



# IMPALHA

IMPACTO DEL PALANGRE EN LOS  
HÁBITATS MARINOS BENTÓNICOS



# IDENTIFICATION OF LONGLINE FISHING GROUNDS USING MACHINE LEARNING FOR BENTHIC HABITAT IMPACT ASSESMENT.

Daniel Cano



# SUMMARY

## 1 INTRODUCTION

- IMPALHA project.
- Study area.
- Longlines.

## 2 CHARACTERIZATION

- Importance of impact studies and fisheries.
- Fishing grounds identification and longlines soaking time.
- Data types.

## 3 MACHINE LEARNING

- Learning processes.
- Inputs / outputs.
- Types of models.
- Decision trees and random forest.

## 4 FIRST RESULTS

- Speed distribution.
- Relevance of selected variables.
- Predictions.
- Identified fishing grounds.

# 1

## INTRODUCTION



# IMPALHA PROJECT

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## IMPACT OF THE BOTTOM LONGLINE ON BENTHIC HABITATS IN THE SCIs OF THE NATURA 2000 NETWORK

Theme:

Protected areas.

Goals:

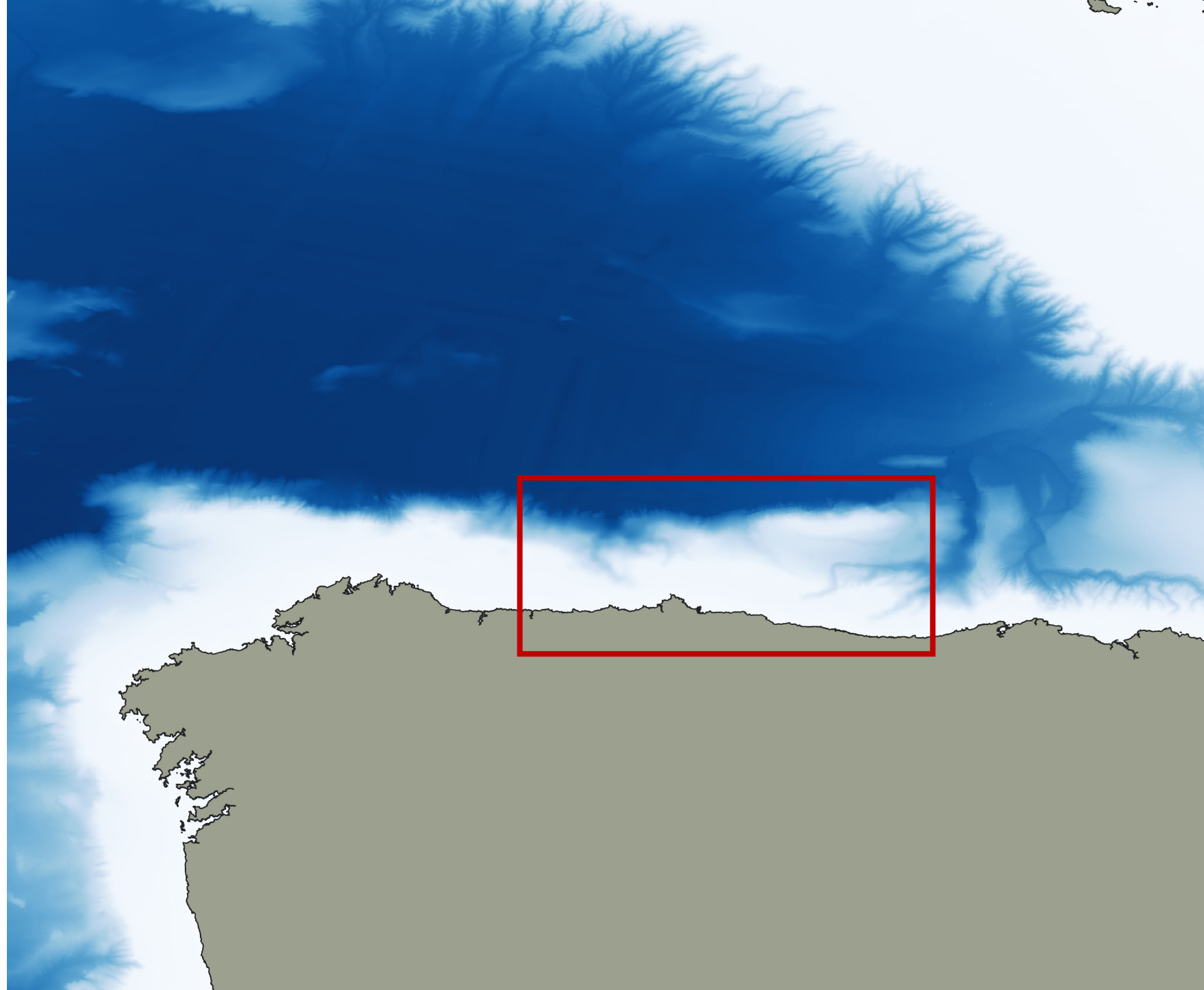
1. Spatio-temporal characterization of longline fishing in the Avilés Canyon SCI and interaction with benthic habitats.
2. Design of the BACI (Before-After-Control-Impact) Campaign, to be developed in the second phase of the project.
3. Communicate the results of the project and the main methodologies and concepts for the study of the impact of fishing activity on habitats and advice on its application.

# STUDY AREA

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## AVILES CANYON

The study area was expanded in order to increase the available data.

