Distributional performance of a Territorial Use Right and co-managed small-scale fishery targeting a metapopulation using artificial shelters:

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Distributional performance

- It involves the implications related to how benefits and costs of management actions spread among individuals, groups or even communities (Clay *et al*., 2014)

- Has been mentioned as a key outcome in

  - The promotion of sustainable development

    (Berke, 1995; Torvanger, 1998; Munasinghe, 2000)

  - The stability of fishery management schemes

    (Nash, 1953; Balland & Plateu, 1999; Agrawal, 2001; Adger *et al*., 2002)

  - And even as part of the fairness and aspects of human rights

    (Cowell, 1977;Capistrano & Charles, 2012; Klain *et al*., 2014).

Rights -based fisheries management

-Granting to fishers a share of the allowable harvest encourages them to improve their efficiency and avoid the “ the race for fish” (or at least diminishes).

-If harvest rights are transferable these will go to those who value them most, achieving in the process higher levels of efficiency and avoiding rent dissipation in the process.

(Christy, 1973; Ostrom and Schlager, 1996; Asche et al., 2009)

- Nevertheless, a concern about RBFM: rising consolidation in the holding of fishing rights.

Contrary to equity and social justice.

(Sumaila, 2010; Clay *et al*., 2014)

RBFM and distributional assessments

-Most of the current research has assessed the distributional effects of ITQ systems.

(Sumaila, 2010; Abayomi and Yandle, 2012; Grainger and Costello, 2015).

-Territorial Use Rights Fisheries (TURFs), “a place based right system”

-Specific users have harvest/exploitation rights to certain resources located within a specified geographic zone

(Christy, 1983 ; Wilen et al. 2012)

-The distributional performance of TURFs has been acknowledged as a key topic which still needs to be addressed.

(Quynh et al., 2017)

Research Question

- What is the spatial distributional performance of a co-managed (TURF) SSF targeting a meta population by the use of artificial shelters

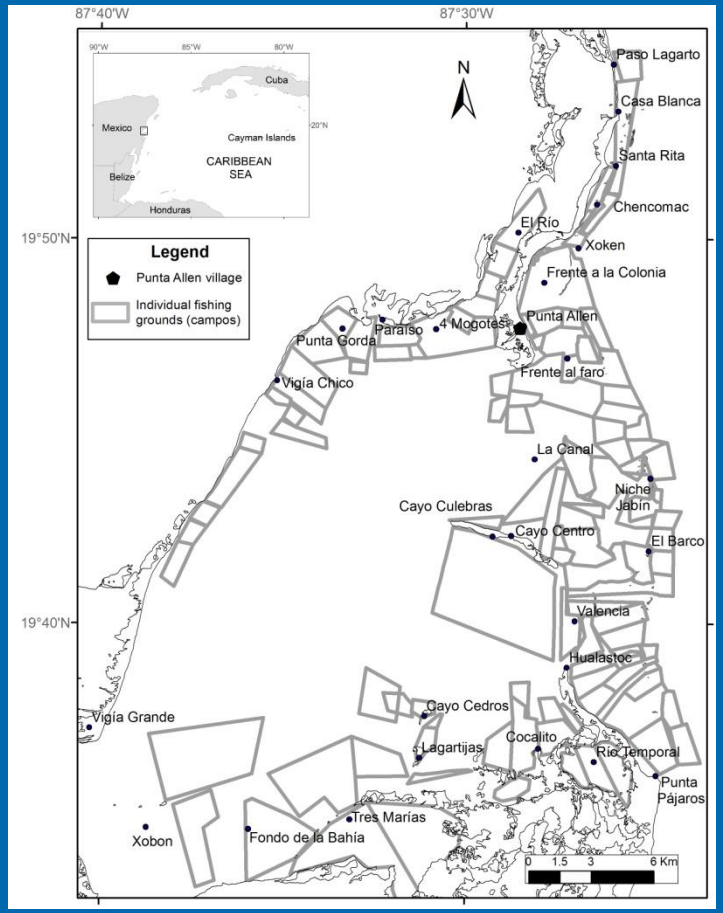
(i) the actual distribution of the fishing incomes earned by fishing rights holders in 2013-2014 lobster season

(ii) the spatial allocation of the resource rent by spatially defined fishing areas in the 2013-2014 fishing season.

