

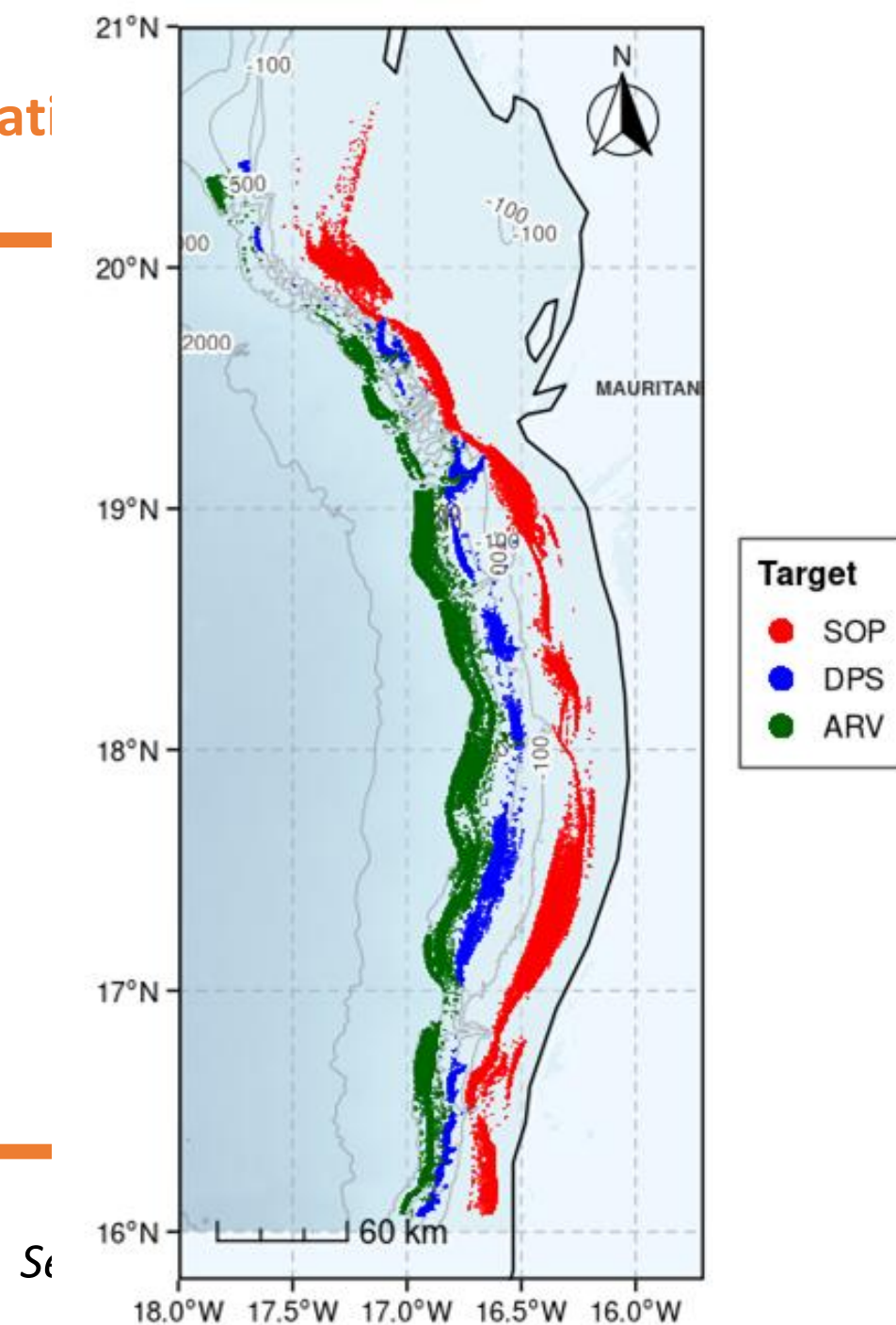
Standardisation de CPUE via sdmTMB

***Cas d'étude : Flottes chalutières
espagnoles ciblant les crevettes en
Mauritanie***

WP 4: Fishing effort characterization and CPUE standardization

Standardisation de CPUE avec sdmTMB

Quelles sont les caractéristiques de ces données ?

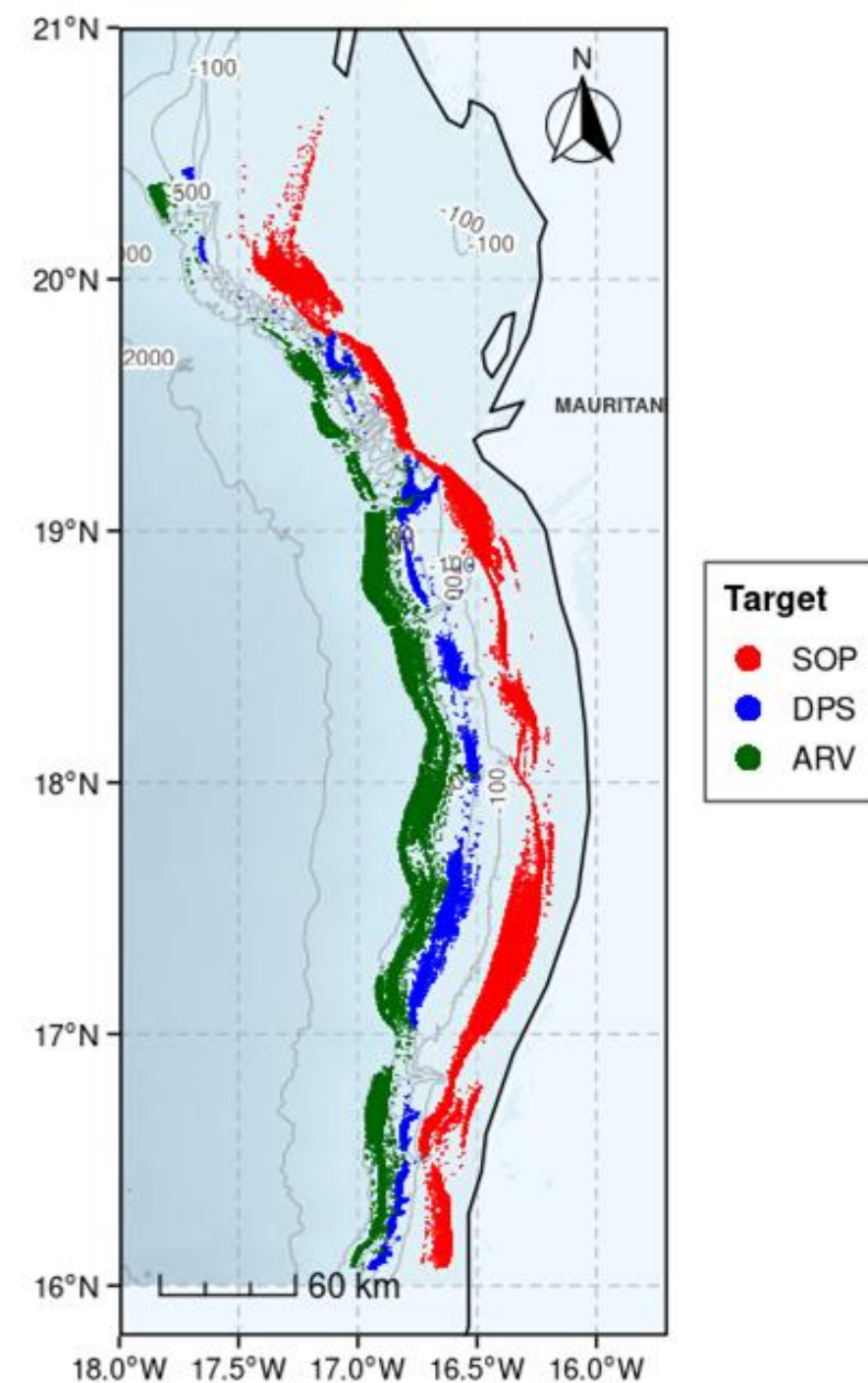


WP 4: Fishing effort characterization and CPUE standardization

Standardisation de CPUE avec sdmTMB

Quelles sont les caractéristiques de ces données ?

- Elles proviennent d'un processus écologique que l'on cherche à étudier (= elles sont **conditionnelles** à ce processus écologique)

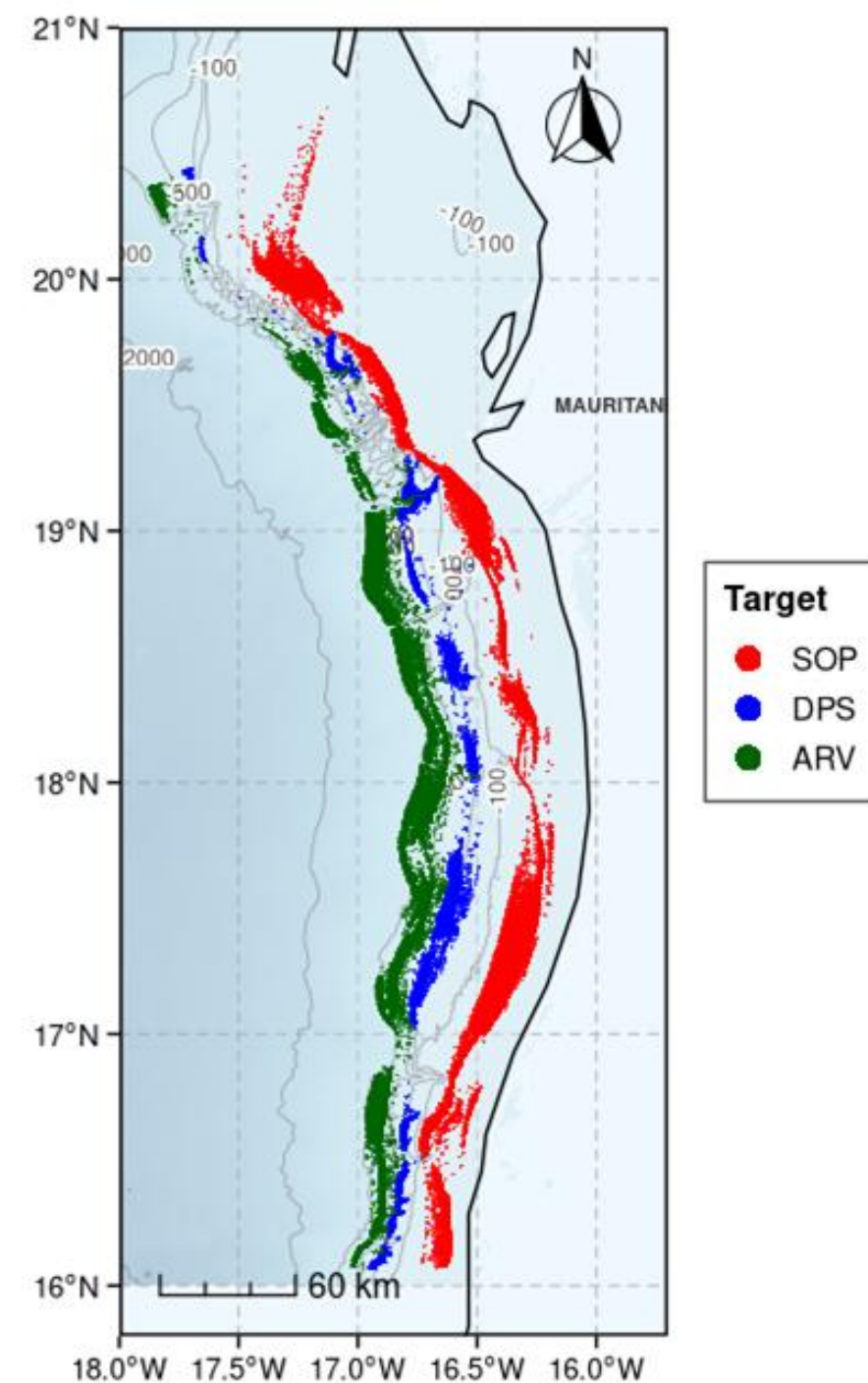


WP 4: Fishing effort characterization and CPUE standardization

Standardisation de CPUE avec sdmTMB

Quelles sont les caractéristiques de ces données ?

- Elles proviennent d'un processus écologique que l'on cherche à étudier (= elles sont **conditionnelles** à ce processus écologique)
- Elles sont **bruitées** (= Elles ne sont pas des observations parfaites du processus d'intérêt)

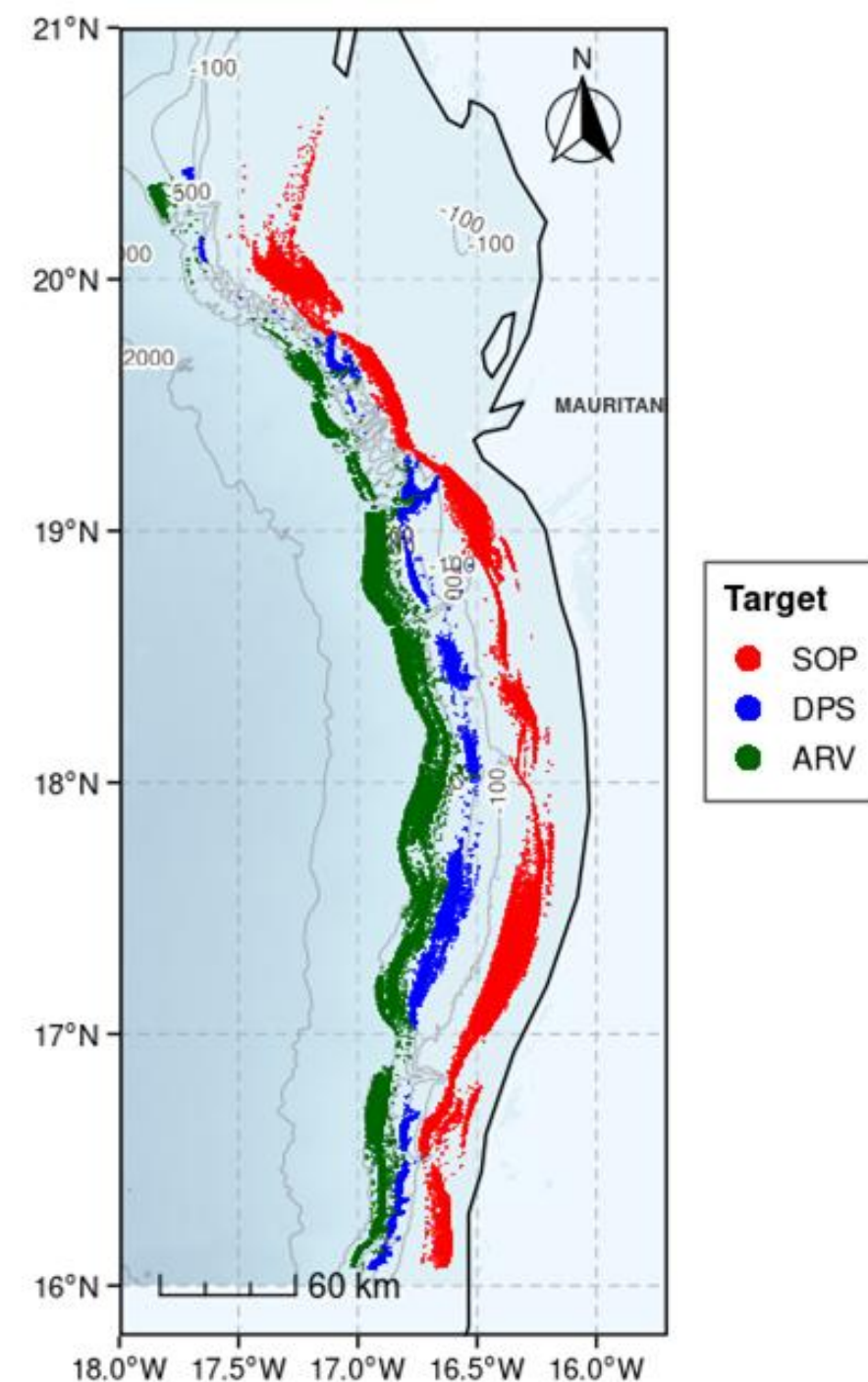


WP 4: Fishing effort characterization and CPUE standardization

Standardisation de CPUE avec sdmTMB

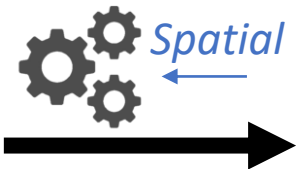
Quelles sont les caractéristiques de ces données ?

