A Bargain for Tuna

Coaseian Solutions to Bigeye Bycatch

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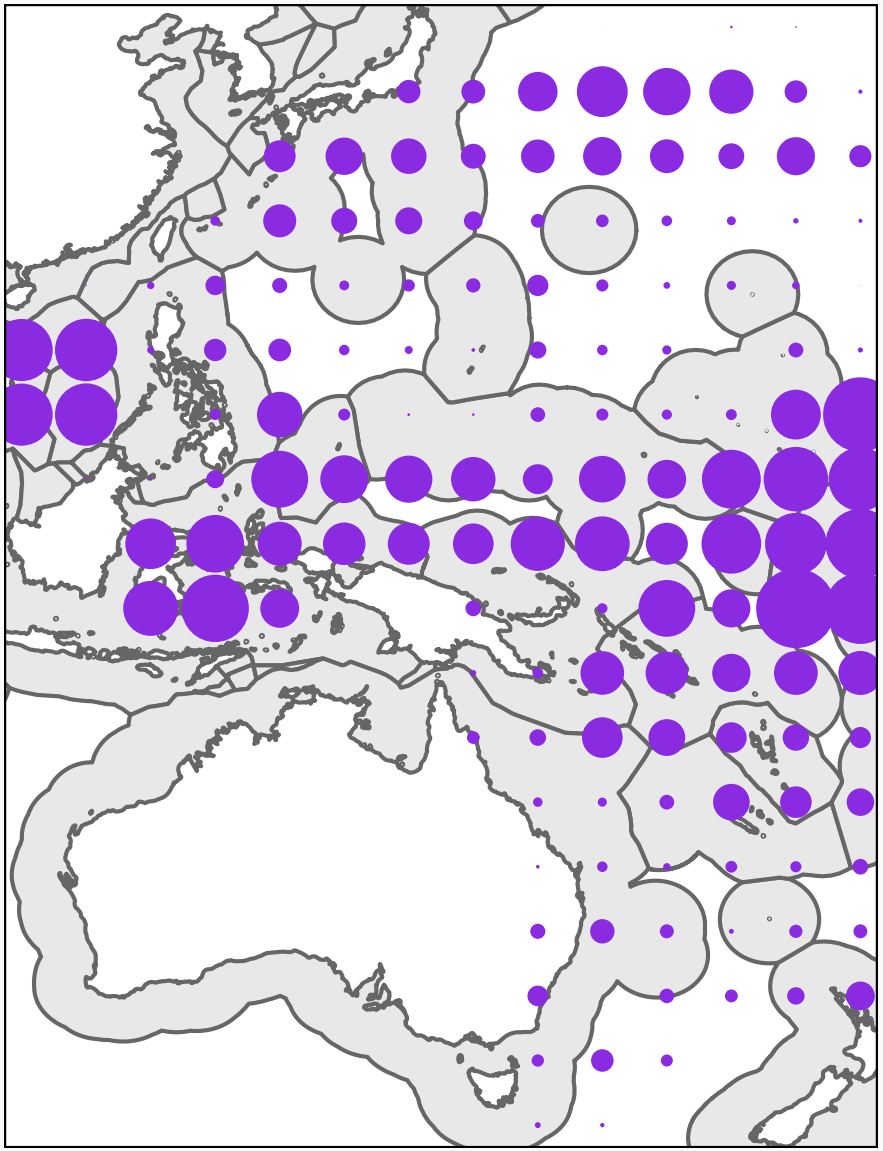
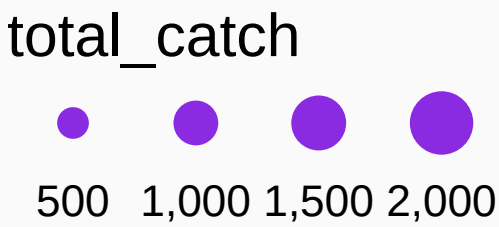
Bigeye Background

- Why are we still overfishing WCPO bigeye tuna?
  - F/F_{MSY} of 1.5
  - B/B_{MSY} of 1, but presumably headed down
  - Overfishing established for over a decade
- Many similar environmental problems persist
- Economic incentives can provide solutions