Inequality metrics

Lorenz curves
Gini index

Punta Allen lobster Fishery



Fishery co-management (TURF)

Government

- Closed season
- Minimum size
- No capture of BF
- Limit to HP

Cooperative

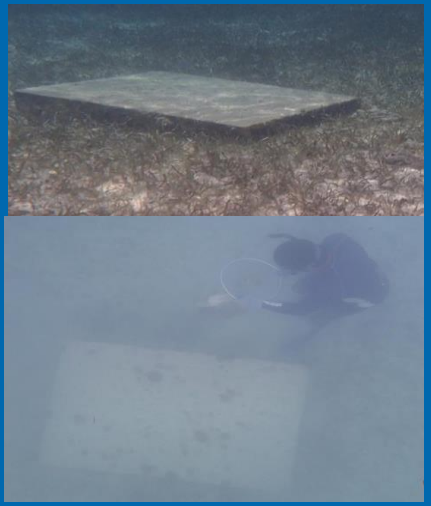
- Forbidden: SCUBA
  Hooka
  Traps/nets
  Gaff
- Coop is the only allowed broker

- Individual Transferable Grounds:120

Study area map modified from Ley-Cooper, K (2015)

(Seijo, 1993; Sosa-Cordero *et al*., 2008)

Punta Allen lobster Fishery



- Artificial shelters: ≈ 27,000
- Harvest: hand net by free diving
- Very specialized: tails and live lobster
- Target species: pan Caribbean Meta-population
- Certified by MSC (2012)

(McKay *et al*., 2014; Headley, et al., 2017))

Materials and Methods: Data collection

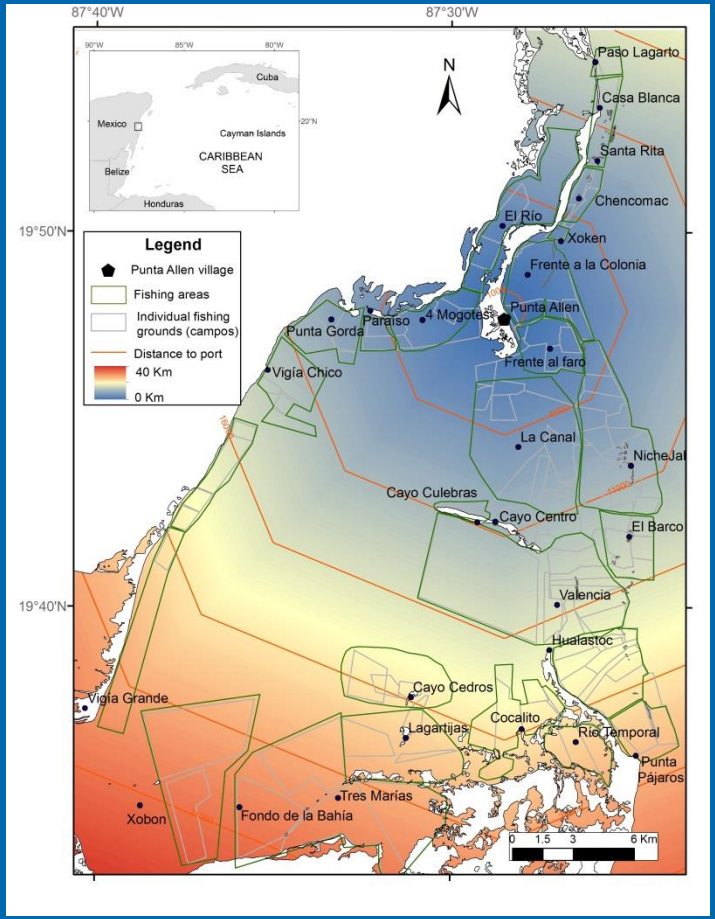
- Semi-structured questionnaires to campo owners

- Quantity and allocation of campo(s)
- Mean cost, life span and allocation of artificial shelters
- Investments and life span of fishing assets

