THE UNIVERSITY OF WESTERN AUSTRALIA

SCHOOL OF AGRICULTURAL & RESOURCE ECONOMICS

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Improvements in marine spatial planning: the benefits of incorporating enforcement costs

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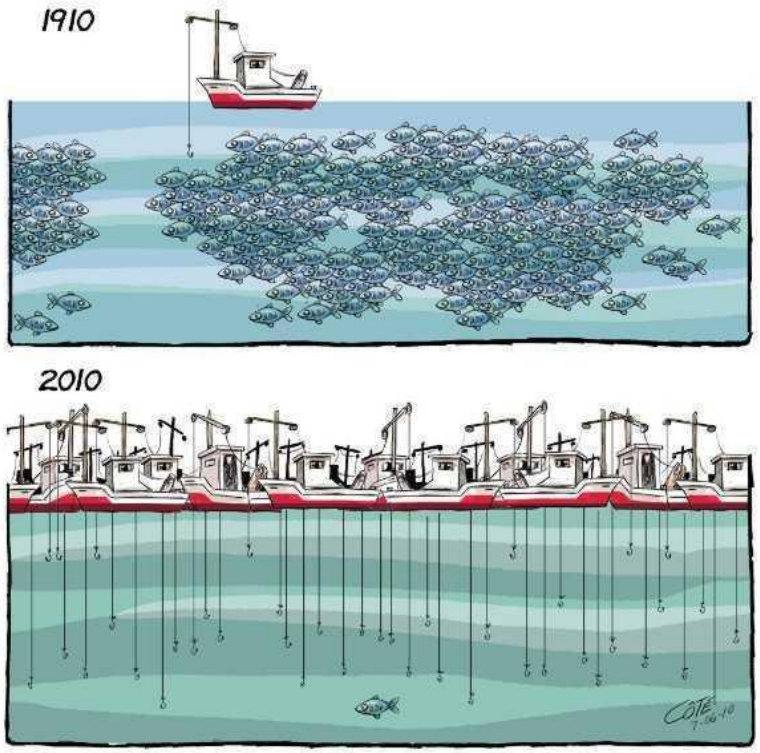
Restricted-use management zones

- No-take
- User rights



Spatial optimisation

- Terrestrial
  - National parks
- Marine
  - Minimize losses to fishers
- Limited economic analysis

Aim

- Incorporate more comprehensive economic analysis into a spatial optimisation model
- Determine impact of including direct and opportunity costs on optimal marine zoning

Direct costs = management or transaction costs

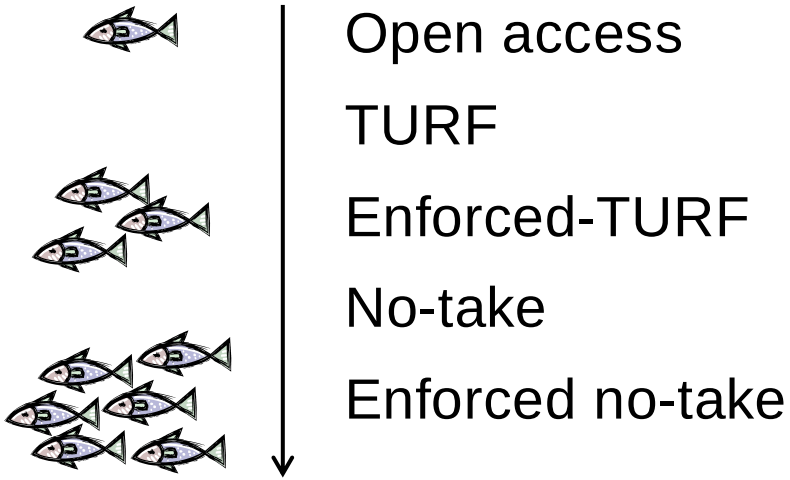
→ Enforcement

Chile

- 4,200 km of coastline
- Rich marine resources
- Top 10 in world fisheries landings

