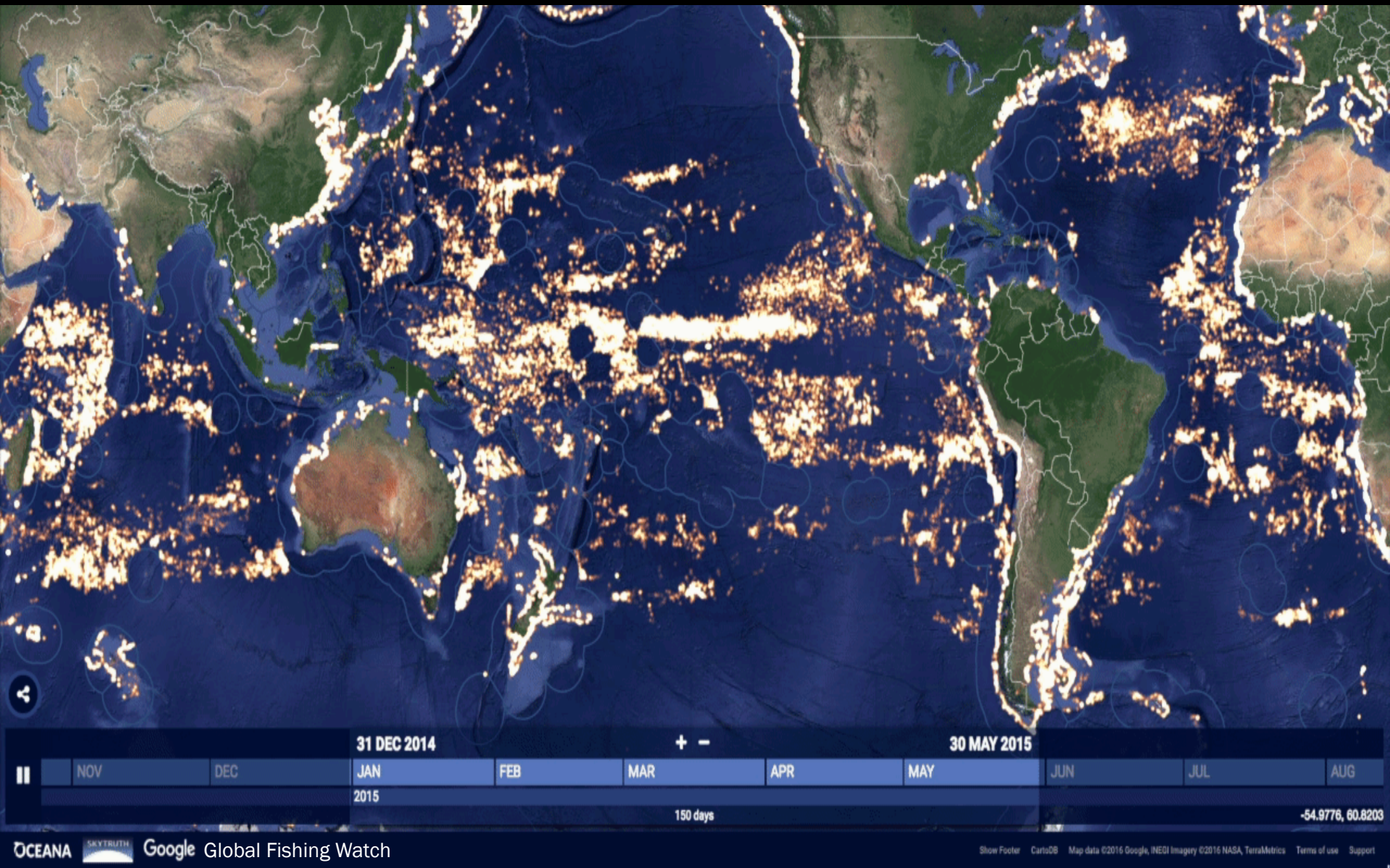
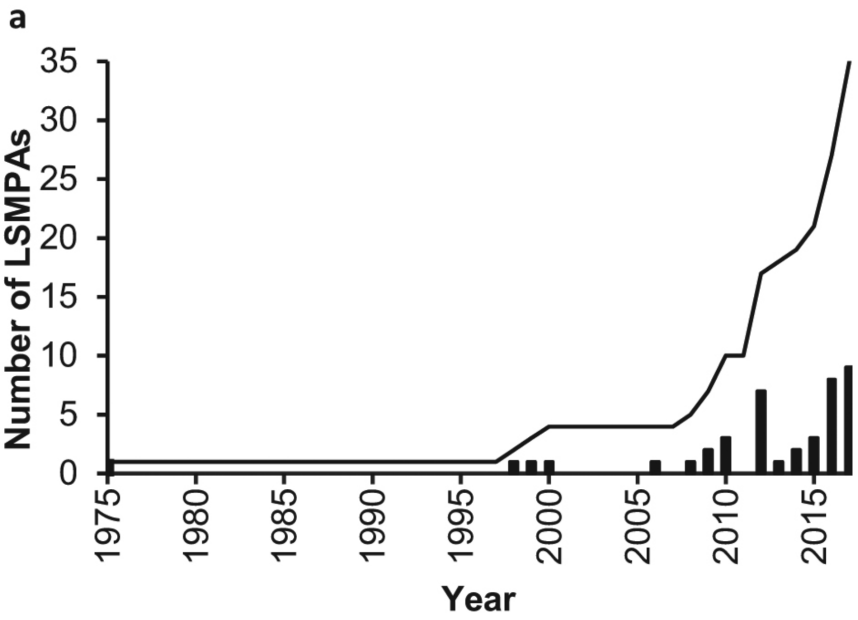
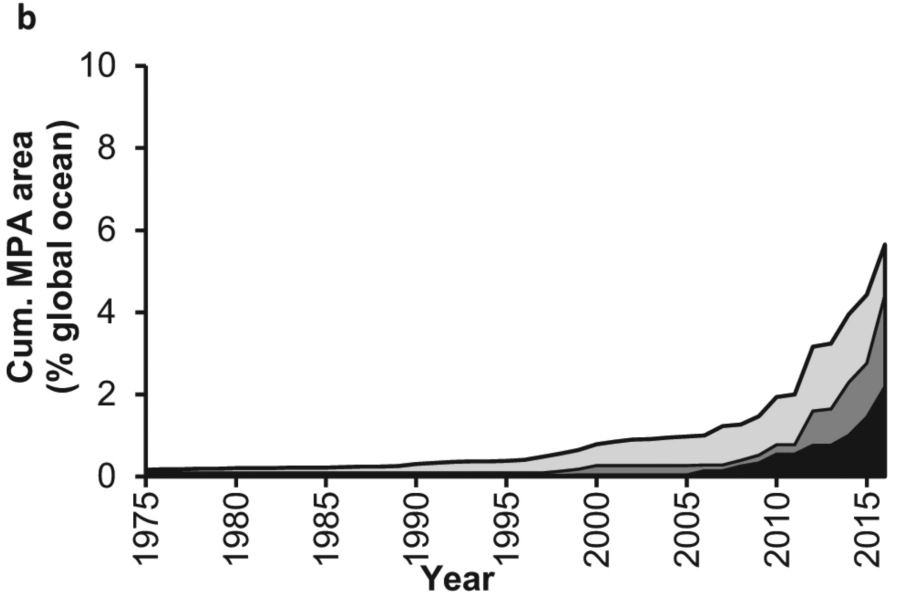
# The effects of large MPAs on industrial fishing effort



# Global growth of large MPAs




O'Leary et al. 2018

Great conservation potential but lots of unknowns

# Heavy criticism of large MPAs


FOX NEWS

**Obama's new ocean preserves are bad for the environment and for people**

By **Ray Hilborn** · Published October 06, 2016 · Fox News


The New York Times

OP-ED CONTRIBUTOR

**Bigger Is Not Better for Ocean Conservation** March 2018

## Main critiques

1. Too difficult to enforce
2. Low fishing in remote regions
3. Large MPAs may increase regional effort

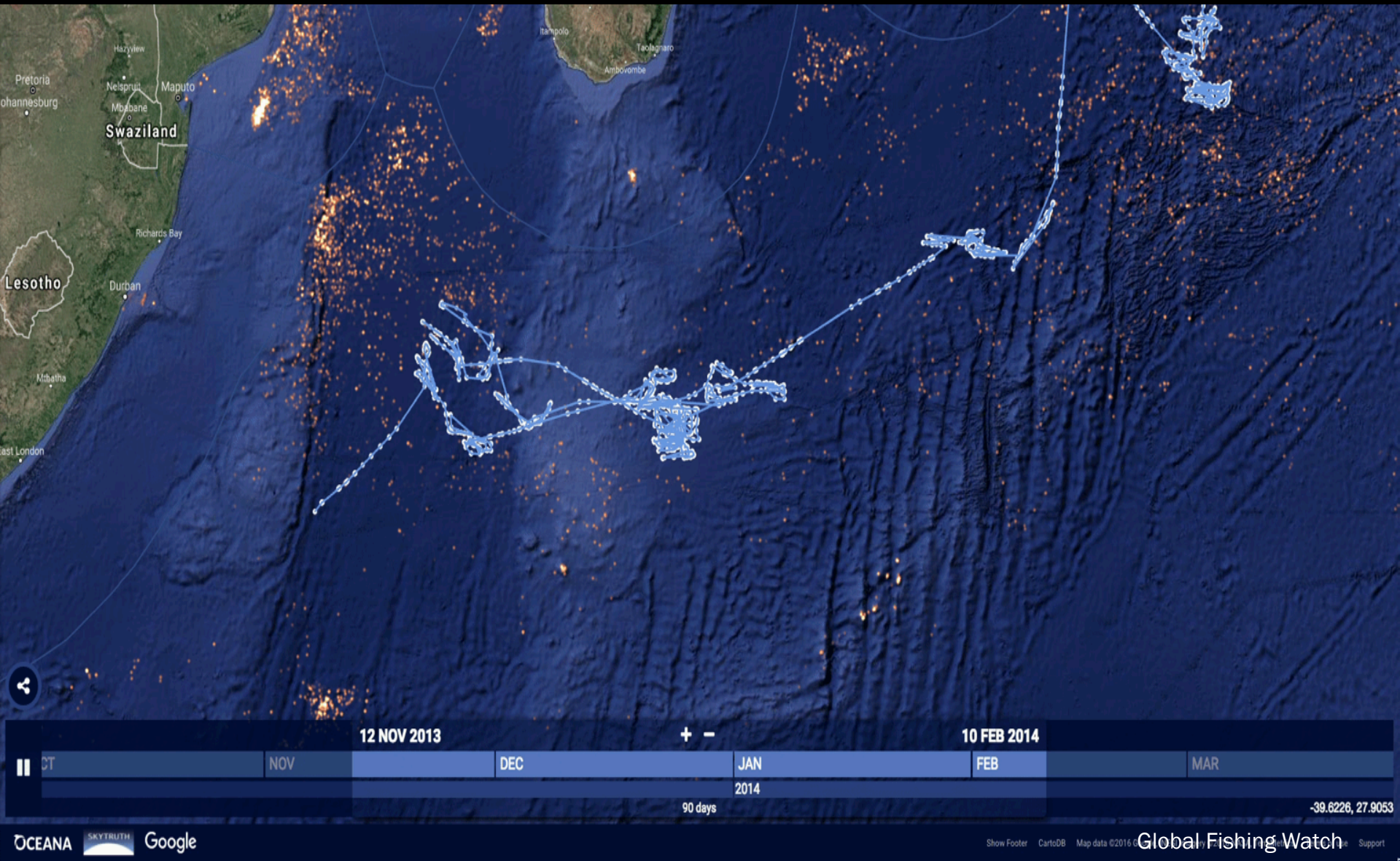
# Research questions to address large MPA criticisms