Bell et al. 2015

Bigeye Background



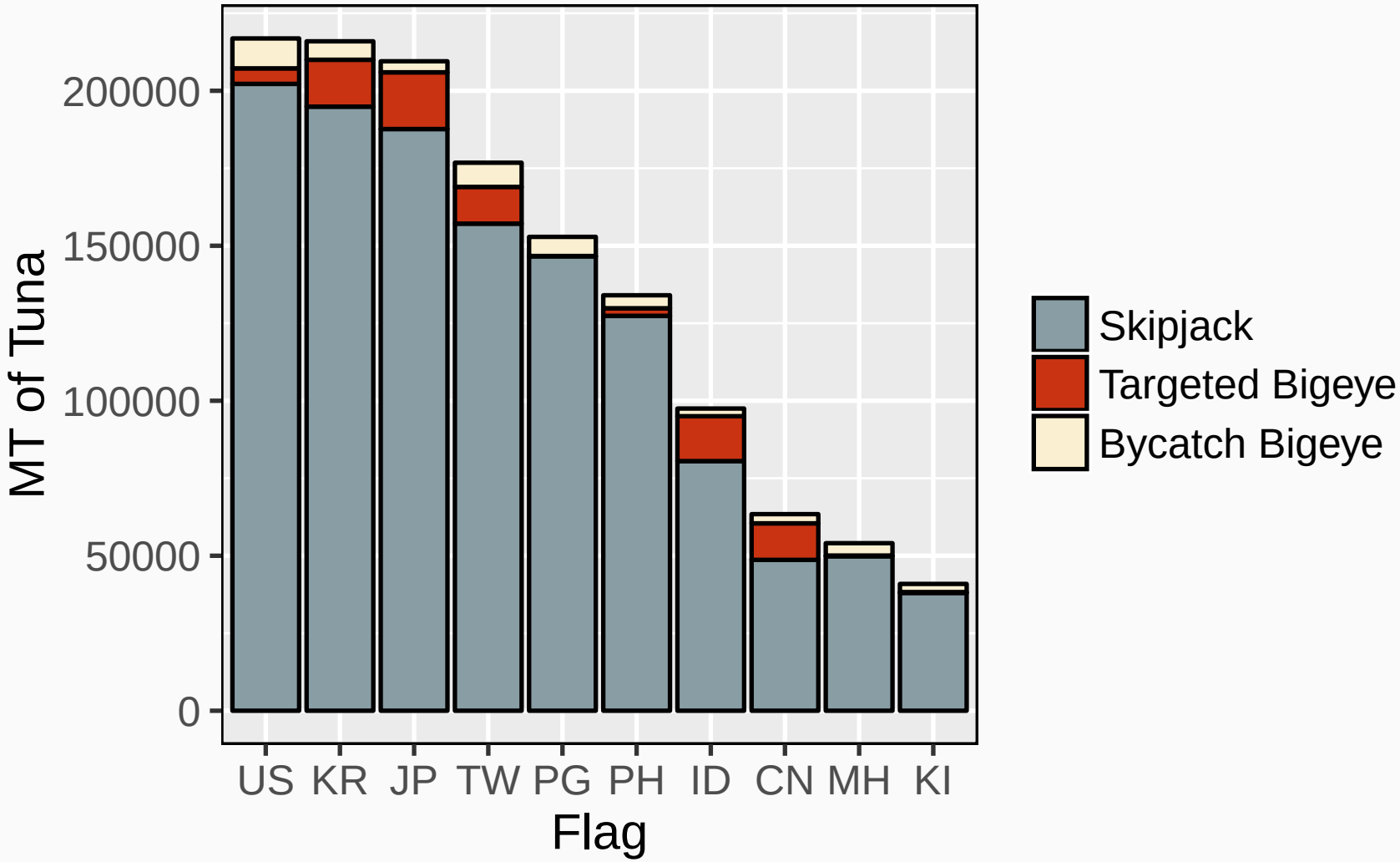


Bigeye Background

- WCPO bigeye tuna (BET) supplies 40% of global consumption
- Large adults caught by targeted line fishing
- Up to $10,000/MT
- Line caught targeted BET make up 50% of WCPO catches
- Other 50% juvenile bycatch in skipjack purse seine fishery

Bigeye Background

Skipjack >>>> Bigeye



Bigeye Management

- BET and SKJ managed by Western and Central Pacific Fisheries Comission (WCPFMC)
  - Seasonal FAD closures
  - High Seas purse-seine closures
  - Catch limits
- PNA countries operate vessel day scheme (VDS)
  - Set cap of vessel days
  - Sell vessel days to interested parties
- Despite these, bycatch remains
- What's the incentive for reform?

The Bargain

What if bigeye tuna interests subsidized purchase of FAD-free days?

- VFDs in EEZs leased from PNA countries
  - \$10,000/VFD
- BET provides payments to PNA
- PNA uses payments to subsidize FAD-free SKJ days
- Is WTP $\geq$ WTA?

Methods

Methods

WTP is the expected benefit relative to BAU

$$WTP = \sum_{t=0}^{T} p_l^{BET} r^{targeted} (y_t^{BET,bargain} - y_t^{BET,BAU})(1+\delta)^{-t}$$

WTA is the expected loss in SKJ and BET catch relative to BAU

$$WTA = \sum_{t=0}^{T} (p_{ps}^{skj} skj^{lost} + p_{ps}^{bet} bet^{saved})(1+\delta)^{-t}$$

where WTP & WTA $= fun(f^{targeted}, f^{bycatch})$

We assume $f^{targeted}$ constant

$\Delta f^{bycatch}$ a function of FAD-days removed

Methods

Our goal is to translate FAD removals into bycatch removals...

And from there into changes in f

$$f^{bargain} = f^{bycatch} + f^{targeted}$$

$$f^{bargain} = \frac{(y_{today}^{bycatch} - \Delta y^{bycatch})/MSY}{b_{today}} + \frac{y_{today}^{targeted}/MSY}{b_{today}}$$

Assuming a constant f policy, we then project using surplus production model

Methods

How do we get the change in catch per FAD removal?

Limited published data, so turned to empirics

$$y_i = fun(FAD_i + Effort_i + Region_i + SST_i ...)$$

fit using delta-GAM

$$\Delta y_i = y_{i,FAD=1} - y_{i,FAD=0}$$

Repeat for BET and SKJ

Select $i|FAD = 1$, predict $y_i|FAD = 0$

Sort by ascending cost per unit BET

Early exploration, but promising

Methods

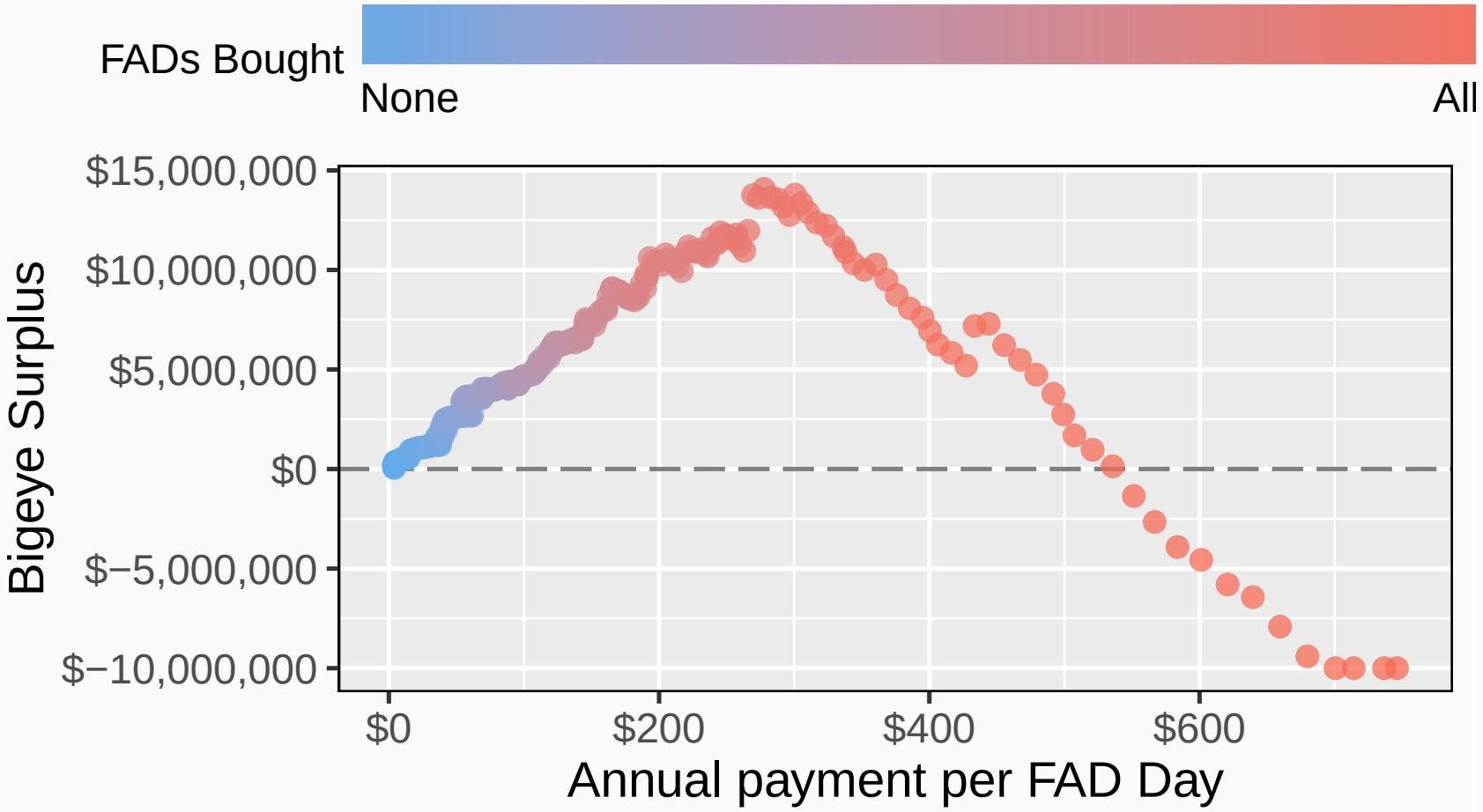
To summarize....

