_MIN +     I(
SSTMIN_CM^2) + SST_MAX + I(SSTMAX_CM^2) + CHLOR_MEAN +
CHLOR_MIN + I(CHLMIN_CM^2) + fitted(eigfun.e)

Step:  AIC=1015.71
OCC_FUNCT ~ DEPTH + DISTCOAST + I(SSTSD_CM^2) + SST_MEAN + SST_MIN +     S
ST_MAX + I(SSTMAX_CM^2) + CHLOR_MEAN + CHLOR_MIN + I(CHLMIN_CM^2) +
fitted(eigfun.e)

Step:  AIC=1014.86
OCC_FUNCT ~ DEPTH + DISTCOAST + I(SSTSD_CM^2) + SST_MEAN + SST_MIN +     S
ST_MAX + I(SSTMAX_CM^2) + CHLOR_MEAN + CHLOR_MIN + fitted(eigfun.e)

Step:  AIC=1014.28
OCC_FUNCT ~ DEPTH + I(SSTSD_CM^2) + SST_MEAN + SST_MIN + SST_MAX +     I(SS
TMAX_CM^2) + CHLOR_MEAN + CHLOR_MIN + fitted(eigfun.e)

**Step:  AIC=1013.59**
**OCC_FUNCT ~ DEPTH + I(SSTSD_CM^2) + SST_MEAN + SST_MIN + SST_MAX +**
**CHLOR_MEAN + CHLOR_MIN + fitted(eigfun.e)**

Anthropogenic model combinations = 3
Start:  AIC=994.95
OCC_FUNCT ~ FISHGRD + I(FISHGRD_CM^2) + FISHROUTE + DIVE + TOUR +
fitted(eigfun.a)

Step:  AIC=993.01
OCC_FUNCT ~ FISHGRD + FISHROUTE + DIVE + TOUR + fitted(eigfun.a)

**Step:  AIC=992.17**
**OCC_FUNCT ~ FISHGRD + FISHROUTE + TOUR + fitted(eigfun.a)**

Synergy model combinations = 9
Start:  AIC=998.42
OCC_FUNCT ~ FISHGRD + I(FISHGRD_CM^2) + FISHROUTE + DIVE + TOUR +
DEPTH + I(DEPTH_CM^2) + DISTCOAST + SST_SD + I(SSTSD_CM^2) +
SST_MEAN + I(SSTMEAN_CM^2) + SST_MIN + I(SSTMIN_CM^2) + SST_MAX +     I(S
STMAX_CM^2) + CHLOR_MEAN + I(CHLMEAN_CM^2) + CHLOR_MIN +     I(CHLMIN_
CM^2) + CHLOR_SD_1 + I(CHLSD_CM) + fitted(eigfun.s)

Step:  AIC=996.42
OCC_FUNCT ~ FISHGRD + FISHROUTE + DIVE + TOUR + DEPTH + I(DEPTH_CM^2) +
DISTCOAST + SST_SD + I(SSTSD_CM^2) + SST_MEAN + I(SSTMEAN_CM^2) +     SST_

MIN + I(SSTMIN_CM^2) + SST_MAX + I(SSTMAX_CM^2) + CHLOR_MEAN + I(CHLMEAN_CM^2) + CHLOR_MIN + I(CHLMIN_CM^2) + CHLOR_SD_1 + I(CHLSD_CM) + fitted(eigfun.s)

Step: AIC=994.44
OCC_FUNCT ~ FISHGRD + FISHROUTE + DIVE + TOUR + DEPTH + I(DEPTH_CM^2) + DISTCOAST + SST_SD + I(SSTSD_CM^2) + SST_MEAN + I(SSTMEAN_CM^2) + SST_MIN + SST_MAX + I(SSTMAX_CM^2) + CHLOR_MEAN + I(CHLMEAN_CM^2) + CHLOR_MIN + I(CHLMIN_CM^2) + CHLOR_SD_1 + I(CHLSD_CM) + fitted(eigfun.s)

Step: AIC=992.58
OCC_FUNCT ~ FISHGRD + DIVE + TOUR + DEPTH + I(DEPTH_CM^2) + DISTCOAST + SST_SD + I(SSTSD_CM^2) + SST_MEAN + I(SSTMEAN_CM^2) + SST_MIN + SST_MAX + I(SSTMAX_CM^2) + CHLOR_MEAN + I(CHLMEAN_CM^2) + CHLOR_MIN + I(CHLMIN_CM^2) + CHLOR_SD_1 + I(CHLSD_CM) + fitted(eigfun.s)

Step: AIC=990.78
OCC_FUNCT ~ FISHGRD + DIVE + TOUR + DEPTH + I(DEPTH_CM^2) + DISTCOAST + SST_SD + SST_MEAN + I(SSTMEAN_CM^2) + SST_MIN + SST_MAX + I(SSTMAX_CM^2) + CHLOR_MEAN + I(CHLMEAN_CM^2) + CHLOR_MIN + I(CHLMIN_CM^2) + CHLOR_SD_1 + I(CHLSD_CM) + fitted(eigfun.s)

Step: AIC=989.07
OCC_FUNCT ~ FISHGRD + DIVE + TOUR + DEPTH + I(DEPTH_CM^2) + DISTCOAST + SST_SD + SST_MEAN + I(SSTMEAN_CM^2) + SST_MIN + SST_MAX + CHLOR_MEAN + I(CHLMEAN_CM^2) + CHLOR_MIN + I(CHLMIN_CM^2) + CHLOR_SD_1 + I(CHLSD_CM) + fitted(eigfun.s)

Step: AIC=988.44
OCC_FUNCT ~ FISHGRD + DIVE + TOUR + DEPTH + I(DEPTH_CM^2) + DISTCOAST + SST_SD + SST_MEAN + I(SSTMEAN_CM^2) + SST_MAX + CHLOR_MEAN + I(CHLMEAN_CM^2) + CHLOR_MIN + I(CHLMIN_CM^2) + CHLOR_SD_1 + I(CHLSD_CM) + fitted(eigfun.s)

Step: AIC=987.28
OCC_FUNCT ~ FISHGRD + DIVE + TOUR + DEPTH + I(DEPTH_CM^2) + SST_SD + SST_MEAN + I(SSTMEAN_CM^2) + SST_MAX + CHLOR_MEAN + I(CHLMEAN_CM^2) + CHLOR_MIN + I(CHLMIN_CM^2) + CHLOR_SD_1 + I(CHLSD_CM) + fitted(eigfun.s)

**Step: AIC= 986.58**
**OCC_FUNCT ~ FISHGRD + TOUR + DEPTH + I(DEPTH_CM^2) + SST_SD + SST_MEAN + I(SSTMEAN_CM^2) + SST_MAX + CHLOR_MEAN + I(CHLMEAN_CM^2) + CHLOR_MIN + I(CHLMIN_CM^2) + CHLOR_SD_1 + I(CHLSD_CM) + fitted(eigfun.s)**