- 1989-1991 Fisheries law
  - Territorial user rights for fishing

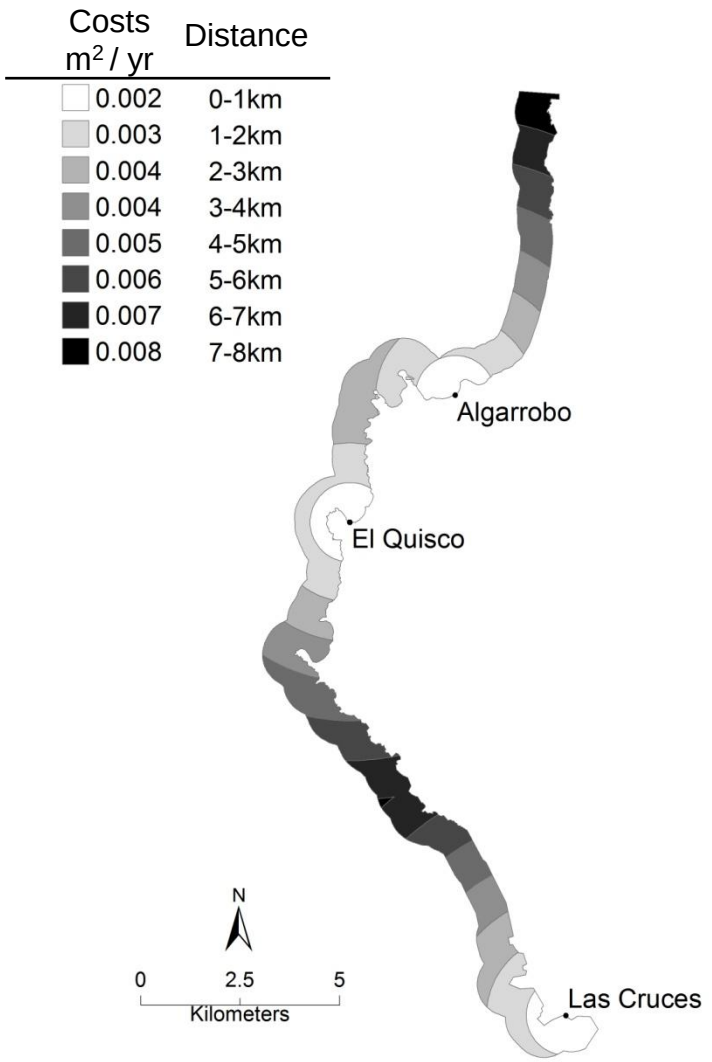
Central marine region of Chile



Enforcement costs

Deterring poachers and enforcing catch restrictions:

- Costs vary spatially



Spatial optimisation model

- Allocate cells ($C_{i=1,..,96}$) to management zones

Open access, TURF, Enforced-TURF, No-take, Enforced-no-take

- Objective: Maximize revenue from fish caught

Revenue_{C_i} = (Price x Number of fish which can be caught) – Enforcement costs

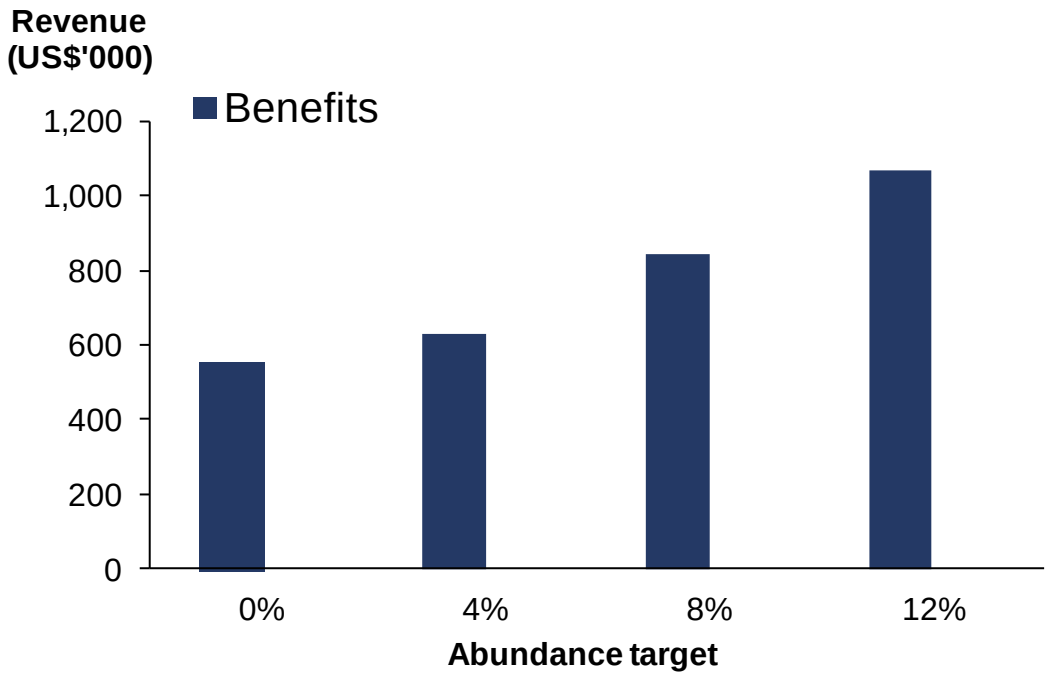
- Subject to minimum abundance targets
  - *Targets based on maximum abundance*