1. Get data from WCPFC
2. Estimate FAD effect
3. Project biomass and catch under BAU
4. Project biomass and catch under bargains
5. Calculate WTP, WTA, and surplus

Results

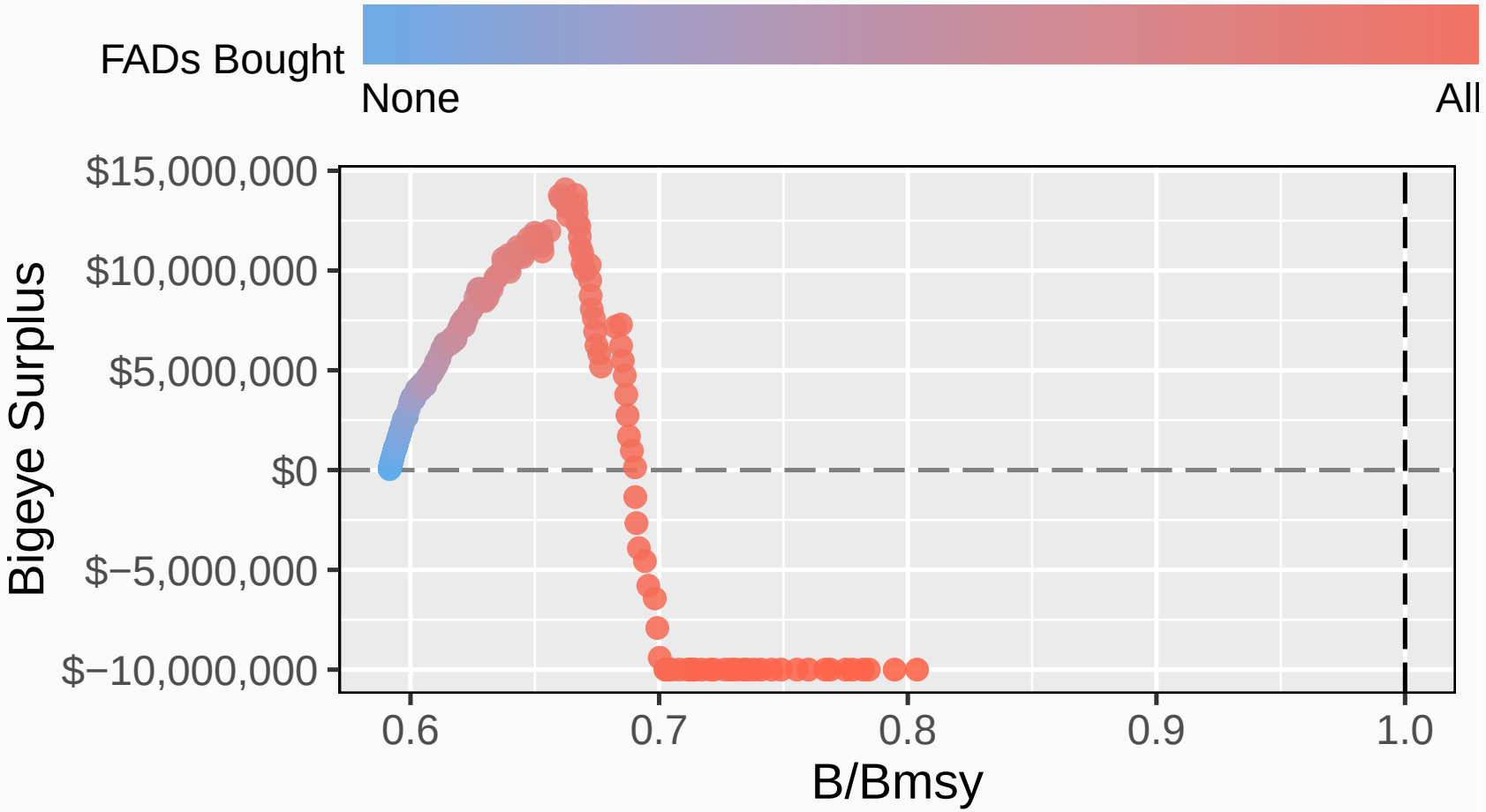
A Bargain is Possible!