- Cooperative´s log-books and records

- Total Catch (kg of tail/whole lobsters)
- Fuel and oil consumed
- Fishing area where the daily fishing trips occurred

Fishing benefits: quasi-profits ($q\pi$)



- $q\pi$ of the variable costs earned by campo owner

  i from first trip (*f*) to the last one (*F*)

$$q\pi_i = \sum_f^F (p_x y_{i,f,x} - c_{i,f,i'}) \quad (1)$$

  according to catch type *x*, quantity y_x and price p_x

- $q\pi$ of the variable costs achieved in fishing area *i´*

$$q\pi_{i'} = \sum_f^F (p_x y_{i',f,x} - c_{i',f}) \quad (2)$$

Fishing trips costs (*c*) determined by distance to the campo located in the fishing area *i´*

Fishing benefits: profits (π)

- π by campo owner *i*: subtracting from the quasi-profits additional expenses involved in the fishing operation as:

(3)

$$\pi_i = q\pi_i - (m + es + dg + hg + mc)$$

Where: (bm), boat maintenance

(es) preventive and corrective engine services,

(dg) free diving gears (mask, snorkel and fins),

(hg) harvest gears

(mc), cooperative membership payment

Fishing benefits: profits (π)

- π by fishing area i': subtracting the mentioned additional expenses from the quasi-profits by fishing area, homogeneously allocated to all (I') fishing area

$$\pi_{i'} = q\pi_{i'} - \frac{(bm + es + dg + hg + mc)}{I'} \qquad (4)$$

Fishing benefits: resource rent ($\prod$)

- $\prod_i$ of campo owner *i* in lobster fishing season t (2013-2014):

$$\prod_i = \pi_i - occ(b, e, g, s_i) - dc - ocl \qquad (5)$$

Where:

(occ): opportunity cost of investment on:

- (b) the boat,
- (e) outboard engine
- (g) the GPS
- (s_i)artificial shelters by campo owner *i*

(dc): linear depreciation cost of :

(ocl): opportunity cost of labor

Fishing benefits: resource rent ($\prod$)

- $\prod_{i'}$ achieved by fishing area *i´* in lobster fishing season t (2013-2014):

$$\prod_{i'} = \pi_{i'} - \frac{occ(b,e,g)}{I'} - occ(si_{'}) \_ dc_{i'} \_ ocl_{i'} \qquad (5)$$

($s_{i'}$): artificial shelters deployed in fishing area *i´*

($ocl_{i'}$): opportunity cost of labor

Fishing benefits: resource rent ($\prod$)

- $\prod_{i'}$ achieved by fishing area *i´* in lobster fishing season t (2013-2014):

$$\prod_{i'} = \pi_{i'} - \frac{occ(b,e,g)}{I'} - occ(si_{'}) \_ dc_{i'} \_ ocl_{i'} \qquad (5)$$

($s_{i'}$): artificial shelters deployed in fishing area *i´*

($ocl_{i'}$): opportunity cost of labor

Intergenerational inequality analysis: a proxy

-With the data obtained by the semi-structured questionnaires to campo owners, there were categorized three age groups.

-Kruskal-Wallis non parametric test was used to analyze statistical differences between the resource rent obtained by the fishers between the three age groups.

Catch prices, costs, fishing assets investments

Table1. Price and cost parameters used to calculate the quasi-profits of the variable cost of a fishing trip

Item	Value	Units
Tail lobster price	25.72	$US\$\cdot kg^{-1}$
Whole lobster price	14.79	$US\$\cdot kg^{-1}$
Gasoline cost	1.00	$US\$\cdot l^{-1}$
Two stroke engine oil cost	6.43	$US\$\cdot l^{-1}$
*Exchange rate (April, 2015)	15.55	$MXP\$\cdot US\$^{-1}$

Campo owners ≥ 16 fishing trips in 2013-2014 lobster season

Fishing areas ≥ 150 artificial shelters deployed

Table 2. items and values used to calculate the cost function of small-scale lobster fishery