- Elles proviennent d'un processus écologique que l'on cherche à étudier (= elles sont **conditionnelles** à ce processus écologique)
- Elles sont **bruitées** (= Elles ne sont pas des observations parfaites du processus d'intérêt)
- **Localisées** (= ne couvrent pas l'ensemble de la zone d'étude, ce qui nécessite de mettre en place un certain nombre d'hypothèses)



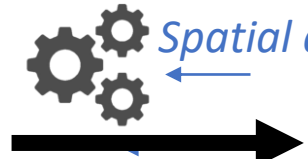
Standardisation de CPUE avec sdmTMB

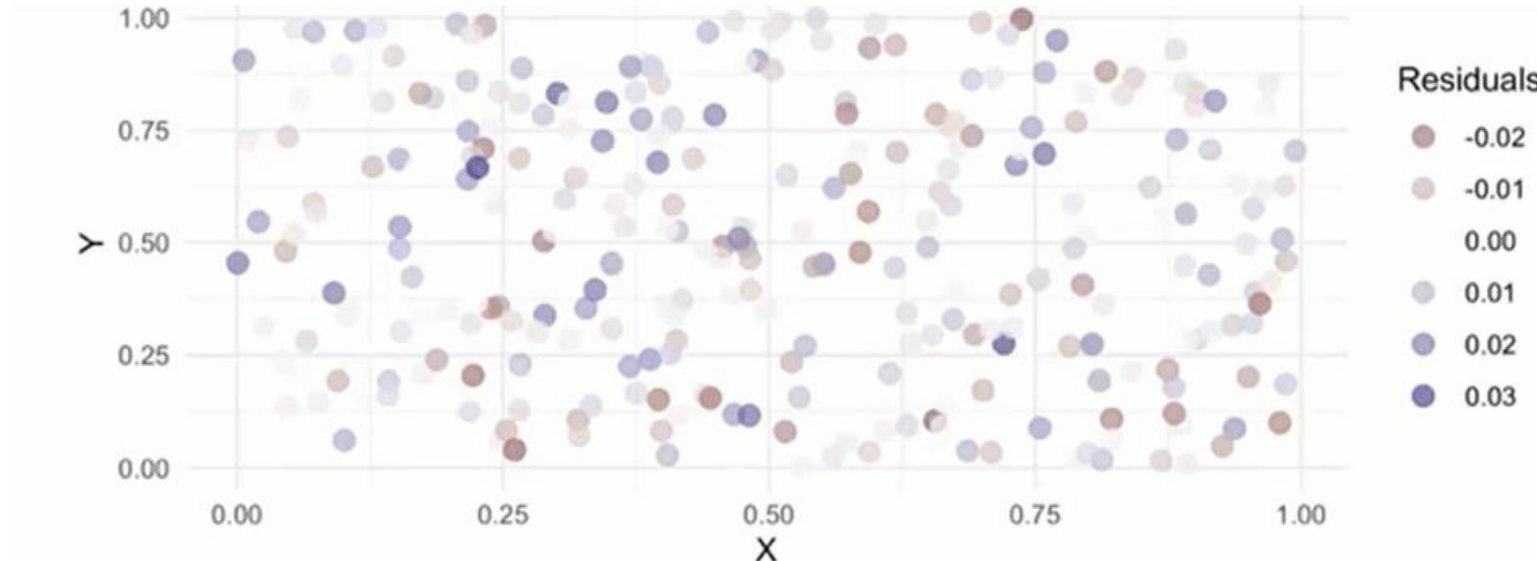
- Ecological data often have spatial attributes

- Ideal modelling process  Residuals are uncorrelated

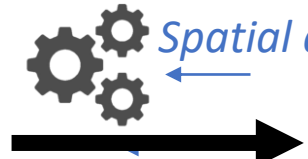


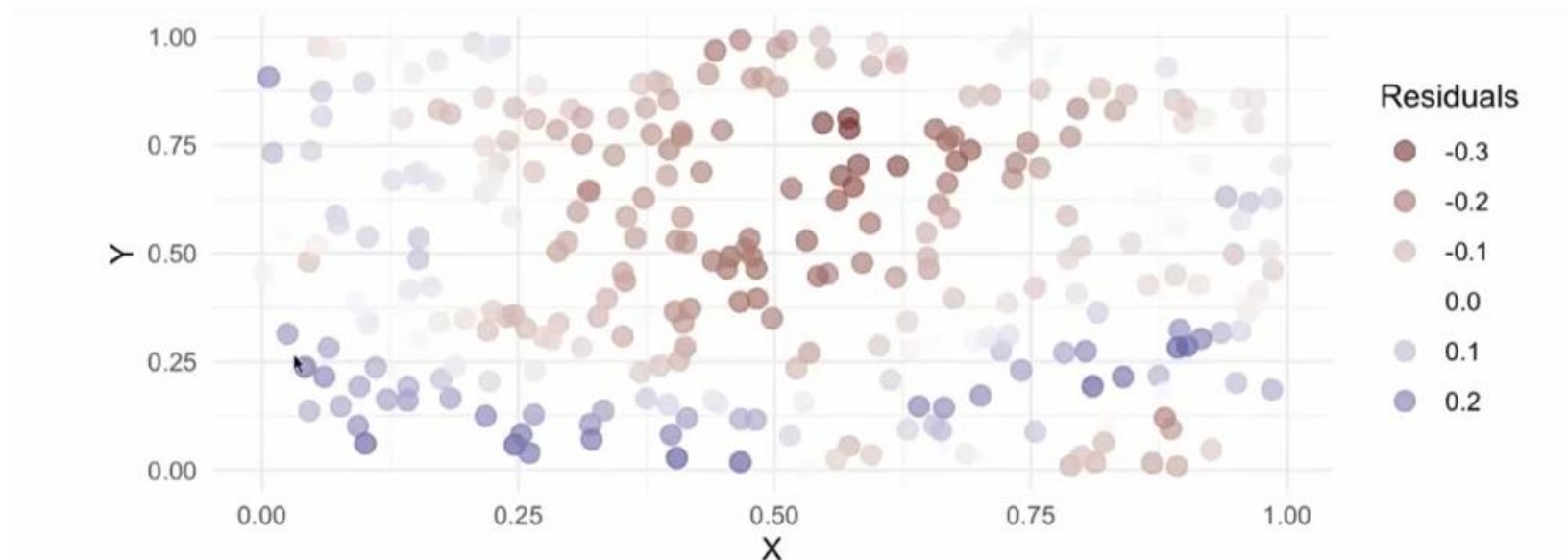
Standardisation de CPUE avec sdmTMB

- Ideal modelling process  Residuals are **uncorrelated**



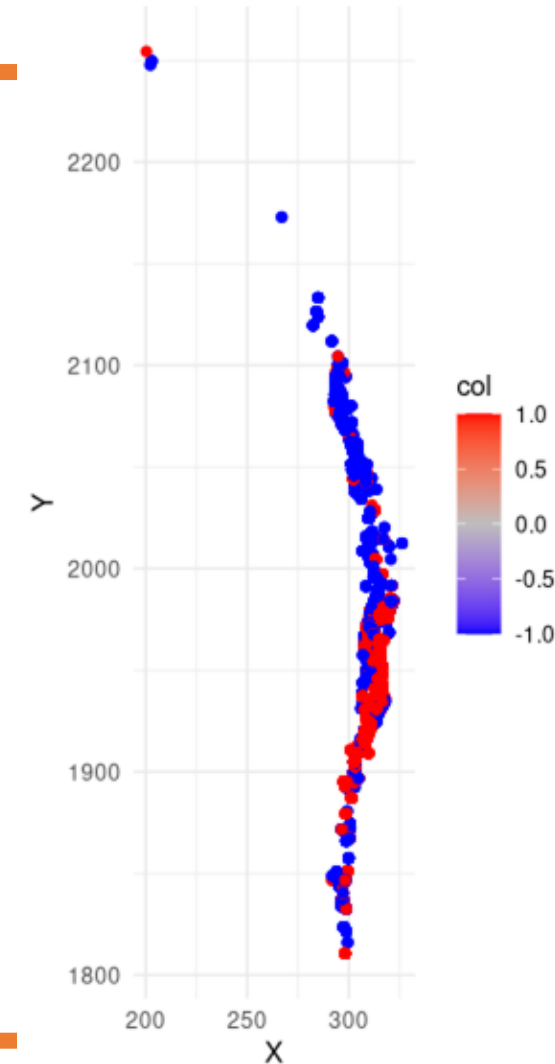
Standardisation de CPUE avec sdmTMB

- **Real** modelling process  Residuals are **correlated...**



Standardisation de CPUE avec sdmTMB

Real modelling process  Residuals are **correlated...**

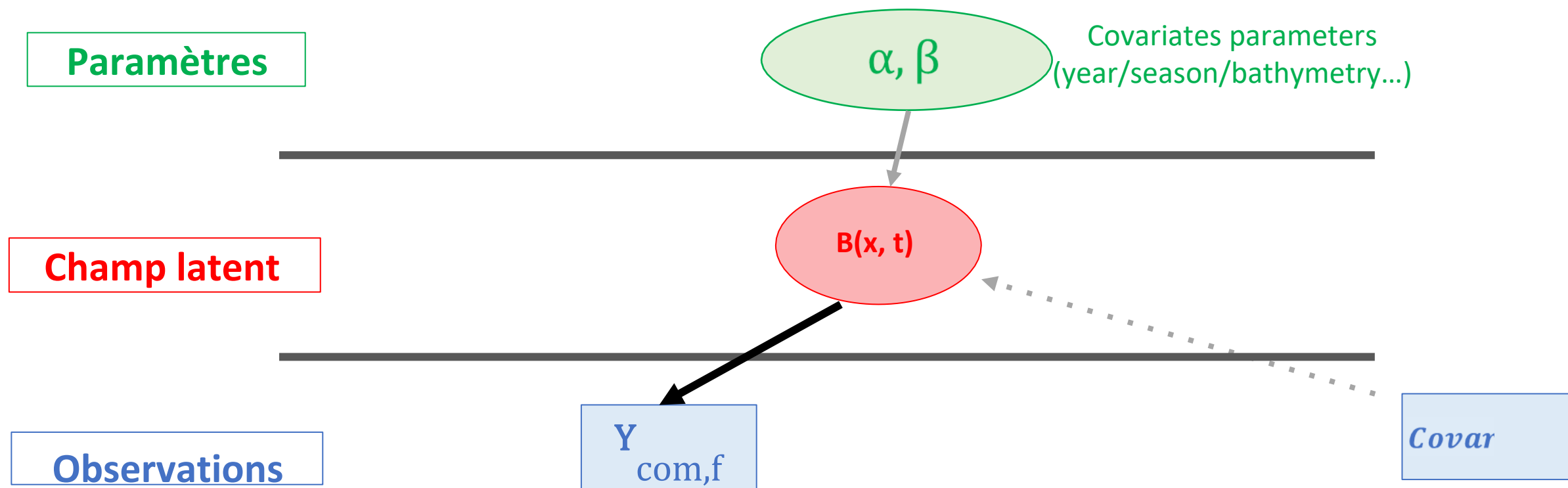


Standardisation de CPUE avec sdmTMB

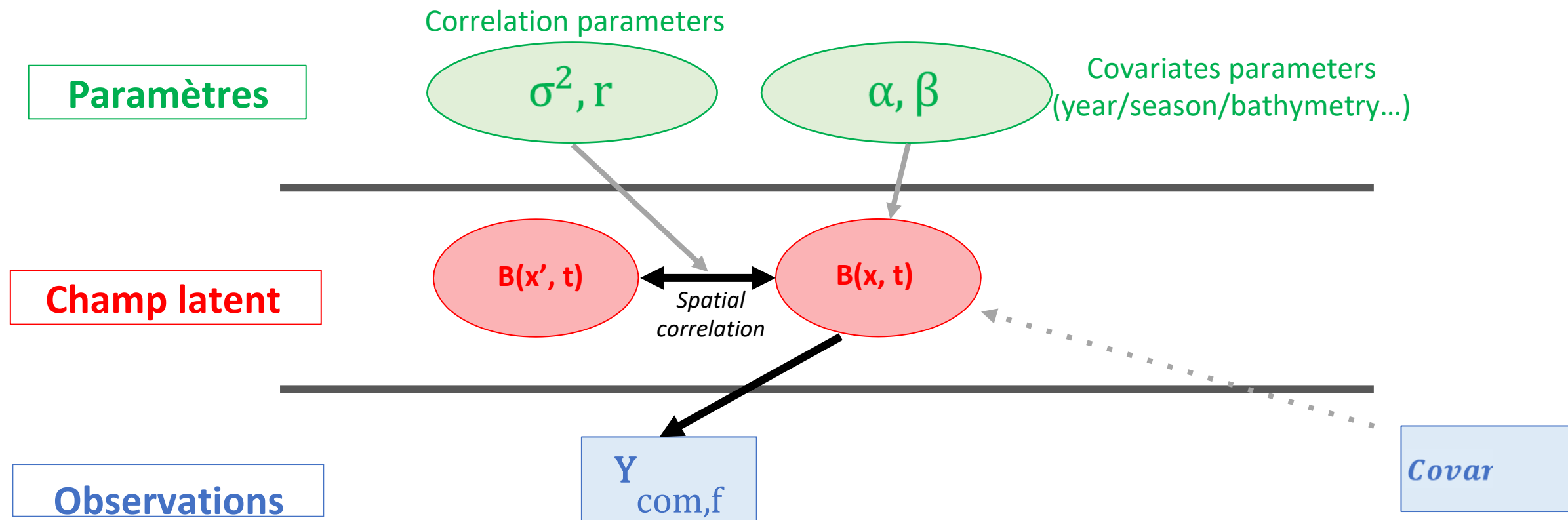
- Need to approximate all spatial variables missing from model
 - Temperature
 - Substrat
 - Oceanic currents
 - Competitions on habitats
 - ...

[?] Hierarchical modelling and Random Field

Standardisation de CPUE avec sdmTMB



Standardisation de CPUE avec sdmTMB



Standardisation de CPUE avec sdmTMB

$$Y|\delta, \beta \sim \mathcal{L}(\mathbf{S}, \sigma^2)$$

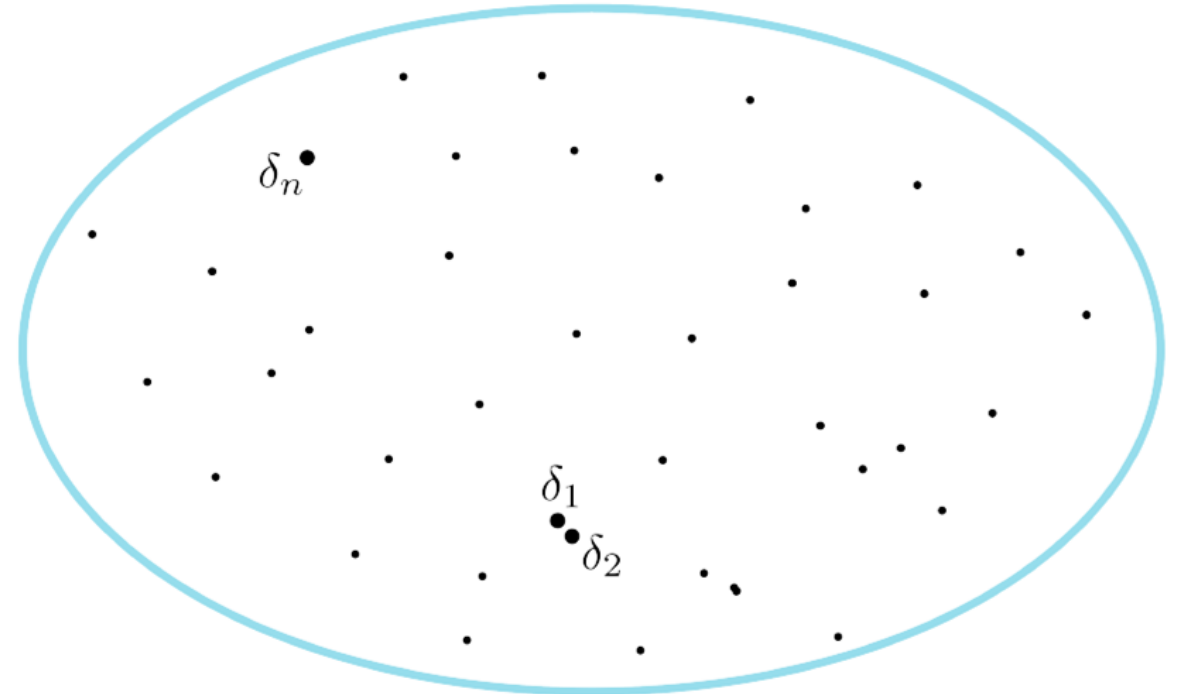
$$f(\mathbf{S}) = \mathbf{X} \cdot \beta + \delta$$

$$\delta \sim \mathcal{MG}(0, \mathbf{\Sigma})$$

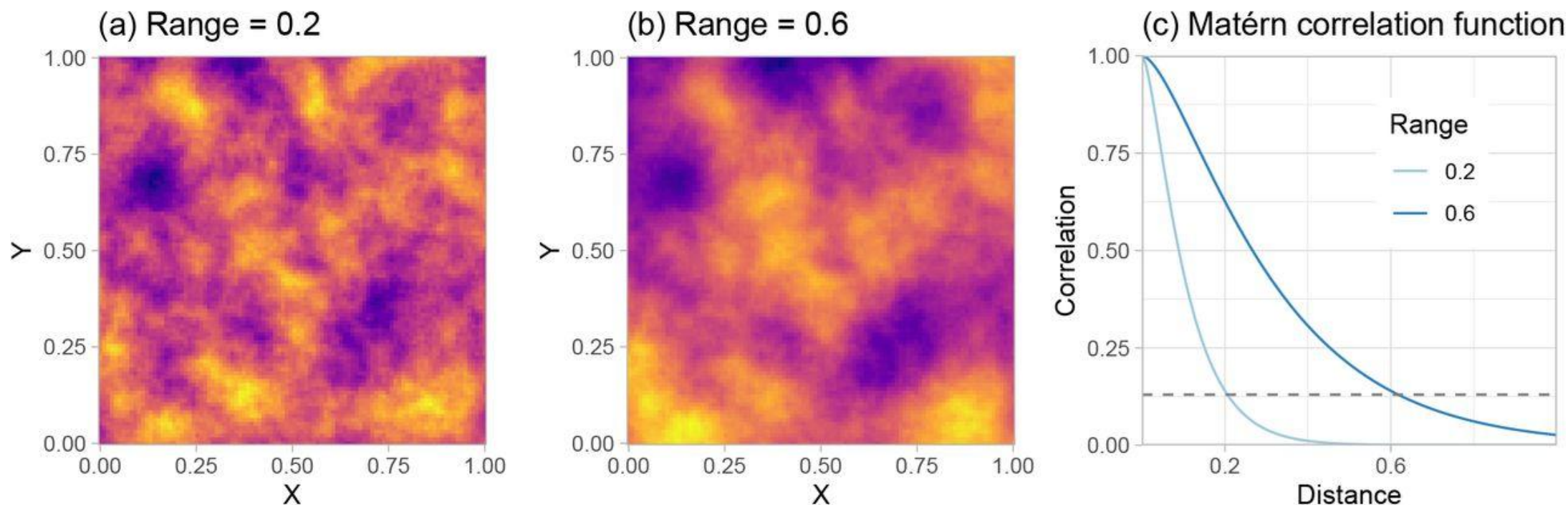
The key element is the covariance matrix $\mathbf{\Sigma}_{(n \times n)}$