FAD removal creates 80% reduction in BET bycatch, 13% for SKJ



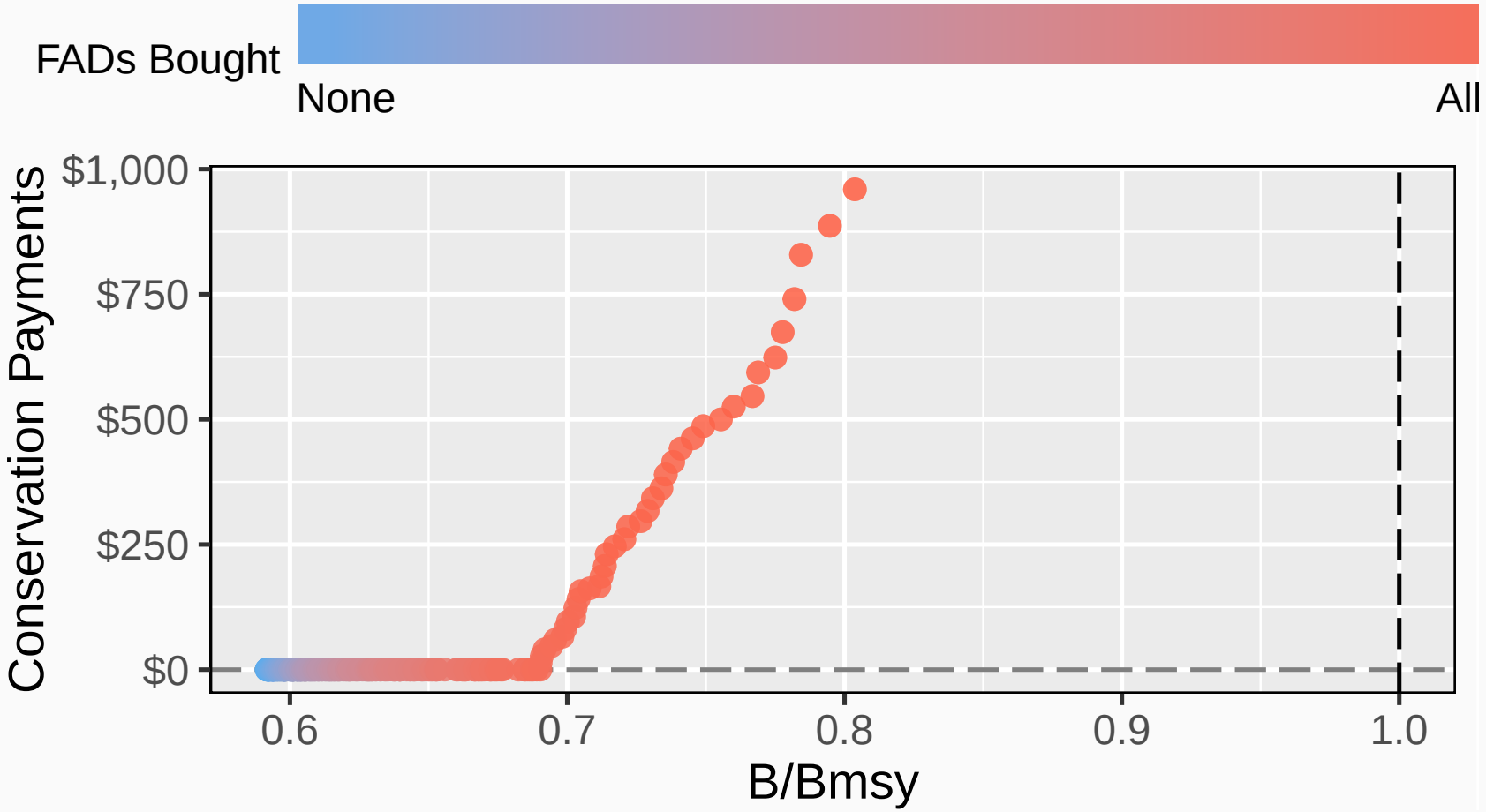
What about Conservation?

FAD assocaited bycatch could rebuild up to 0.8 B/B_{MSY}



Conservation Payments

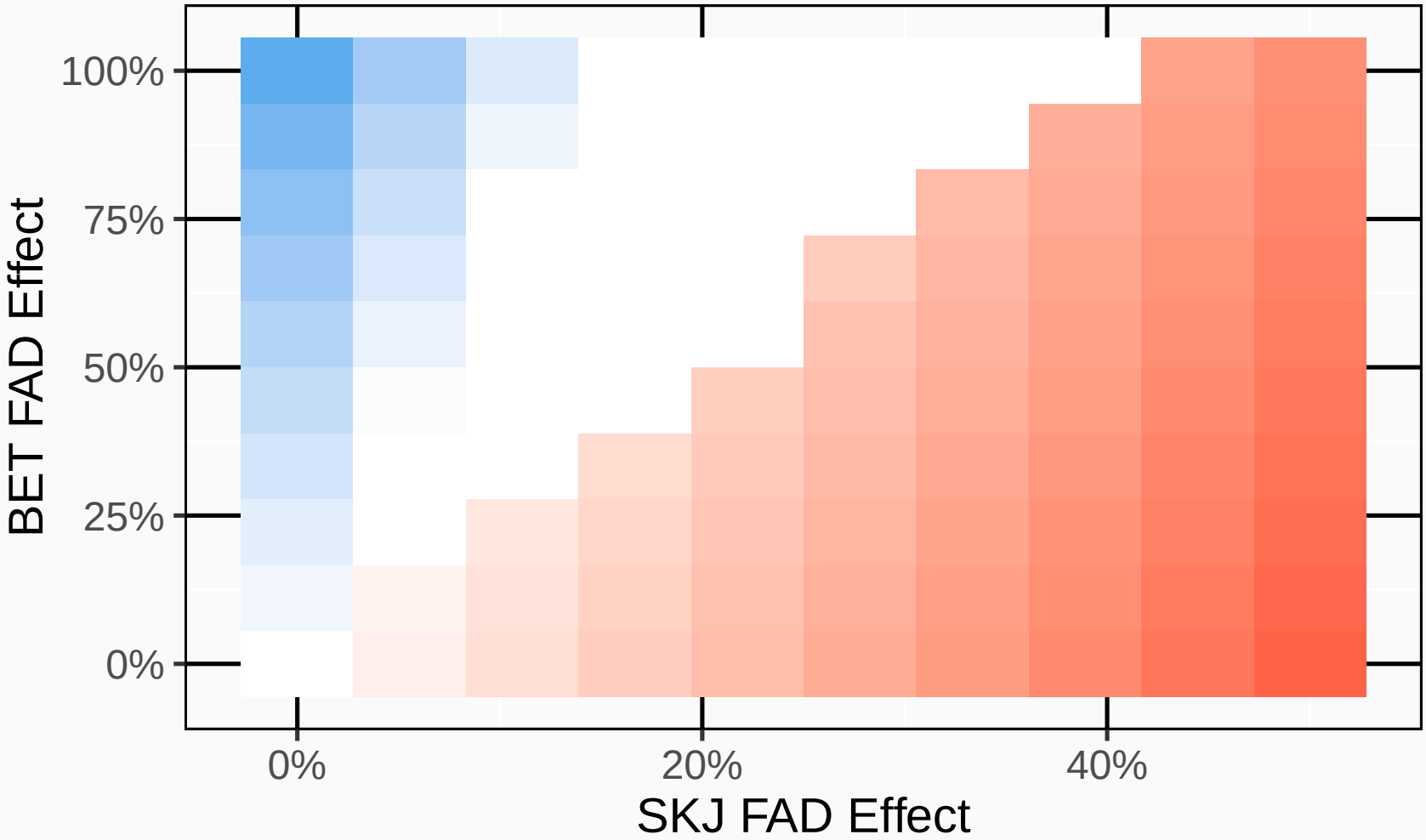
How much would additional conservation payments be?