Spatial optimisation model

- Multiple scenarios – impact of enforcement
  - No enforcement: *a* → *O, T, N*
  - Enforcement, no cost: *b* → *O, T, ET, N, EN*
  - Enforcement, cost: *c* → *O, T, ET, N, EN* → *$$*

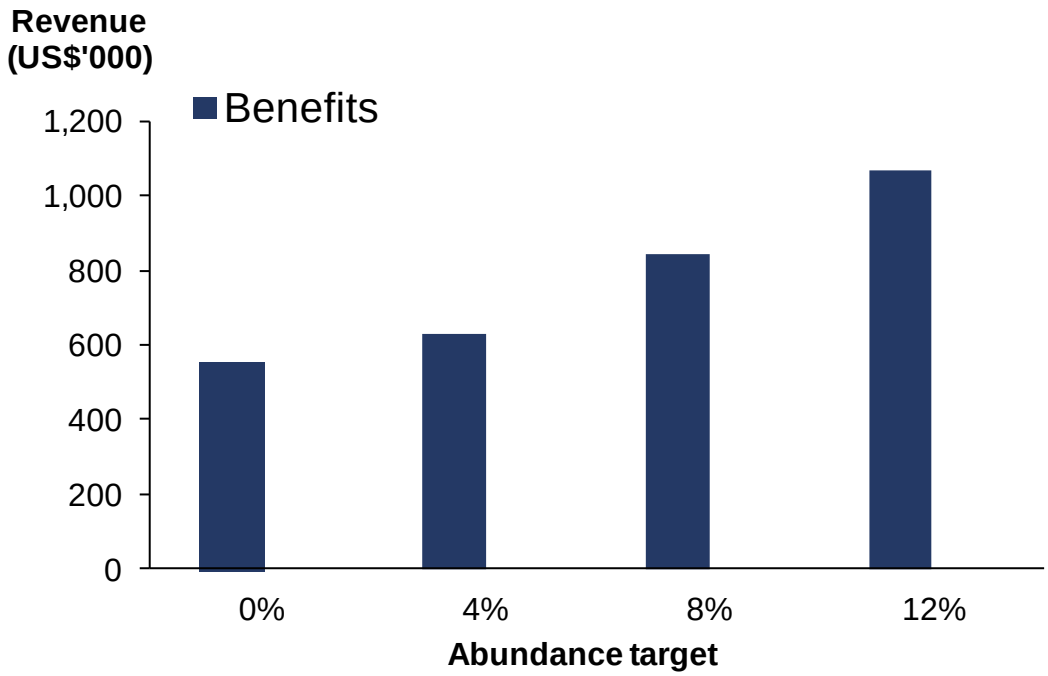
Fisher revenue

Benefits of enforcement = Revenue scenario *b* (Enforcement, no cost) - Revenue scenario *a* (No enforcement)



Fisher revenue

Costs of enforcement = Revenue scenario *b* (Enforcement, no cost) - Revenue scenario *c* (Enforcement and cost)