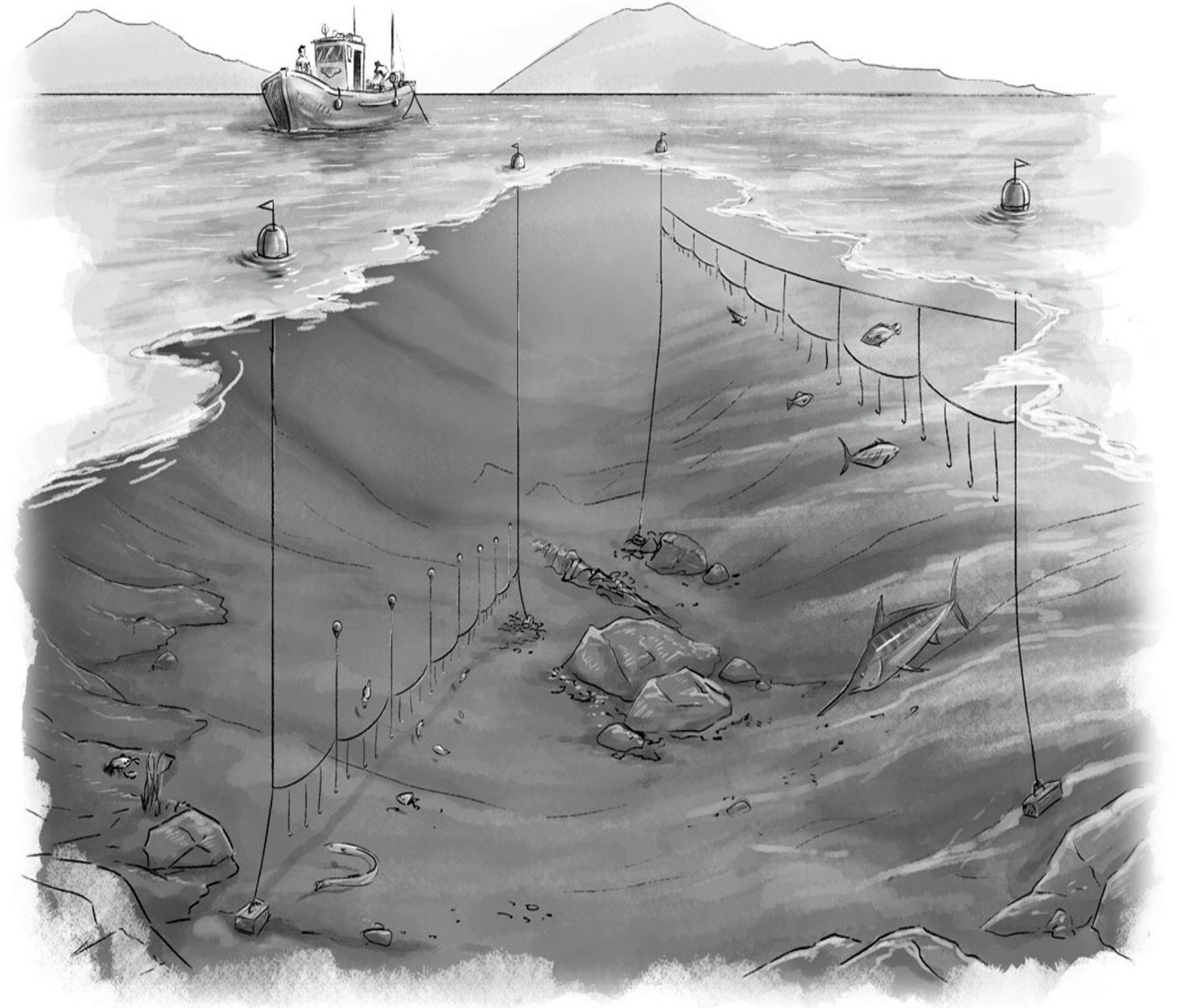


# LONGLINE FISHING

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## Description

- Line of hooks
- Variable length
- Two basic types
  - Surface
  - Bottom
- Selective gear



# 2

## CHARACTERIZATION

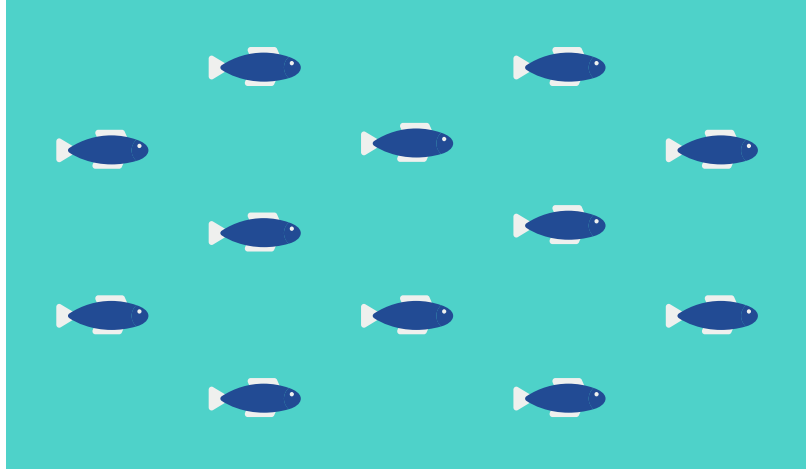
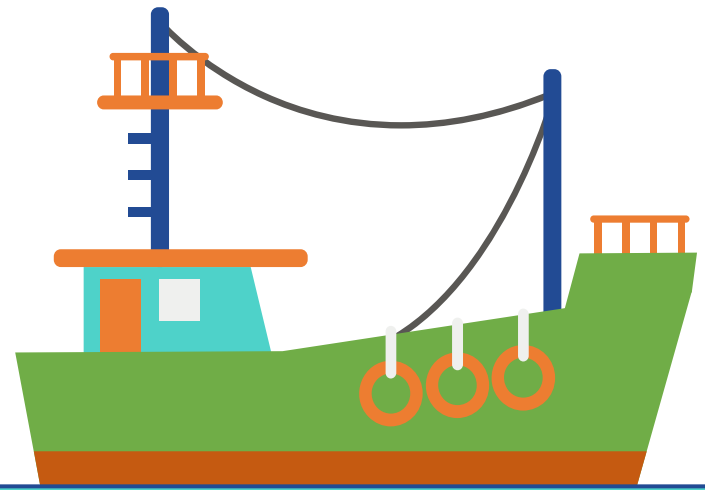
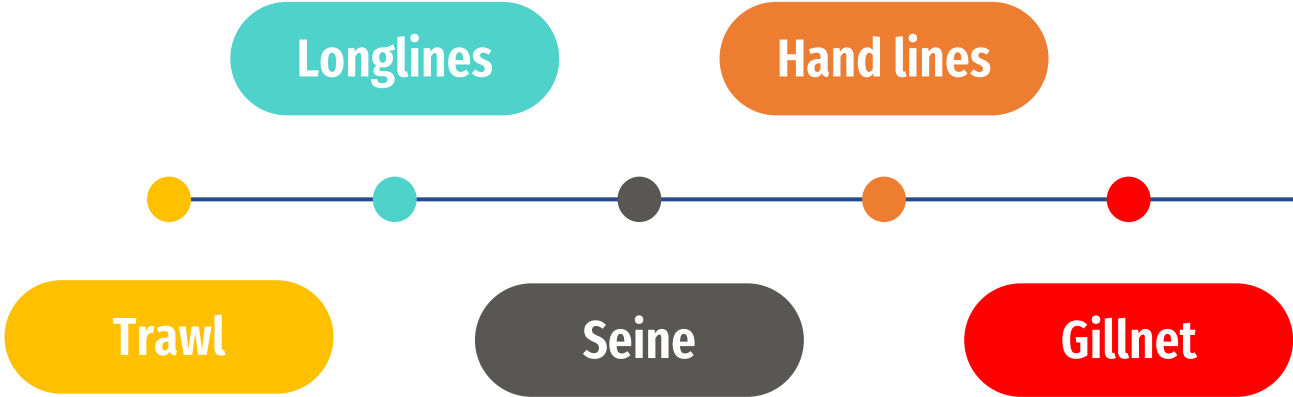


