Random and ambiguous thoughts on the use of ocean space

~~Costello~~ Gaines Lab Meeting

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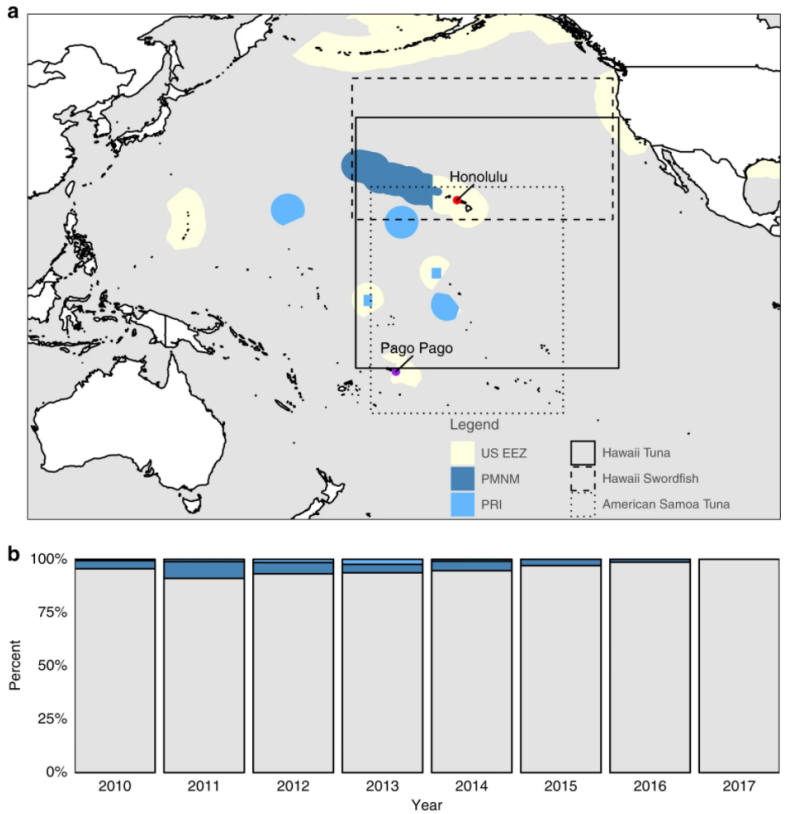
Before we begin

- We'll be looking at ocean space
- Motivated by past MPA and vessel displacement
- NOT about MPA displacement (I think)

Aggregate effort displacement

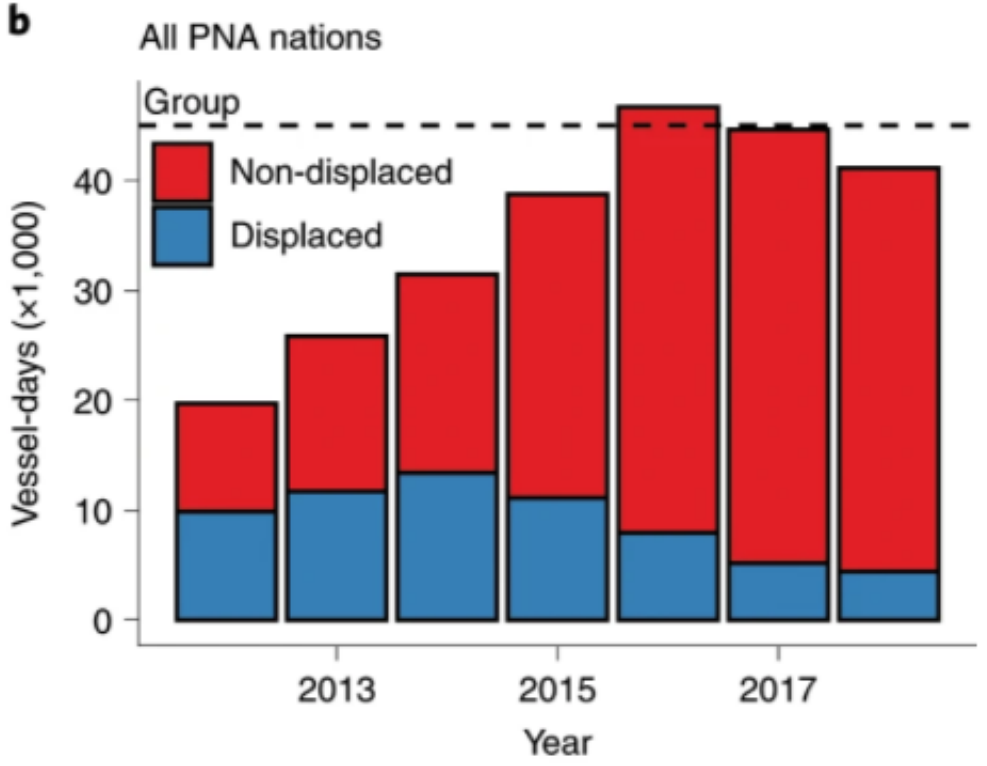
Expansion of Papahanaumokuakea



Lynham et al., 2020

Aggregate effort displacement

Phoenix Island Protected Area



Villaseñor-Derbez et al., 2020

What's the question?