Standardisation de CPUE avec sdmTMB

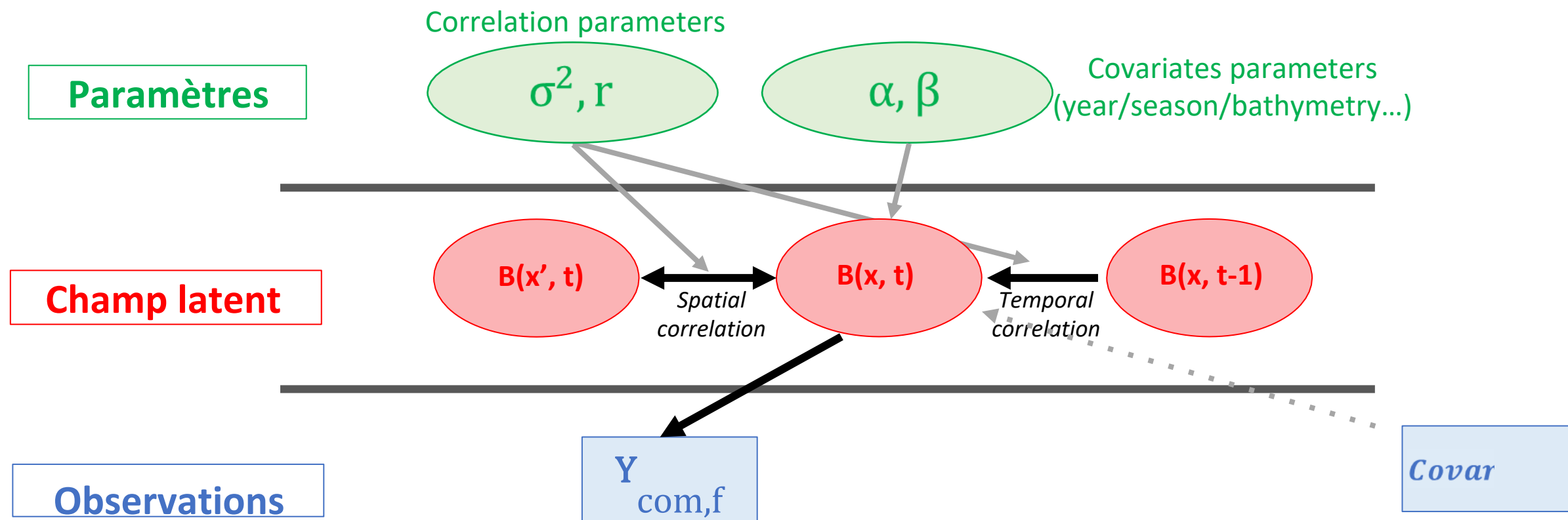
$$\Sigma = \begin{pmatrix} \text{Var}[\delta_1] & \text{Cov}[\delta_1, \delta_2] & \cdots & \text{Cov}[\delta_1, \delta_n] \\ \text{Cov}[\delta_2, \delta_1] & \text{Var}[\delta_2] & \ddots & \vdots \\ \vdots & \ddots & \ddots & \vdots \\ \text{Cov}[\delta_n, \delta_1] & \cdots & \cdots & \text{Var}[\delta_n] \end{pmatrix}$$