Could this work?

Sensitivity

Blue = Positive, White = 0, Red = Negative



Feasibility

The idea: BET subsidizes the purchase of FAD free vessel days from PNA countries

- We've established a potential bargain
- Success depends on
  - Transaction costs
  - Property rights
- Neither perfect, but reason for optimism

Transaction Costs

Proposed system minimizes transaction costs

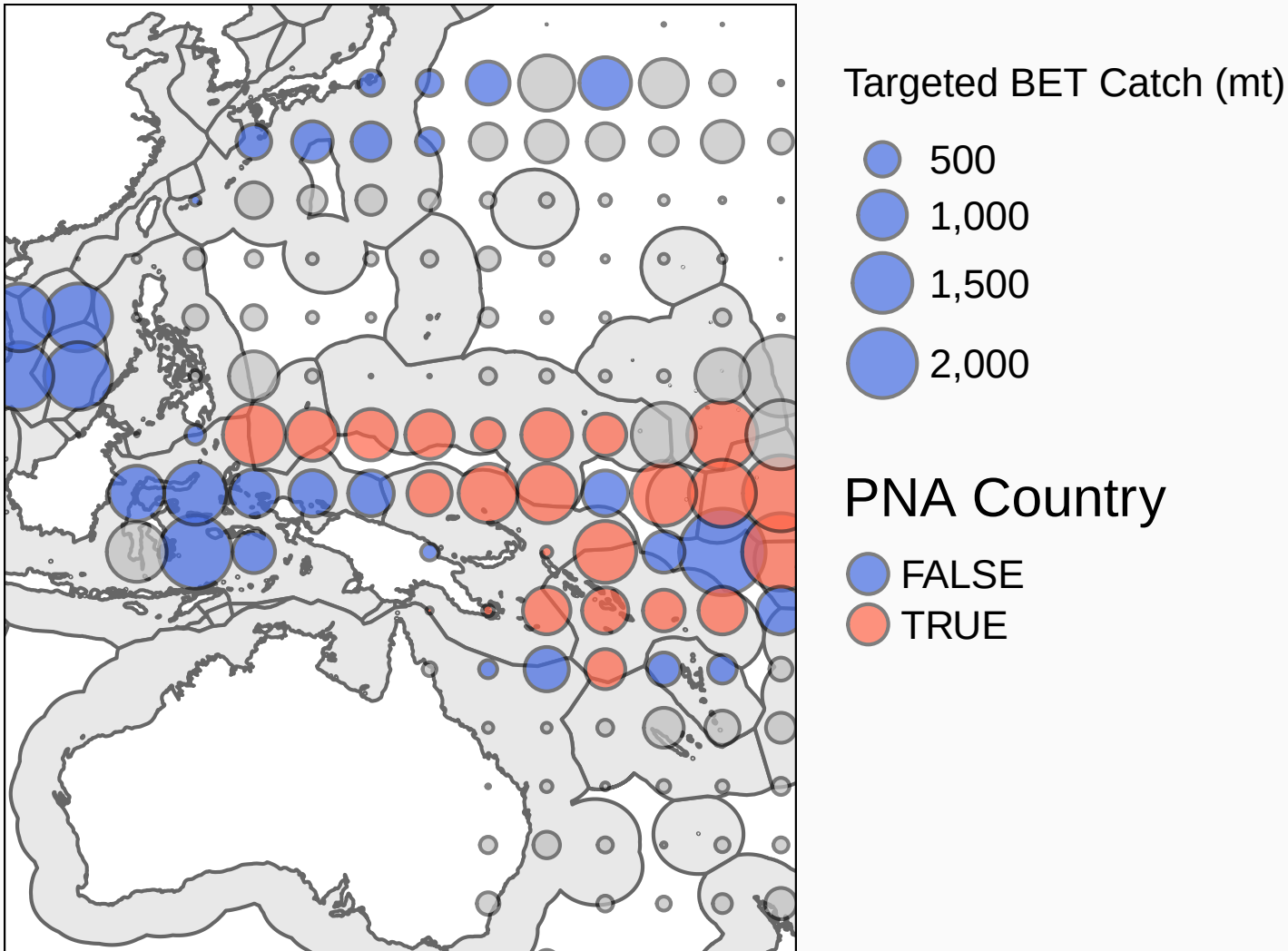
- The vessel day system provides infrastructure
- Minimal additional transaction costs for SKJ
- Transaction costs concentrated between BET & PNA
- Limited # of BET beneficiaries
- PNA countries already coordinate
- Potential surplus for side payments to PNA to limit vessel days

Property Rights

- Can benefits be captured?
- ~80% of tuna in WCPO caught in EEZs
- Effectively limited entry fishery
- Vessel Day system creates weak property right