# IMPORTANCE OF IMPACT STUDIES AND FISHERIES

Quantify actual impacts

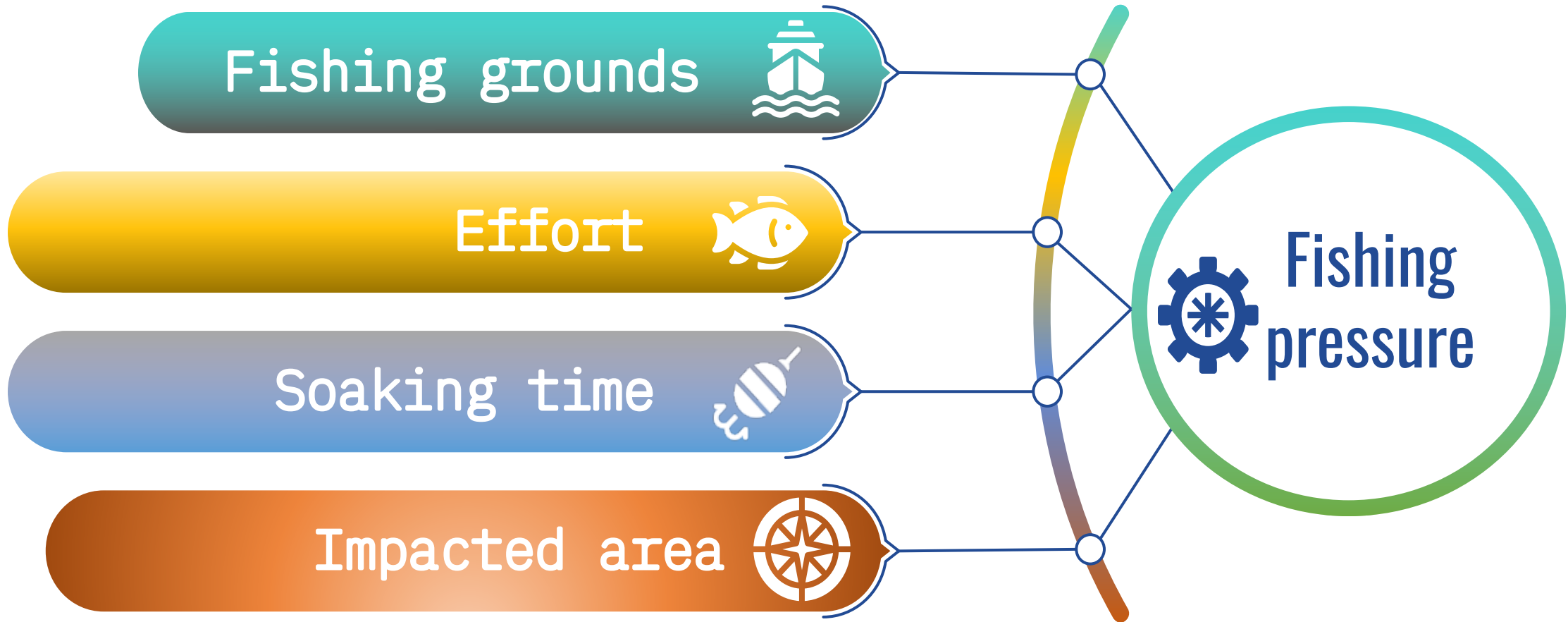
Identify its spatial extent

Mitigation





# FISHING GROUNDS IDENTIFICATION AND LONGLINES SOAKING TIME

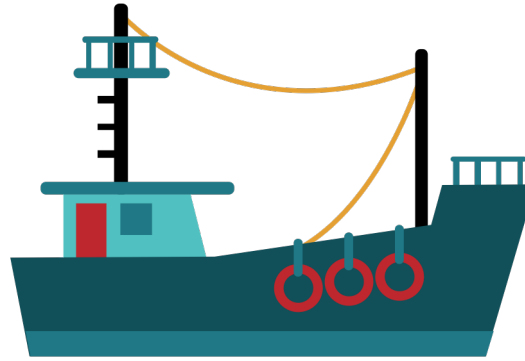


# DATA TYPES



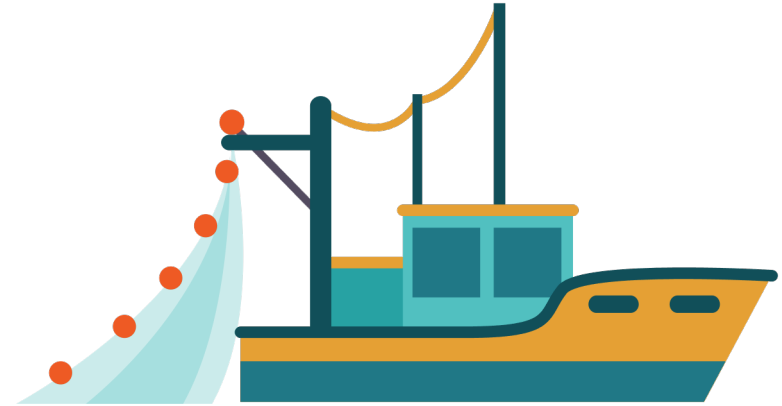
VMS

- Fishing vessels  $\geq 15\text{m}$
- Resolution  $\sim 2$  hours



AIS

- All vessels
- Variable resolution
  - Typically 3-5 minutes
- Yearly AIS  $\sim 400\text{M}$



GREEN BOXES

- Some fishing vessels
- GPS information

# 3

MACHINE LEARNING



# LEARNING PROCESS

## 01 Data collection

Different sources

## 02 Data curation

Filter, select, homogenization ...