Not sure, but...

Why do fishers fish where they fish?

- Understanding *why* processes arise is interesting

- Understanding this will be relevant for MSP:
  - Offshore wind farms
  - Offshore aquaculture
  - Ocean energy harvesting

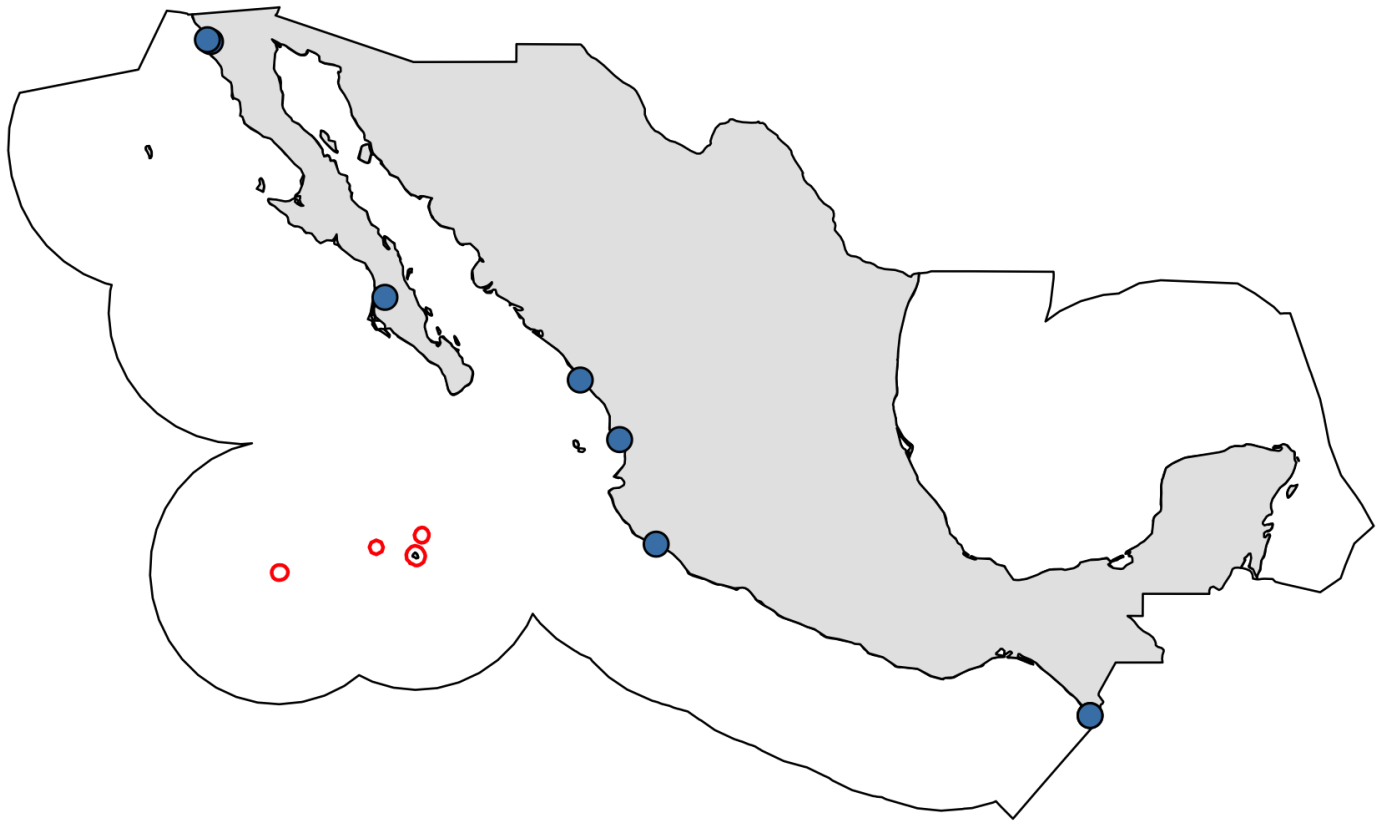
Thoughts

I think it's an interaction between proximity (low cost of exploring) and ability / knowledge / proficiency