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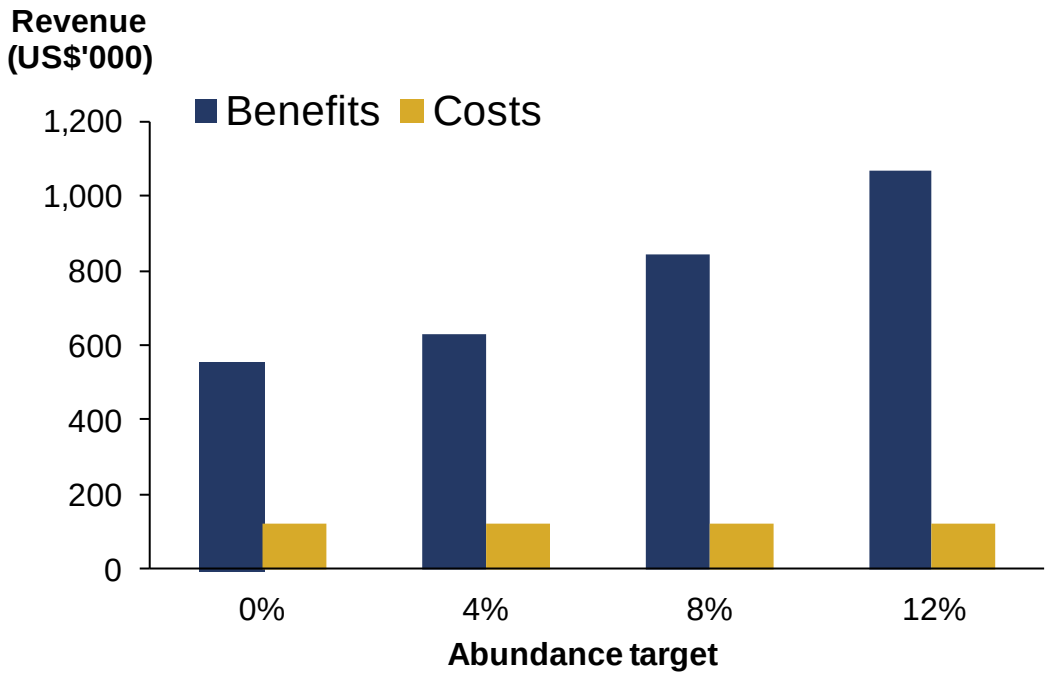