## 03 AI training

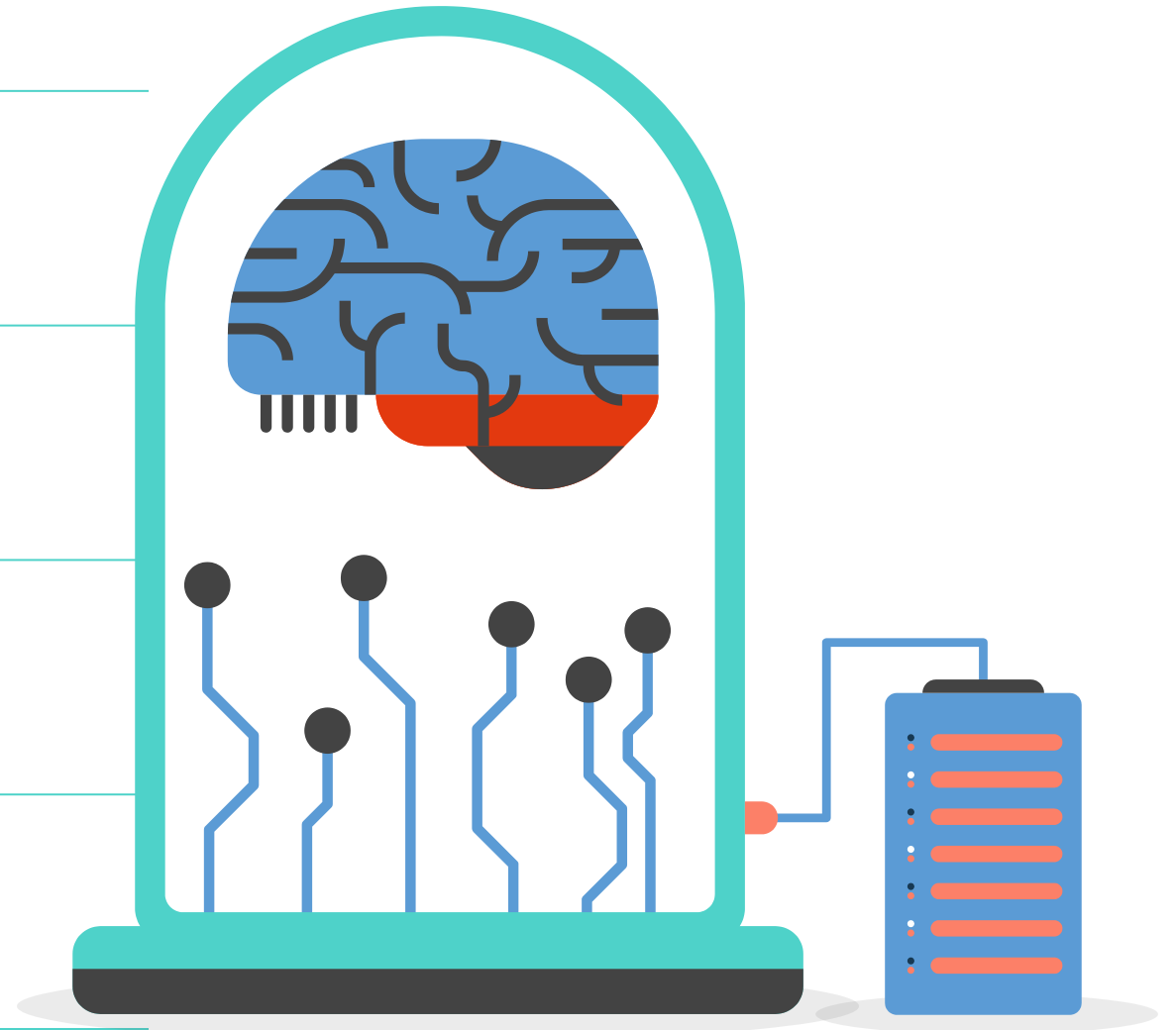
Relevant variable selection

## 04 AI evaluation

Sensitivity, specificity, errors ...