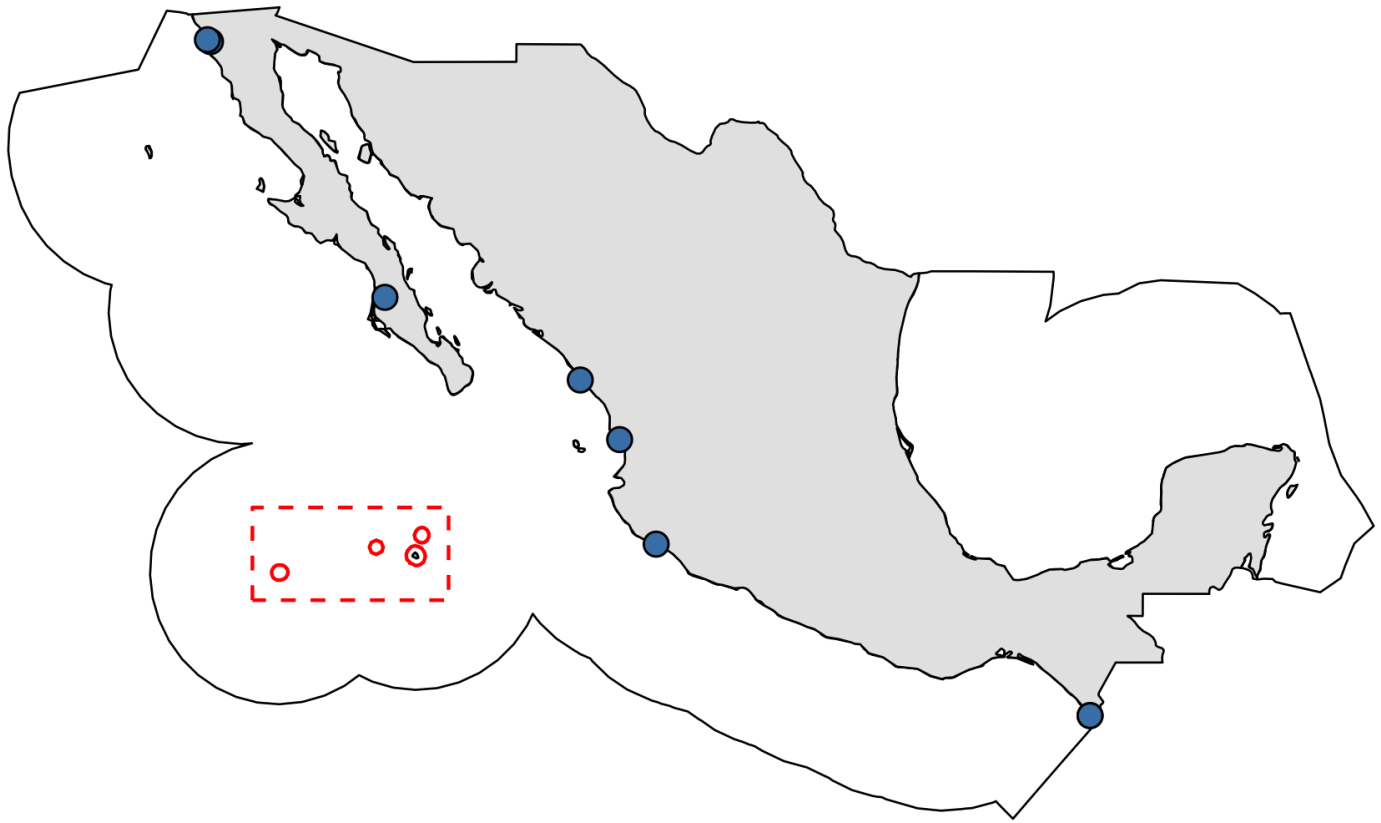
> **For any given patch of ocean in the world, who fishes there will be determined by their access and ability to fish it**

I don't think the examples above have the data I need to explore this

Revillagigedo (*Revilla*) - Old polygon



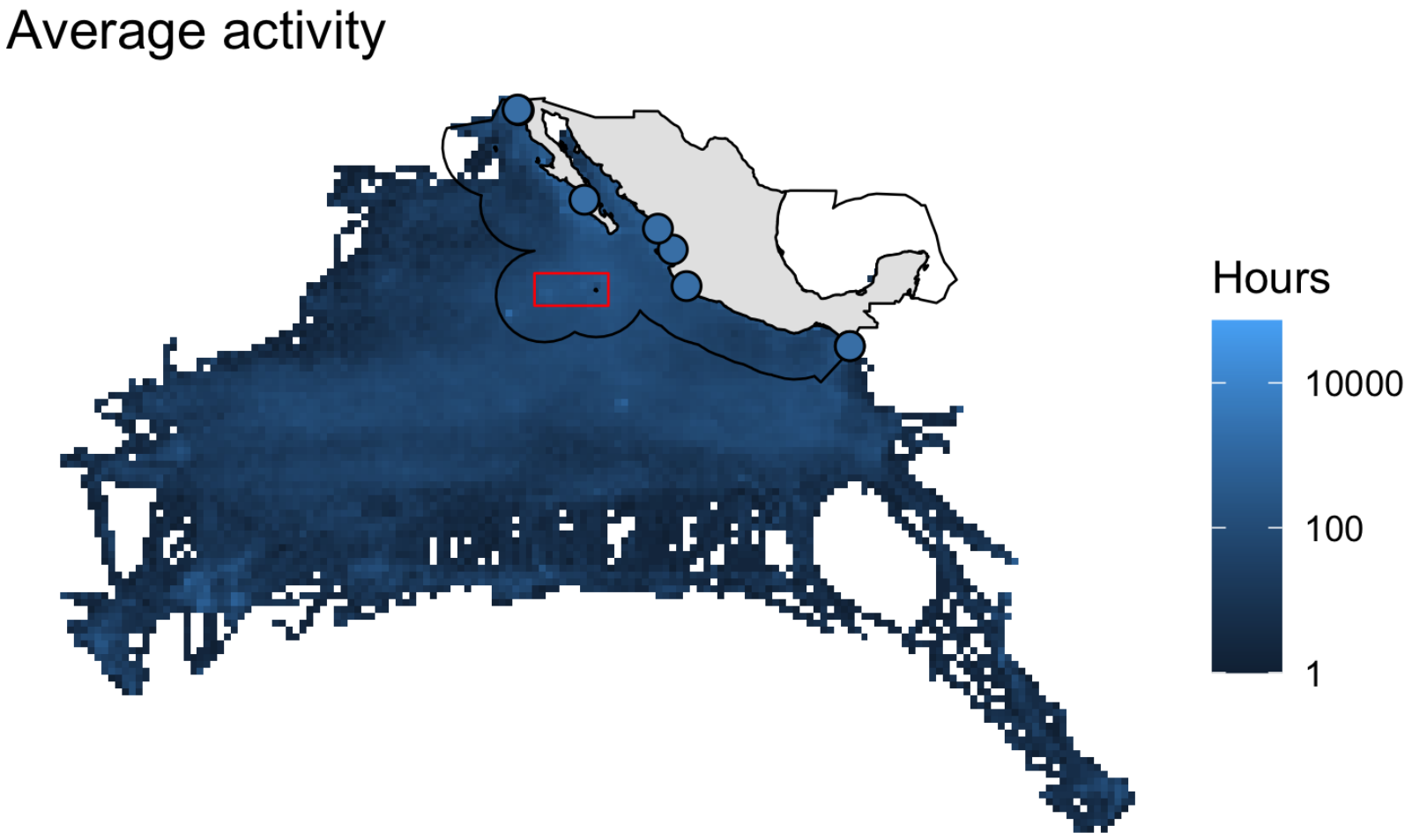
Revillagigedo (*Revilla*) - Expansion (2017)