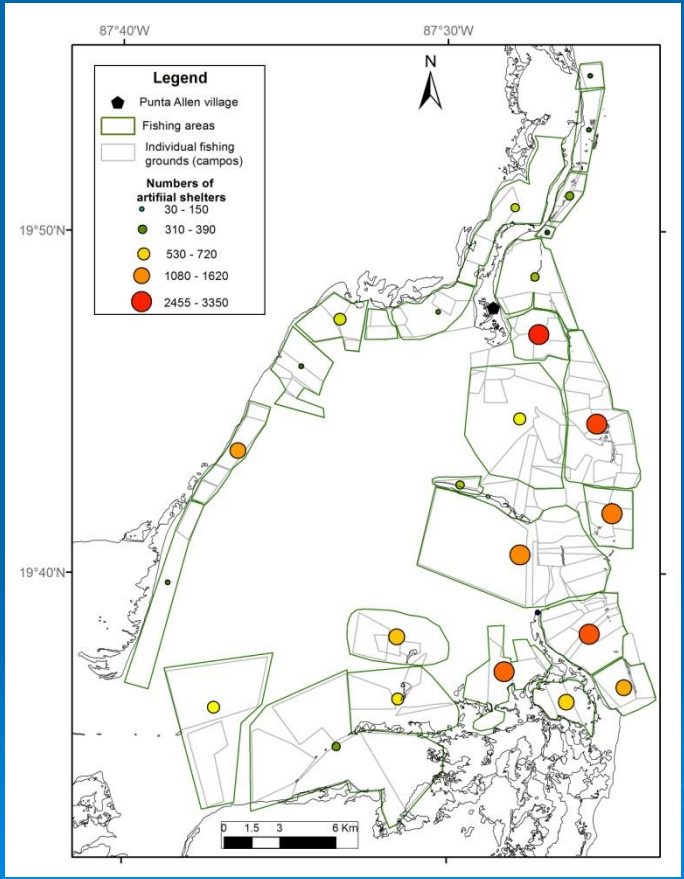
Item	Acquisition /fee (US$)	Average life span (years)	Annualized cost
Assets			
Boat	3,500	20	175
Boat modifications	1,608	20	80
Out-board engine	9,646	5	1,929
GPS	220	3	73
Other expenses			
Boat maintenance	514	1	514
Preventive and corrective engine services	1,200	1	1,200
Free diving gears	113	1-2	74
Harvest gears	51	0.25	204
Cooperative membership	2,058	1	2,058

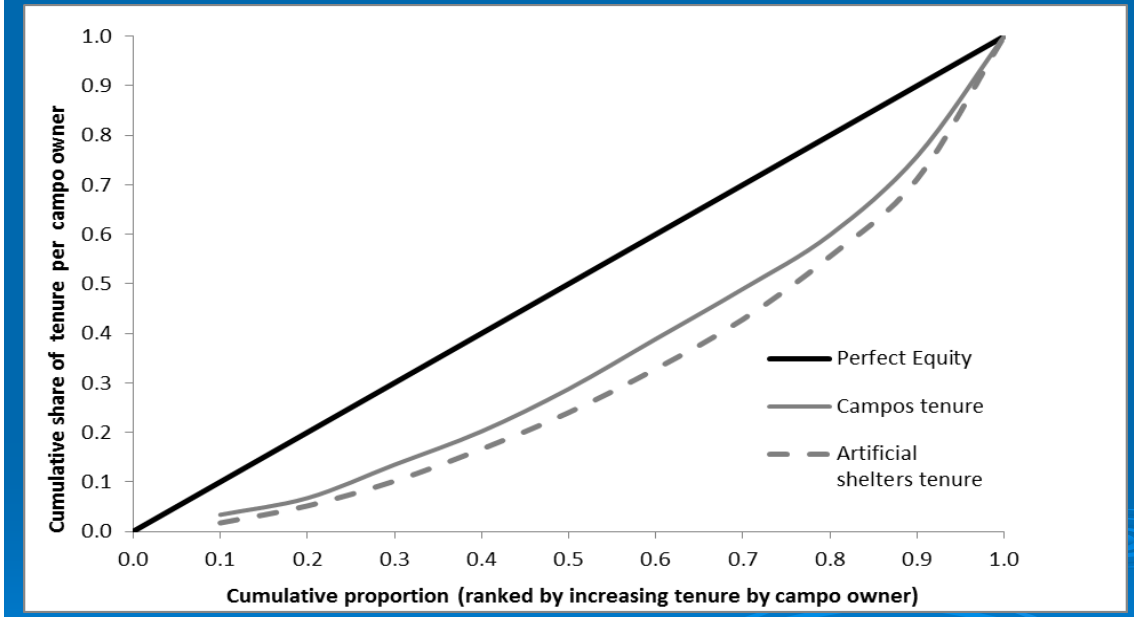
Opportunity cost of the capital parameters