1. Do large MPAs actually decrease fishing effort?

2. Are they established in places where effort is already low?

3. Do they increase regional effort by making boats fish more?

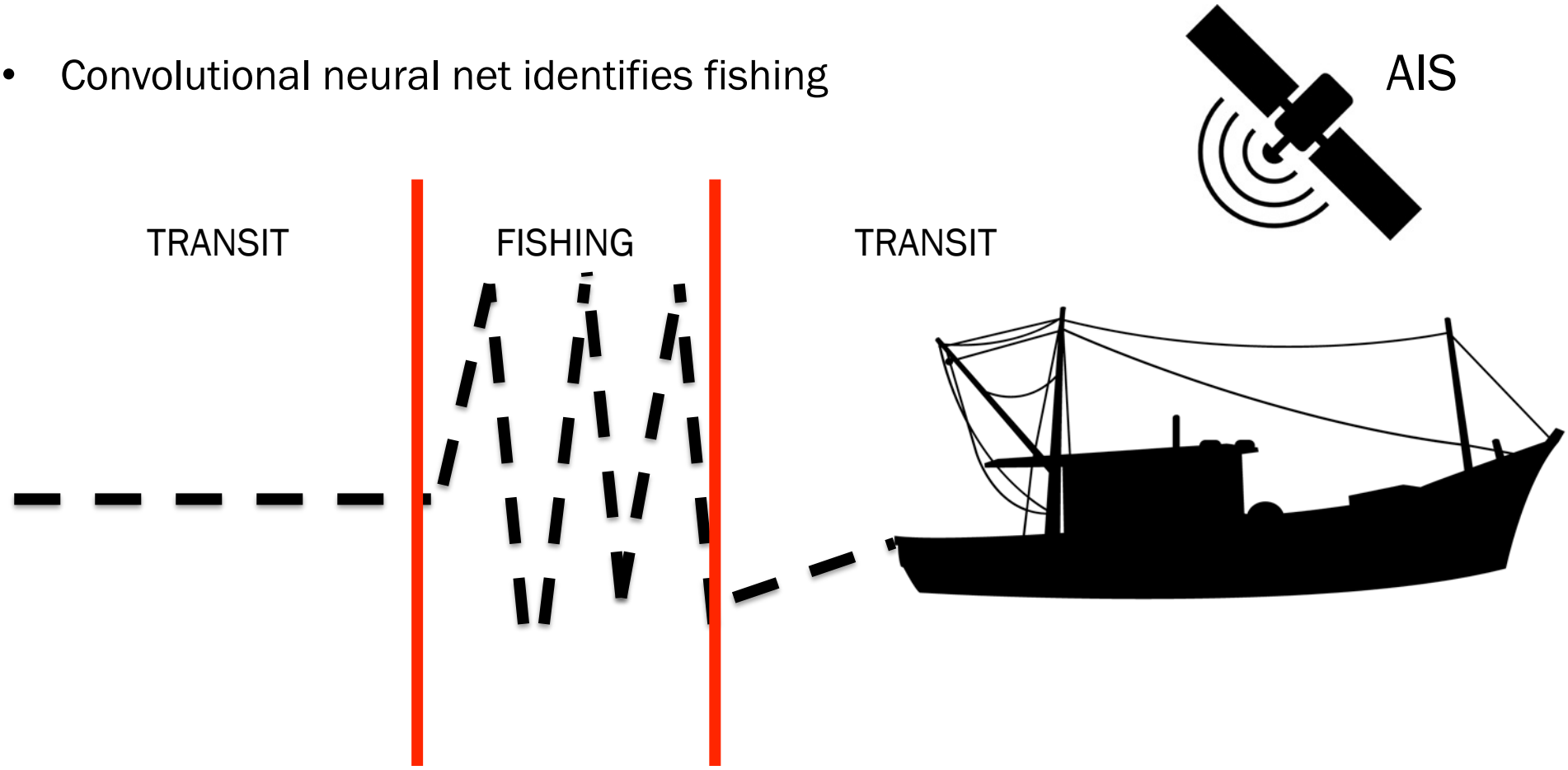
# Tracking industrial fishing vessels using Automatic Identification Systems (AIS)



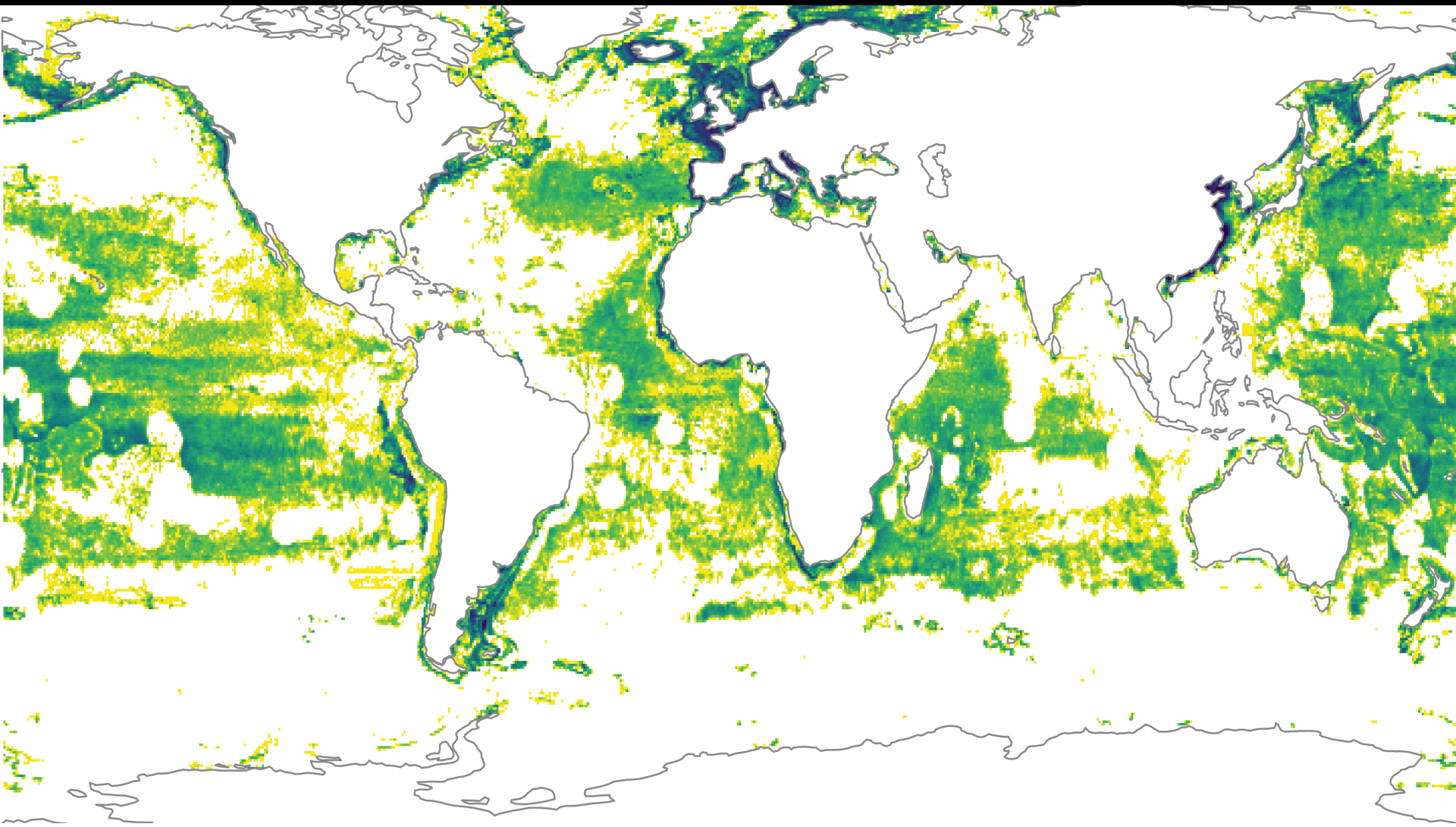
# Automatic identification system (AIS)

*Tracking industrial fishing vessels*

- AIS transmissions include position, ship name, vessel ID
- Convolutional neural net identifies fishing