I do have some data

- Mexico requires vessels > 10m to have a government-issued GPS
- A bunch of benefits come with it
- Tracking data are available (2011-2021)
  - Hourly position for ~2,500 vessels
- Lots of info on vessel info
  - size
  - crew
  - gear
  - ownership

Tuna purse seining activity (55 vessels)

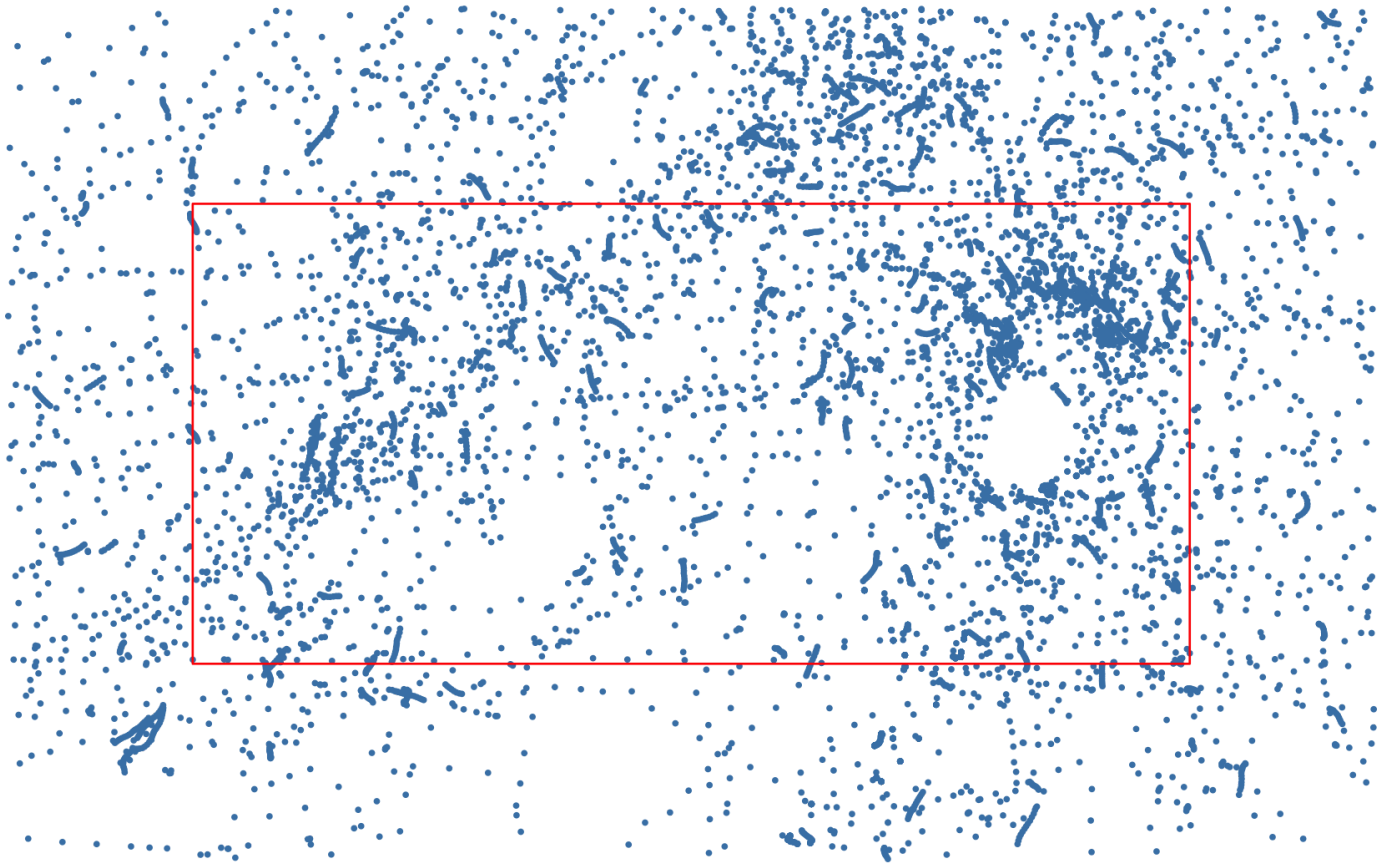


Today

- What positions are fishing vs transiting?
- What is the historical use of Revilla?
- How does this vary across vessels?
- What might drive this variation?