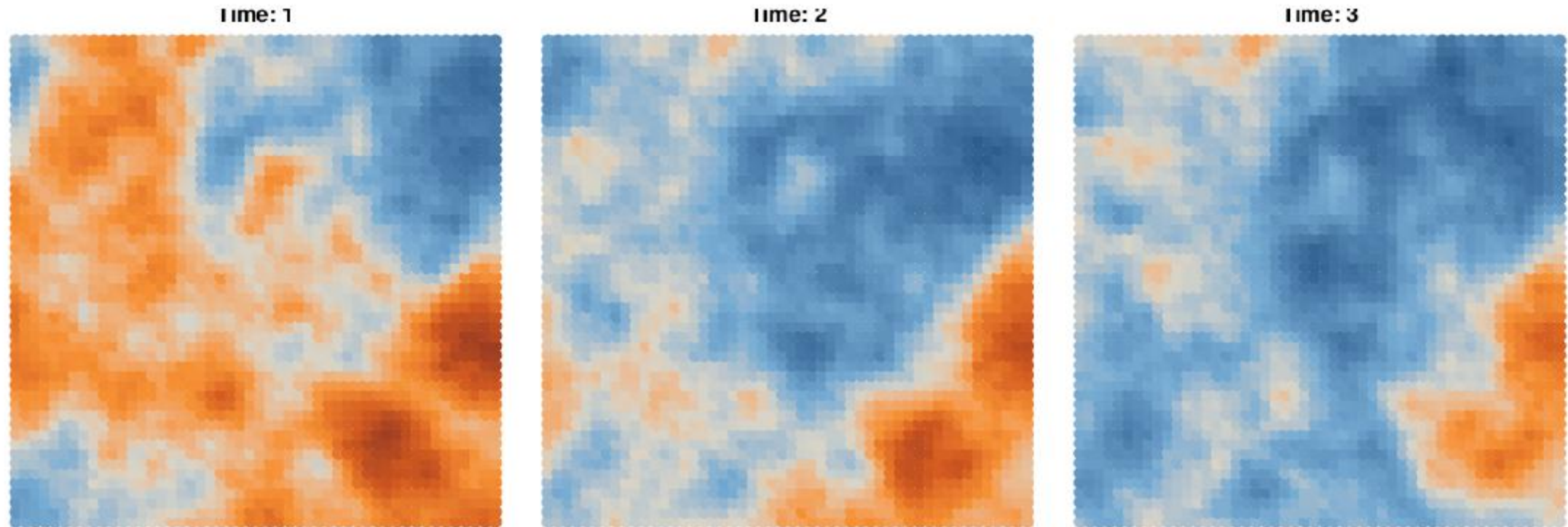
Standardisation de CPUE avec sdmTMB



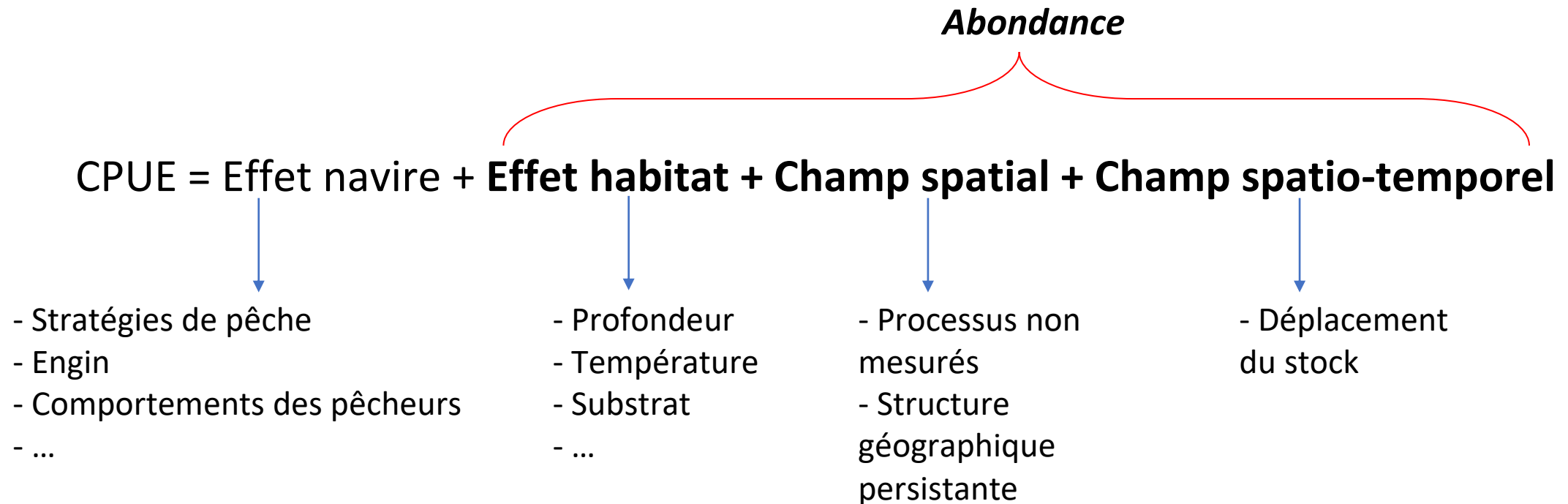
Standardisation de CPUE avec sdmTMB



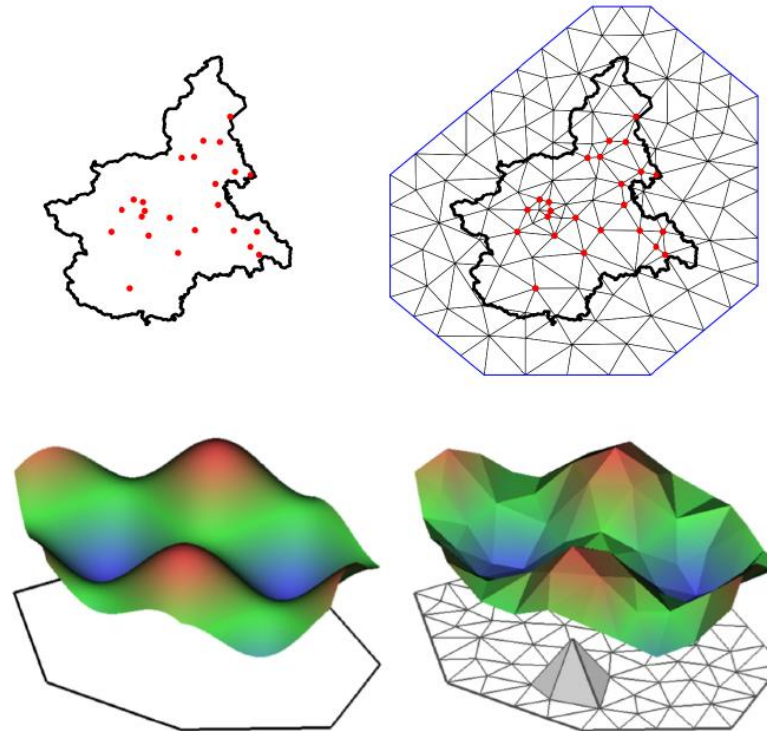
Standardisation de CPUE avec sdmTMB



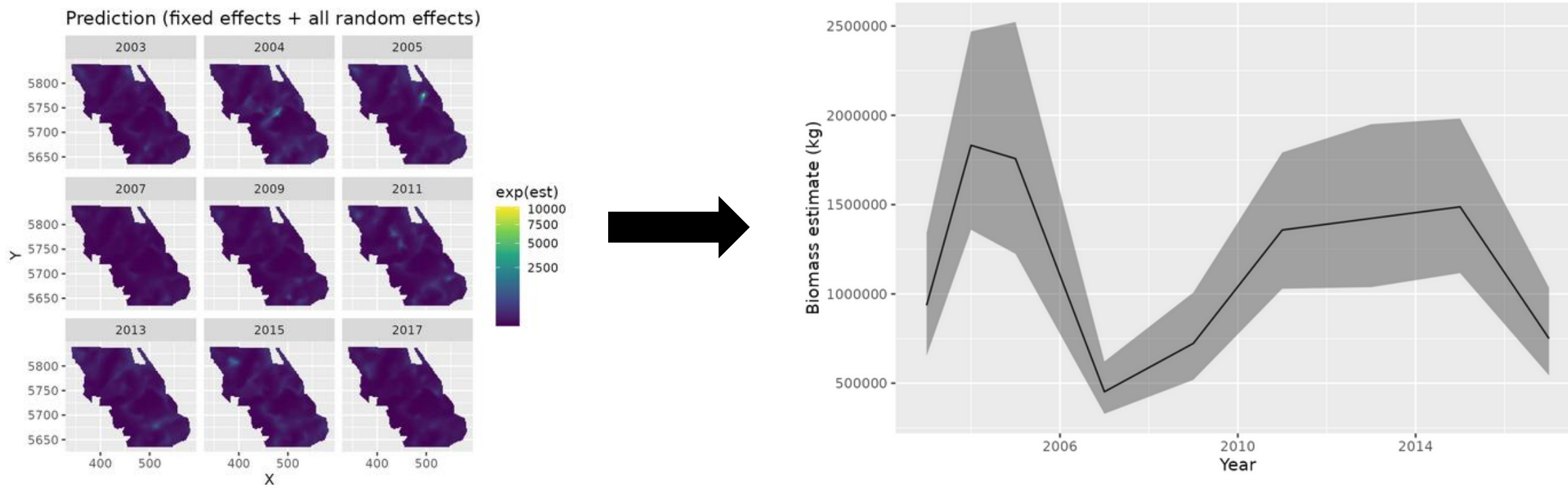
Standardisation de CPUE avec sdmTMB



Standardisation de CPUE avec sdmTMB



Standardisation de CPUE avec sdmTMB

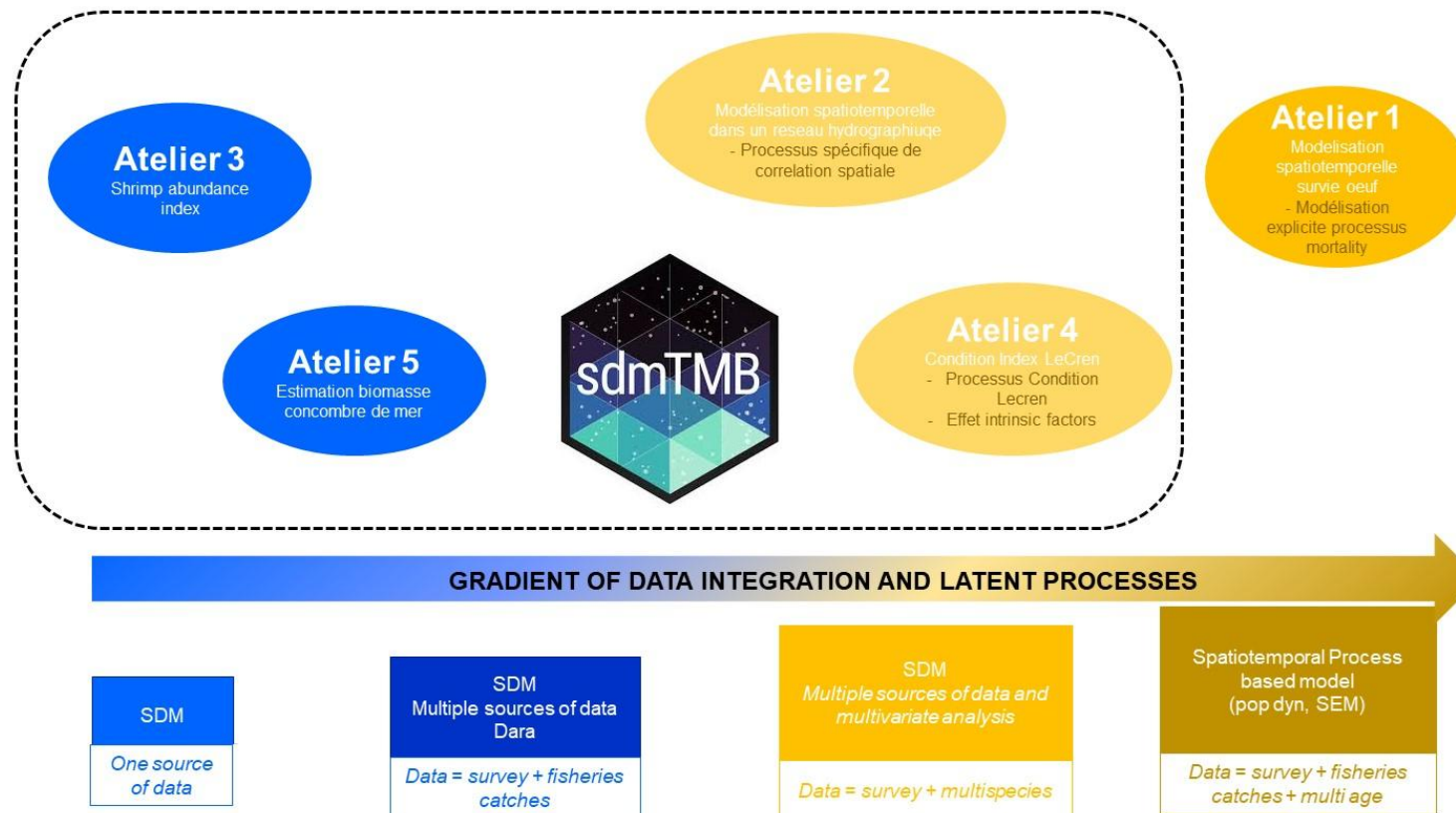


Case study : Spanish trawlers targetting Mauritanian shrimps

Case study : Spanish trawlers targetting Mauritanian shrimps

**Groupe de travail sur les Modèles Spatio-Temporels
Rennes le 2-3 février**

Case study : Spanish trawlers targetting Mauritanian shrimps

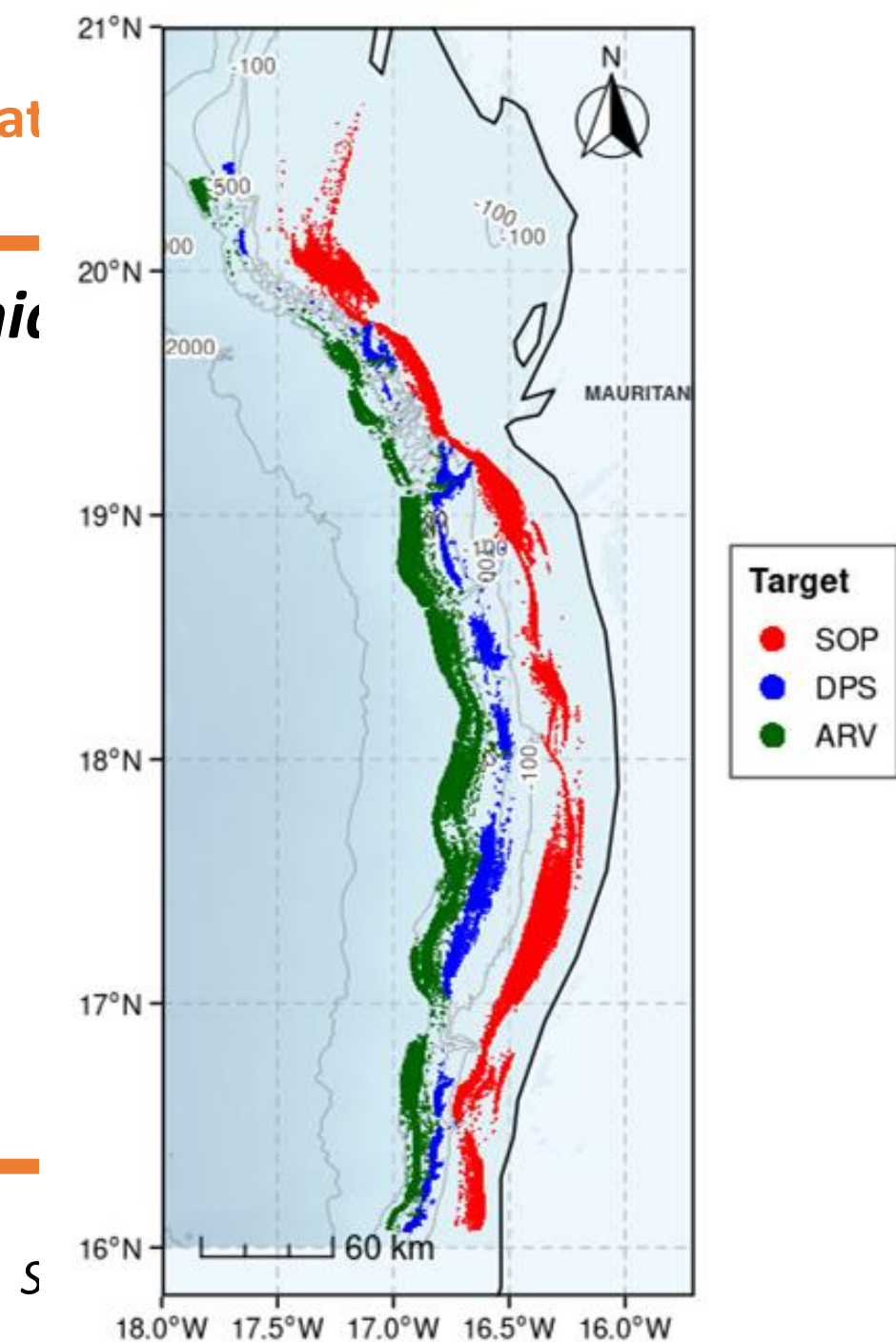


WP 4: Fishing effort characterization and CPUE standardizat

Case study : Spanish trawlers targetting Mauritanian

1. Data assumptions

- Species distribution do not overlap :
Penaeus notialis - PEN : 10-80m
Parapenaeus longirostris – DPS : 150-350m
Aristeus varidens – ARV : 400-1000m
- No zeros at the moment in the dataset
- VMS Centroid
- Catch are modelled using Effort as an offset



Case study : Spanish trawlers targetting Mauritanian shrimps

2. Data available

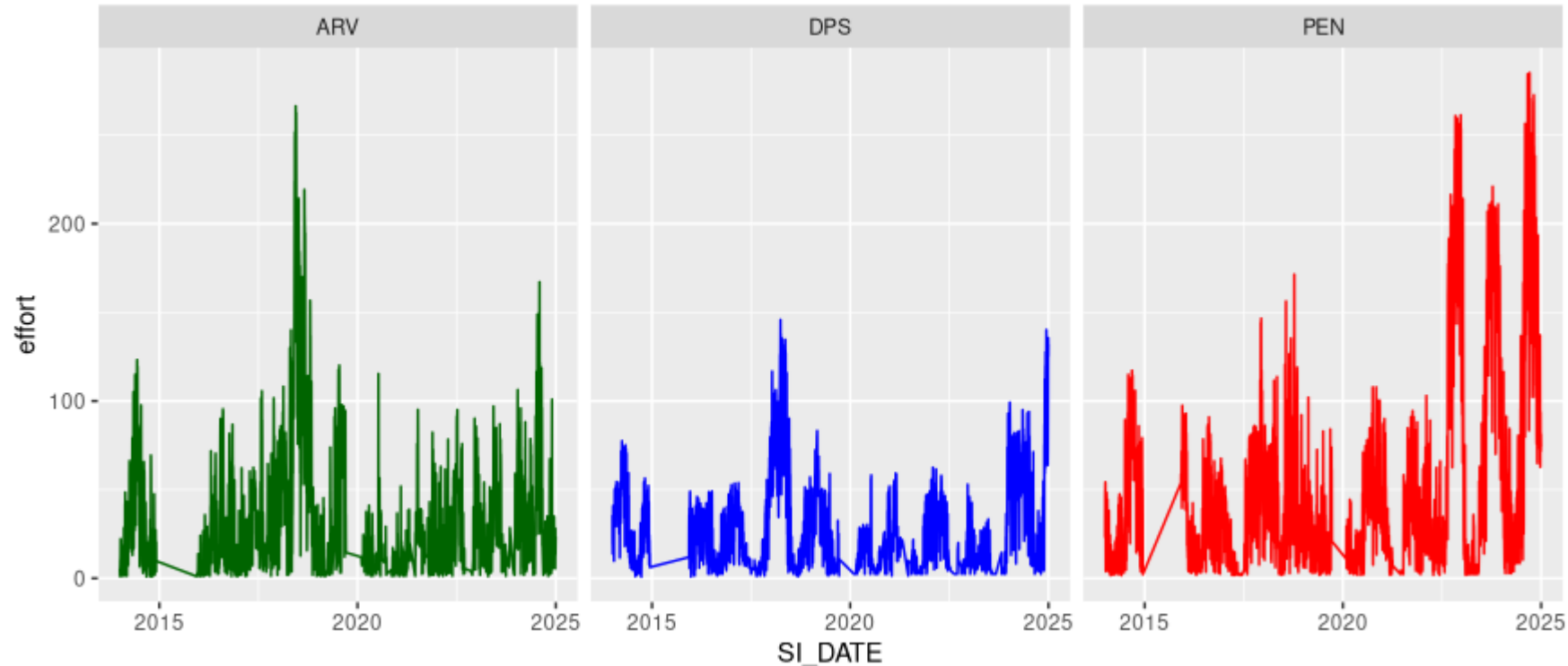
- 2014-2024
- Daily effort & catch
- 20 vessels
- 3 metiers

Case study : Spanish trawlers targetting Mauritanian shrimps

2. Data available

Effort (heures pêchées)

- ❑ Variations intrannuelle
- ❑ Variations interannuelles
- ❑ Variations entre espèces

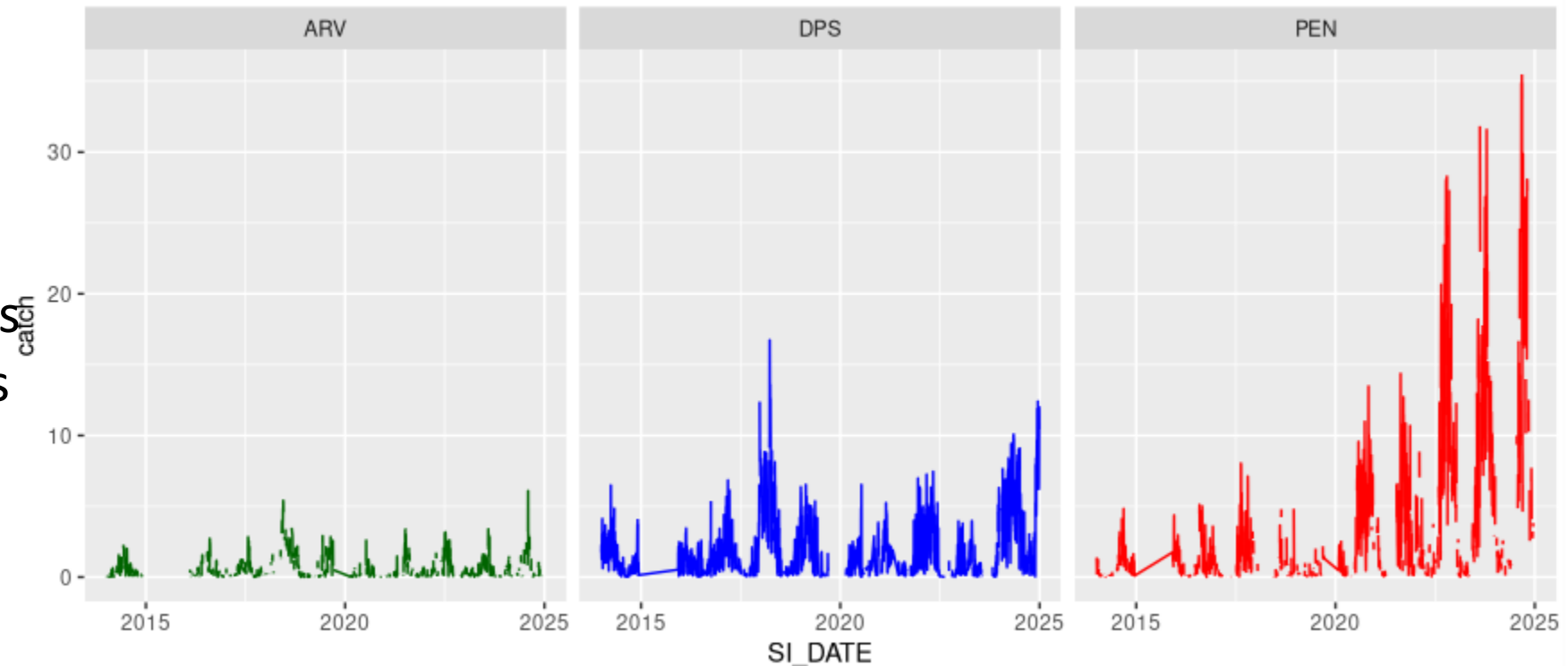


Case study : Spanish trawlers targetting Mauritanian shrimps

2. Data available

Captures (tonnes)

- ❑ Variations intrannuelle
- ❑ Variations interannuelles
- ❑ Variations entre espèces

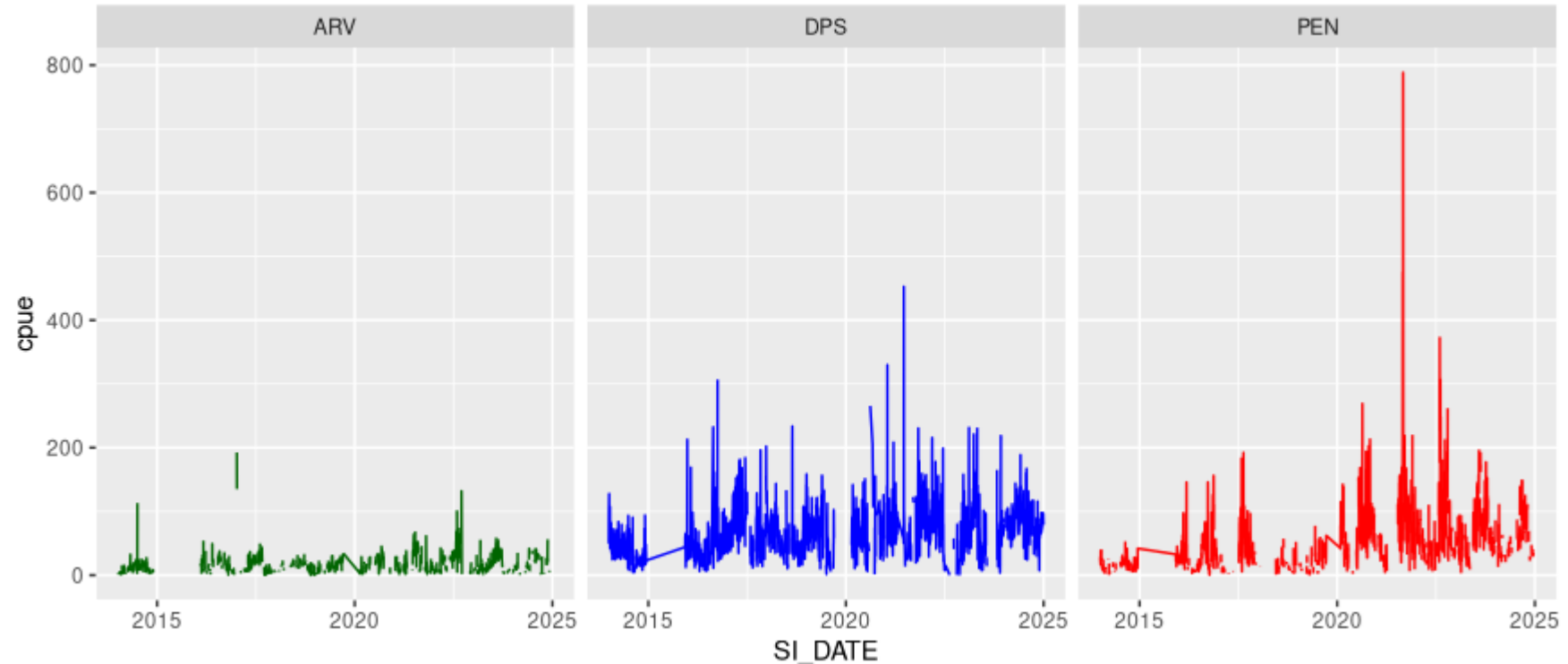


Case study : Spanish trawlers targetting Mauritanian shrimps

2. Data available

Cpue (kg/heure pêchée)

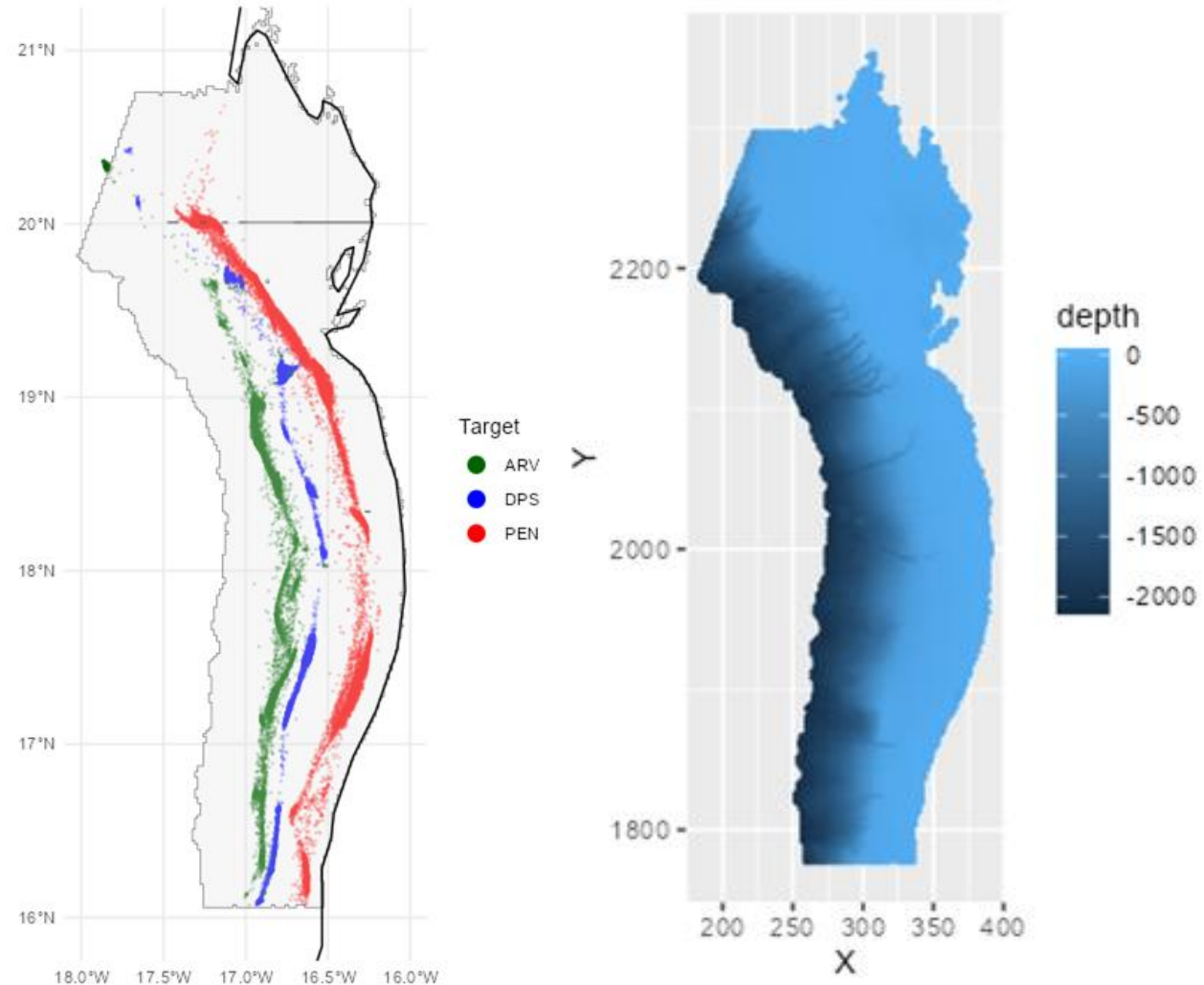
- ❑ Variations intrannuelle
- ❑ Variations interannuelle
- ❑ Tendance à la diminution sur les années récentes ?