## 05 Improve

Continuous process



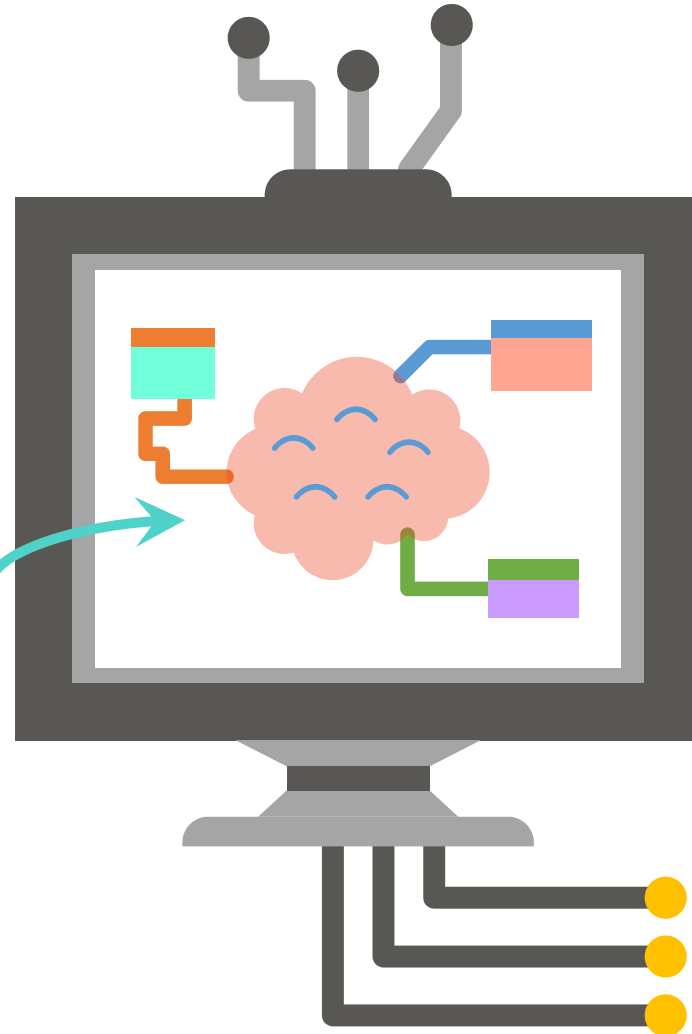
# INPUTS / OUTPUTS

## Inputs

Relevant variables

- Speed
- Day or night
- Arg. acceleration
- Date & time
- Turning angle
- Mod. acceleration
- Change rates