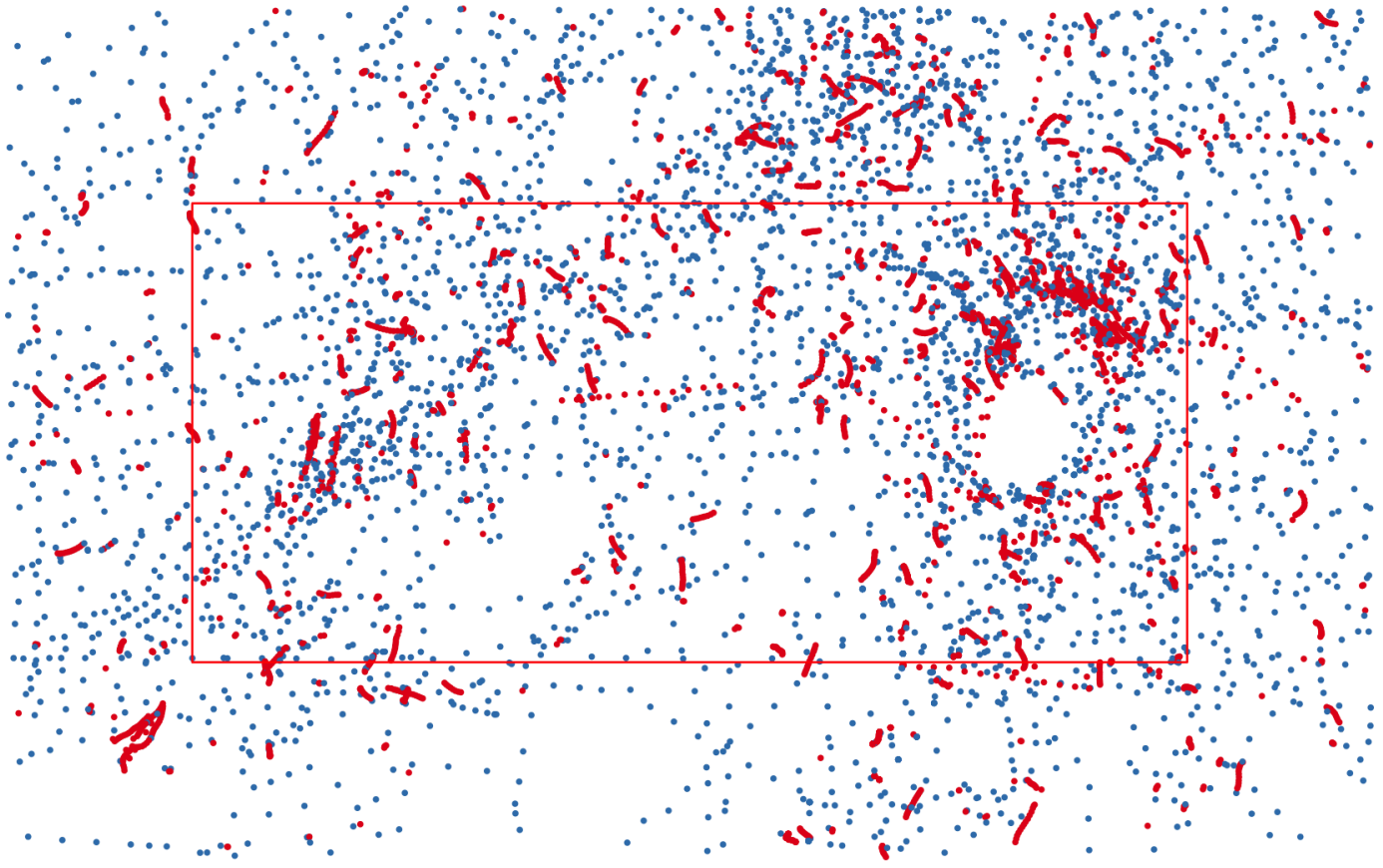
In-house ML

All pre-expansion activity by `Madeira`



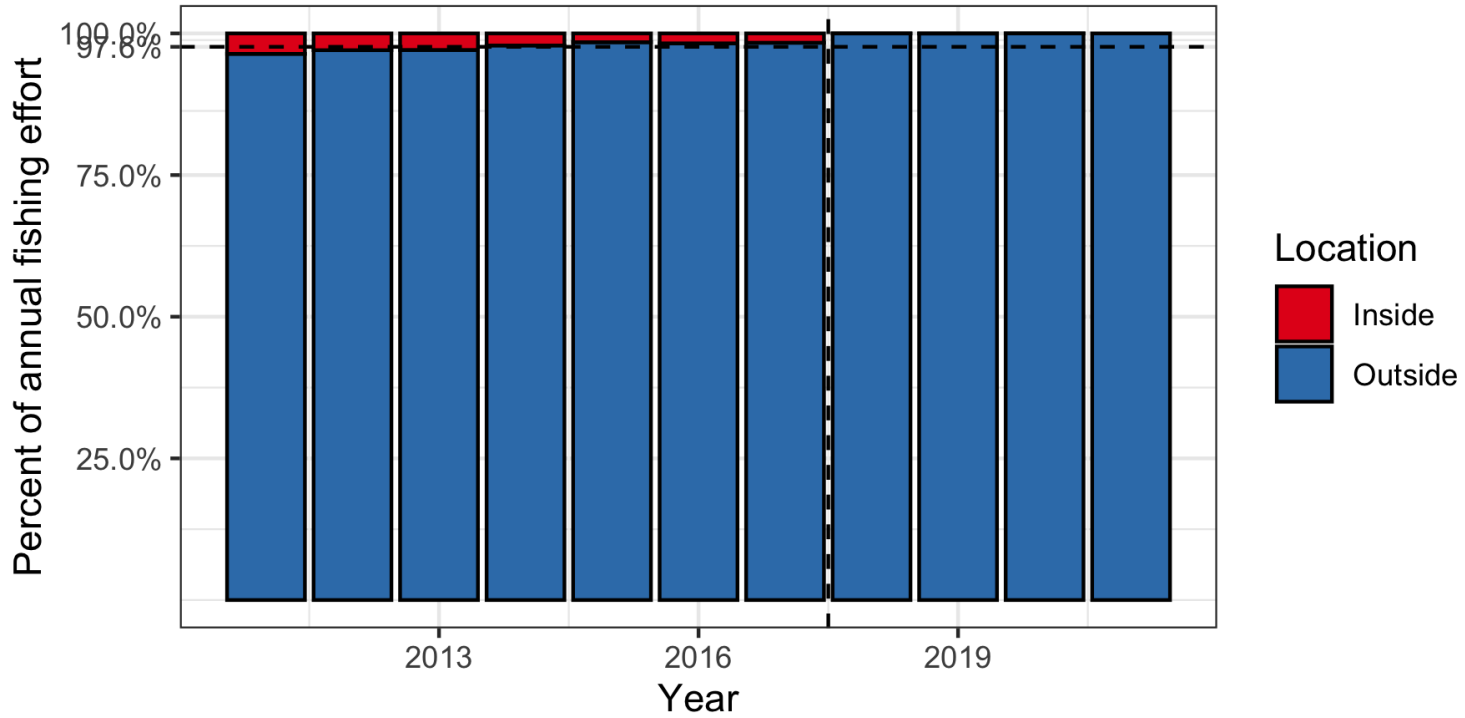
