Assessing the Social and Economic Impacts of Marine Protected Areas

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Study design

Outcome well-being indicators

Covariates: controlling for treatment biases and confounding factors

Other relevant data sources
Simultaneous high dependence and negative impacts on marine resources
Rapid increase in MPA numbers and size
Ecological impacts well studied, however social impacts unclear
1. Impacts of MPAs on U.S. coastal populations

2. Variation of impacts across:
   • different contexts (e.g. mainland vs. offshore)
   • social groups (gender, age, ethnicity)

3. Role of governance and context in impacts
Design

Neyman-Rubin model:

\[ \text{Impact} = T_{\text{outcomes}} - C_{\text{outcomes}} \]

Quasi experimental Difference in Difference with matching
  • Match MPA and non-MPA communities based on relevant covariates
  • Difference in trends in MPA vs non-MPA populations

\[ \text{ATT} = \mathbb{E}\{\mathbb{E}(Y_i | X_i, T_i = 1) - \mathbb{E}(Y_i | X_i, T_i = 0) | T_i = 1\} \]
\[ Y = \Delta \text{ outcomes}; T = \text{treated}; X = \text{covariates} \]
Outcome (human well-being) indicators:
Economic wellbeing
Educational attainment
Employment
Health
Empowerment
Causal pathway

MPA

? 

Economic well-being
Economic well-being

Resource use rights

MPA

Resource use patterns

Fishing pressure

Fish biomass

Visitor attraction

Visitation rates

Tourism economic activity

Economic well-being

Glew et al *in press*, Bene 2017
Economic well-being

Resource use patterns

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Fish biomass

Supply of tourism services

Visitor attraction

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Tourism economic activity

Economic well-being

MPA

Resource use rights

Park infrastructure

Glew et al. *in press*, Bene 2017
Causal pathway - Tourism

- Resource use rights
  - Park infrastructure
  - Local & int’l exposure
- Resource use patterns
- Fishing pressure
- Fish biomass
- Supply of tourism services
- Visitor attraction
- Visitation rates
- Tourism economic activity
- Economic well-being

MPA

Glew et al *in press*, Bene 2017
CAUSAL PATHWAY - TOURISM

- Alternative livelihood programs
- Resource use patterns
- Fishing pressure
- Fish biomass
- Local & int’l exposure
- Park infrastructure
- MPA
- Resource use rights
- Supply of tourism services
- Visitor attraction
- Visitation rates
- Tourism economic activity
- Economic well-being

Glew et al *in press*, Bene 2017
CAUSAL PATHWAY - TOURISM

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MPA
- MPA

Resource use rights
- MPA

Resource use patterns
- Fish biomass
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Alternative livelihood programs
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Park infrastructure
- Supply of tourism services

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- Visitor attraction
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Economic well-being
- Tourism economic activity
- Visitor attraction
- Visitation rates

Opprt. costs & income for higher education
- Education outcomes

Glew et al. in press, Bene 2017
Causal pathway - Tourism

- Alternative livelihood programs
- Resource use rights
- Park infrastructure
- Local & int’l exposure
- MPA

- Resource use patterns
- Fishing pressure
- Supply of tourism services
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- Fish biomass
- Visitation rates
- Tourism economic activity

- Opprt. costs & income for higher education

- Economic well-being

- Real estate demand
- Health outcomes

- Property values
- Education outcomes

Glew et al in press, Bene 2017
Causal pathway - Available data

Other soc, econ, ecol factors

MPA governance
MPA

Resource use patterns

Alternative livelihood programs

Fishing pressure
Fish biomass

Supply of tourism services
Visitor attraction
Visitation rates

Tourism economic activity
Real estate demand

Income, poverty, unemployment

Opprt. costs & income for higher education

Education outcomes

health exp. & services

Health outcomes

Property values

Glew et al in press, Bene 2017
Causal pathway - Available data

Other soc, econ, ecol factors

- Alternative livelihood programs
  - MPA governance
  - Resource use patterns
  - Park infrastructure
  - Local & int’l exposure

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Property values

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Home values

Morbidity

health exp. & services

Property values

Real estate demand

Health outcomes

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Tourism economic activity
Matching covariates

Treatment (location) bias:
Least political resistance (no extractive uses)
High biodiversity/tourism value
Matching covariates

Treatment (location) bias:
- Least political resistance (no extractive uses)
- High biodiversity/tourism value

Other confounding factors:
- Historic social & economic conditions
- Distance to population centers
- Biophysical environment (coastal amenities)
- Spatial temporal changes
Matching covariates

**Treatment (location) bias:**
- Population density
- Proximity to population centers
- Proximity to recreational beaches

**Other confounding factors:**
- Historic income, home values, dominant employment sectors (1970)
- Proximity to population centers
- Proximity to coastline
- Match by State, distance
MPA DATA

NOAA MPA spatial dataset: commercial fishing prohibited (n=329 MPAs)
CENSUS DATA

Longitudinal, spatially harmonized census tract data (1970-2010)

>26,000 coastal census tracts
PRELIMINARY RESULTS:

MPA VS NON-MPA INCOME DIFFERENCES

![Graph showing income differences between MPA and non-MPA categories over different years.](image)
Spatial heterogeneity
• small scale (spillover)
• large scales (e.g. island vs mainland, US vs non-US)

Heterogeneity amongst groups
• social groups
• social outcomes

Explaining heterogeneity
• context
• governance
Study design
• Causal pathway
• Alternative methodological approaches

Outcome (well-being) indicators: i.e. income, unemployment, property values
• Census indicators
• Other indicators?

Covariates: controlling for treatment biases and confounding factors
• Missing covariates?

Other relevant data sources
• Non-census sources?
THANK YOU

Mentors:
Michael B. Mascia, Conservation International
Alex Pfaff, Duke University
Chris Kennedy, George Mason University
Susie Holst & Peter Edwards, NOAA
MPA DATA

NOAA MPA Inventory spatial dataset

![Establishment Year](chart.png)