Case study : Spanish trawlers targetting Mauritanian shrimps

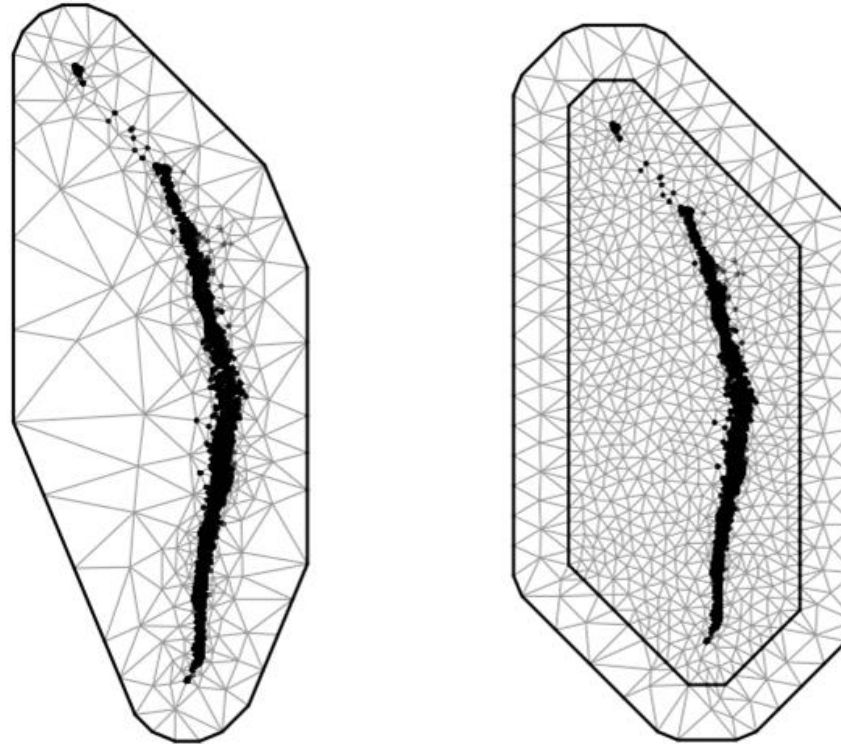
2. Data available

- Grille de prédiction
- Bathymétrie



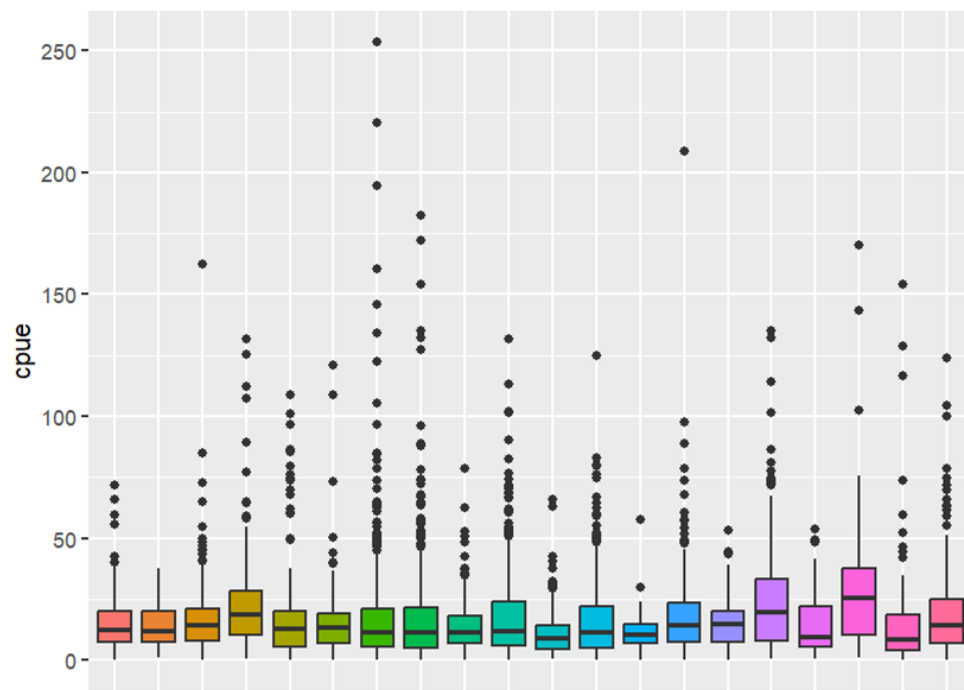
Case study : Spanish trawlers targeting Mauritanian shrimps

3. Préparation de la 'mesh'



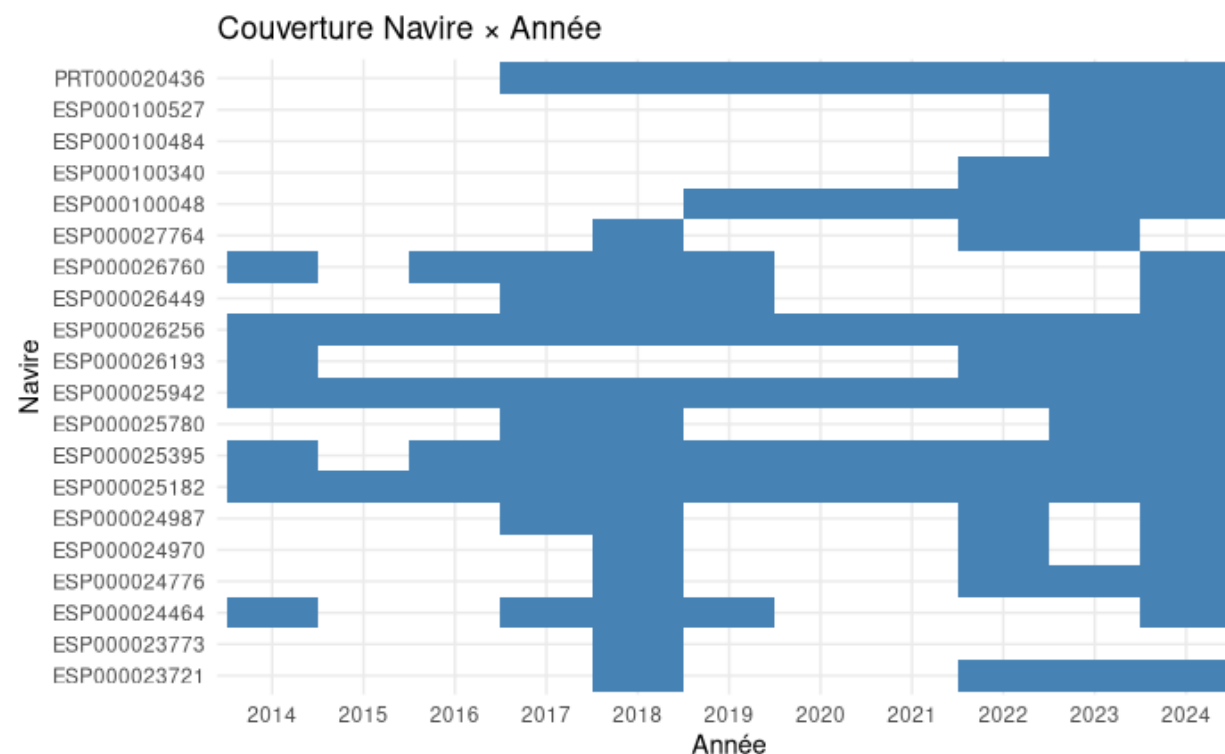
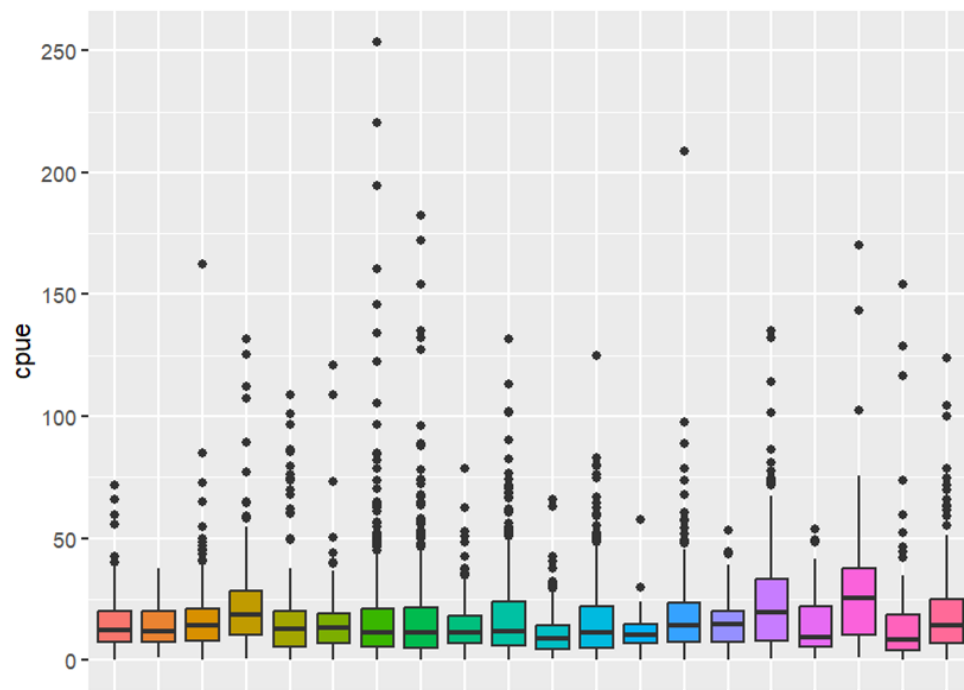
Case study : Spanish trawlers targetting Mauritanian shrimps

4. Sélection des co-variables



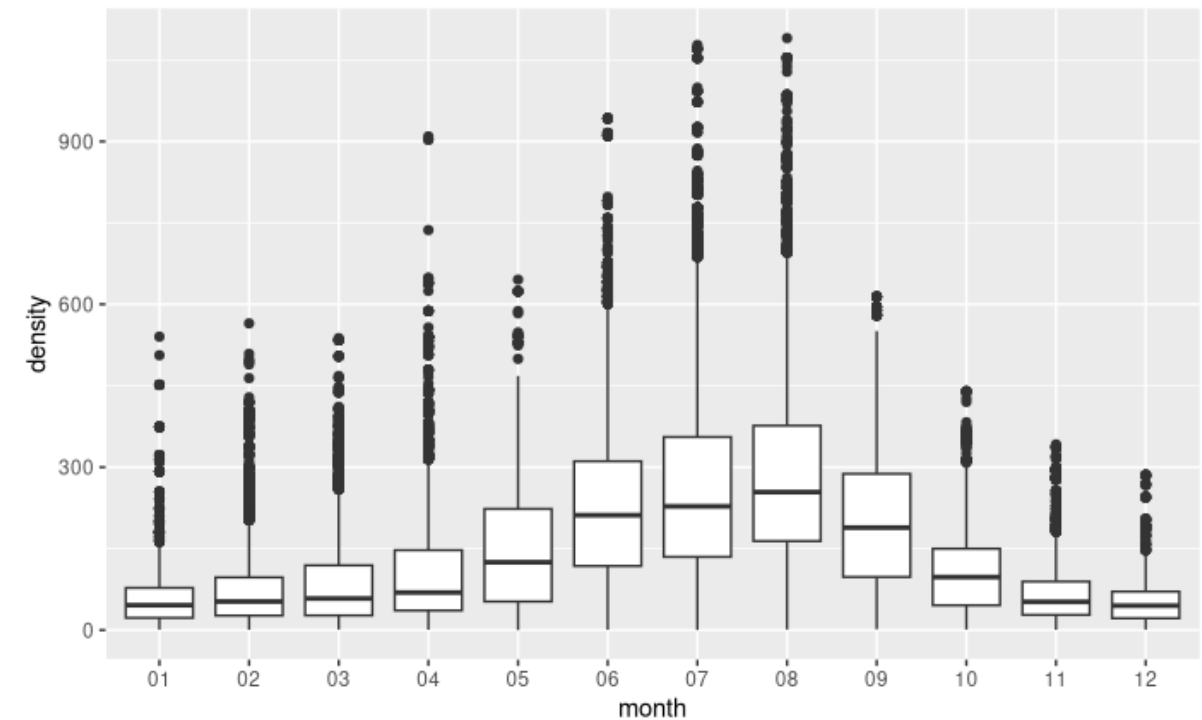
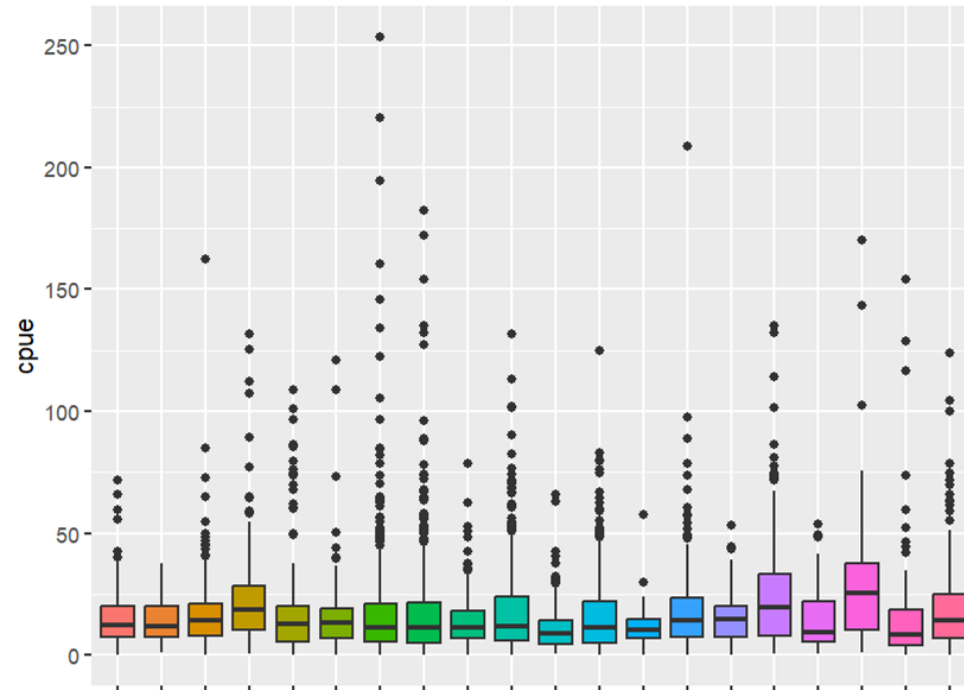
Case study : Spanish trawlers targetting Mauritanian shrimps

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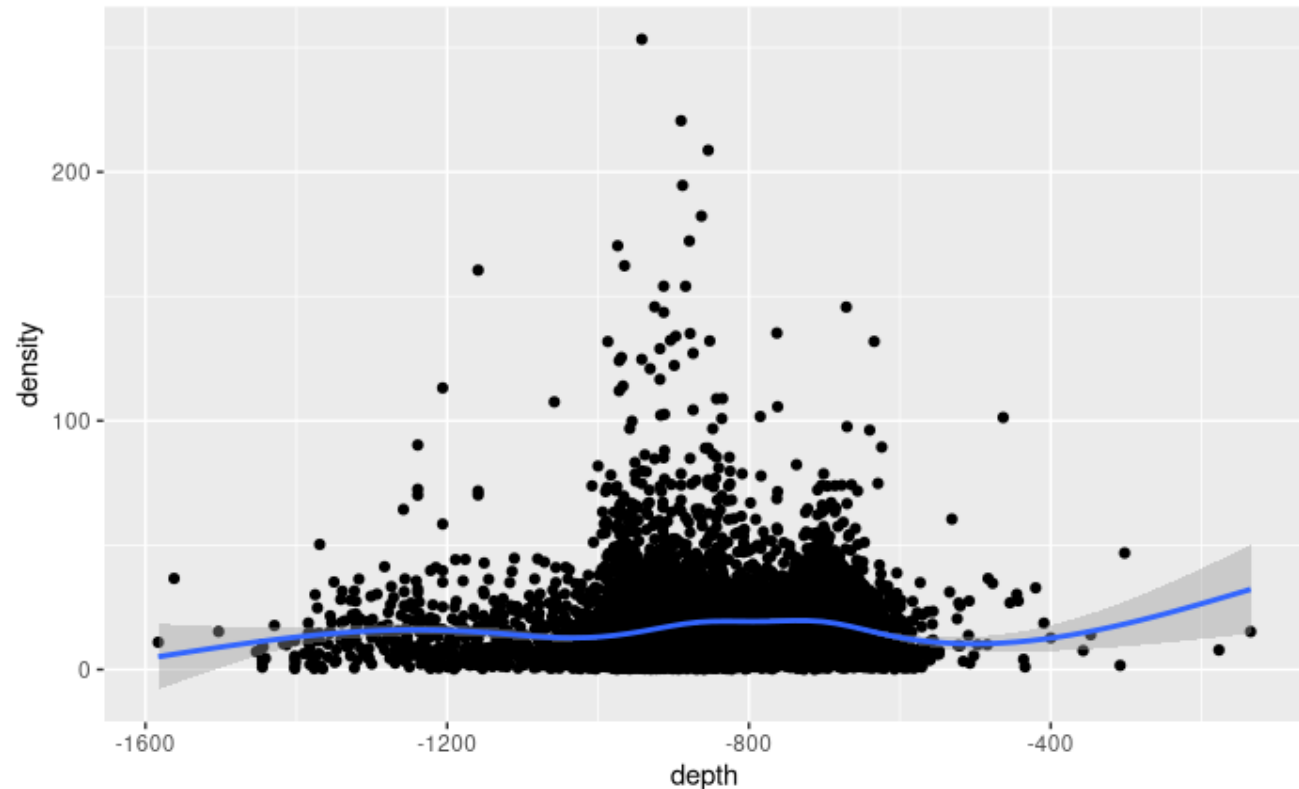
Case study : Spanish trawlers targetting Mauritanian shrimps