In-house ML

Scored pre-expansion activity by `Madeira`



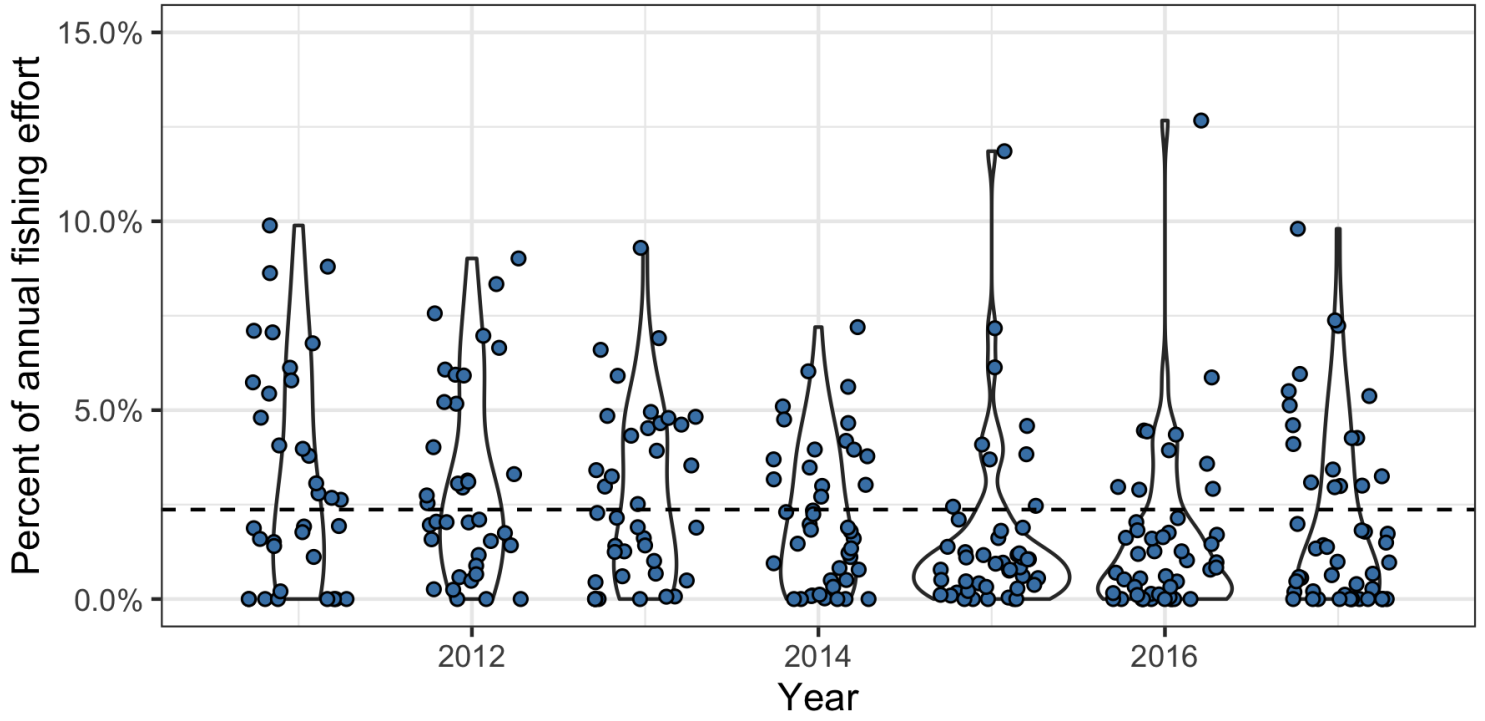
Historical use (aggregate)