	Gross rate(%)	Inflation (%)	Net rate(%)
CETES (1 year)*	4.47	2.6	1.87

*Banxico (Central Bank of Mexico) consulted: 06/17/2016

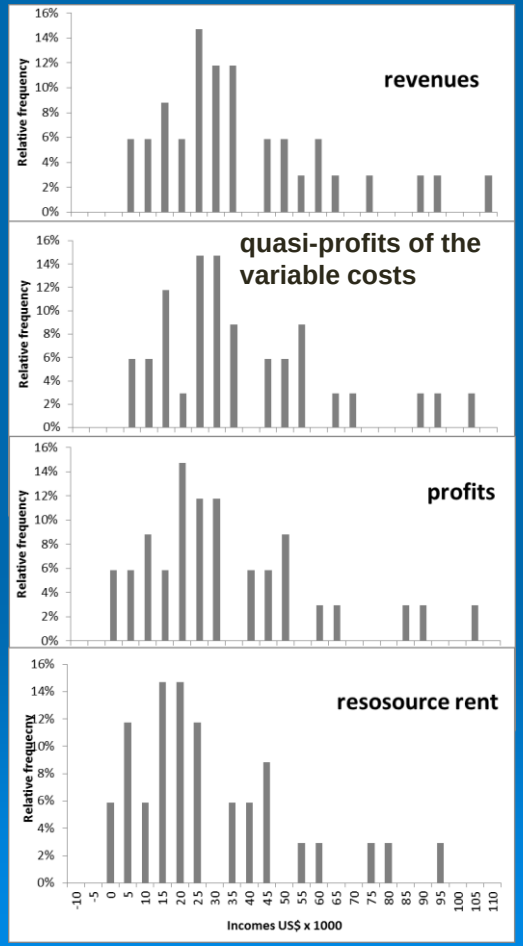
Results. ITG and artificial shelter tenure inequality

