Introduction

The study looked into the fishing activity across marine Nature 2000 sites having a focus on variety of protected features protected by the Habitats Directive. Significant incompatible fishing activity was observed inside Marine Protected Areas (MPAs) across all of the European Union (EU), particularly within reef and sandbank habitats types (codes 1170 and 1110). This poster summarizes the methods used and the main results for reefs.

This study breaks new ground by applying a comprehensive data-driven approach, extracting figures that offer insight into an estimate of the actual conservation status of Nature 2020 as a whole through the analysis of bottom-fishing activities. The results demonstrate that substantive conclusions may be reached using algorithmic methods, in such a way as to be useful for lawmakers in deciding how to approach marine protection.

Results and discussion – case reefs

The study found significant fishing pressure on EU MPAs designated for marine habitat protection, measured as the average density of fishing activity. Table 1 shows the largest fishing countries by fishing hours in 2017. The results showed that many MPAs experience fishing pressure even far exceeding these averages for unprotected waters.

The challenge in interpreting these results lies in understanding how much fishing activity is “acceptable” for a given habitat. In this study only gear-habitat pairs with probable vulnerability were considered and this study aims to only report impactful fishing activity.

Table 2 shows the MPAs experiencing the greatest fishing pressure, by fishing density respectively. These two measures capture different types of MPA being affected by fishing pressure: large MPAs with significant reef complexes and small MPAs protecting isolated individual reefs. The fact that one MPA, Roches de Ponchartrain (FR5302001), appears in both lists, should serve to make that site stand out as particularly pressured.

Methods

Fishing activity

Fishing activity across EU waters was identified using machine learning algorithms run on AIS (Automatic Identification System) data from the Global Fishing Watch (GFW, globalfishingwatch.org). The study compiled every fishing activity of every vessel within N2000 areas for the entire year of 2017. The fishing data was broken down by the type of fishing gear used by each vessel and mapped across the Nature 2000 sites designated to protect specific habitats and species whose conservation are likely incompatible with those fishing gears.

To ensure that the analysis identifies only fishing activity having an impact on listed habitats, only gears with demonstrated potential impact were considered (Figure 1).

The fishing data was gathered from satellite monitoring of vessels via AIS, matched against fleet register databases, and compiled into tracks that encode each vessel’s course. This study used Google BigQuery to search GFWM’s database for fishing events by vessels on the register, fishing in EU waters, in 2017. The key pieces of information extracted were the coordinates and the fishing time, to be summed to determine the total number of hours spent fishing inside the MPAs. There are known limitations to AIS data, however cross-checking with the EU fleet register helps ensure completeness, mitigates false labeling and guarantees that this study cannot over-report the fishing pressure.

To predict whether a vessel is fishing at any given moment the GFW employs a machine learning algorithm that has been trained on a dataset that was hand-labeled as fishing or non-fishing by the GFW and researchers at Dalhousie University. Figure 2 shows that vessels moving very slowly or very quickly are less likely to be fishing, while a “sweet spot” in the middle is conducive to fishing. Finally a logistic regression was applied using the Python package sklearn. Figure 3 demonstrates that the model is robust, accurately and precisely predicting whether a subset of trawlers are fishing. The output of the model is a categorization of all fishing events, recorded by the GFW as fishing or non-fishing.

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Fishing inside Natura 2000

A Python script was written to identify every fishing event and check its location. If the coordinates fell inside an MPA, that fishing event was labeled accordingly. Lacking information on the precise geographic location and extent of every habitat, approximations had to be made to estimate the likely activity experienced by a given habitat inside a given MPA. The following parameters were used as meaningful descriptors of fishing pressure:

- Fishing hours
- Cover-weighted fishing hours: Fishing hours weighted to value MPAs with habitats that are dominant in that MPA.
- Average fishing density: Total hours fished inside an MPA divided by the area of the MPA.

Though high values of cover-weighted fishing hours or average fishing density do not conclusively demonstrate that vessels were caught operating on top of the protected habitat, they indicate important patterns of fishing pressure that may impact on the protected habitat.

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