On average, only 2.3% of fishing effort occurred within the expanded MPA



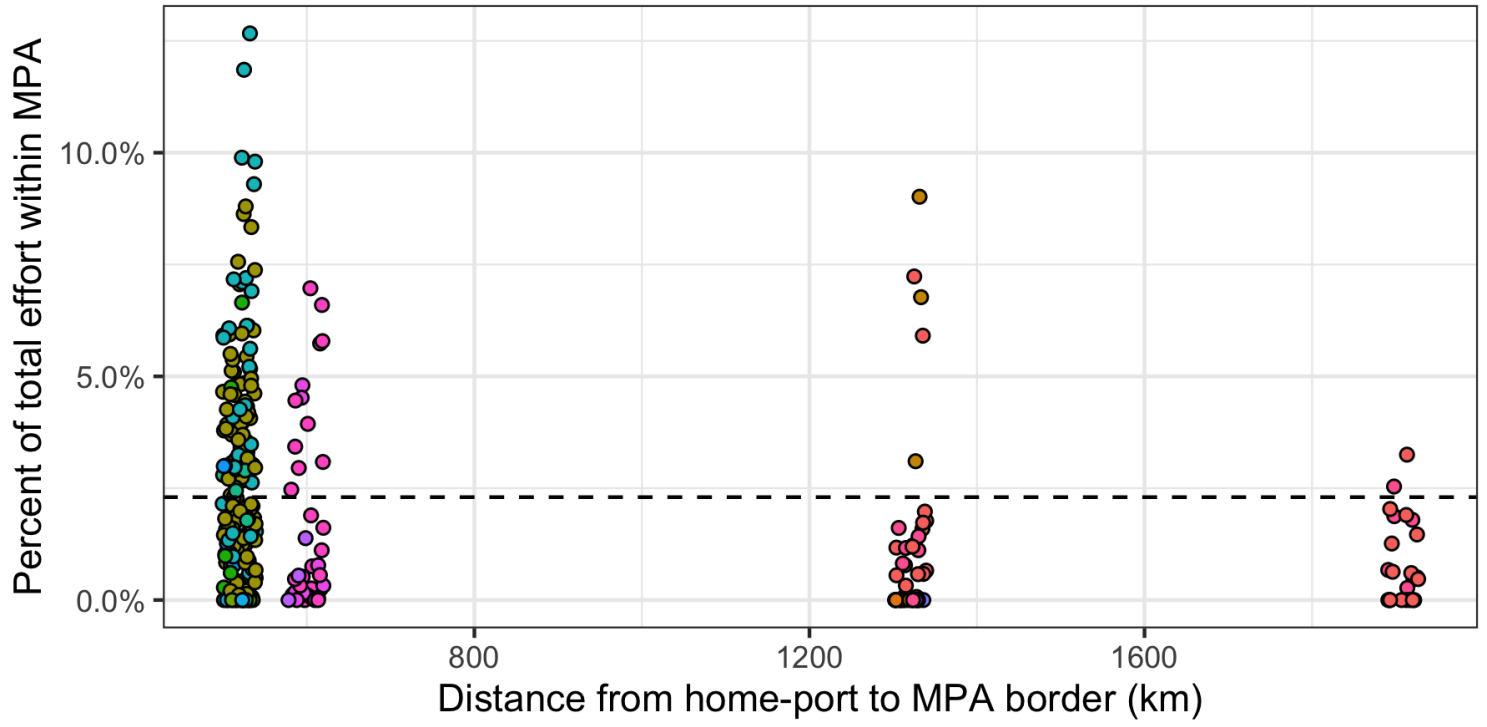
Historical use (individual)