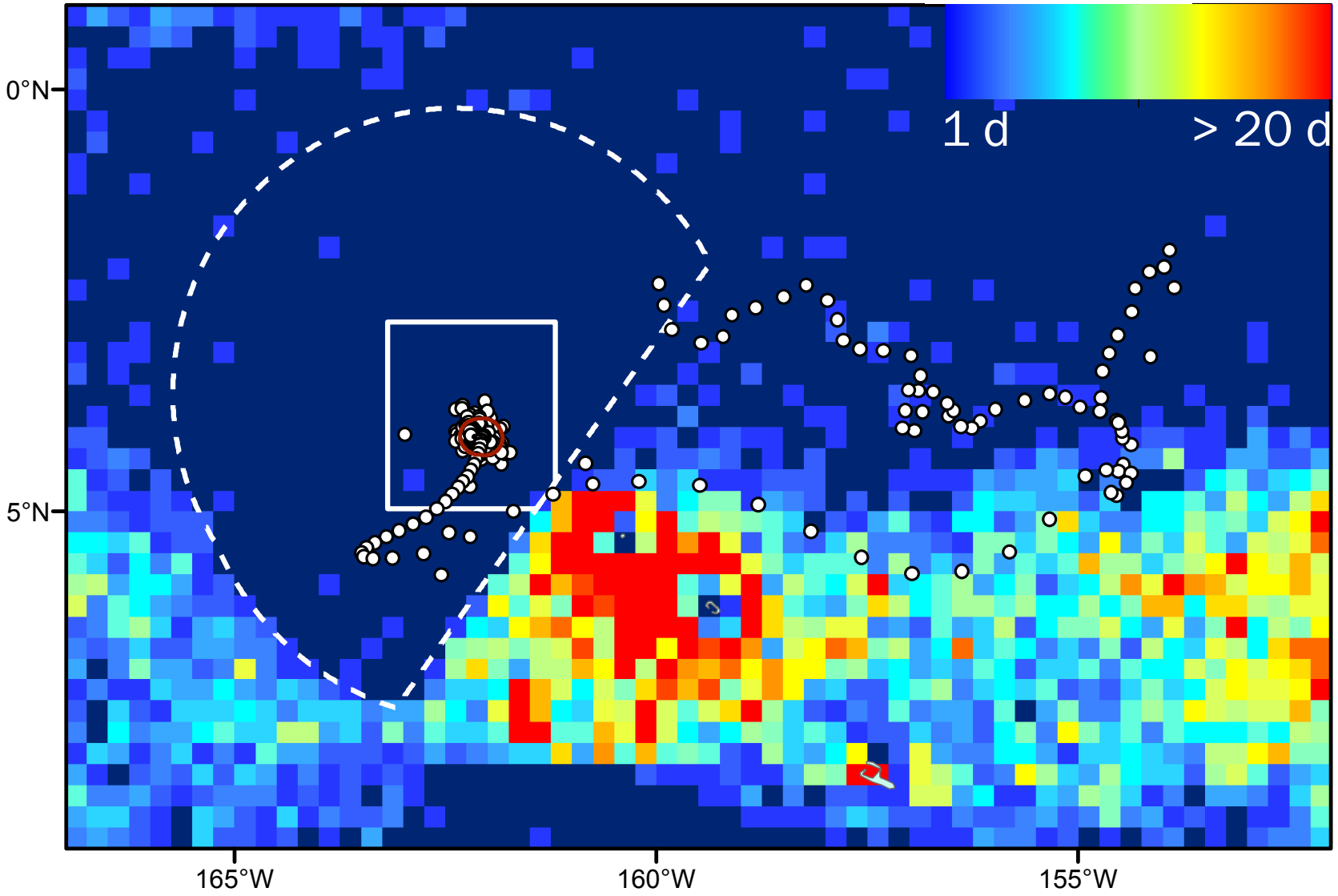


# First global observation of fishing effort

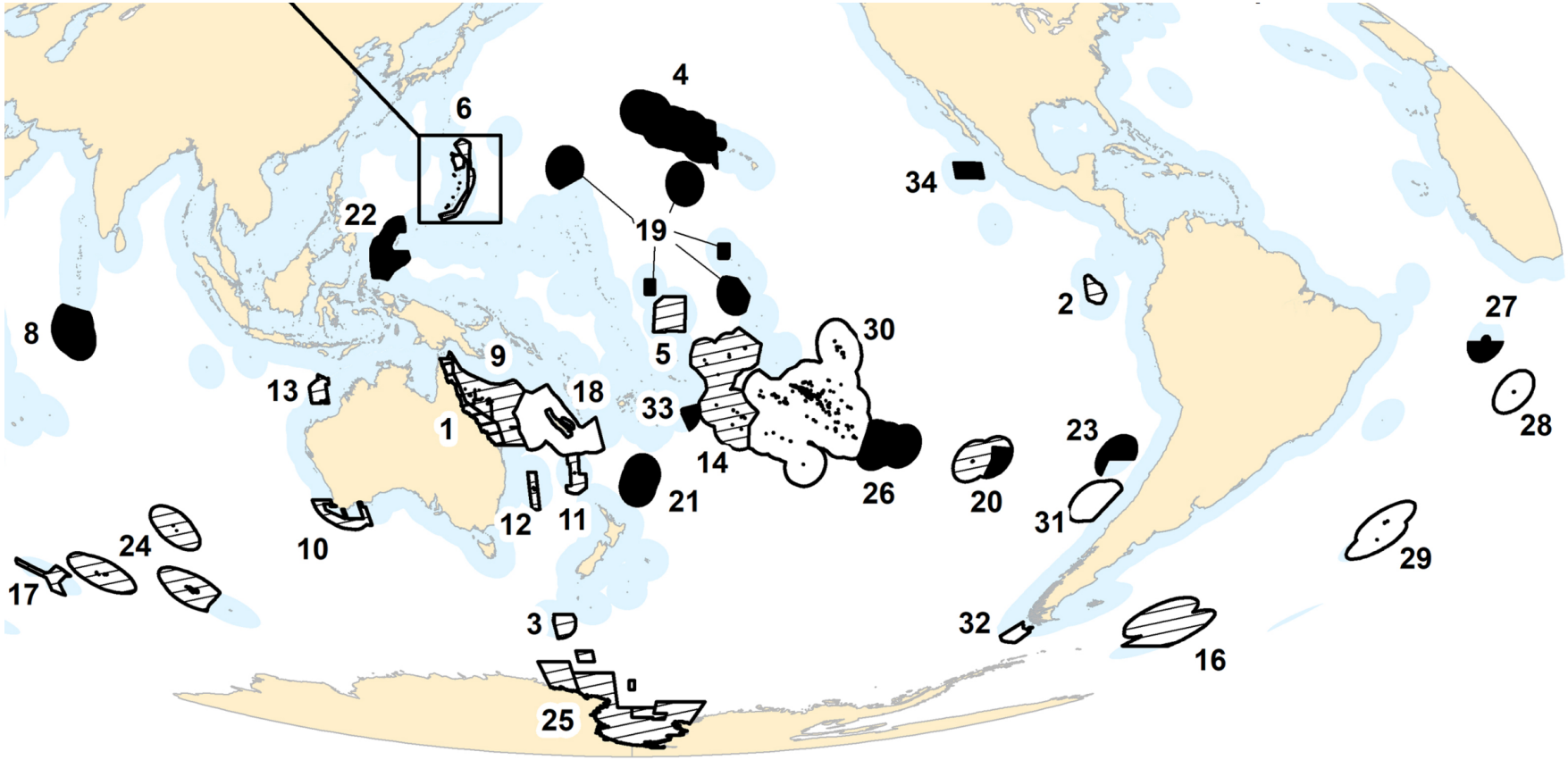


Previously found low effort within MPA.

But was effort already low before the MPA?

