Marine protected areas under effort-control management

NCEAS-Future Earth Working Group

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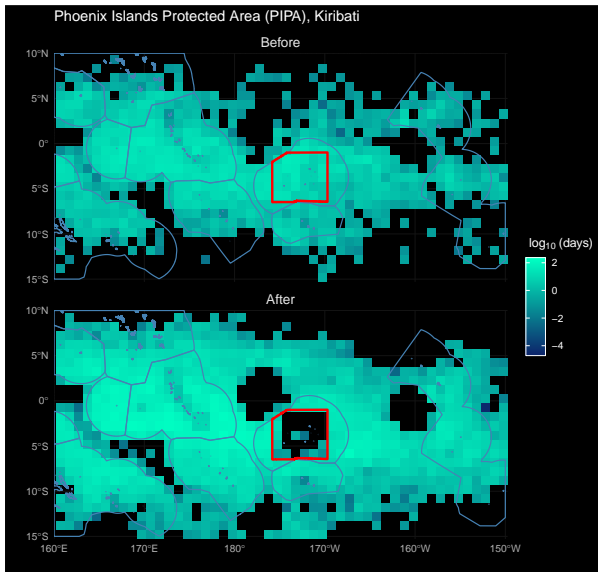
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Outline

- Scope of the project
- Approach: model and assumptions
- Data
- Generalizability to Palau

Background

Phoenix Islands Protected Area (PIPA), Kiribati

Scope and Motivation

- For the countries:
    - What are the costs associated to establishing an MPA?
    - What factors drive these costs?
    - How can these costs be reduced or eliminated?
- For the fishing vessels:
    - How do they respond?
    - Where do they go?

Approach

- 10-patch model of the fishery (9 patches under VDS, one patch under Open Access)

- Vessel-level profits for fishing in patch i are:

$$\Pi_i(E_i, X_i, R) = pqE_iX_i\Omega_i - cE_i^{\beta}$$

- In patch 1, $\Omega_1 = \theta + (1 - \theta)(1 - R)$

- $\Omega = 1$ for patches $i > 1$

- Vessel-day price must equate the marginal profits from the last unit of effort in patches $i = (1, 9)$

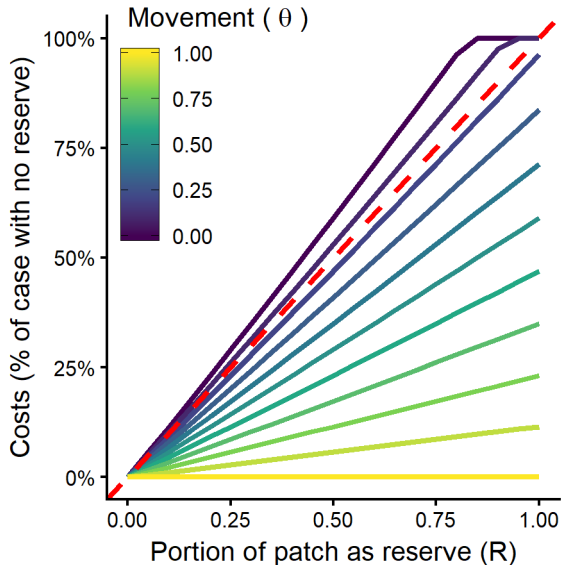$$\pi_i(E_i) = pqX_i\Omega_i - \beta cE_i^{\beta-1}$$

Approach

- Effort is capped at 45,000 vessel-days ($\bar{E}$)

- Measure country-level demand curves

  - No trading: price is patch-specific
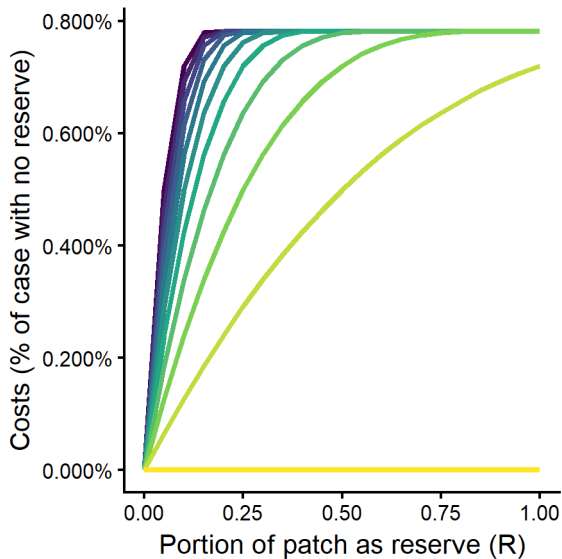
  - Trading: price is the same for all patches
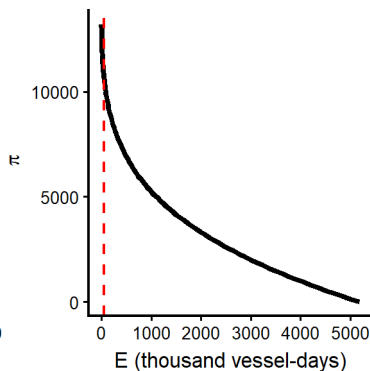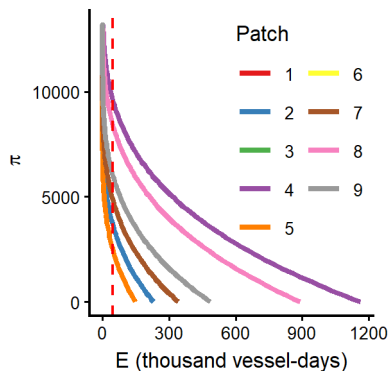
Approach

Less movement increases costs

Vessel-day trading reduces costs

Allocation rules matter

What can we learn from PIPA

- Implemented in January, 2015
- 397,447 Km^2
- 1.5 times area of Ecuador
- ~2% of total PNA area
- ~10% of fishing activity in PNA

Generalizability to Palau