4. Sélection des co-variables



Case study : Spanish trawlers targetting Mauritanian shrimps

4. Sélection des co-variables

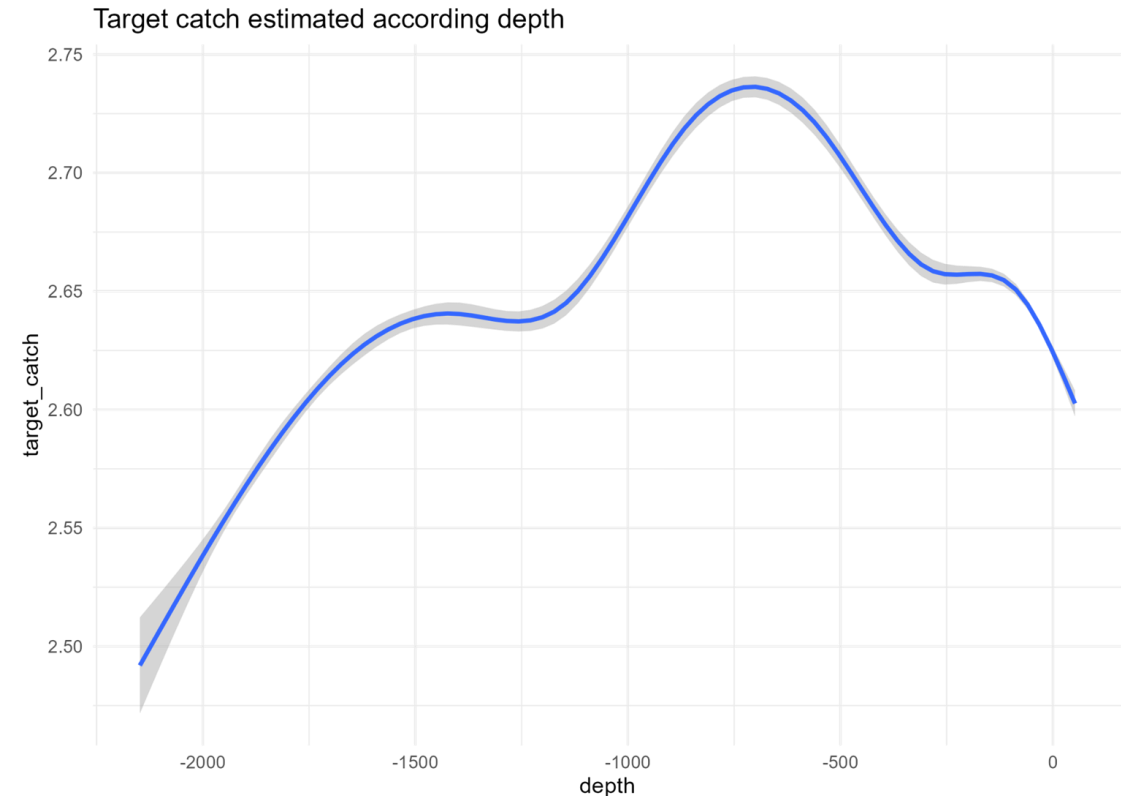


Case study : Spanish trawlers targetting Mauritanian shrimps

4. Sélection des co-variables

L'effet de la bathymétrie n'est pas correctement modélisée in fine :
Attendue = [-1000m ; -400m]

- ❓ Problématiques liées à la fixation des centroïdes ?
- ❓ Résolution de grille de bathymétrie ?
- ❓ Manque de zéros ?

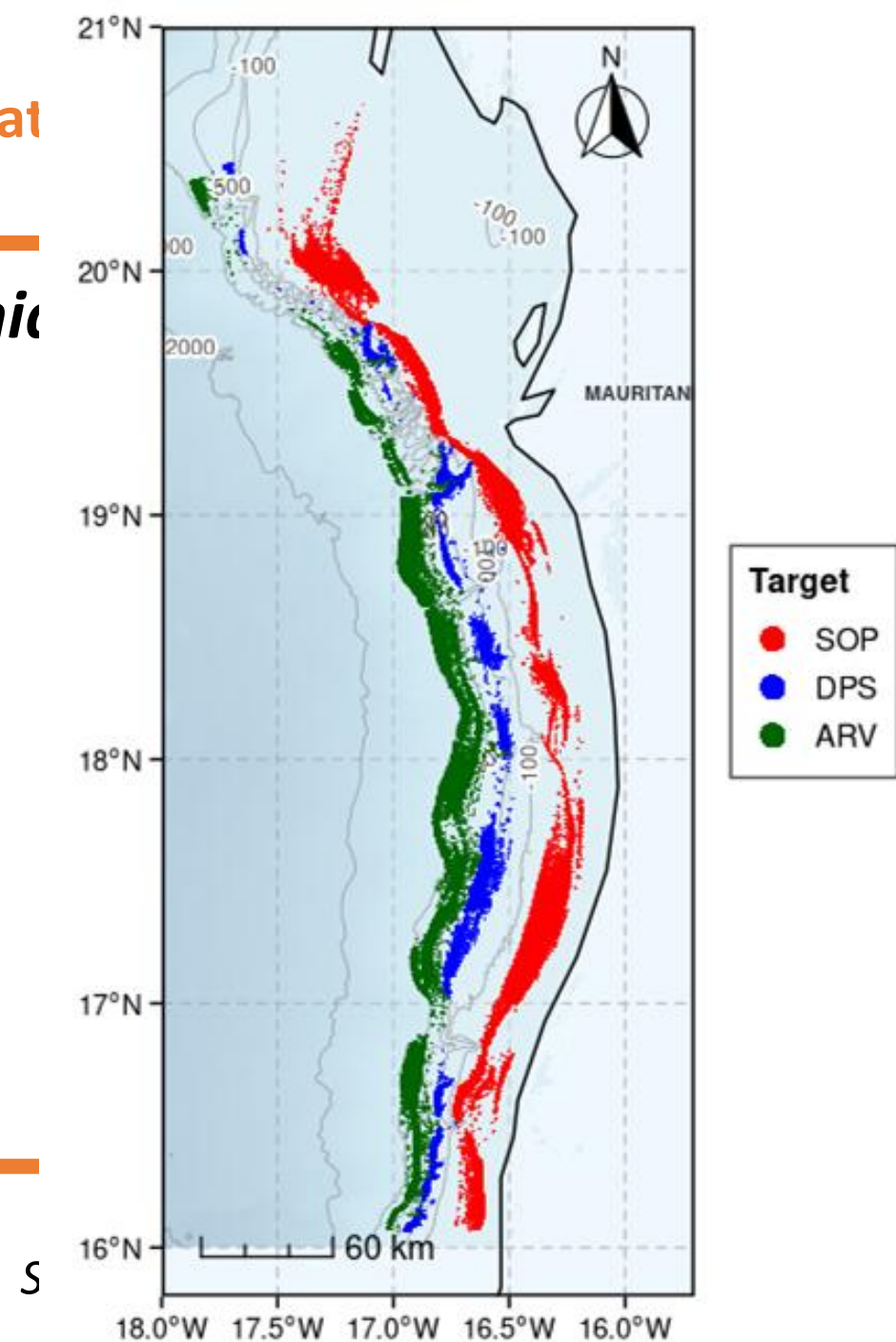


WP 4: Fishing effort characterization and CPUE standardization

Case study : Spanish trawlers targetting Mauritanian

1. Hypothèses de bases

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- ~~VMS Centroid~~ ? **ping VMS**
(36 000 obs => 380 000 obs)
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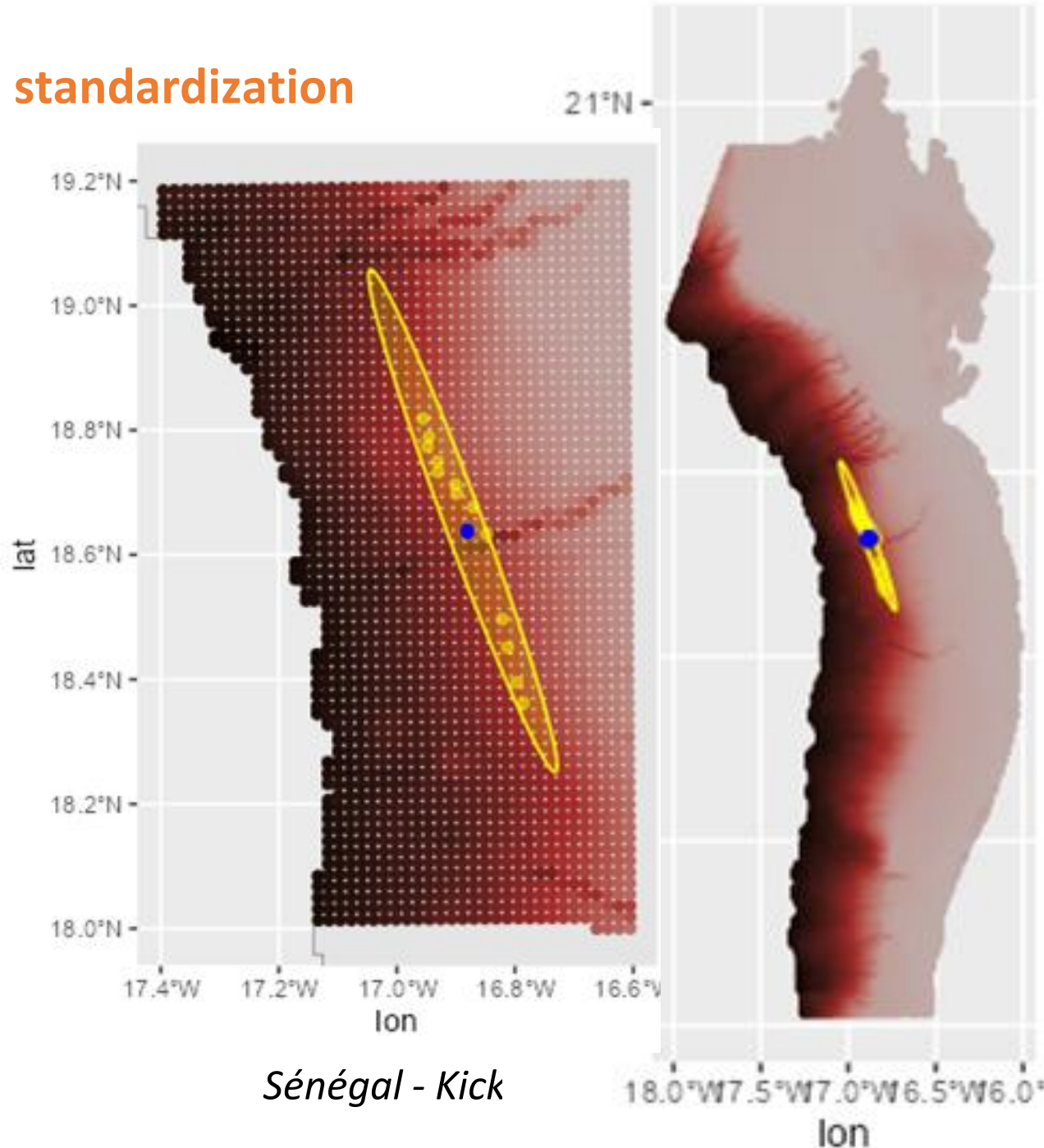


WP 4: Fishing effort characterization and CPUE standardization

Case study : Spanish trawlers targetting

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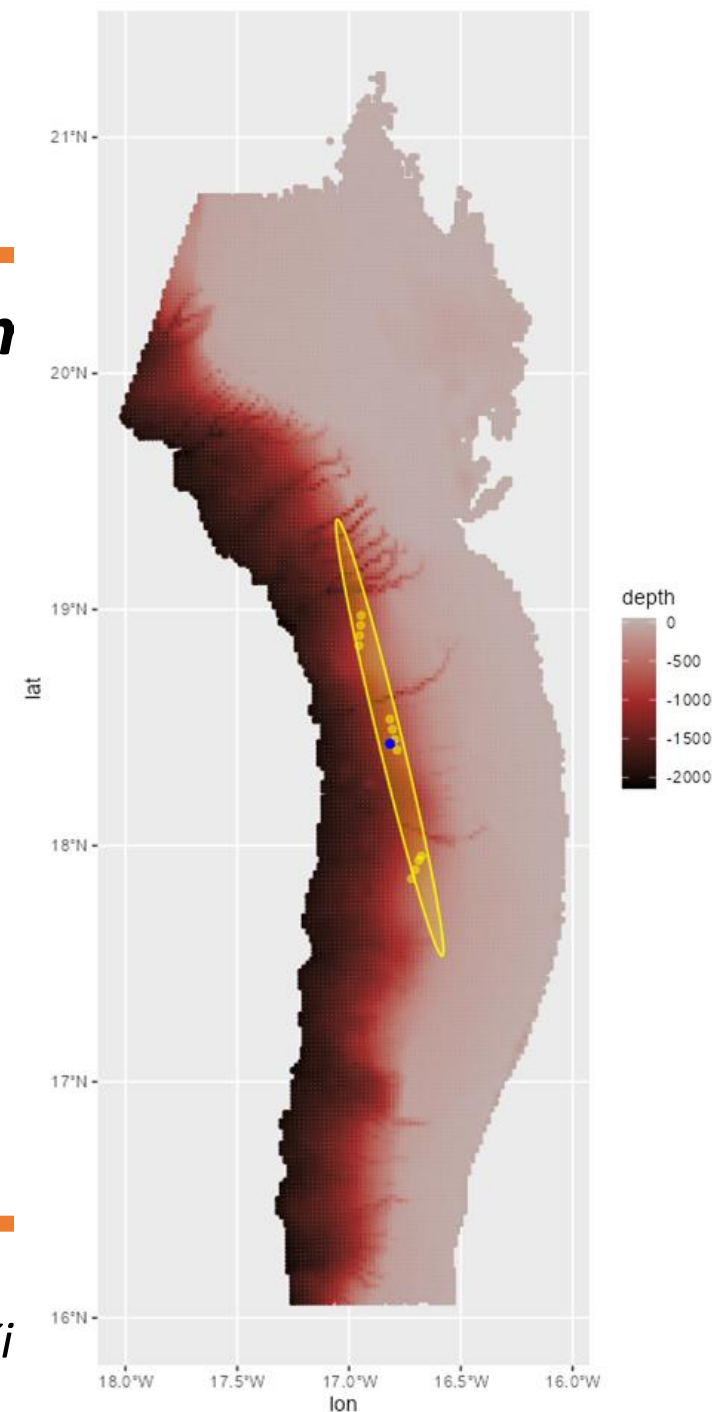


WP 4: Fishing effort characterization and CPUE standardization

Case study : Spanish trawlers targetting Mauritanian shrin

1. Hypothèses de bases

- ❓ Les activités de pêche durant une journée peuvent être très éloignées spatialement