Some vessels are well above 2.3%



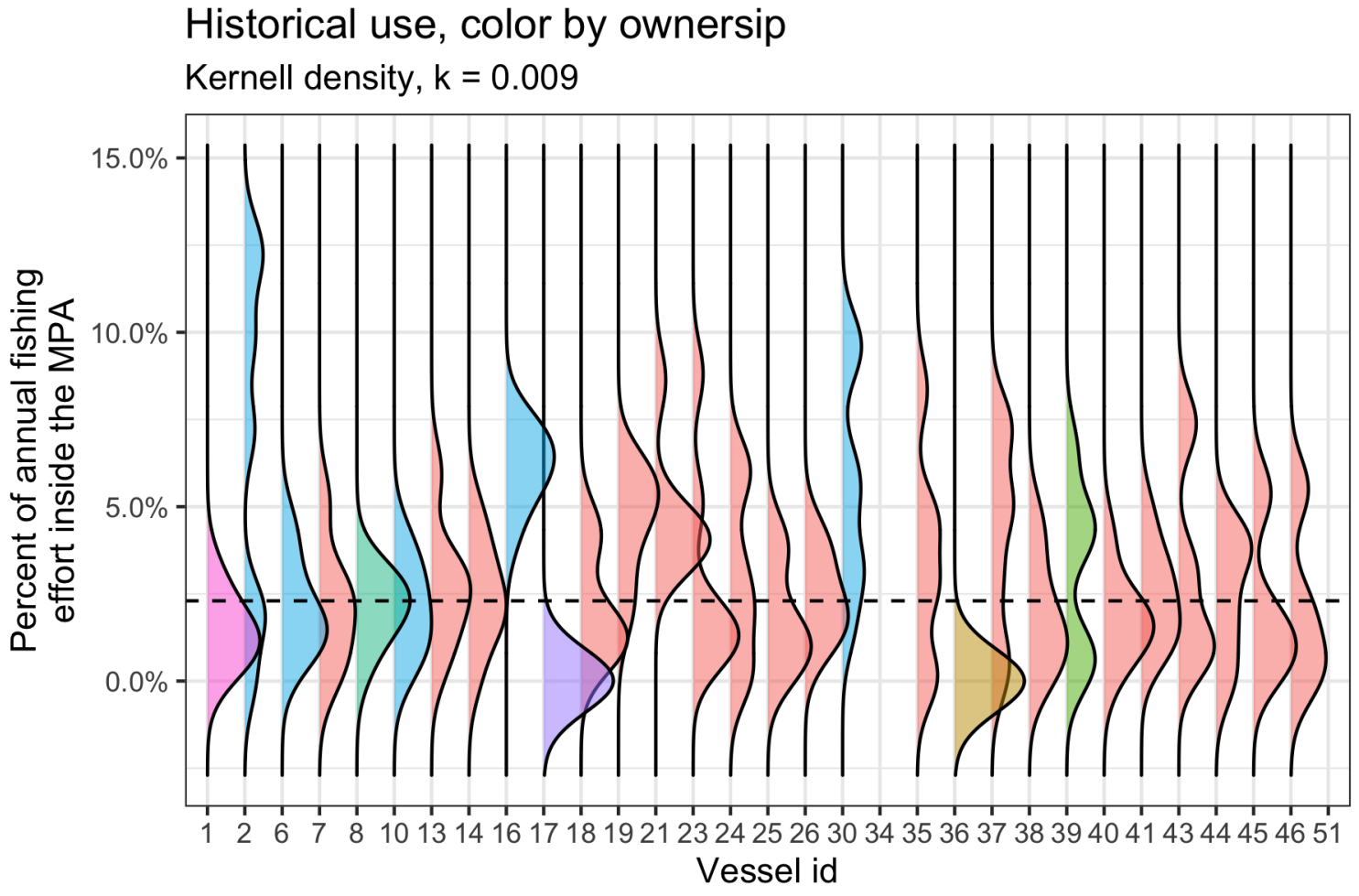
Is it proximity?

That's what it looks like



Let's look into those

Zoom in to equi-distant vessels



Thoughts

$$\Pi_t = pqE_tX_t - cE_t^{\beta}$$

And

$$X_{t+1} = X_t + rX_t(\frac{K - X_t}{K}) - H_t$$

$$\Pi_{it} = \sum_{j=1}^{J} \left(pq_{ij}E_{ijt}X_{jt} - cE_{ijt}^{\beta} \right)$$

I think q_{ij} can be learned in time, thus:

$$q_{ijt} = k_j\theta_{it}$$

With

$$\theta_{i+1} = f(theta_{ijt}, \text{visitation}, \text{distance})$$

Thoughts

Learning-by-doing setting

Learning is costly