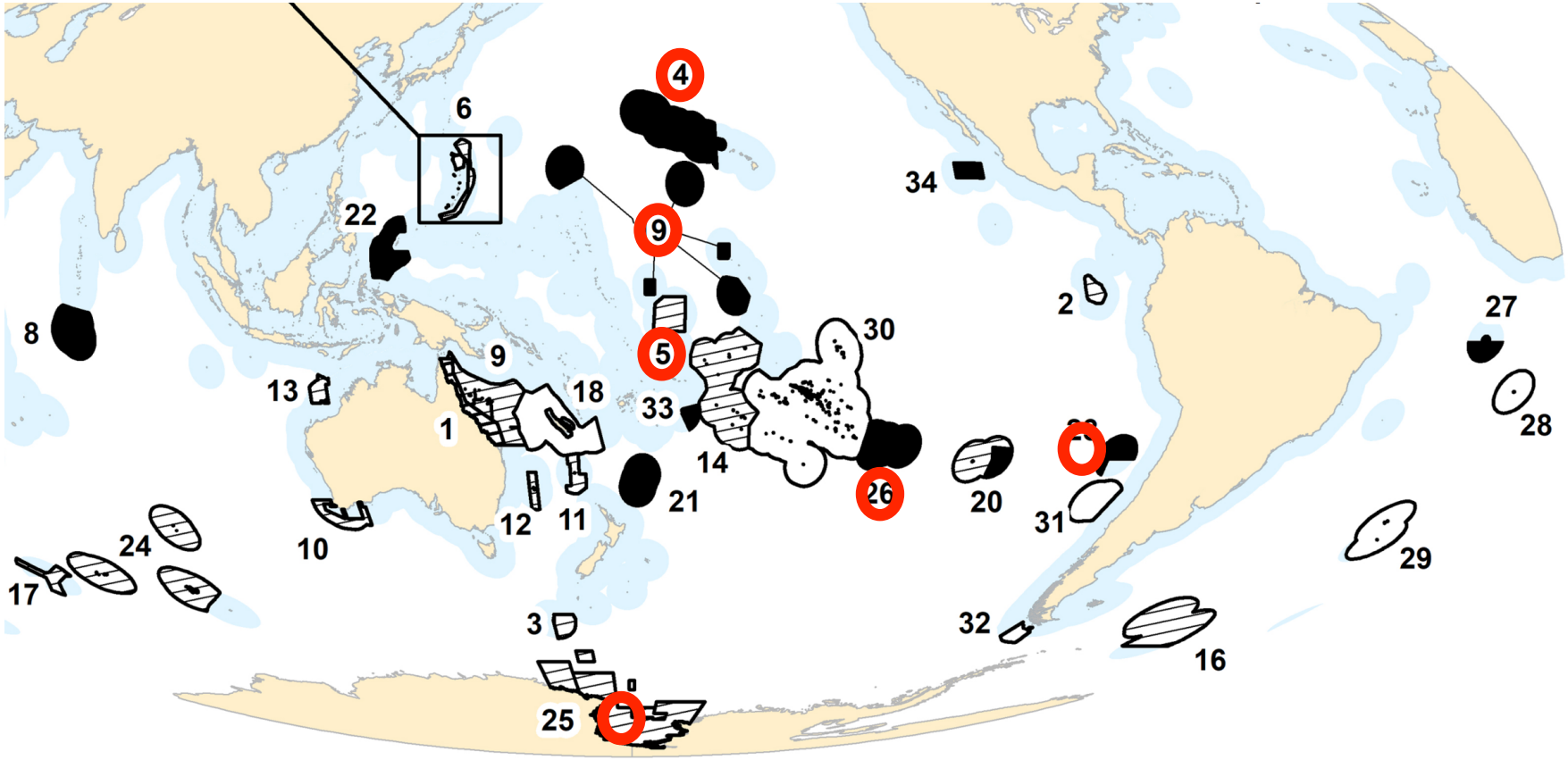


# Large MPAs (no take in black)



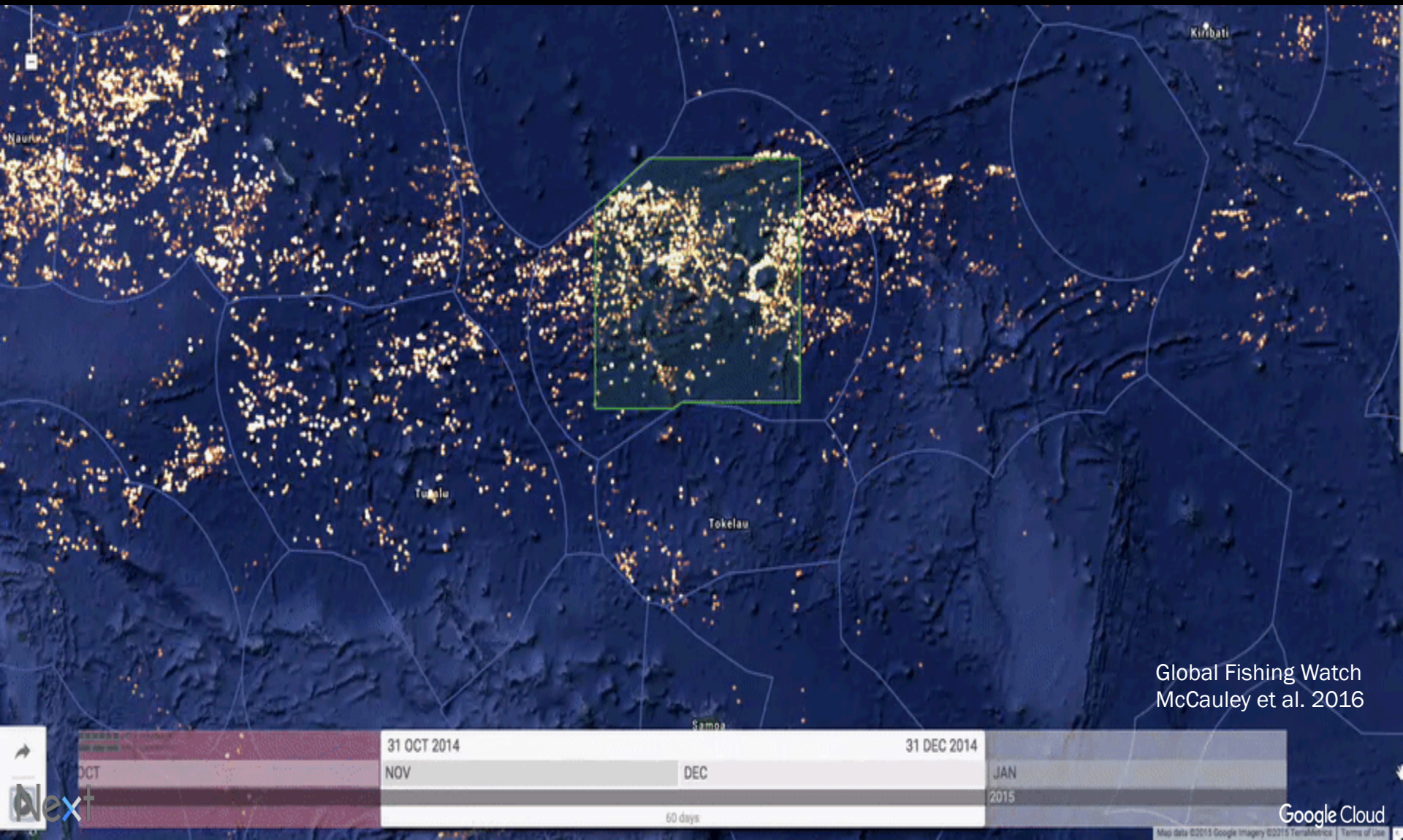

O'Leary et al. 2018

# Large MPAs (no take in black)



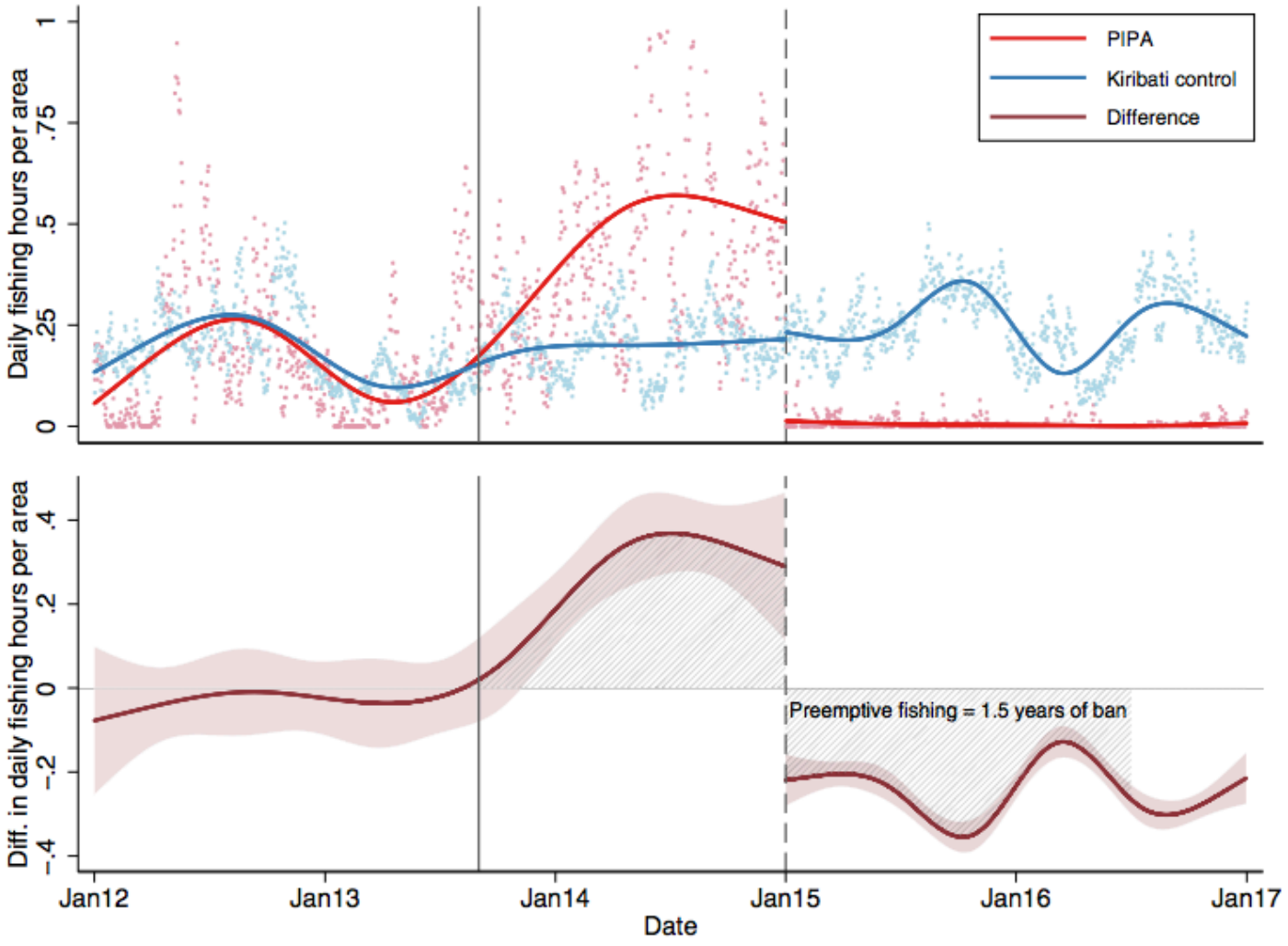

O'Leary et al. 2018

# One example of a large MPA decreasing effort



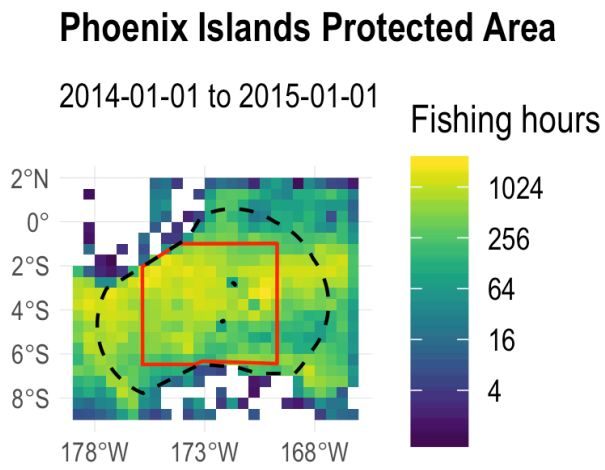

Global Fishing Watch
McCauley et al. 2016

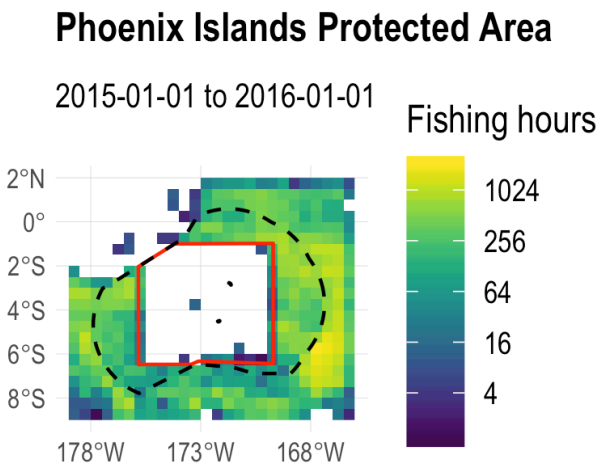
# “Blue paradox” – announcing a marine reserve increased fishing effort

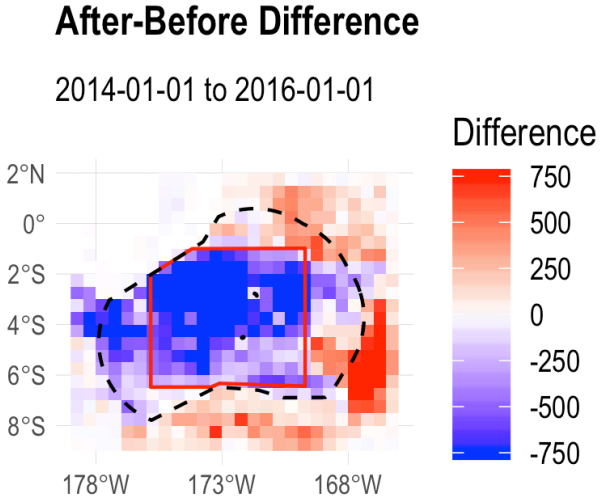



McDermott et al. 2018, PNAS

# Result 1: Most large MPAs established in unfished areas. Only PIPA had initial effort



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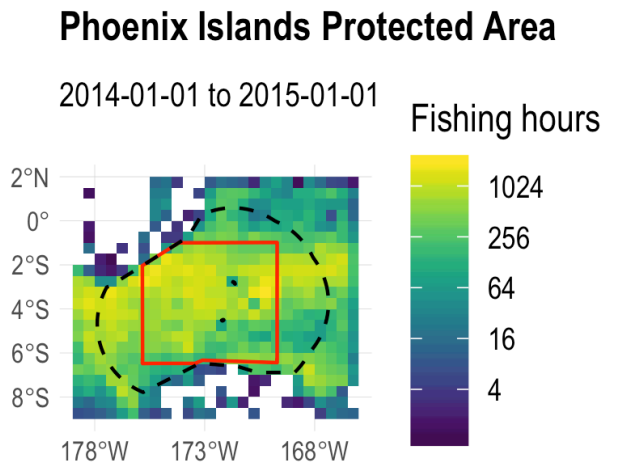
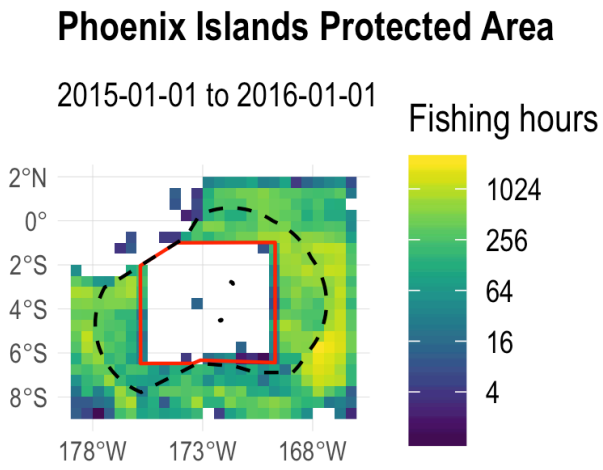
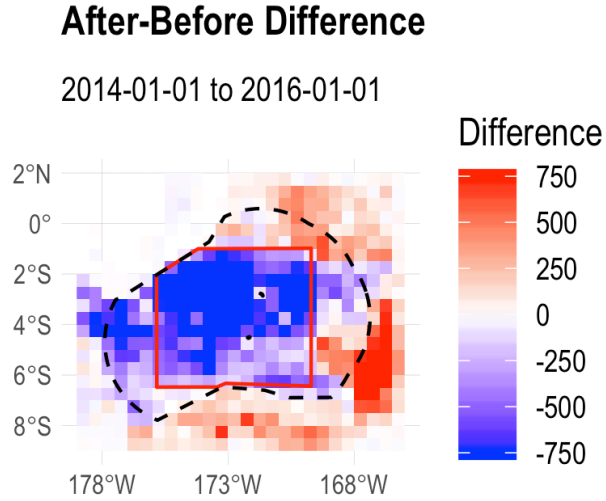
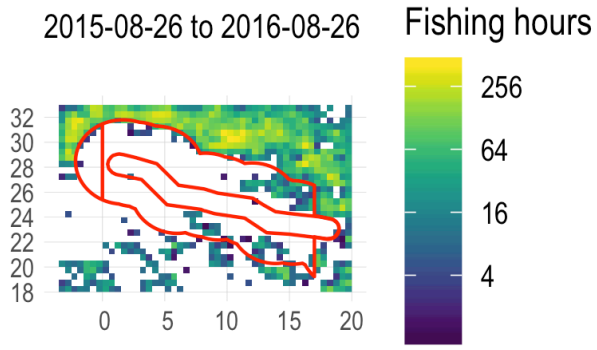
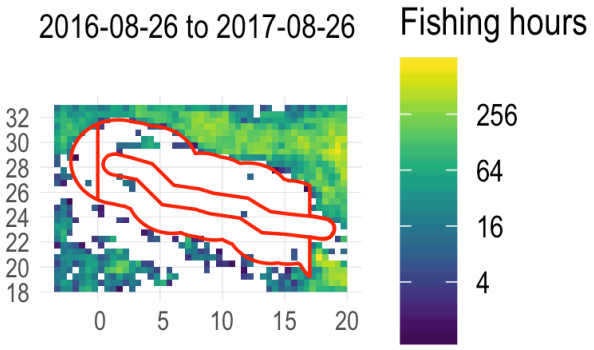
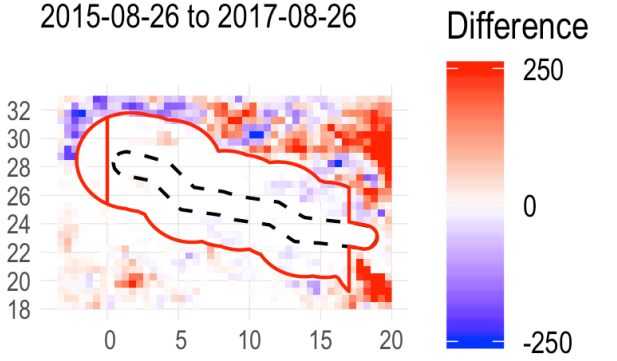


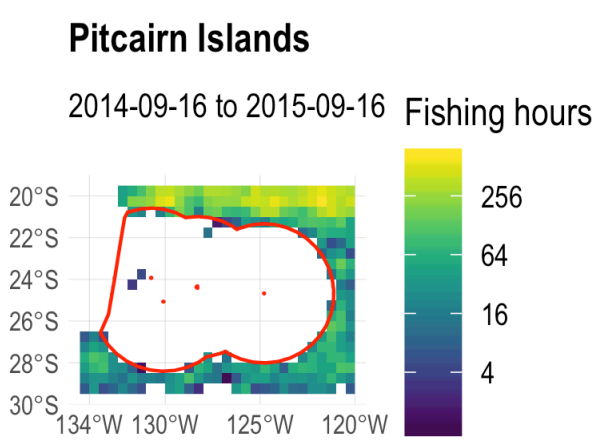



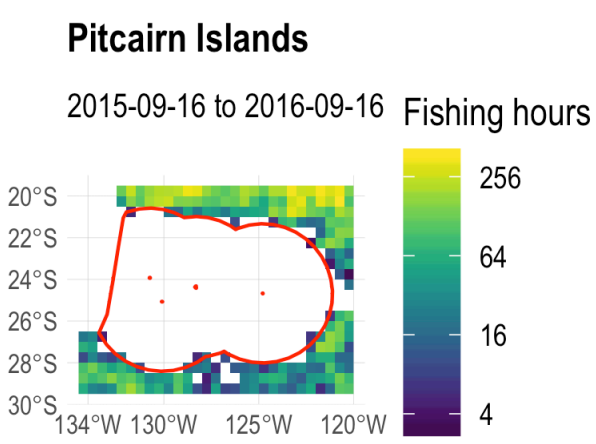



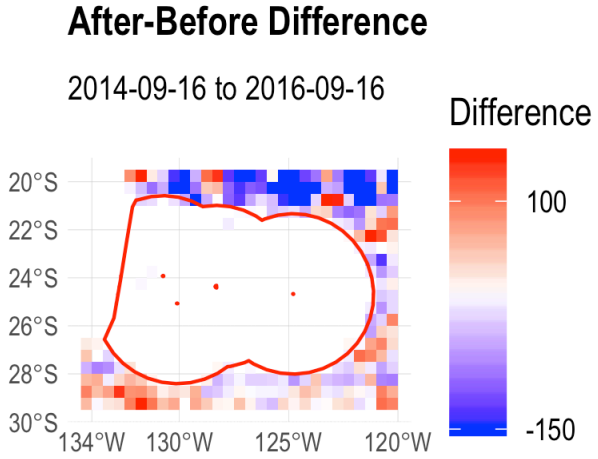



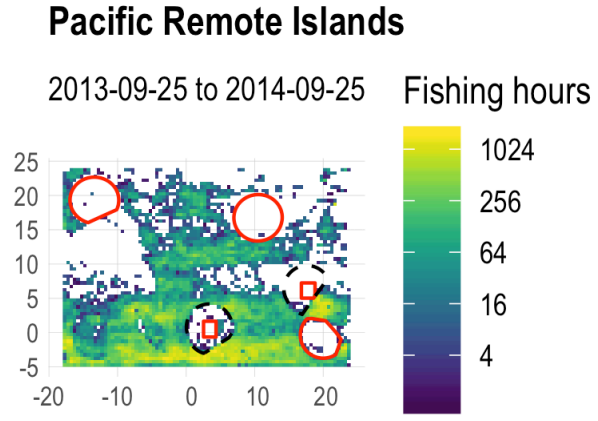



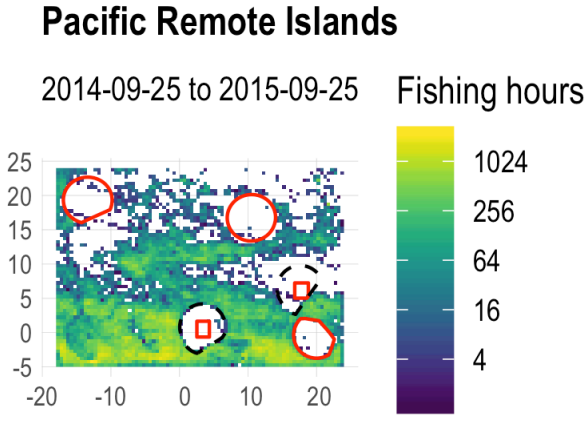
# Result 1: Most large MPAs established in unfished areas. Only PIPA had initial effort