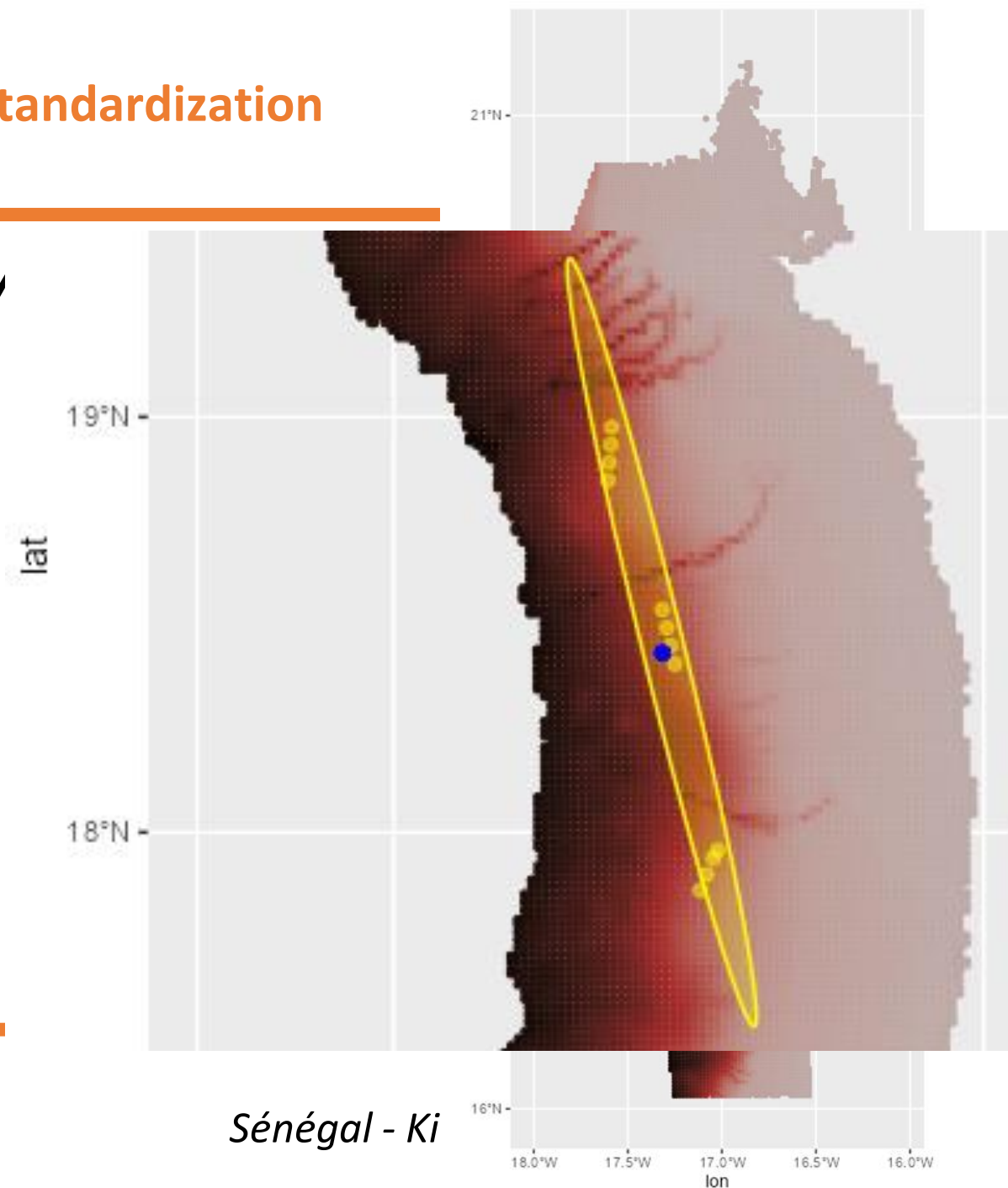
Sénégal - Ki

WP 4: Fishing effort characterization and CPUE standardization

Case study : Spanish trawlers targetting N

1. Hypothèses de bases

- ❓ Les activités de pêche durant une journée peuvent être très éloignées spatialement
- ❓ Mauvaise assignation de la bathymétrie en conservant le centroïde
- ❓ Problème pour modèle spatial

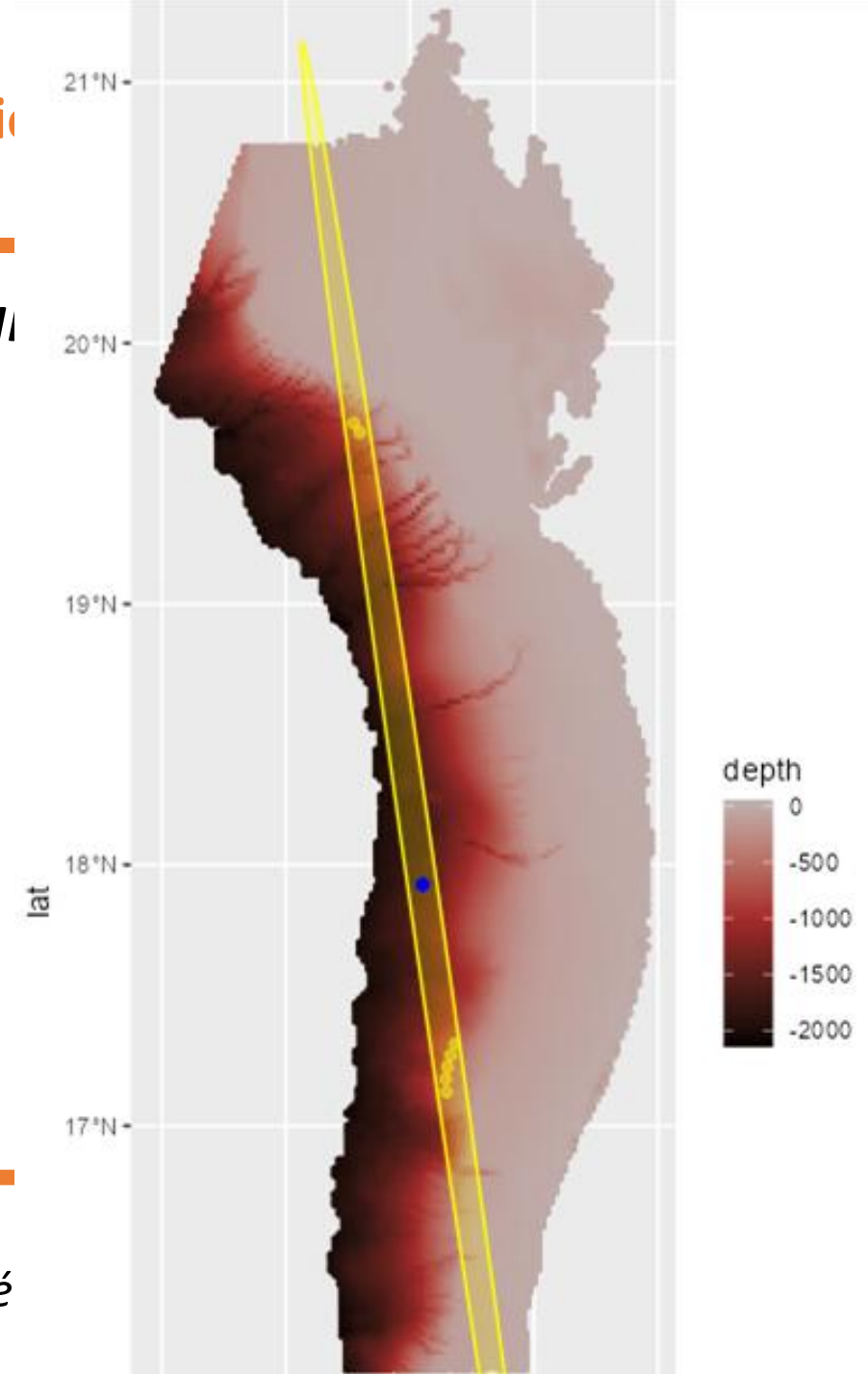


WP 4: Fishing effort characterization and CPUE standardization

Case study : Spanish trawlers targetting Mauritanian

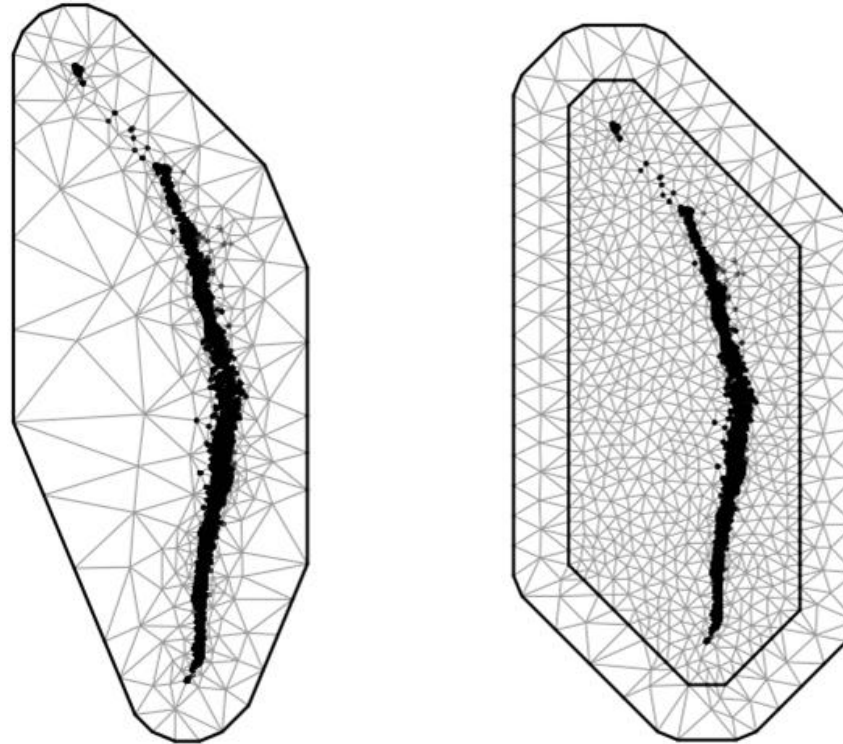
1. Hypothèses de bases

☐ autre exemple (plus évident)



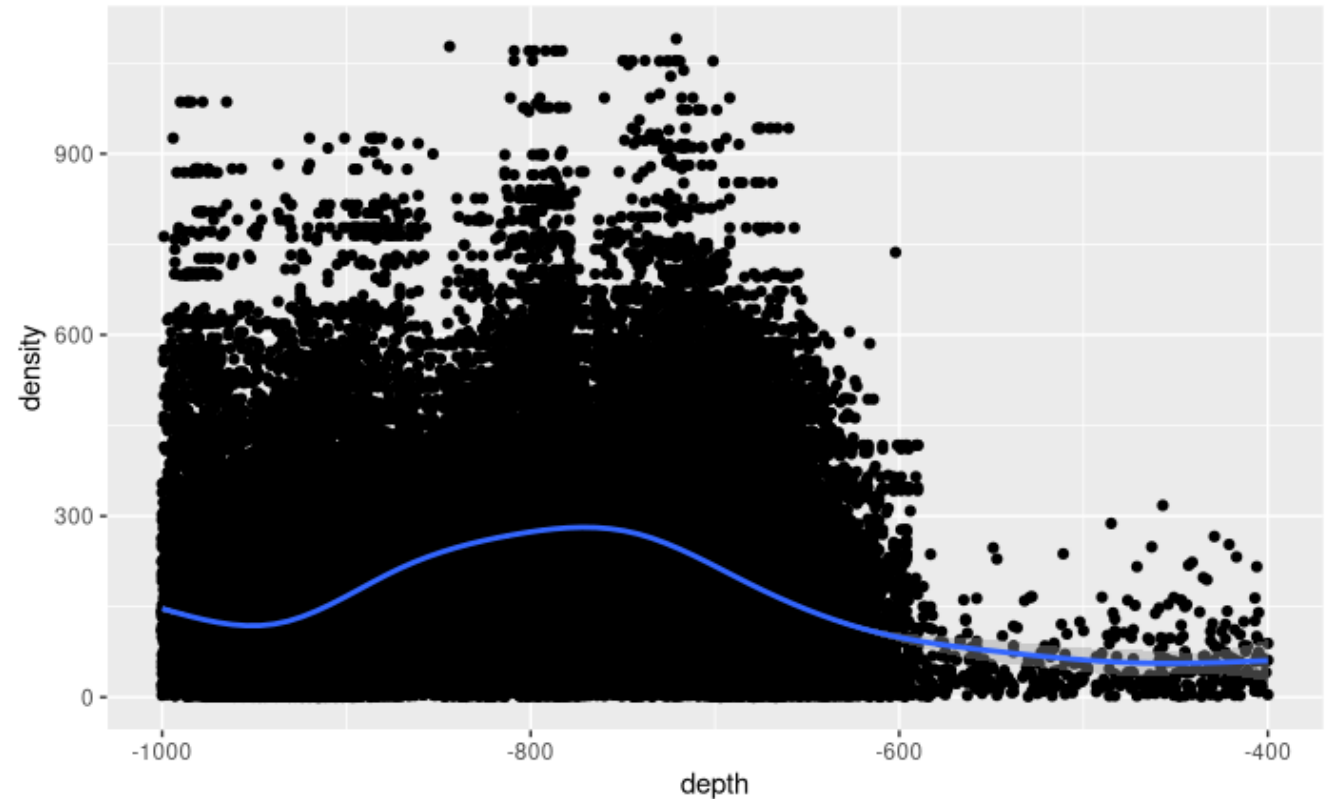
Case study : Spanish trawlers targetting Mauritanian shrimps

3bis. Préparation de la 'mesh'



Case study : Spanish trawlers targetting Mauritanian shrimps

4bis. Sélection des co-variables



Case study : Spanish trawlers targetting Mauritanian shrimps

5. Résultats préliminaires

```
Model_0 <- sdmTMB( data = data_model,  
formula = response ~ 0 + as.factor(year) + (1 | VE_REF) + s(depth, k = 5),  
offset = log(data_model$predicted_eff),  
time = "year",  
spatial = "off",  
spatiotemporal = "off",  
mesh = mesh,  
family = Gamma(link = "log"))
```

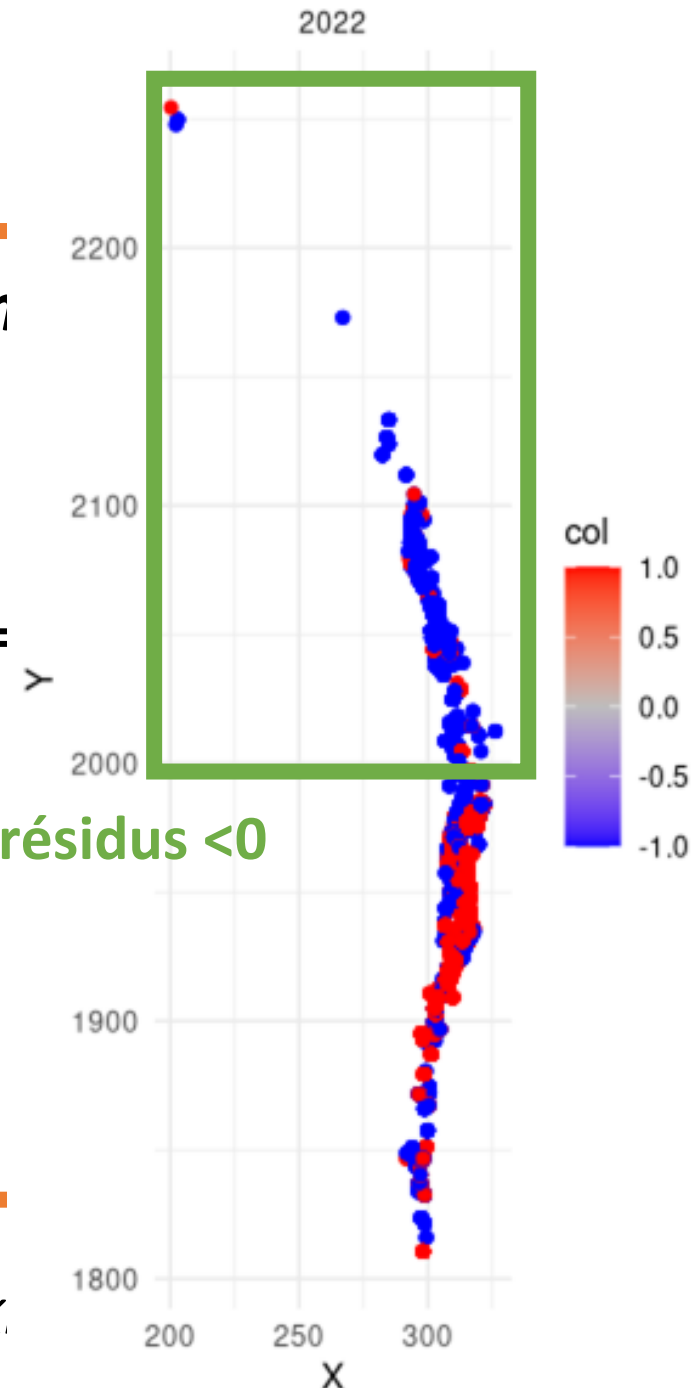
WP 4: Fishing effort characterization and CPUE standardization