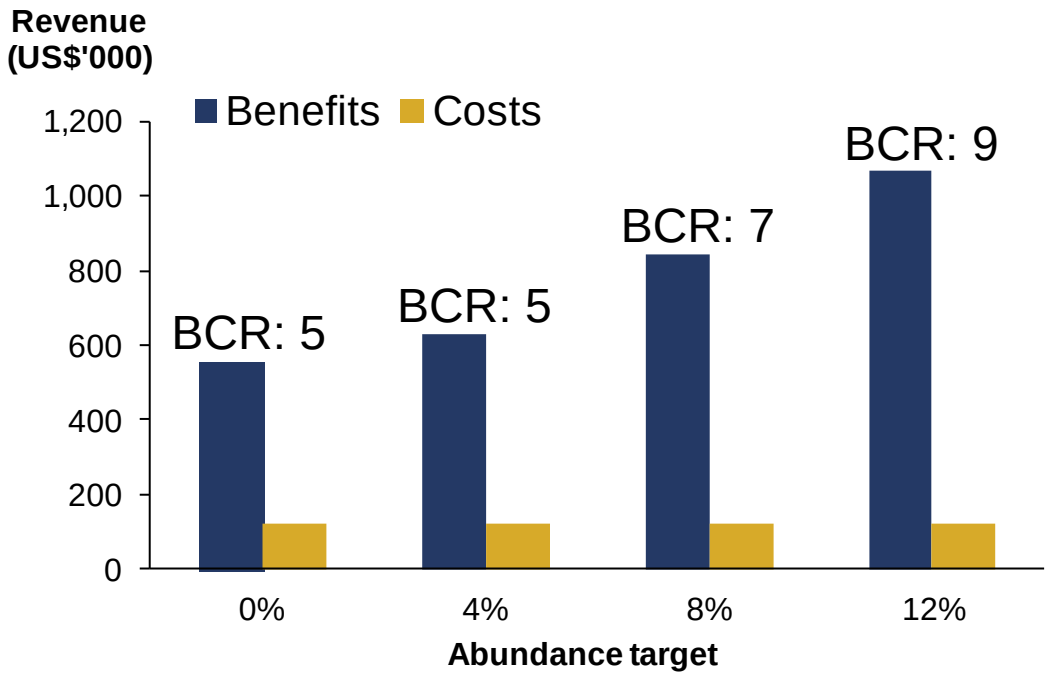
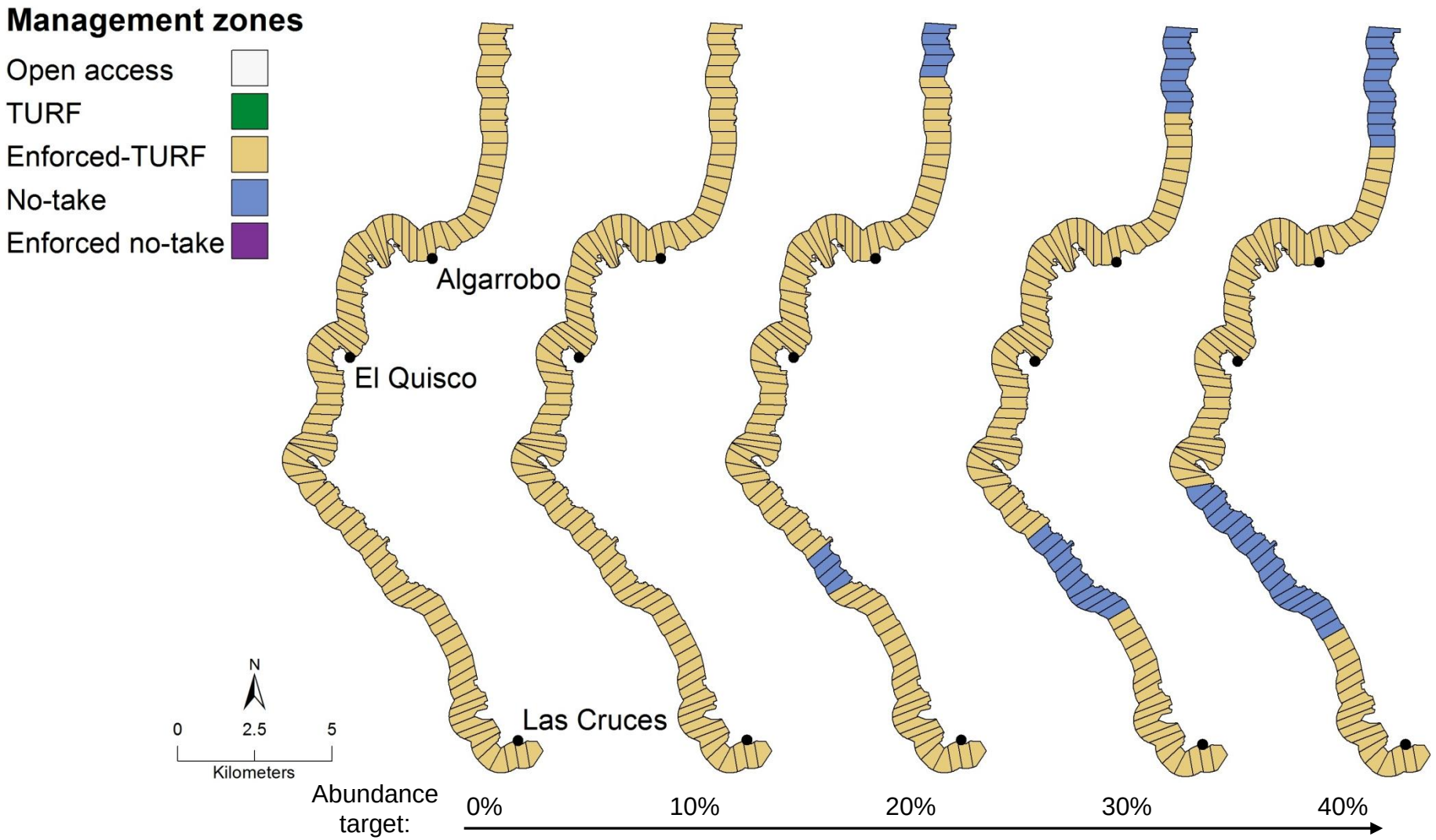