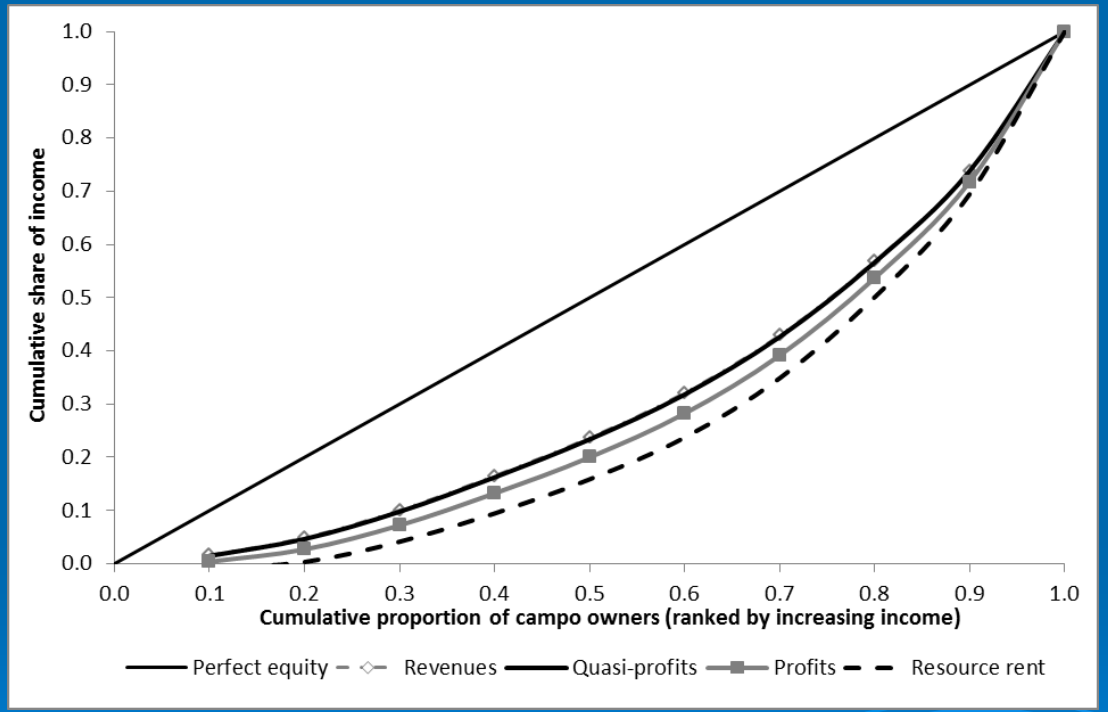




	Tenure by campos owners		
	Campos (ITG)	Artificial shelters	Perfect equity
G	0.308	0.38	0.000

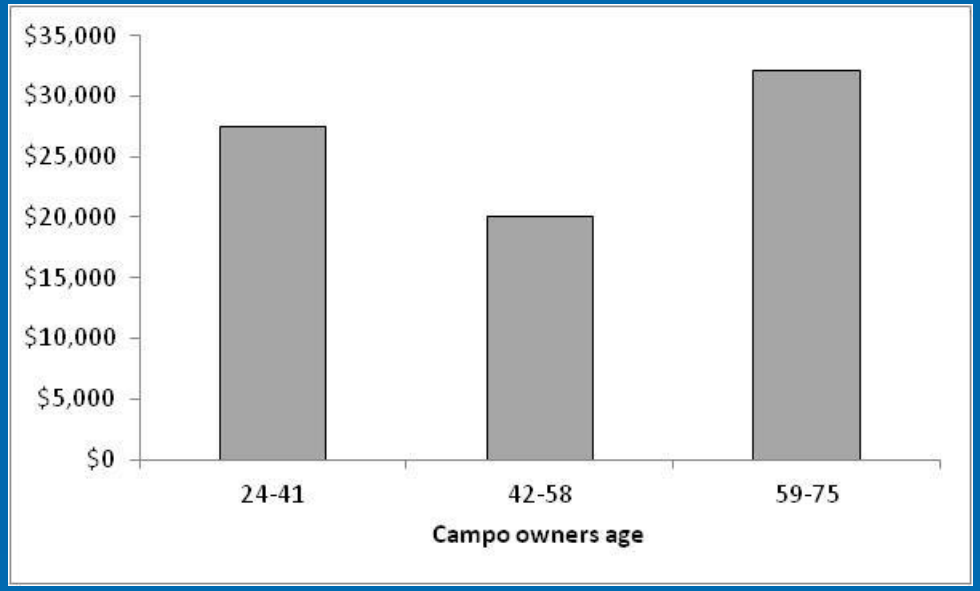
Distribution of fishing incomes by campo owner