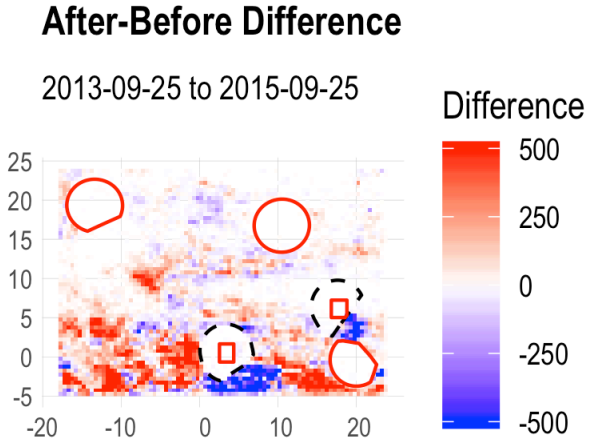


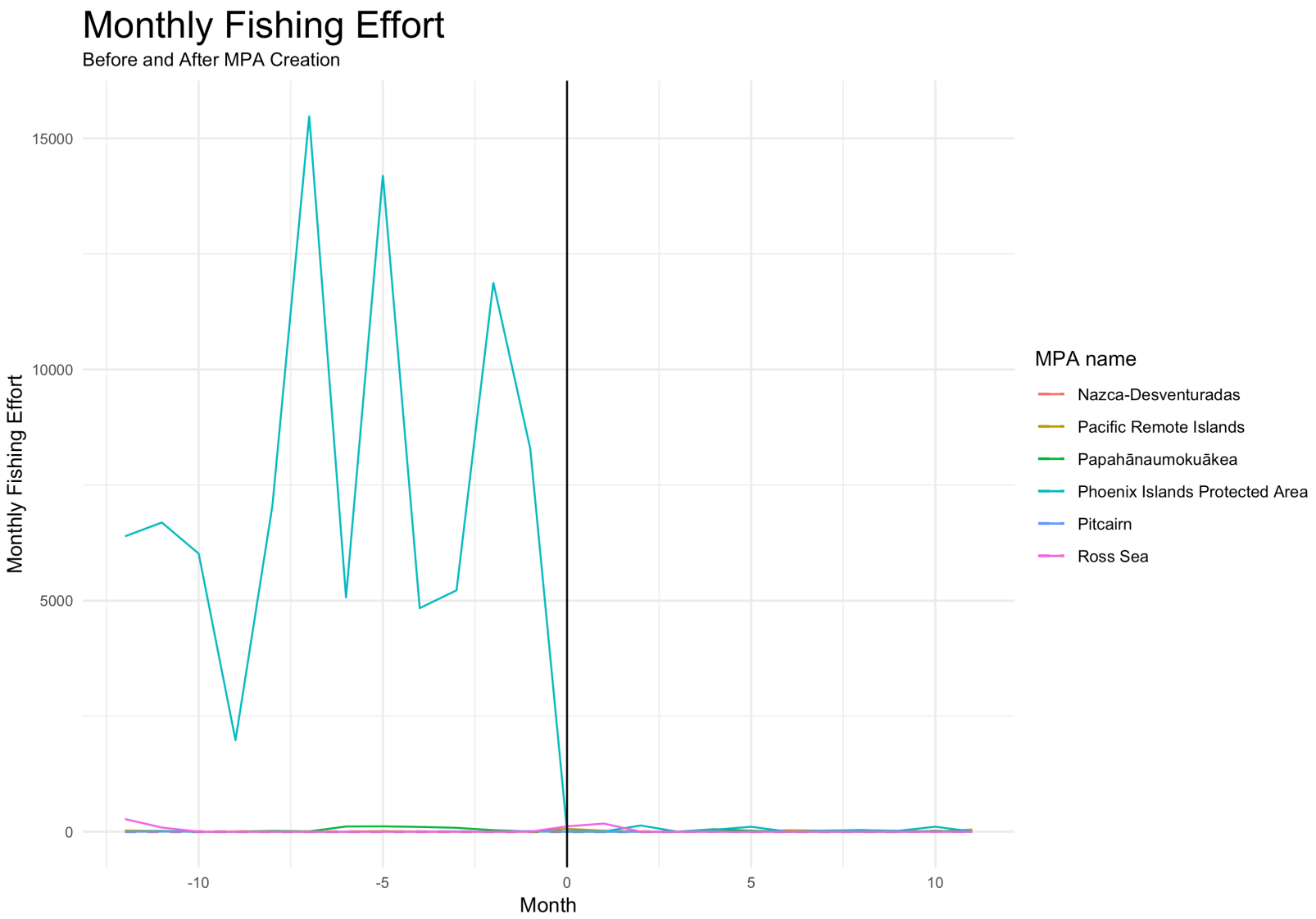



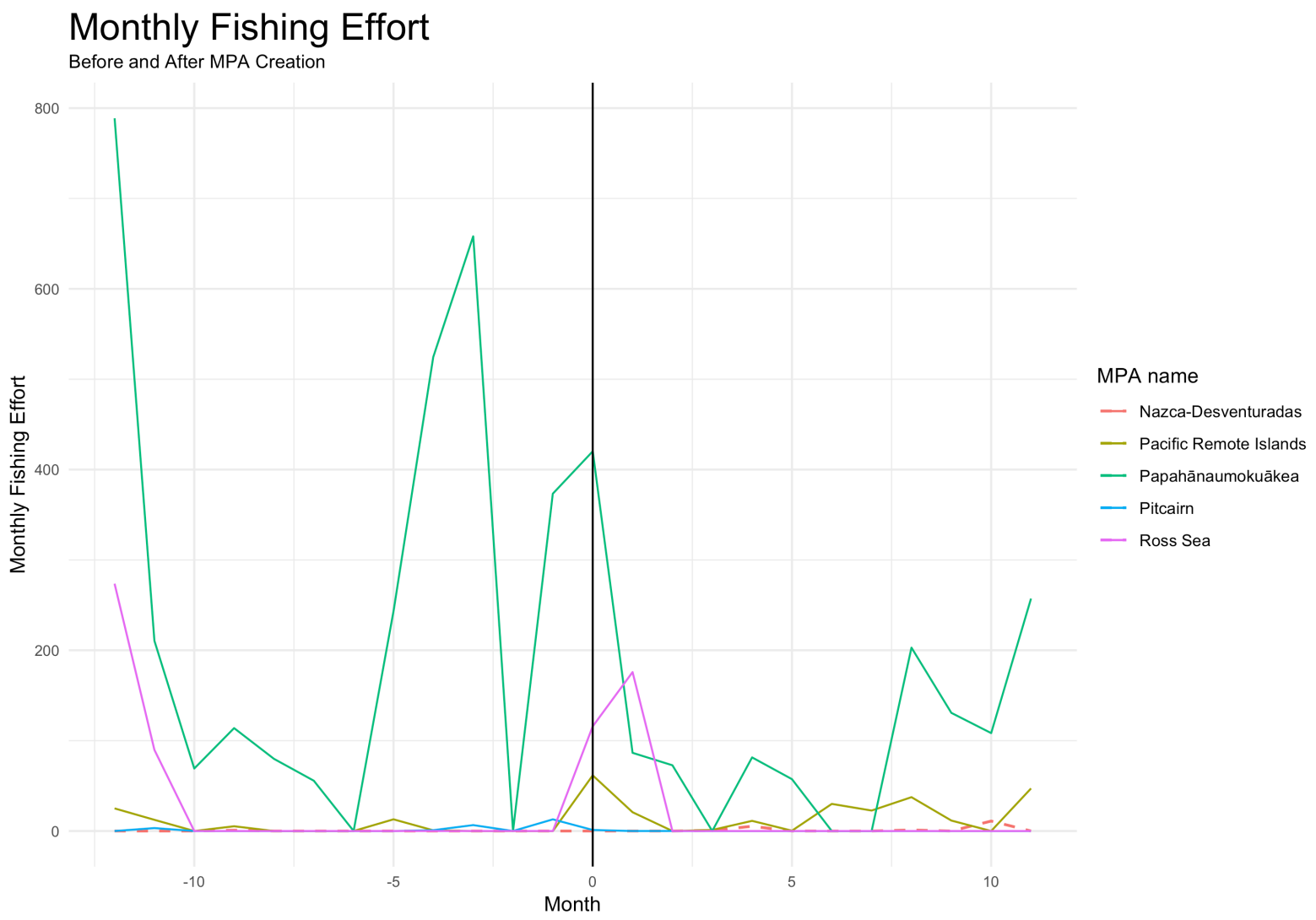



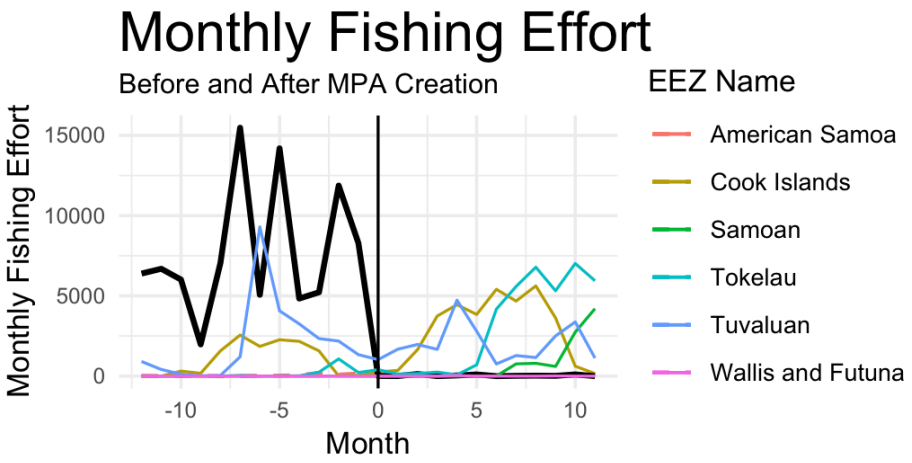
# Result 2: large MPAs are successfully keeping effort low