Fisher revenue

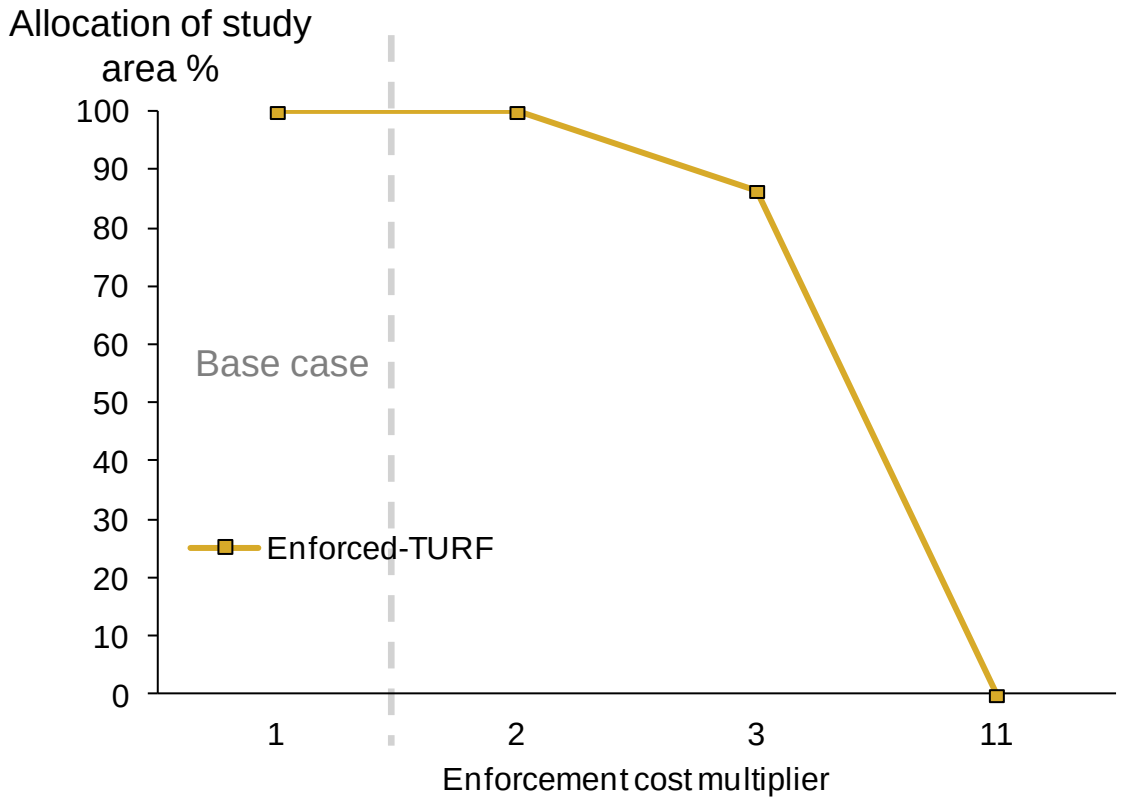
1. Enforcement costs negligible compared to benefits
2. Benefit Cost Ratios (BCRs) > 1