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## Outputs

Binary prediction

- Fishing / no Fishing

# MODEL TYPES

## USED MODELS

Artificial neural networks

Improvable results

Decision trees

Good results

Support-vector machines

Bad results

Random forest

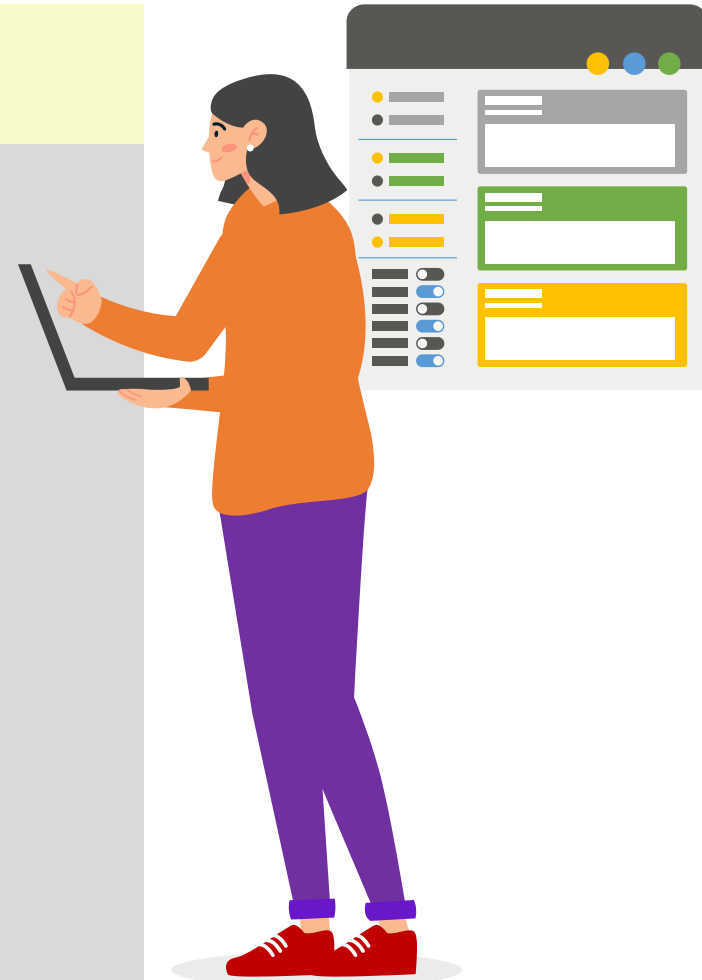
**Better results**

Bayesian networks

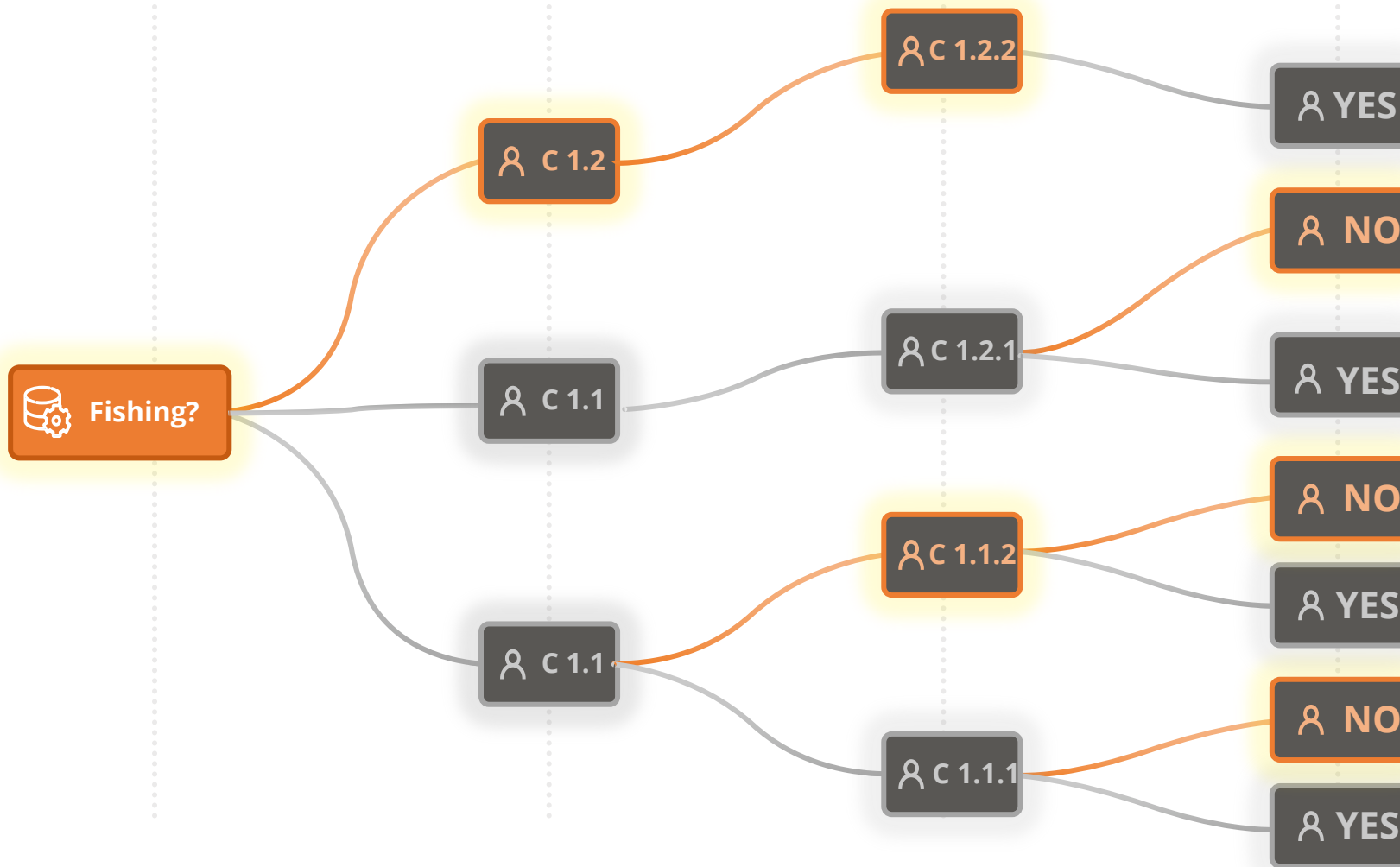
Improvable results

Genetic algorithms

Under development



# DECISION TREES AND RANDOM FOREST



Random forest: The decision tree "democratic" version

# 4

FIRST  