# Same plot without PIPA, same pattern



# MPA effort (black) is much less than surrounding EEZ effort



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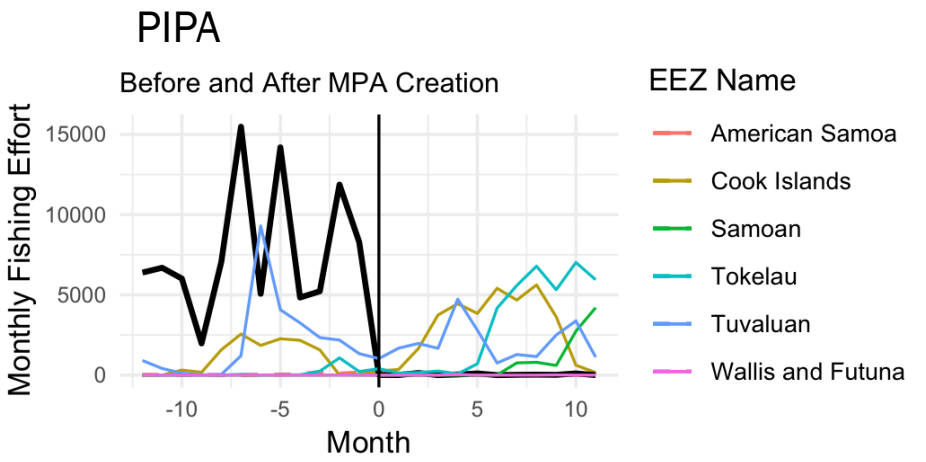
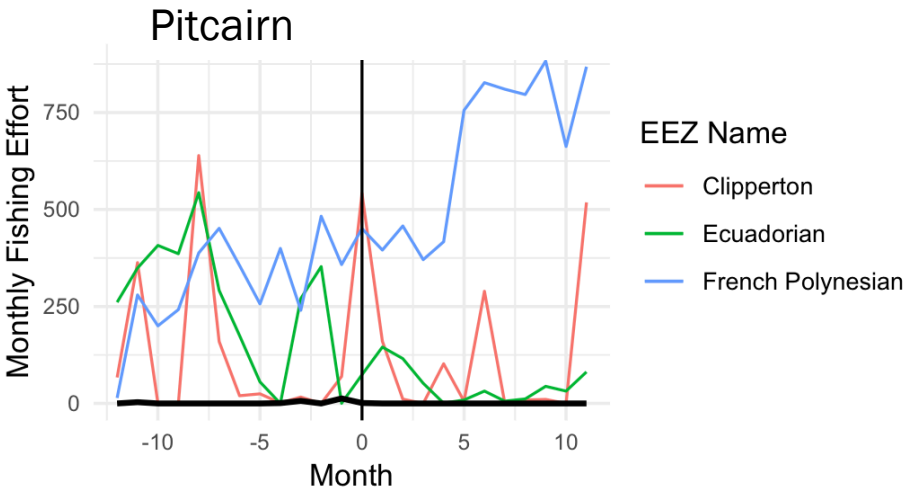
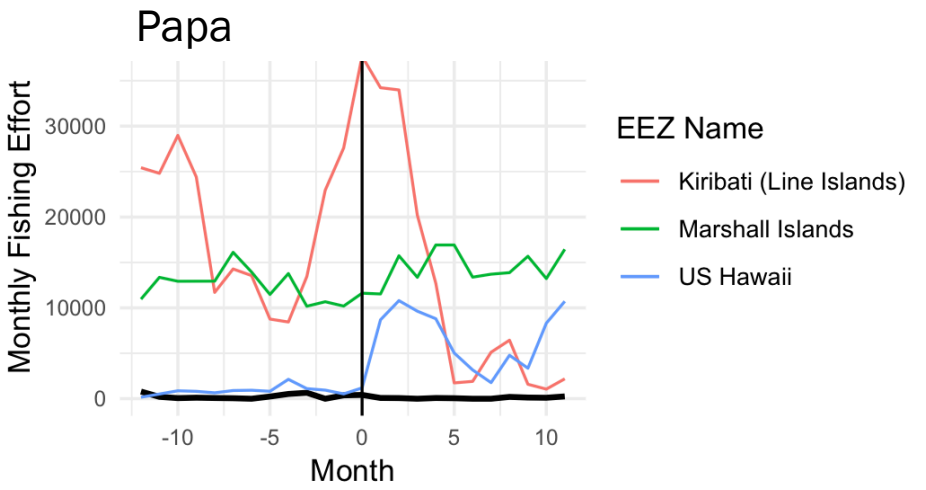
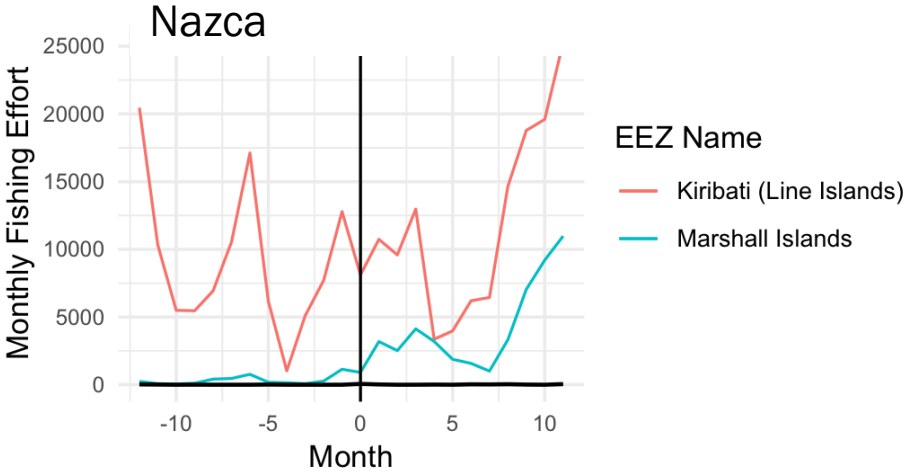
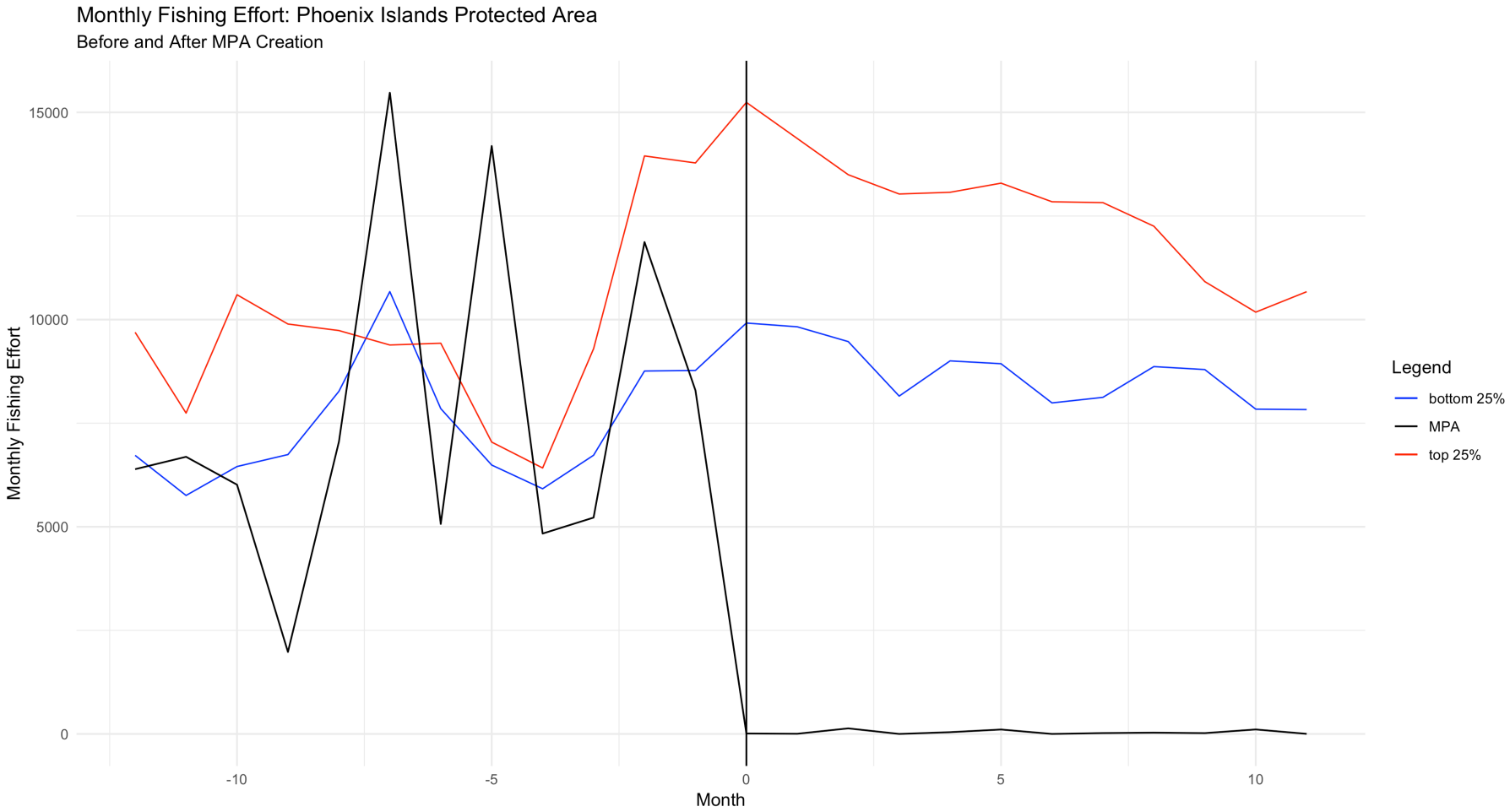