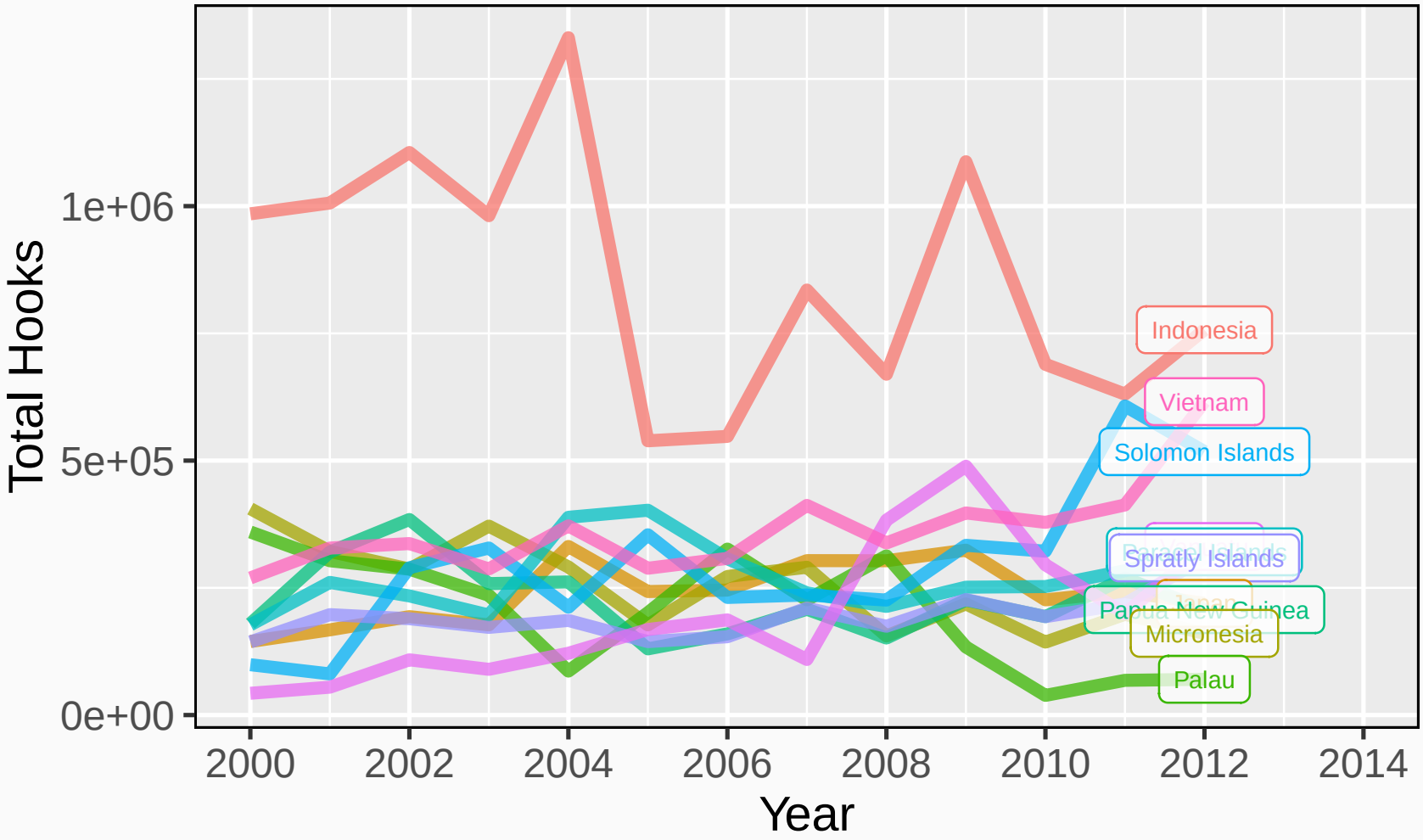
Property Rights

- PNA water cover major fishing grounds
- Substantial catches outside waters though