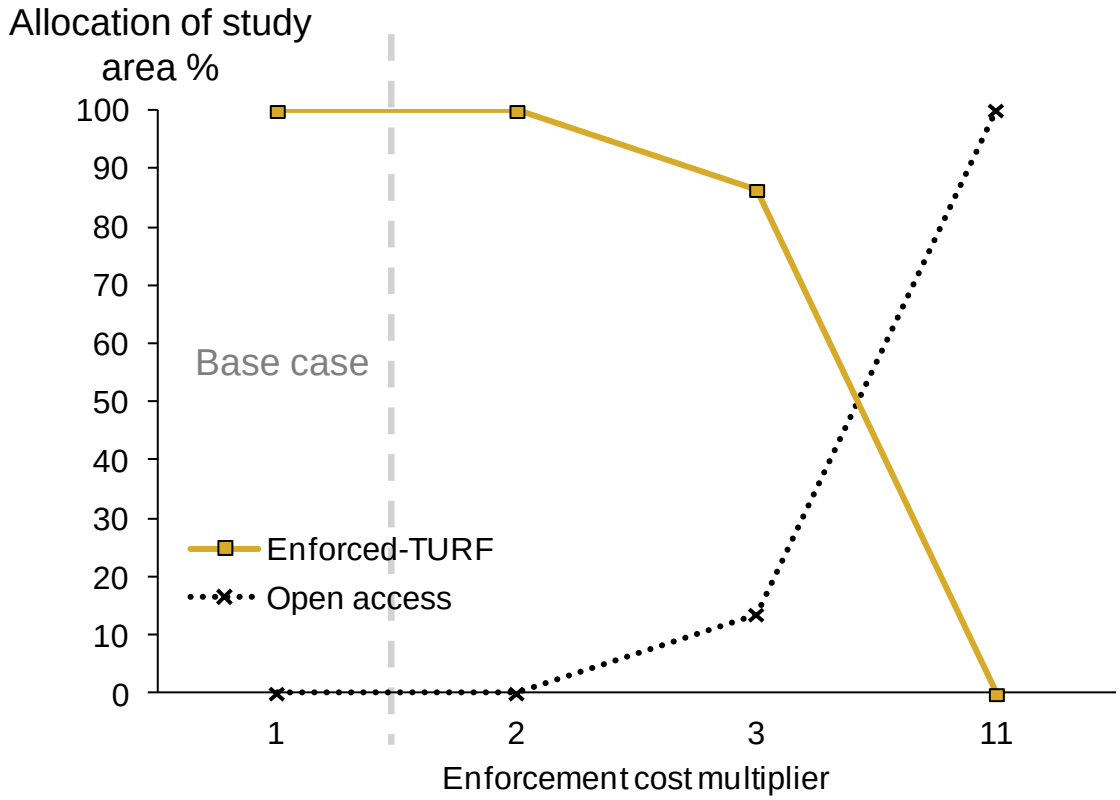
Optimal spatial allocation



Sensitivity analysis - Enforcement costs



Sensitivity analysis - Enforcement costs



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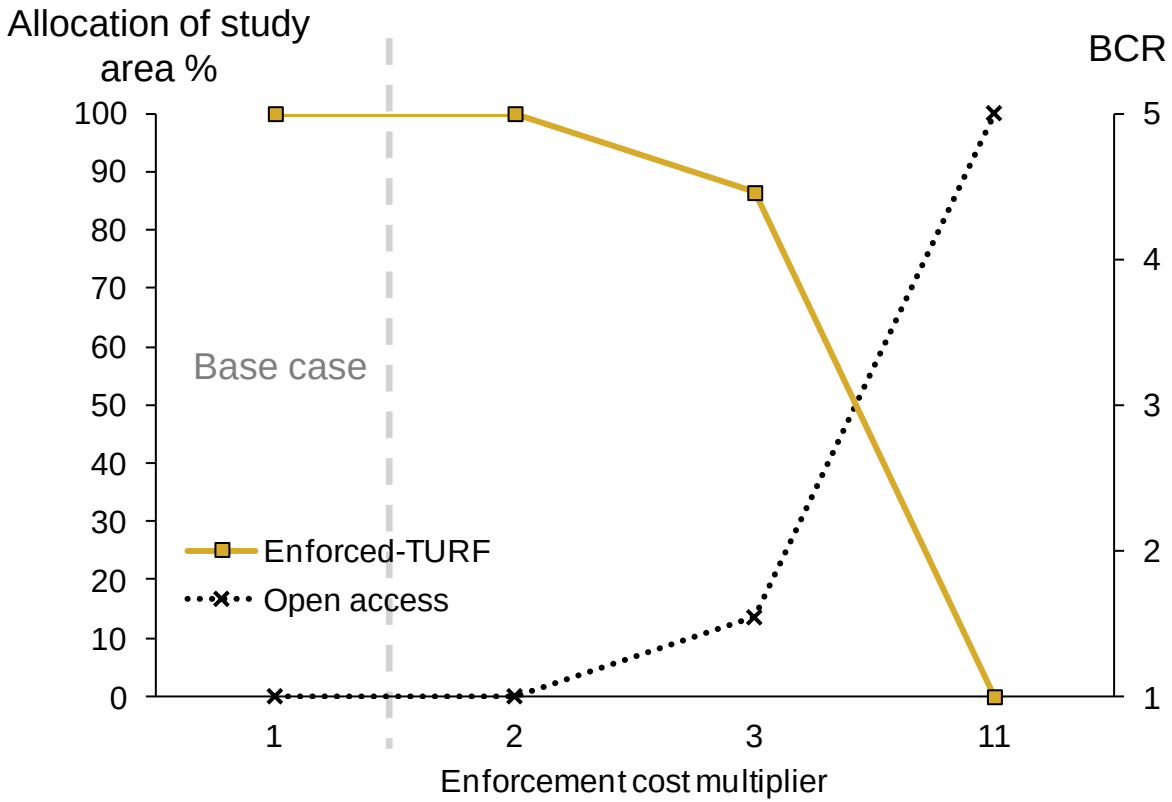