Case study : Spanish trawlers targetting Mauritanian shrin

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```
Model_0 <- sdmTMB( data = data_model,  
formula = response ~ 0 + as.factor(year) + (1|VE_REF) + s(depth, k =  
offset = log(data_model$predicted_eff),  
time = "year",  
spatial = "off",  
spatiotemporal = "off",  
mesh = mesh,  
family = Gamma(link = "log"))
```

80 % résidus <0

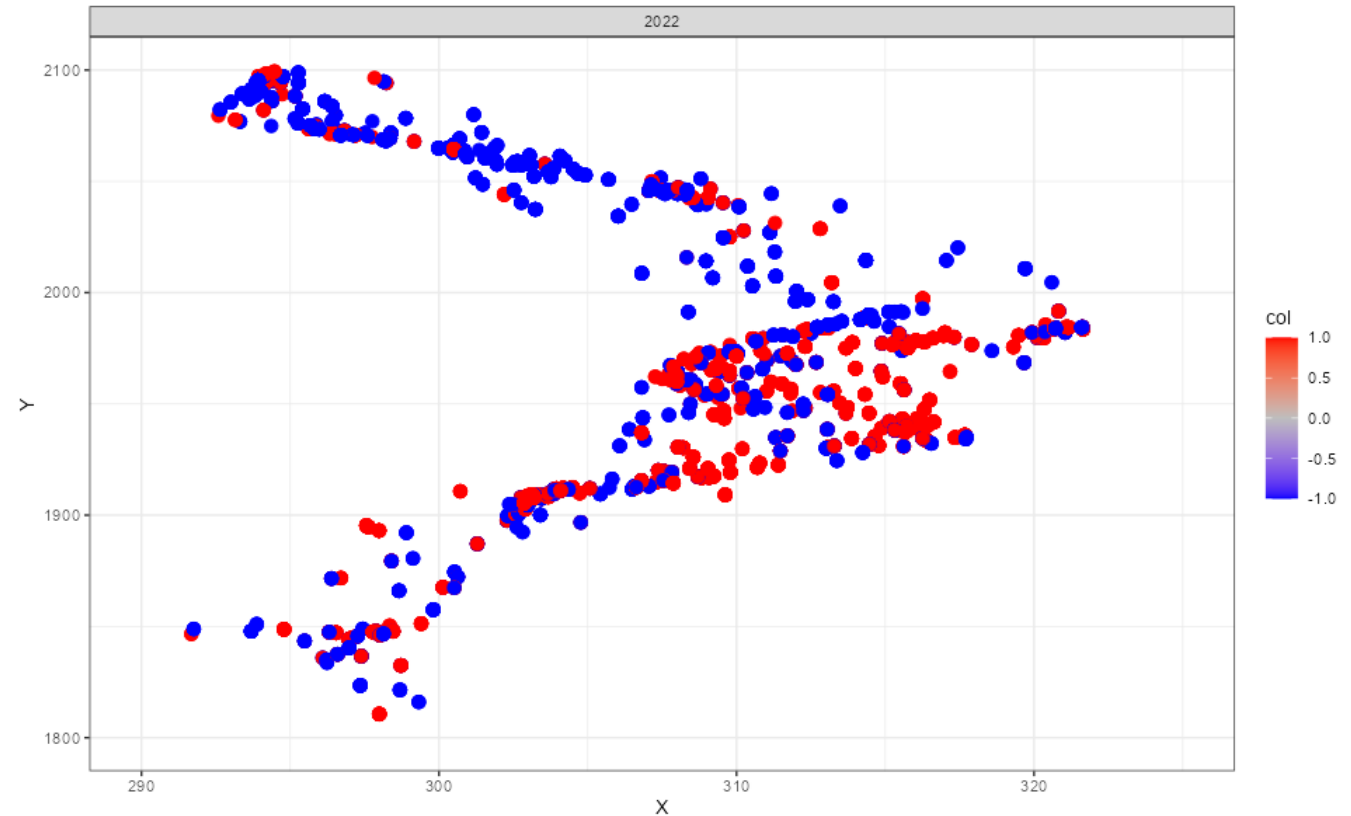


Case study : Spanish trawlers targetting Mauritanian shrimps

5. Résultats préliminaires

Model_0

AIC = 713 000

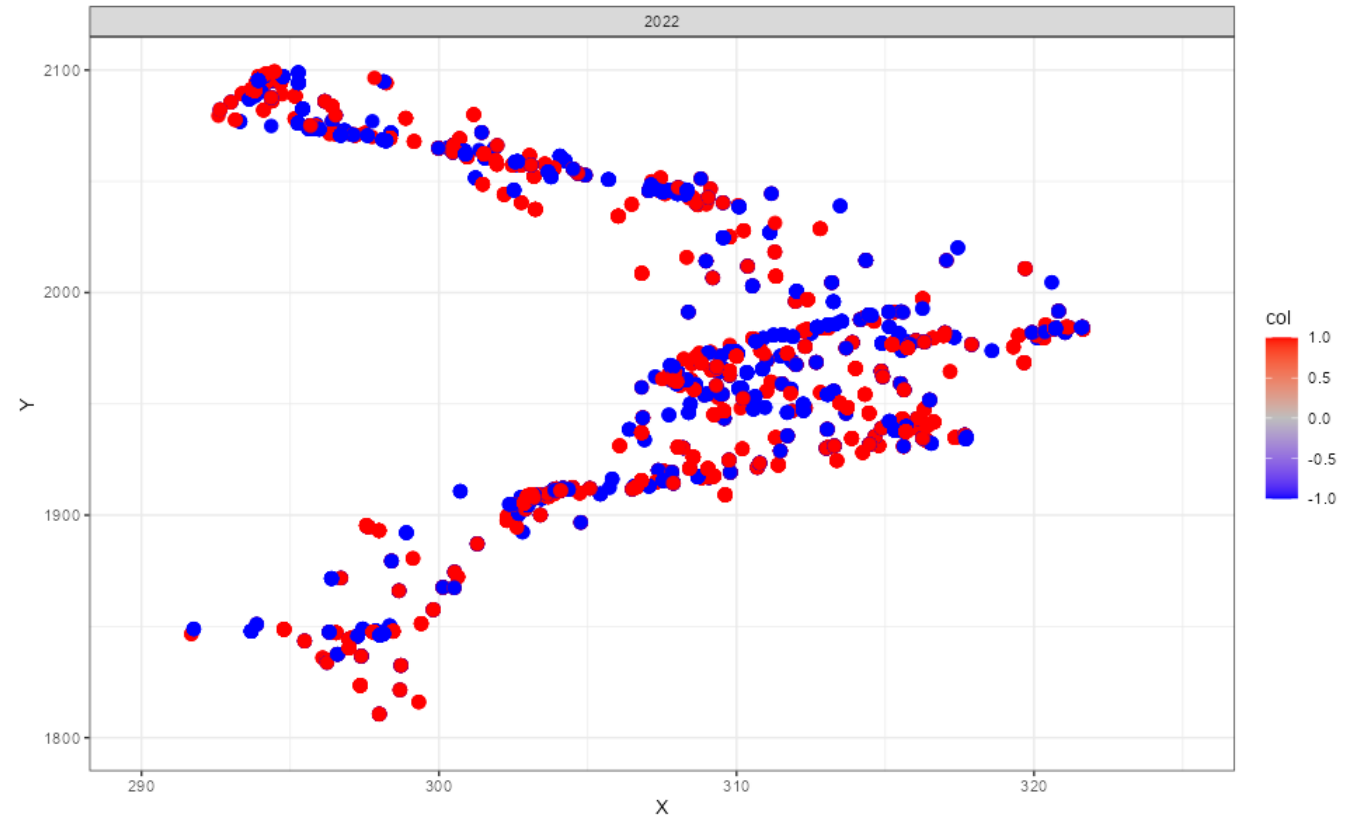


Case study : Spanish trawlers targetting Mauritanian shrimps

5. Résultats préliminaires

Model_1
spatial = "on",
spatiotemporal = "on"

AIC = 647 000



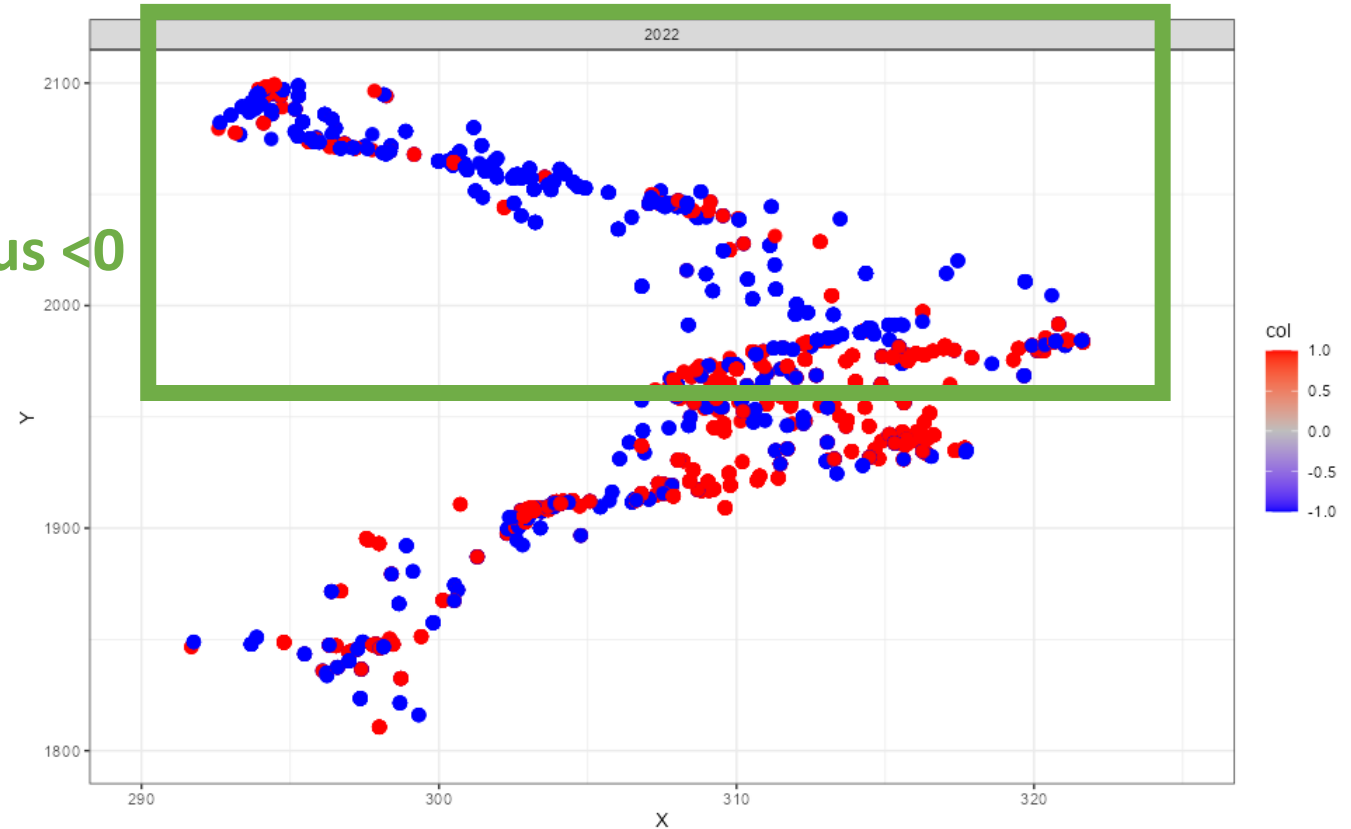
Case study : Spanish trawlers targetting Mauritanian shrimps

5. Résultats préliminaires

Model_0

AIC = 713 000

80 % résidus < 0



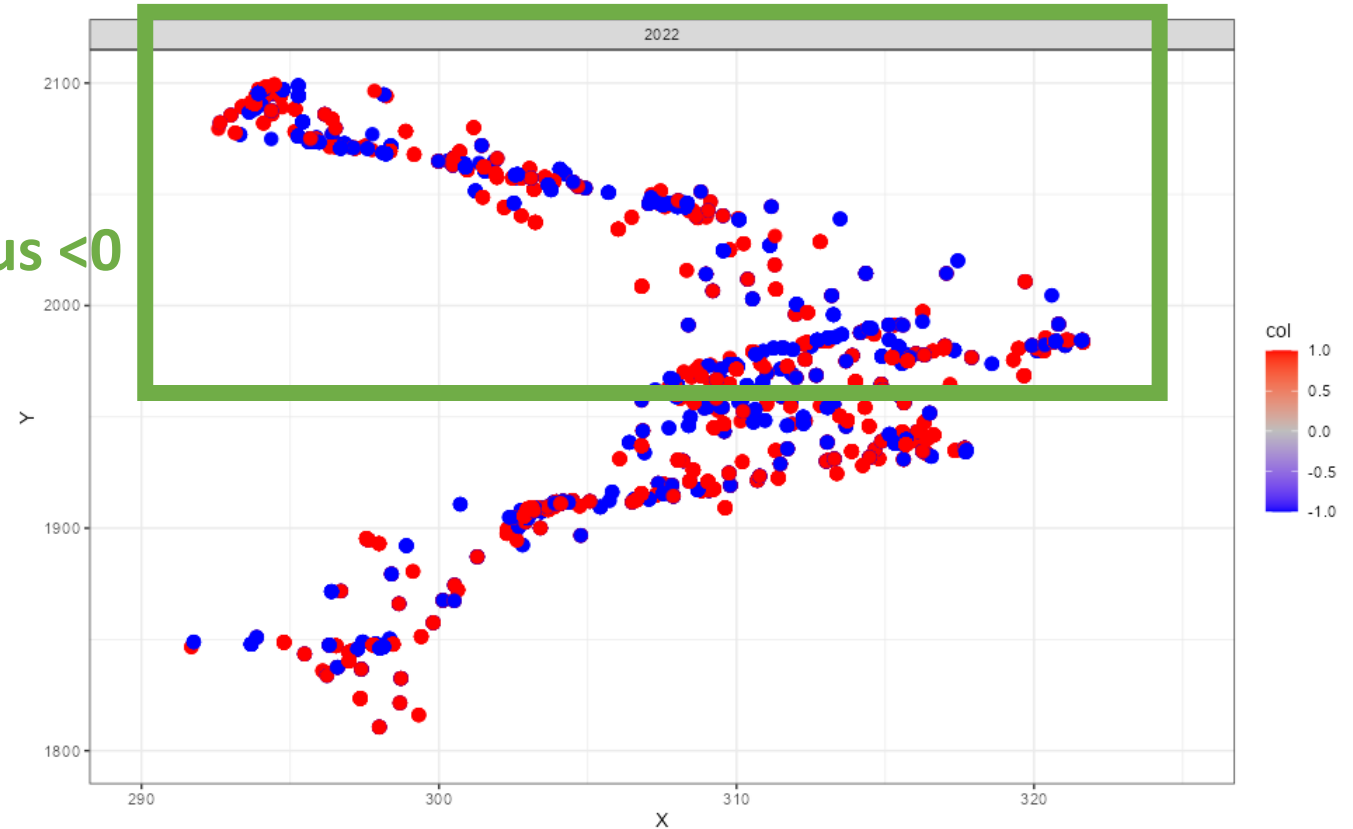
Case study : Spanish trawlers targetting Mauritanian shrimps

5. Résultats préliminaires

Model_1

AIC = 647 000

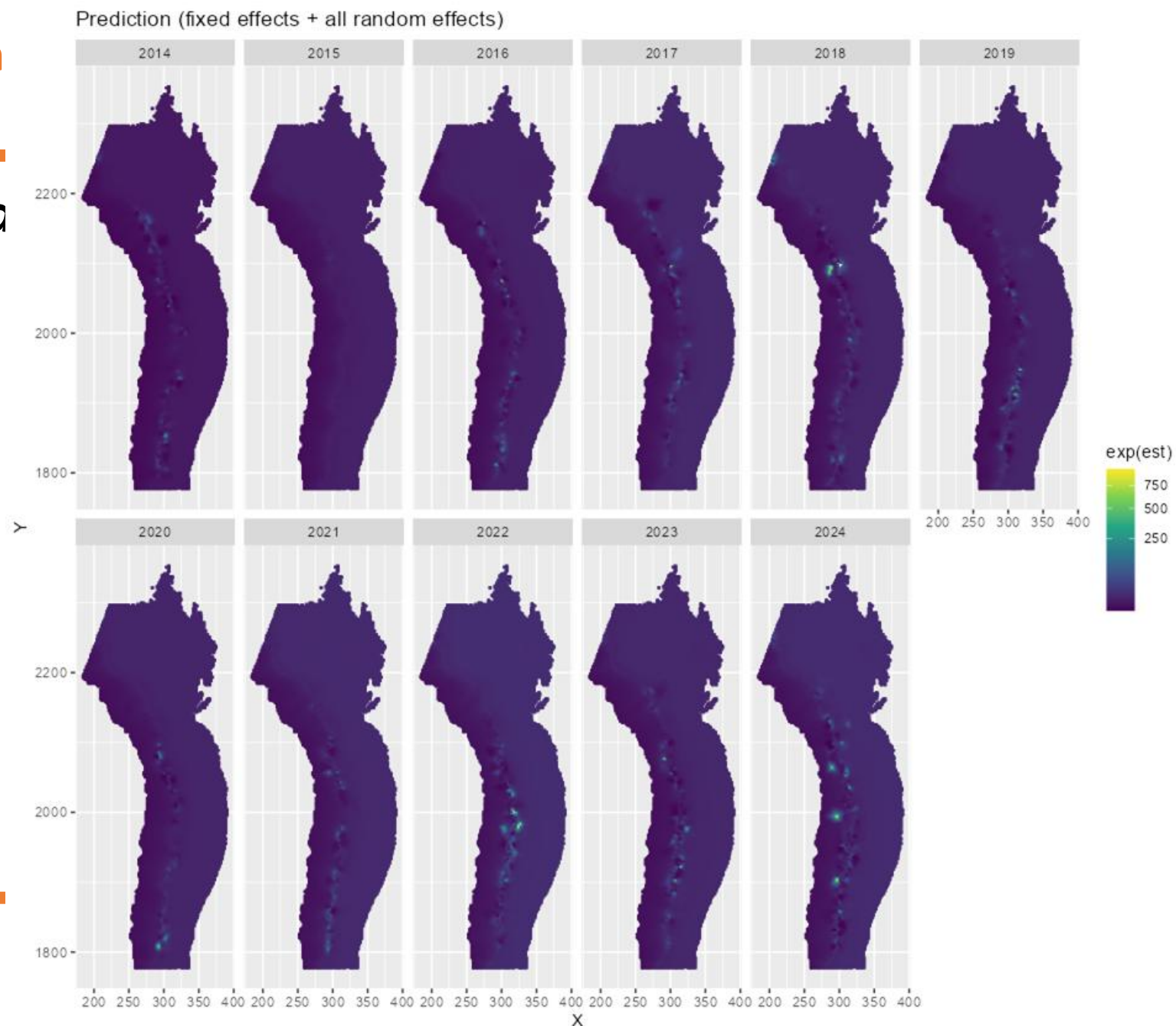
50 % résidus < 0



WP 4: Fishing effort characterization

Case study : Spanish trawlers to

5. Résultats préliminaires



Merci de votre attention !