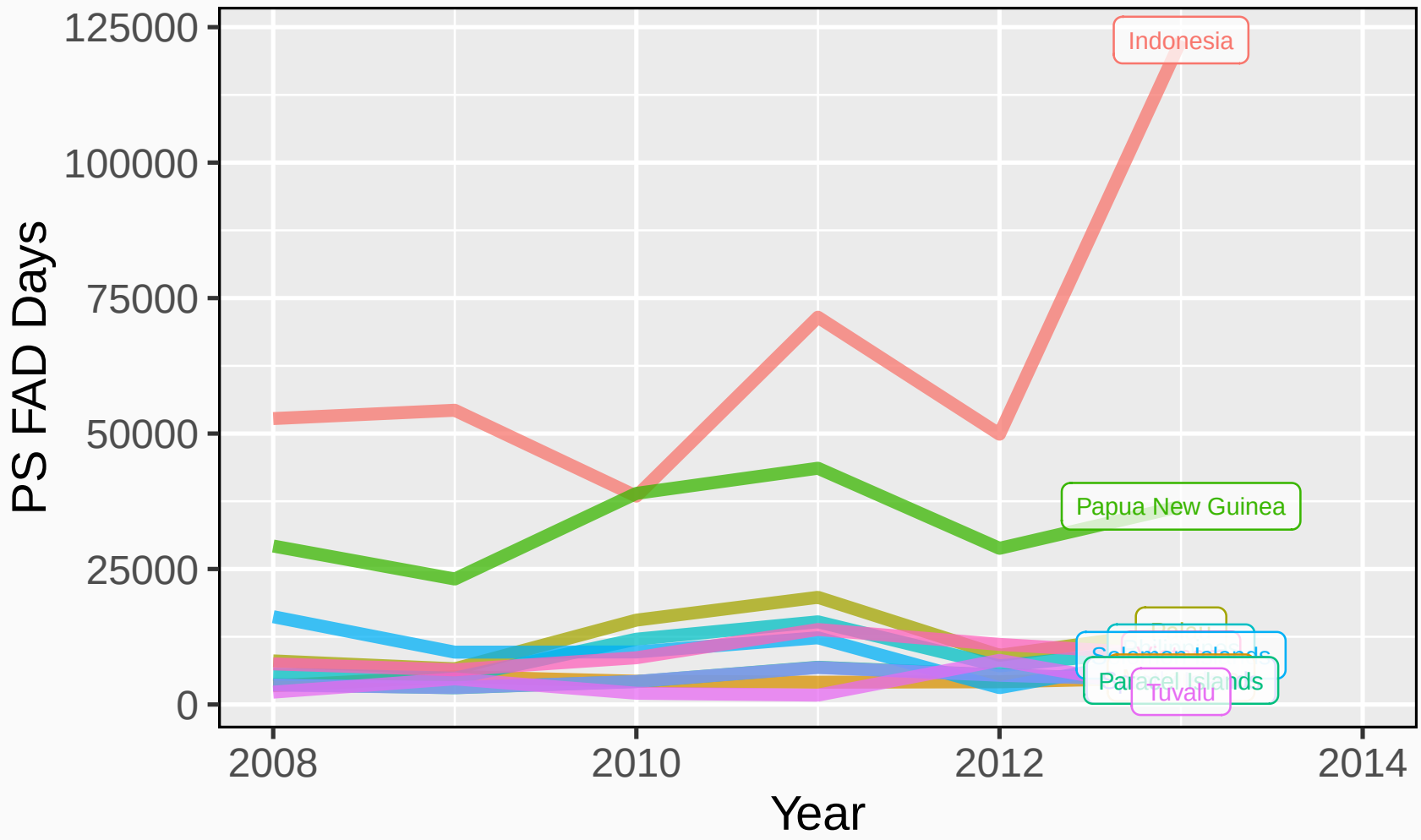
Property Rights

Targeted effort relatively stable



Property Rights

Bycatch effort increasing



Conclusions

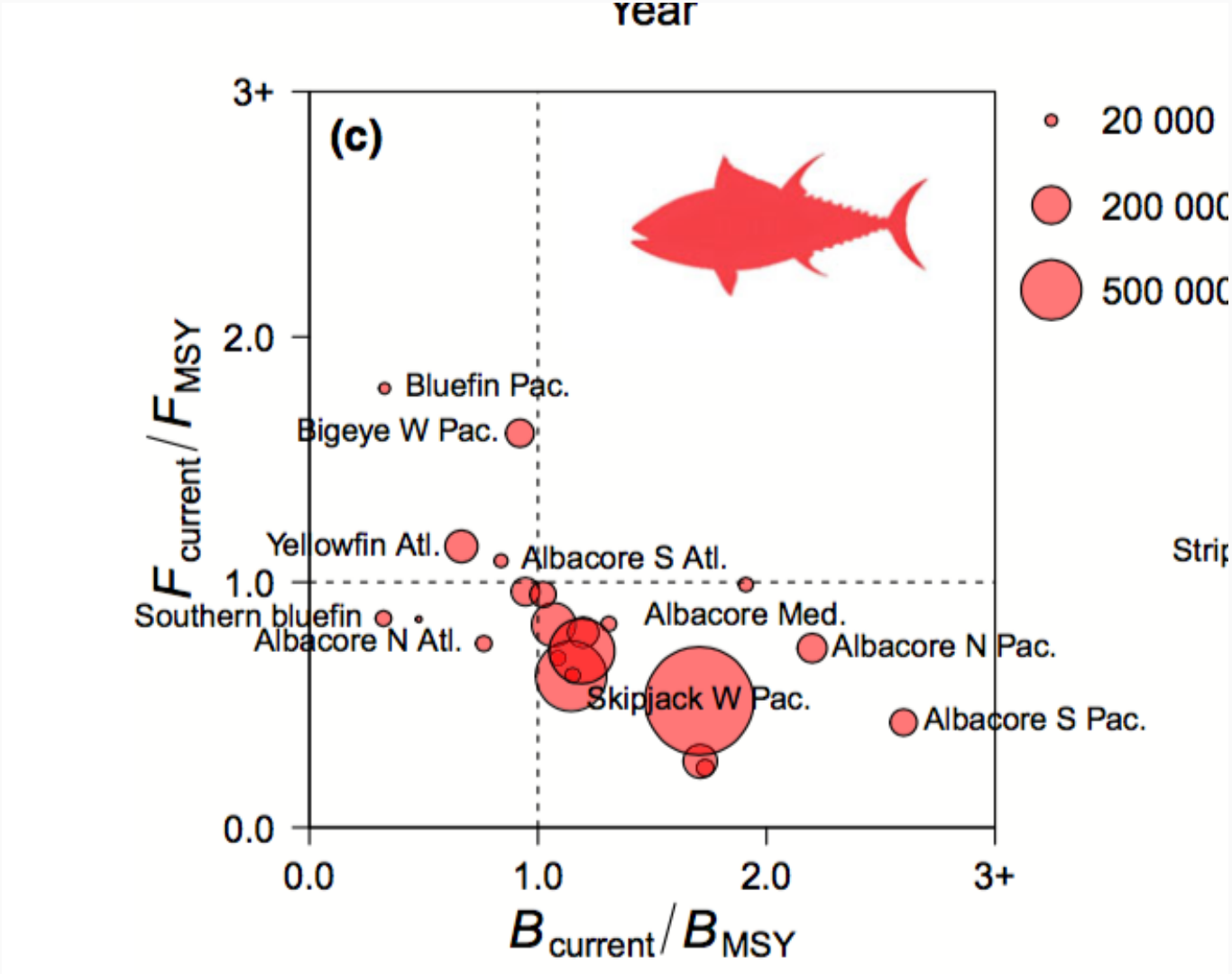
- A Coaseian bargain seems feasible
- More work needed on FAD effect, risk, effort dynamics
- More detailed modeling and institutional design needed next
- FAD-free days can provide economic and ecological benefits
- Creates framework for conservation investment as well
- Coaseian bargain provides incentives for success

Thank You

Special thanks to WWF, TNC, Gary Libecap, Cody Wilgus, and Lennon Thomas, Dale Squires

Questions?

Bigeye Background



Pons et al. 2016

Bigeye Background

- WCPO skipjack fishery supplies canned tuna to the world
- Use purse seines around Fish Aggregating Devices (FADs)
- Sells for $2,000/MT
- Mean bigeye tuna bycatch rate of ~5% (juveniles)