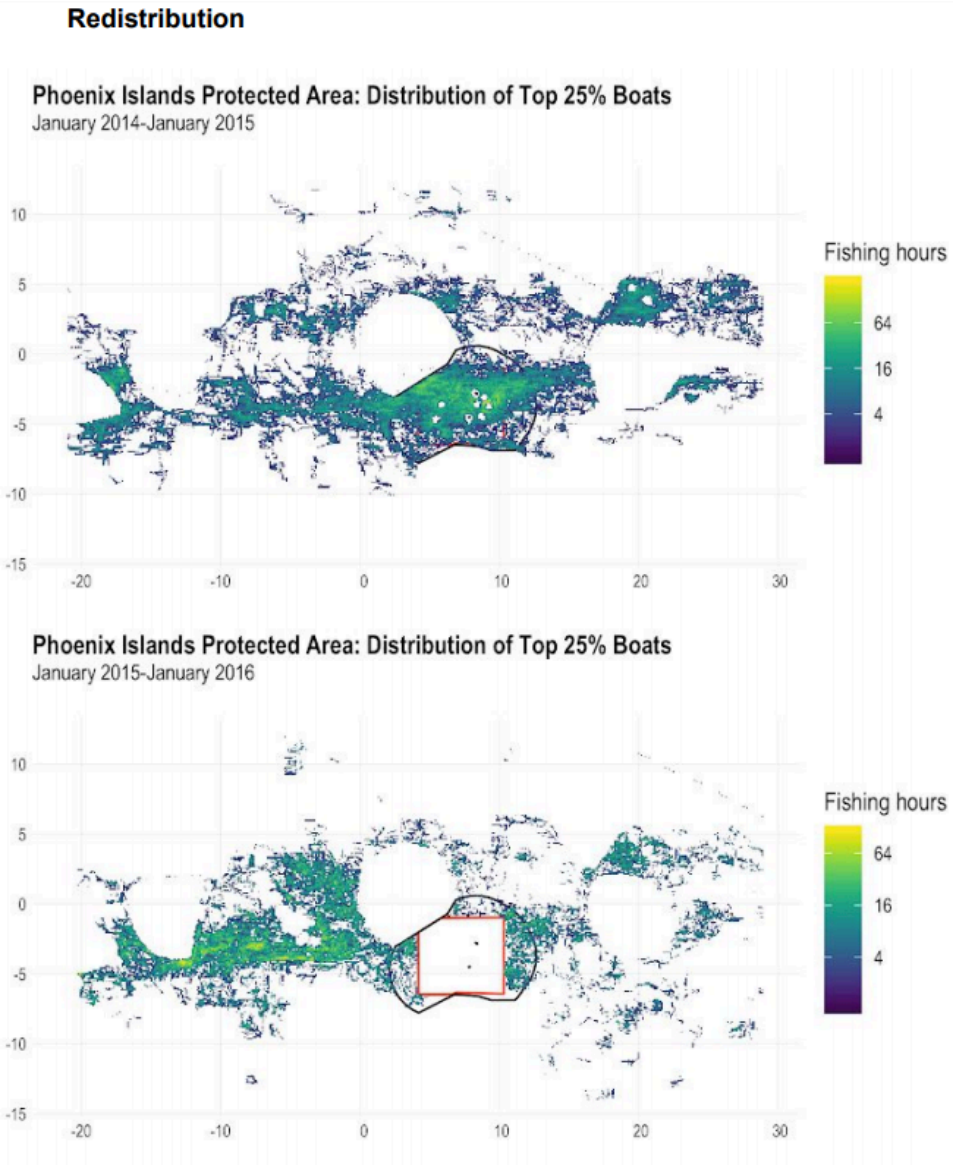



# Fishing effort redistribution: are MPAs making boats less efficient?



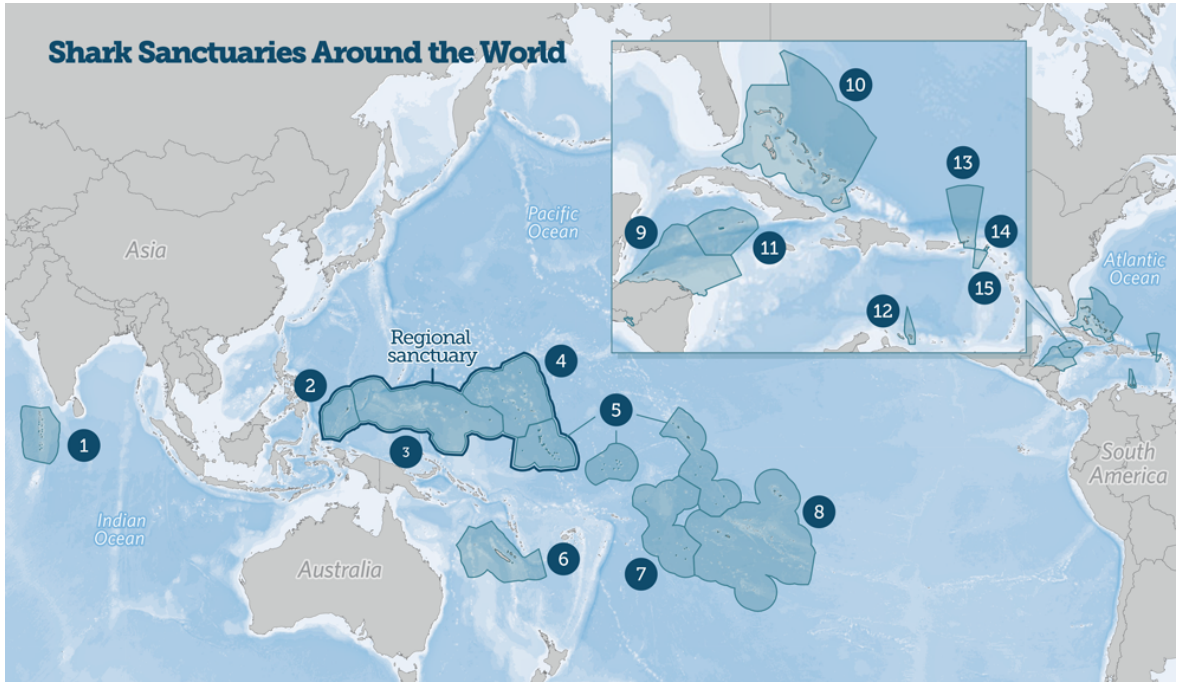

## “Redistribution” doesn’t seem relevant since most MPAs start with low effort

# Fishing effort redistribution: Where did PIPA boats go?



# Next steps

- Target journal/format?
- Stats to compare MPAs/EEZs? Self-evident patterns…
- Additional analyses? Shark sanctuaries?
- Controlled all these plots by area, same pattern –preference?

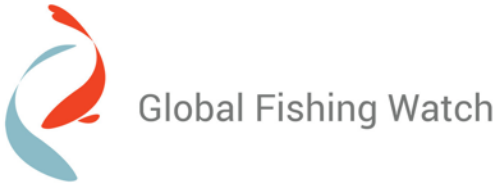


# Acknowledgements and funding


- Stanford: Tiffany Ong, Francesco Ferretti, Giulio De Leo
- Global Fishing Watch: David Kroodsma
- UCSB: Doug McCauley

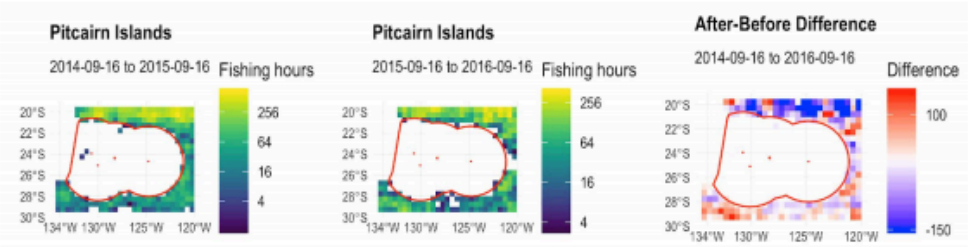
- NSF GRFP and GRIP, Stanford's VPUE internship

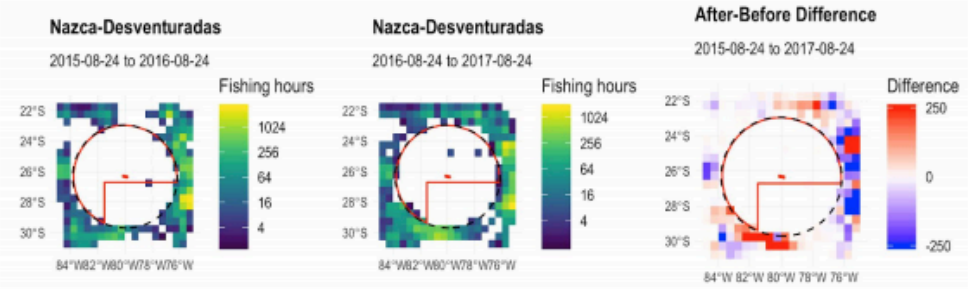


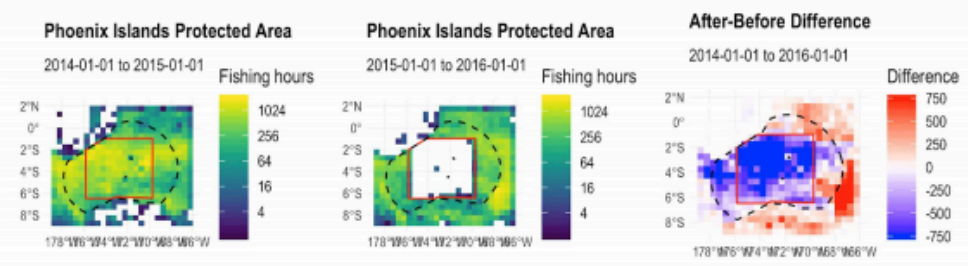


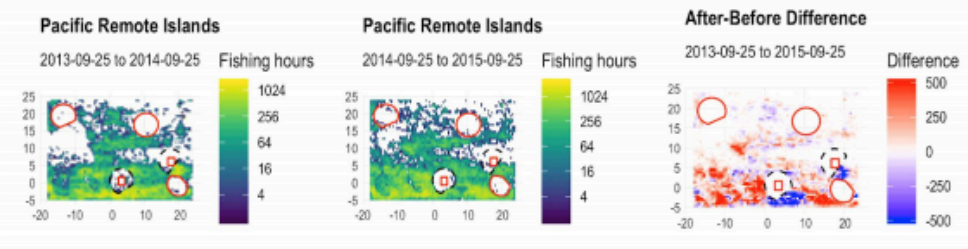

# EEZ effort plotted for 4 years, sorted by total effort. Same story

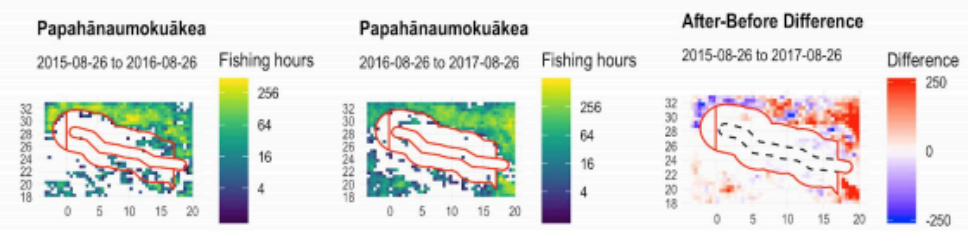
# Effort and Difference



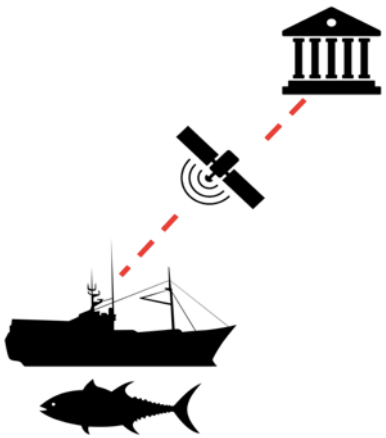
# VMS vs. AIS

*Tracking industrial fishing vessels*

## VMS

*Vessel Monitoring System*

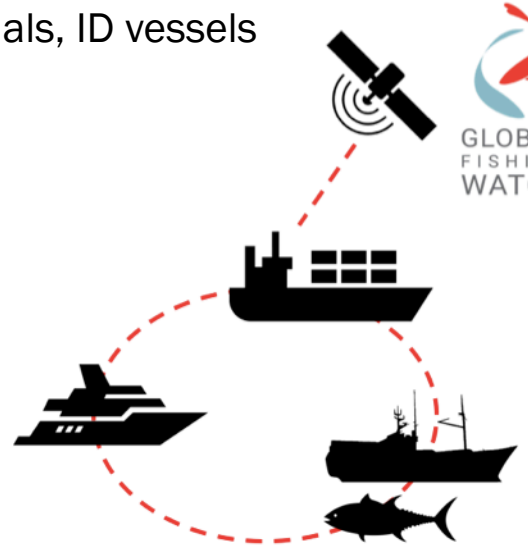
- Closed-access data (most cases)
- Designed to track fishing vessels
- Mandated by governments & fisheries management organizations