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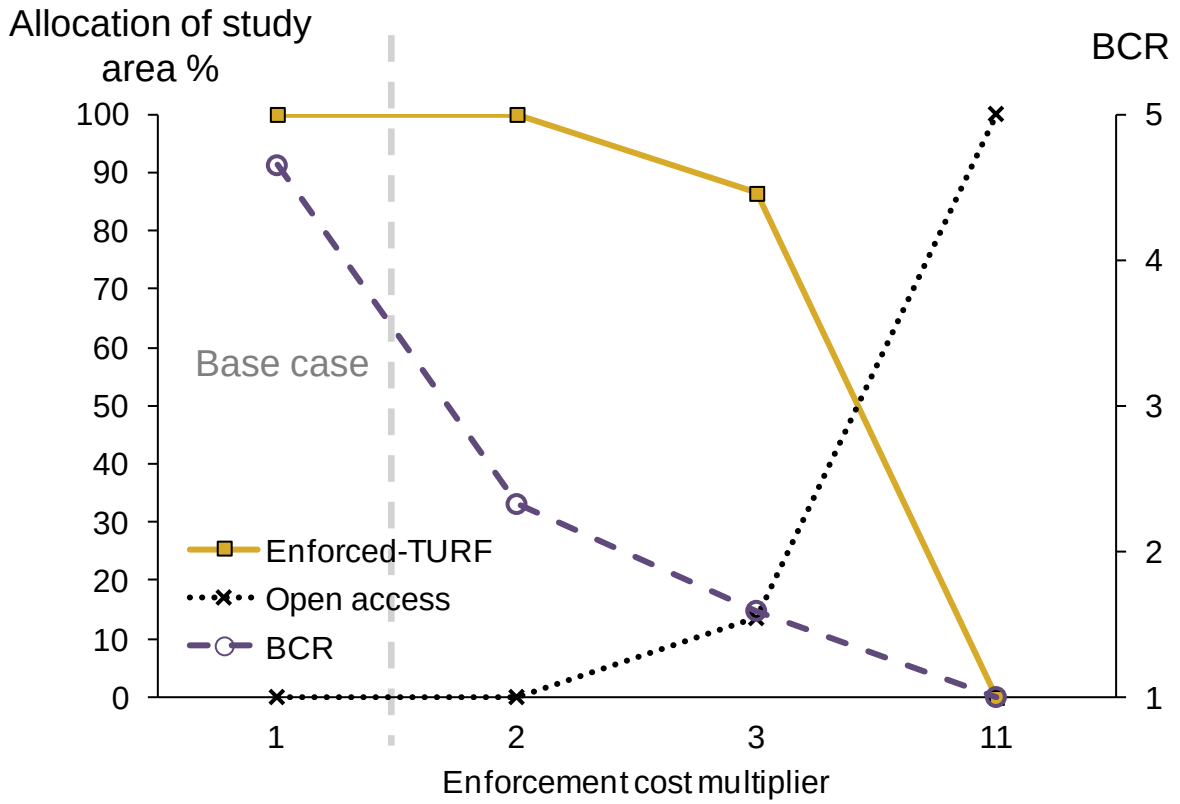

Why don’t fishers enforce?

- Fishers don’t enforce TURFs that are far away
- But – there are net benefits from enforcement??
- Potential explanations
  - Fishers may under-estimate the benefits of enforcement
  - Fisher associations may lack capacity or authority
  - Other biological forces at work
  - Transaction costs of enforcement may be higher than we have modelled

Accounting for enforcement can improve marine management

1. Large benefits from enforcement, negligible costs
2. Costs have a spatial component and can be minimized