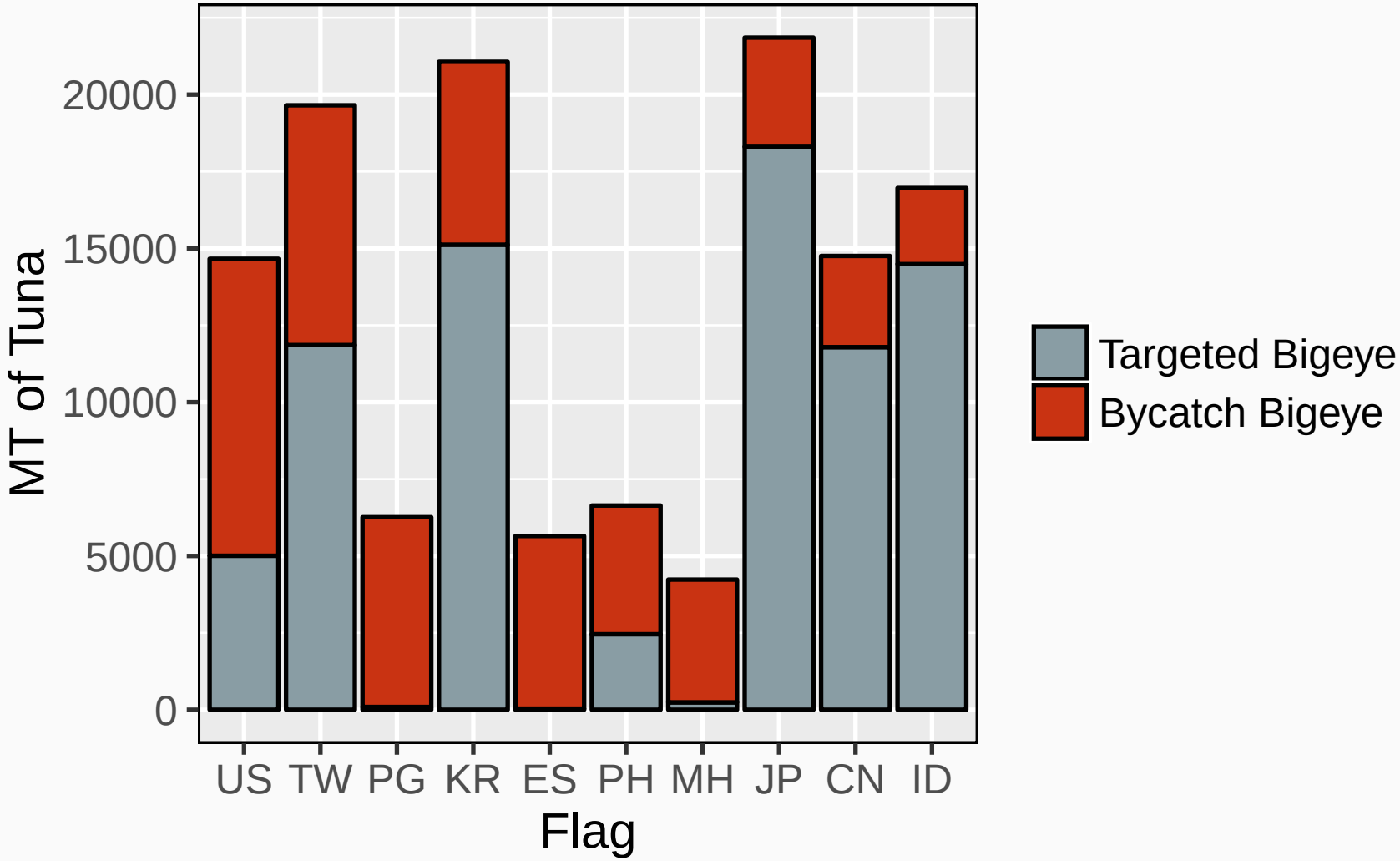
The Problem

- SKJ and BET parties have no incentive to reform
  - Costs SKJ money with no benefit to them
  - SKJ bycatch eats up BET conservation
- We propose a Coaseian solution to the problem

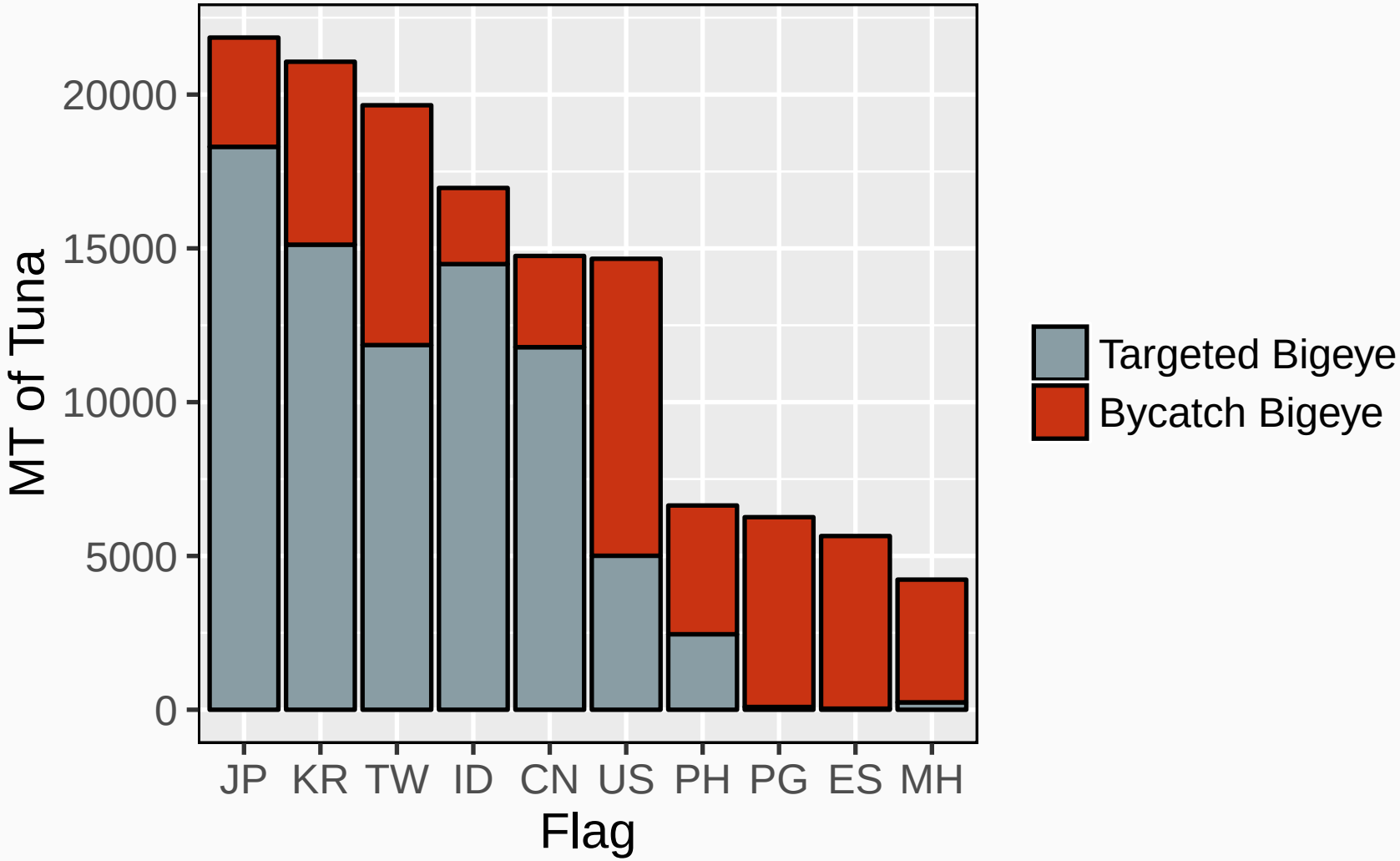
The Bargain

- Could this actually work?
  - Leverages existing systems
  - Lowers transaction costs
  - 56% of BET bycatch in PNA EEZs
- Feasibility aside, WTP must be $\geq$ WTA
- First goal is to establish whether the numbers add up!

Who Gets Paid?



Who Pays?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15000
10000
5000
0
MT of Tuna
JP KR TW ID CN US PH PG ES MH
Flag
Targeted Bigeye
Bycatch Bigeye

Works Cited