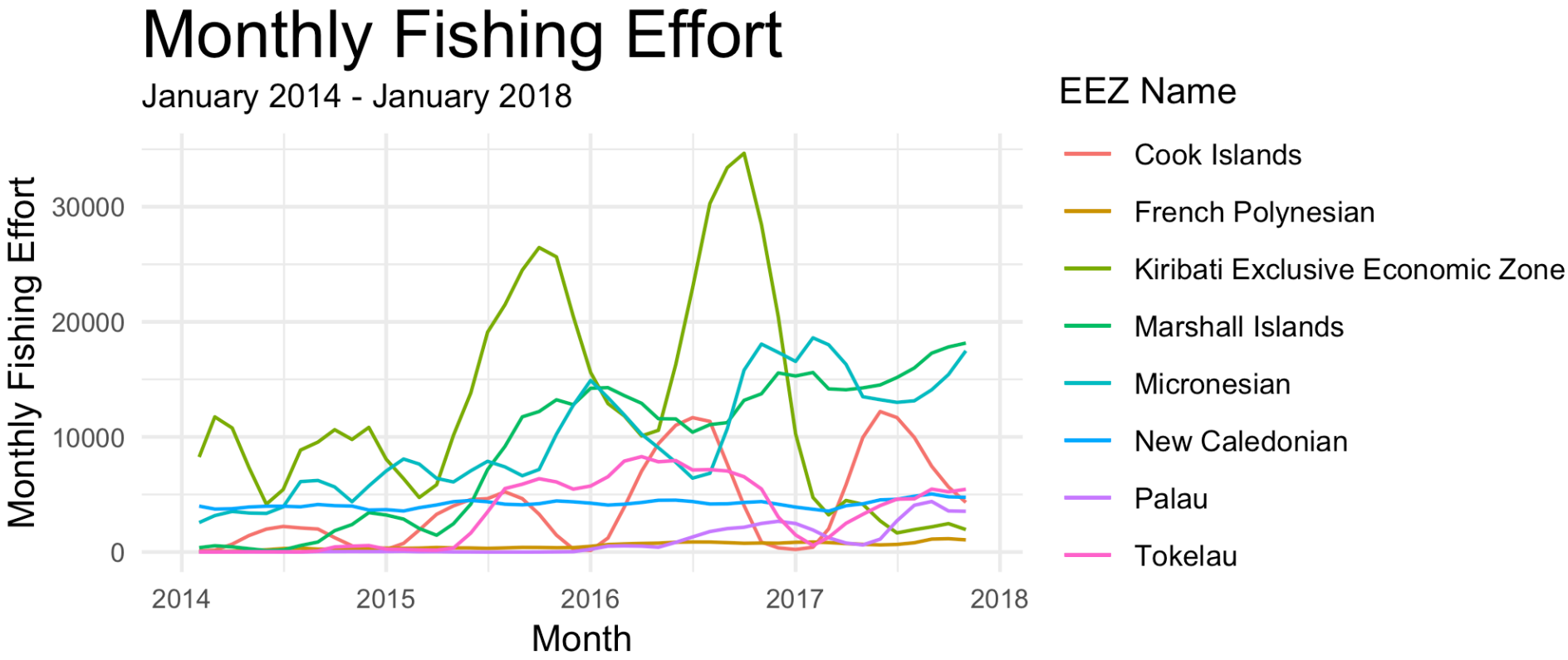
## AIS

*Automatic Identification System*

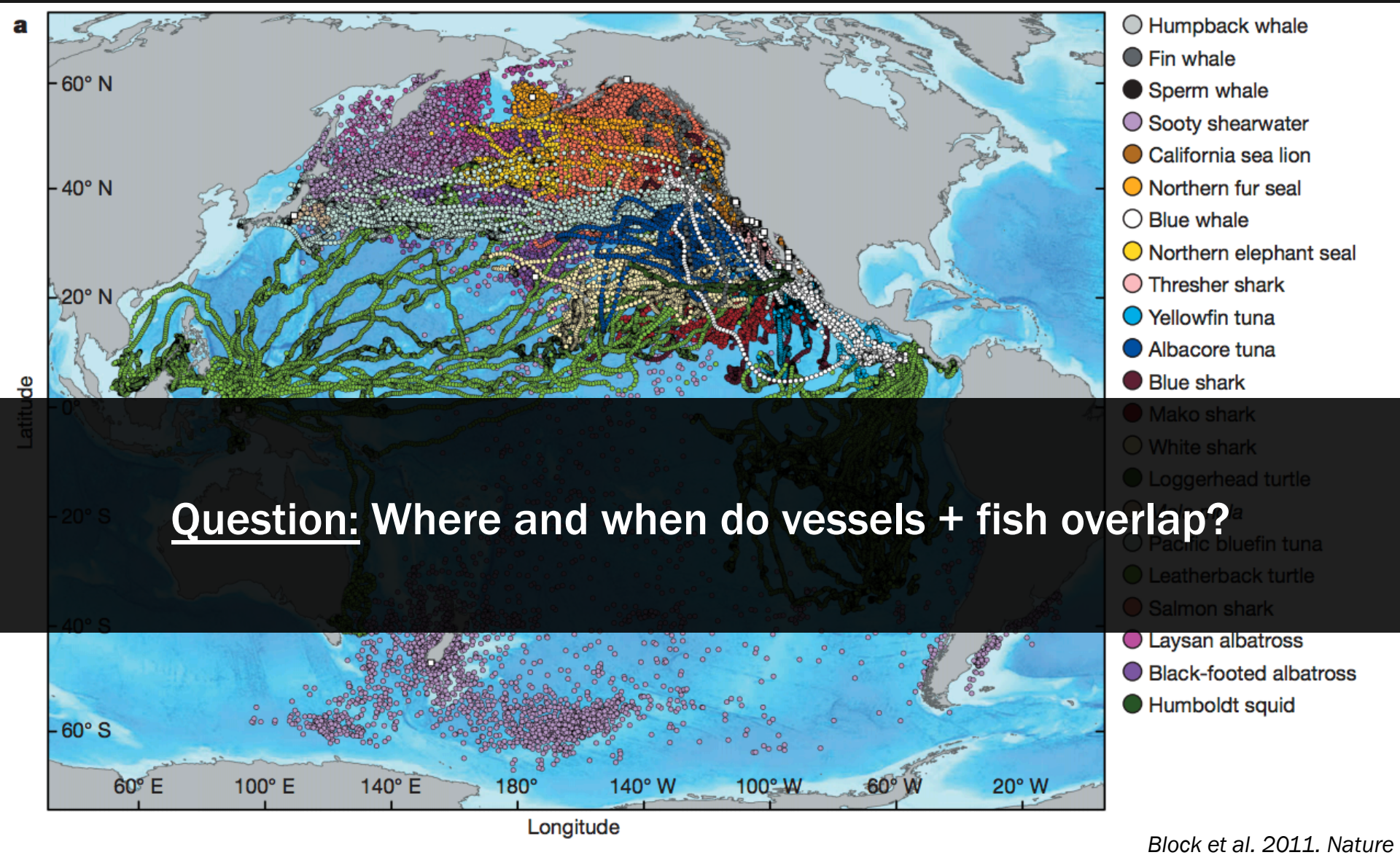
- Publically-available data
- Designed for vessel collision avoidance
- Both mandatory (vessels > 300t required by UN & many nations) & voluntary use
- New analytics required to understand signals, ID vessels



# Shark sanctuary – no trends



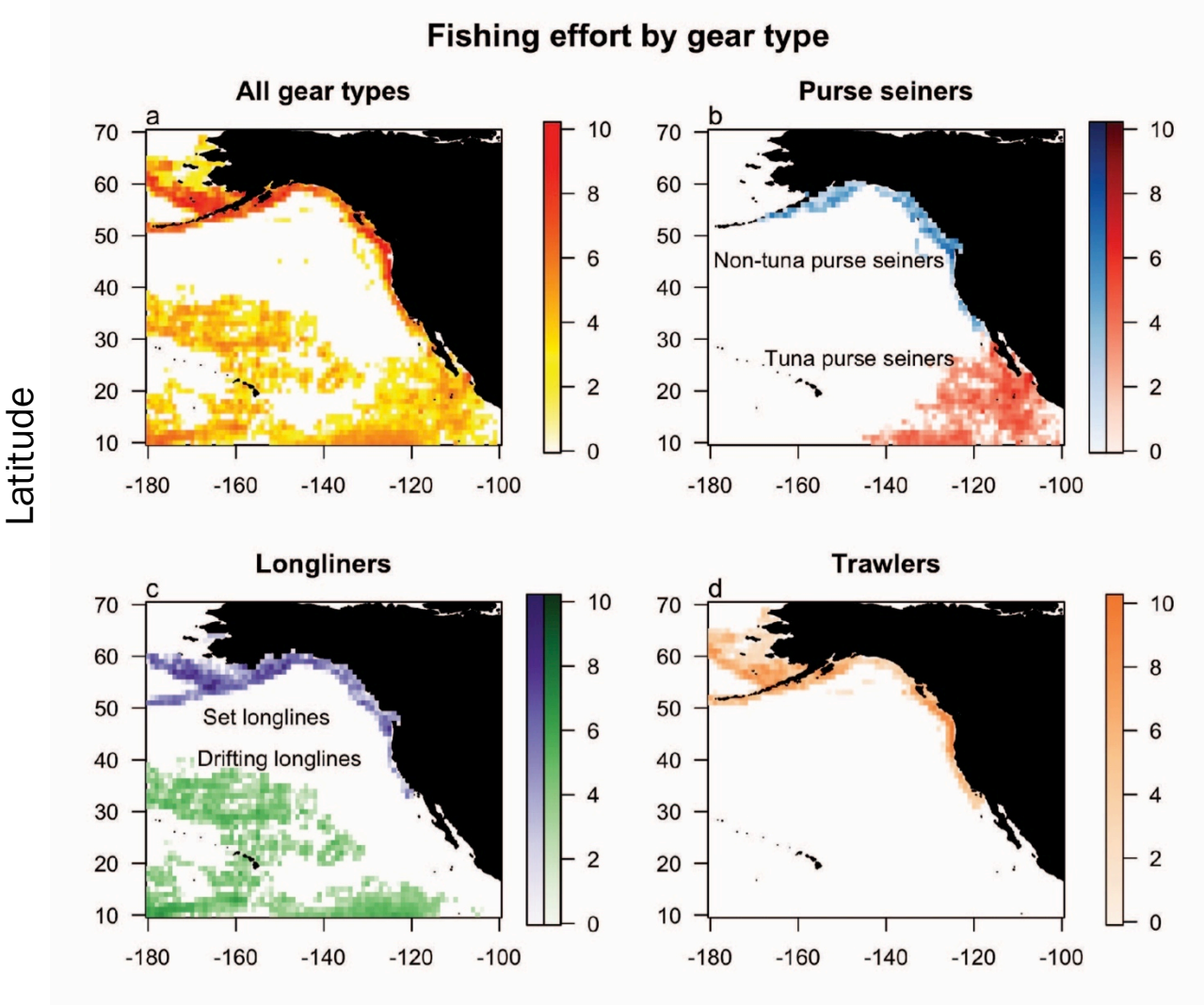
# Many Pacific predators leave national waters




**Question:** Where and when do vessels + fish overlap?

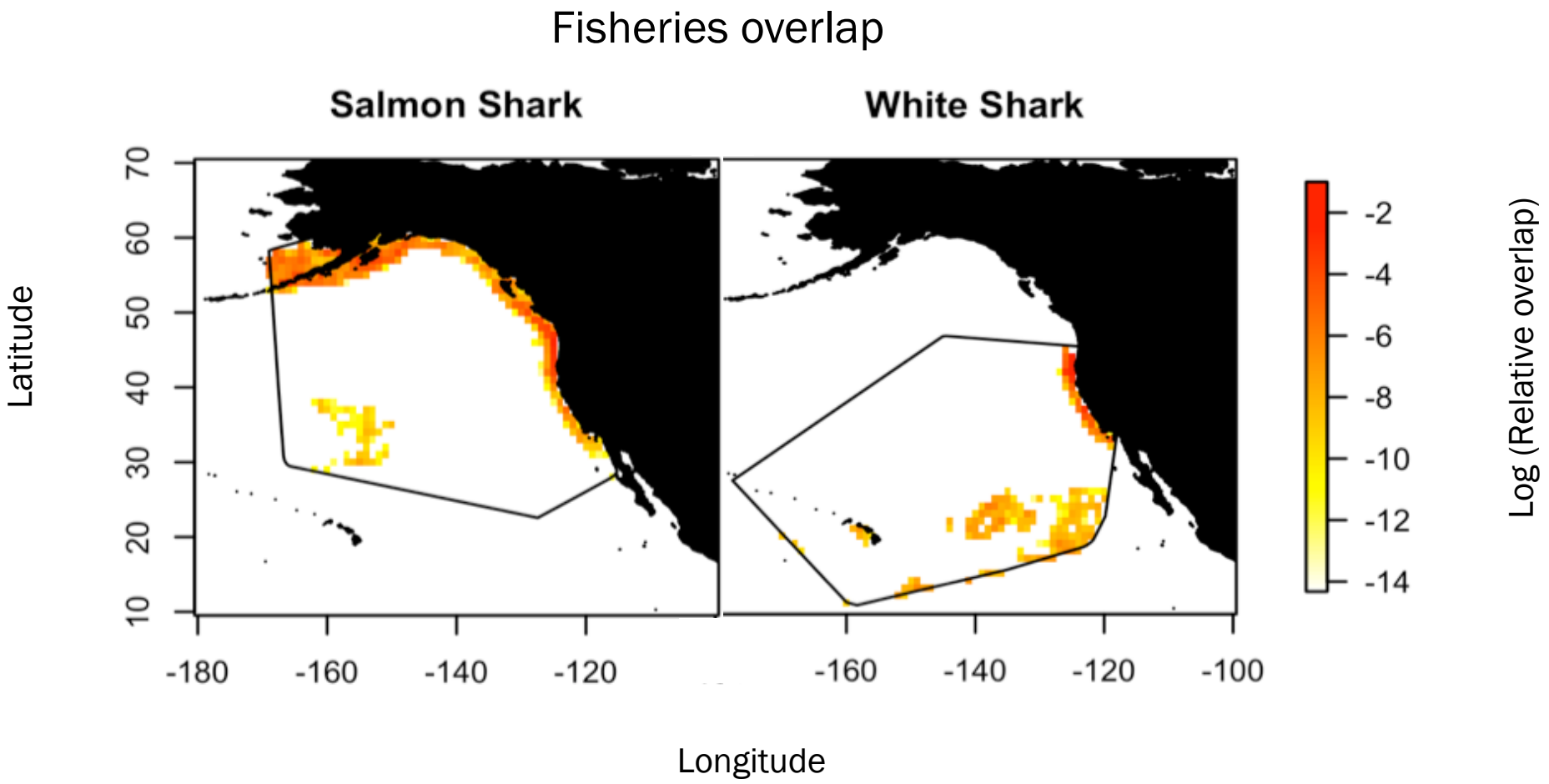
*Block et al. 2011. Nature*

# Result: Mapping fishing effort in the northeast Pacific




White et al., in prep

# Overlap of sharks and fishing effort




White et al., in prep