RESULTS



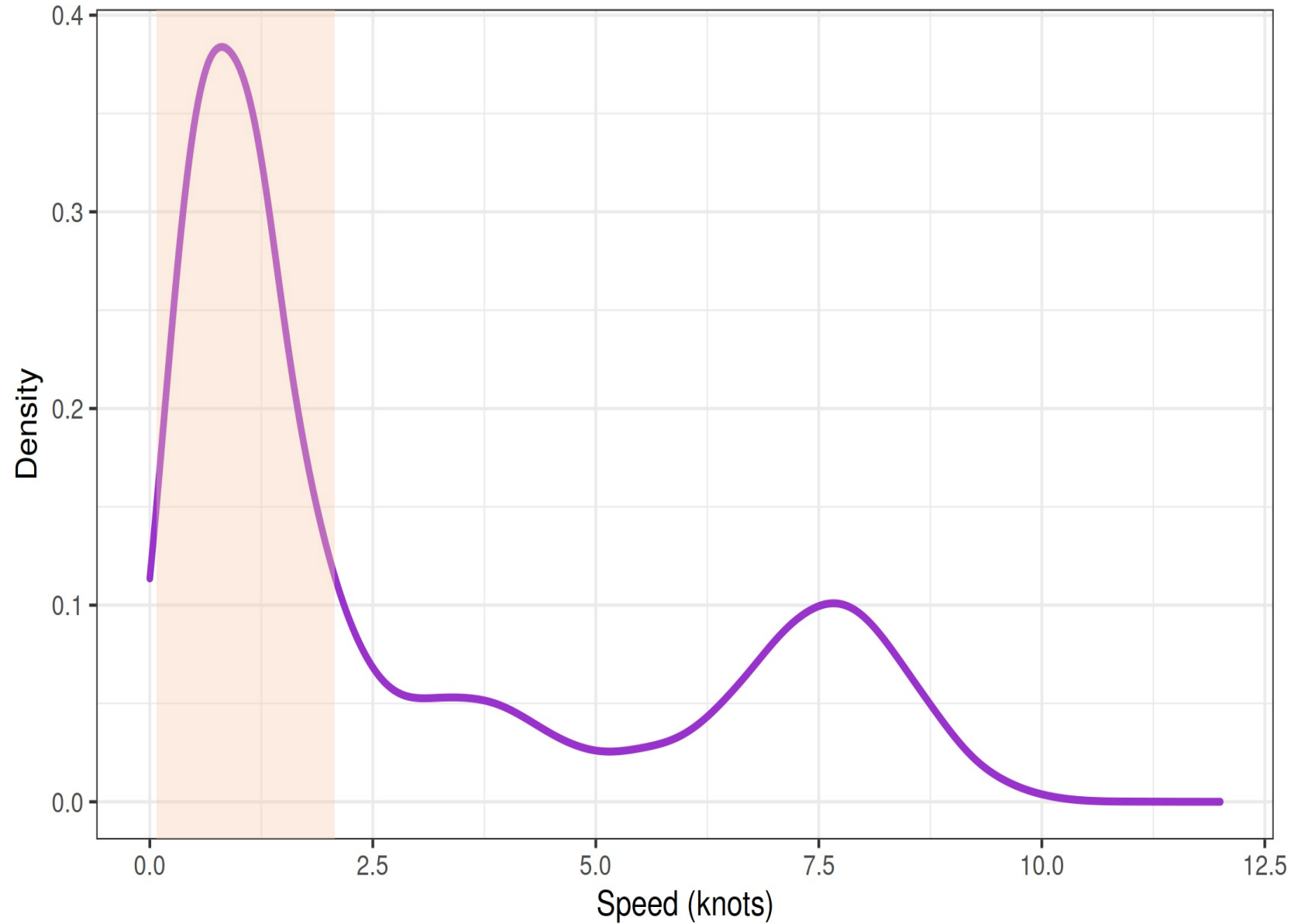


# SPEED DISTRIBUTION

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## Bimodal distribution

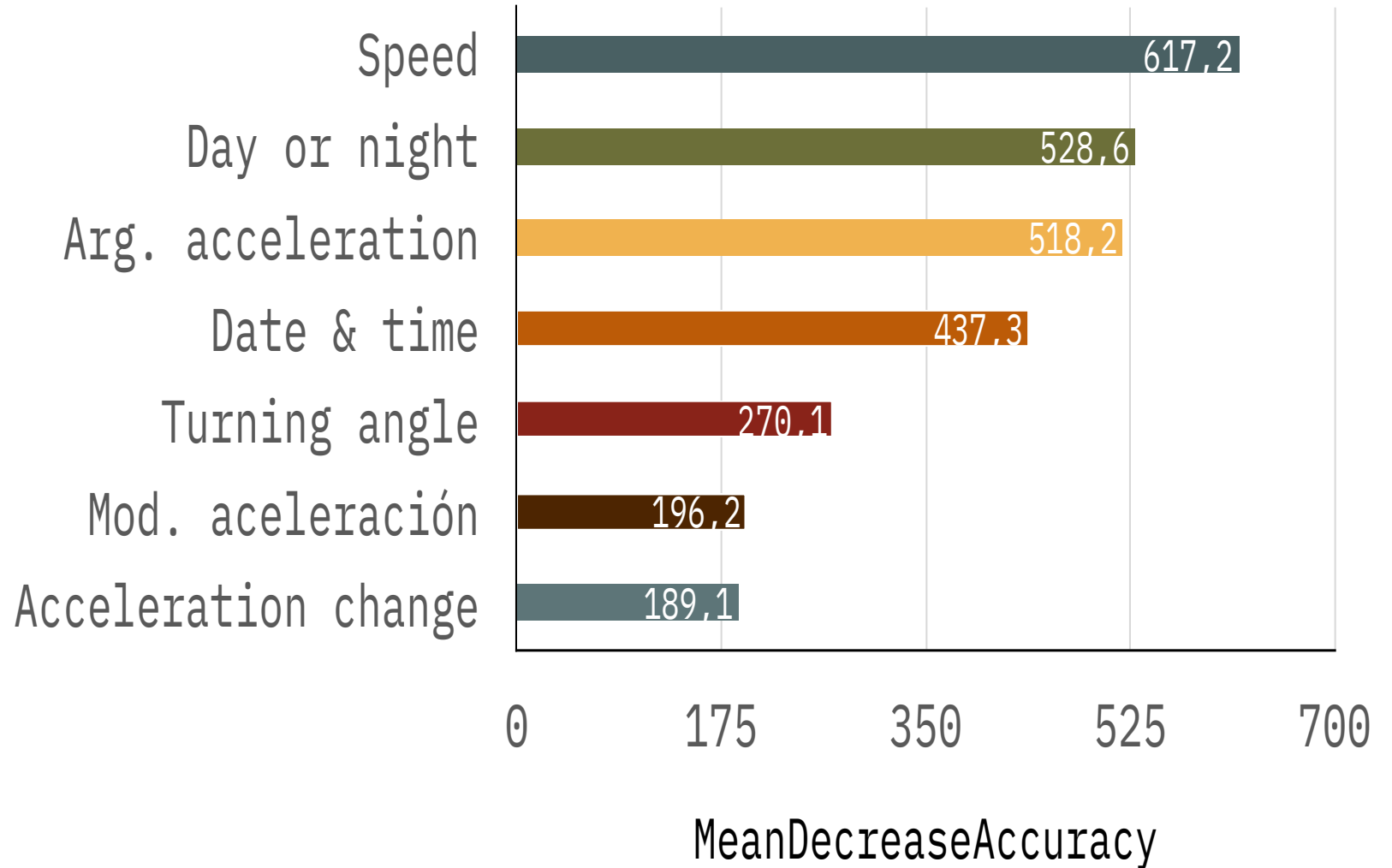
- First mode: High peak for fishing speeds
- Second mode: Sailing speeds.



# RELEVANCE OF SELECTED VARIABLES

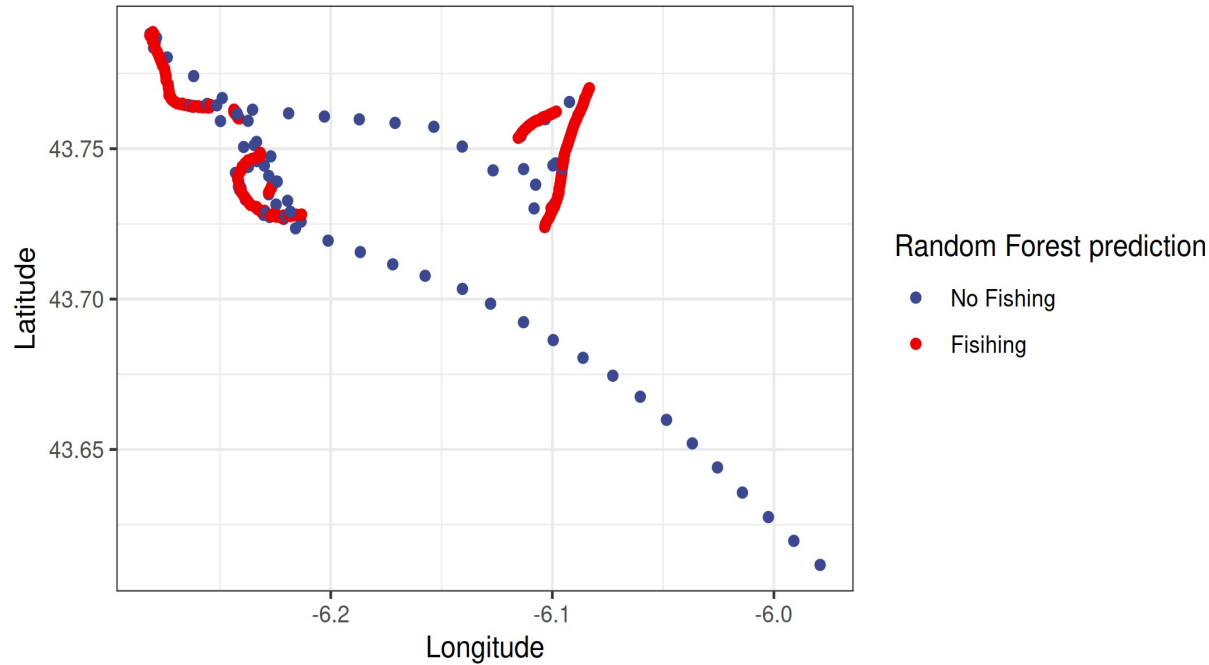
## Direct impact over prediction accuracy

- Each variable has a different impact on the accuracy of the model.
- Variable selection is delicate and very iterative.
- Most relevant variables related to speed and date.



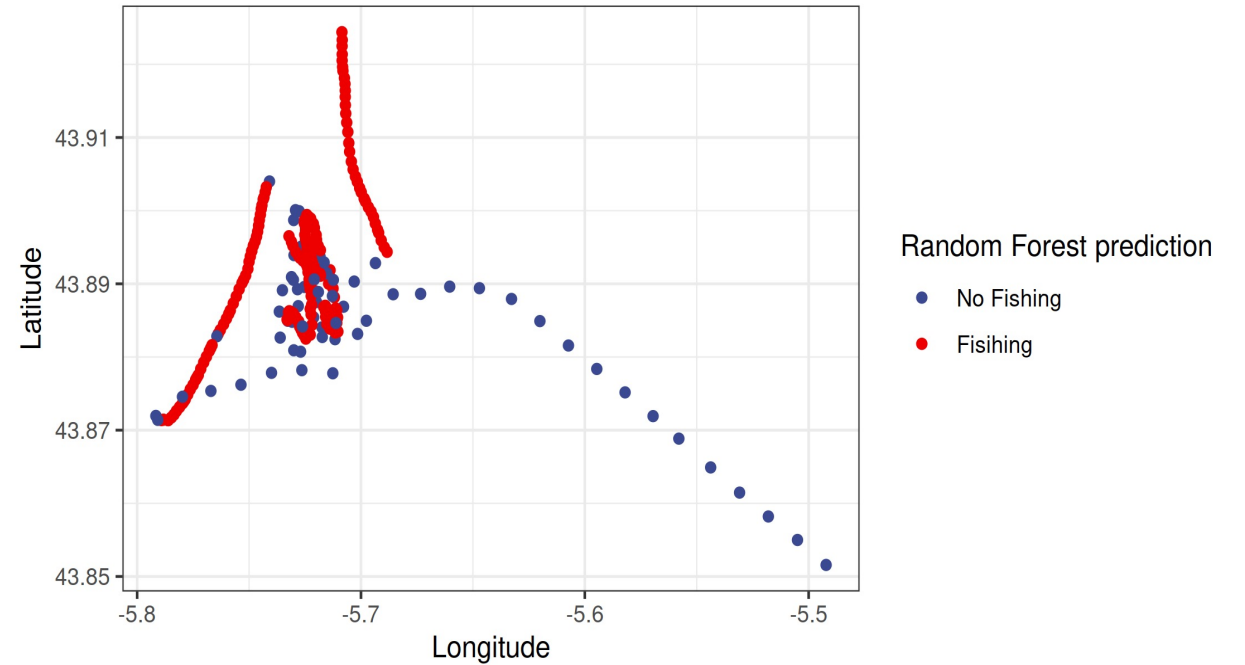
# PREDICTIONS

Fishing trip with identified fishing events  
Random Forest prediction



Source: AIS data

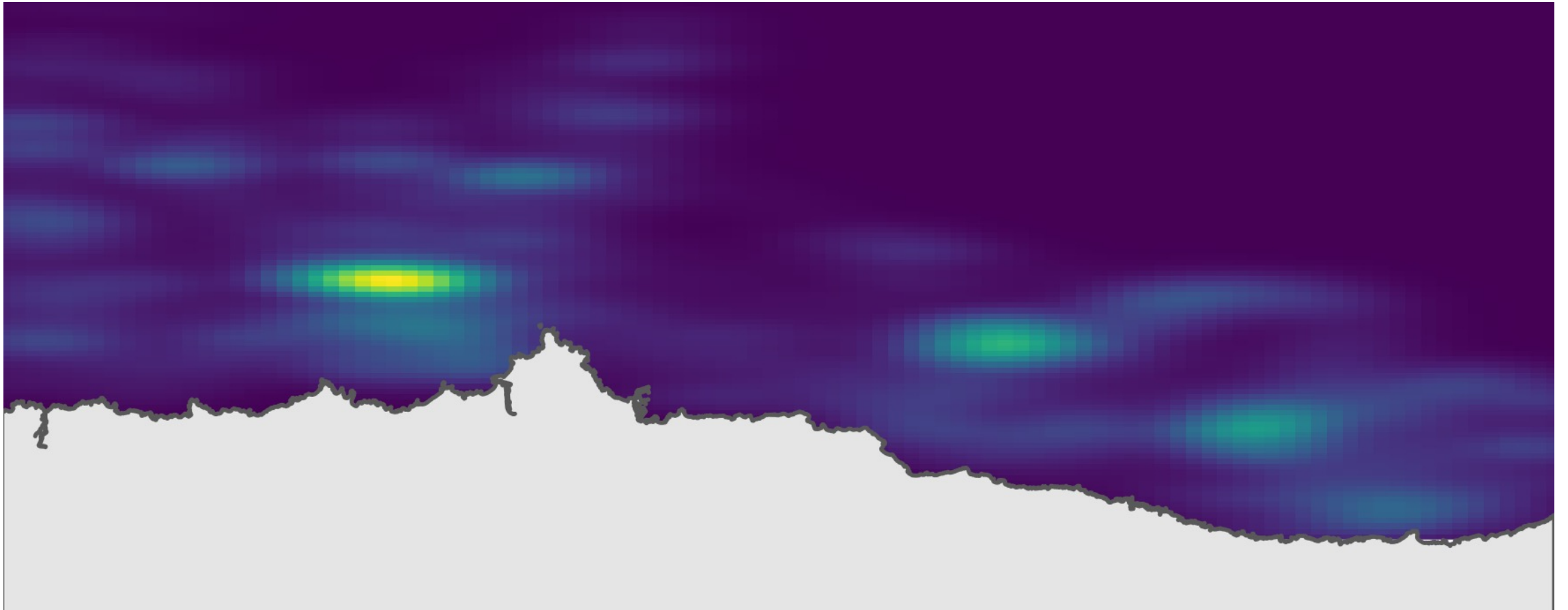
Fishing trip with identified fishing events  
Random Forest prediction



Source: AIS data

Fishing event predictions for two different fishing trips from two different ships and in two different places.

# IDENTIFIED FISHING GROUNDS





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Con la colaboración de la Fundación Biodiversidad, del Ministerio para la Transición Ecológica y el Reto Demográfico, a través del Programa Pleamar, cofinanciado por el FEMP

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**ROC Curve for Random Forest. AUC = 0.847553477828212**