	Revenues	Quasi-profits	Profits	Resource rent
G	0.375	0.379	0.427	0.486

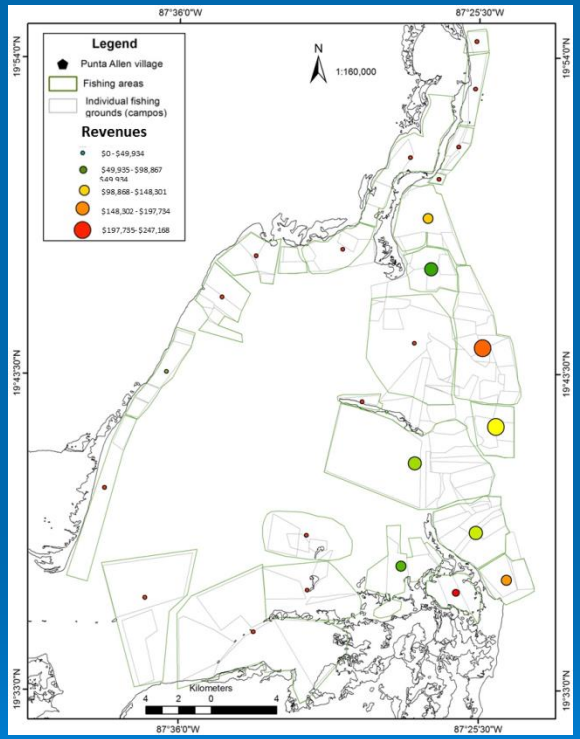
Results. Intergeneration inequality

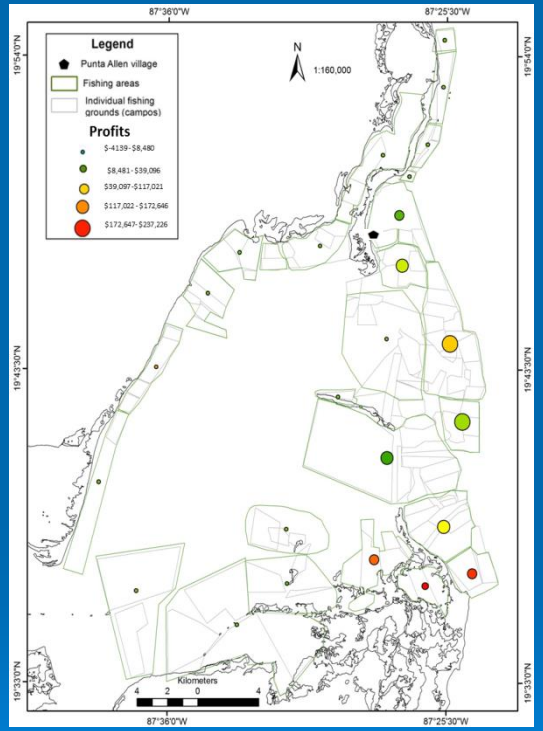


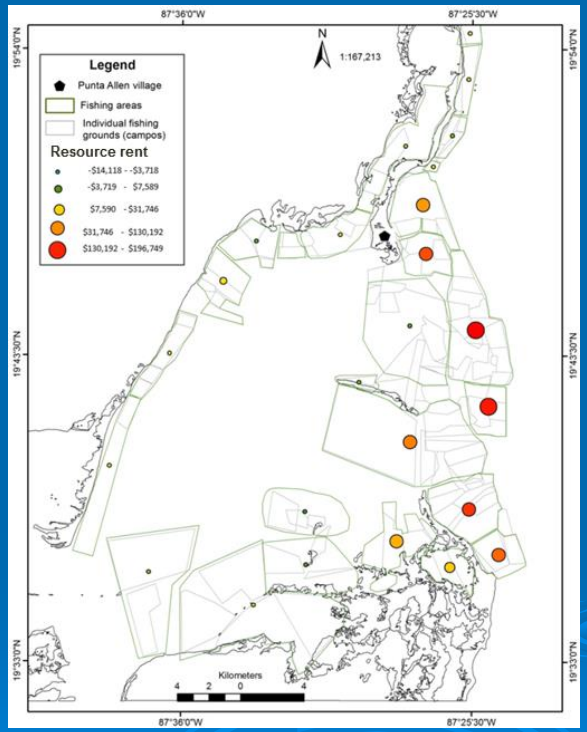
Results of the comparative resource rent analysis applied to three age groups of campo owners of the Vigía Chico Cooperative

Age groups	mean (± sd)	Sum of Ranks	Kuskal-Wallis test:	*p*-value
1 (24-41)	US$ 27,464 (±US$ 19,699)	154	4.048953	0.1321
2 (42-58)	US$ 20,110 (±US$ 27,011)	206		
3 (59-75)	US$ 32,142 (±US$32,142)	235		

Distribution of fishing incomes by fishing area

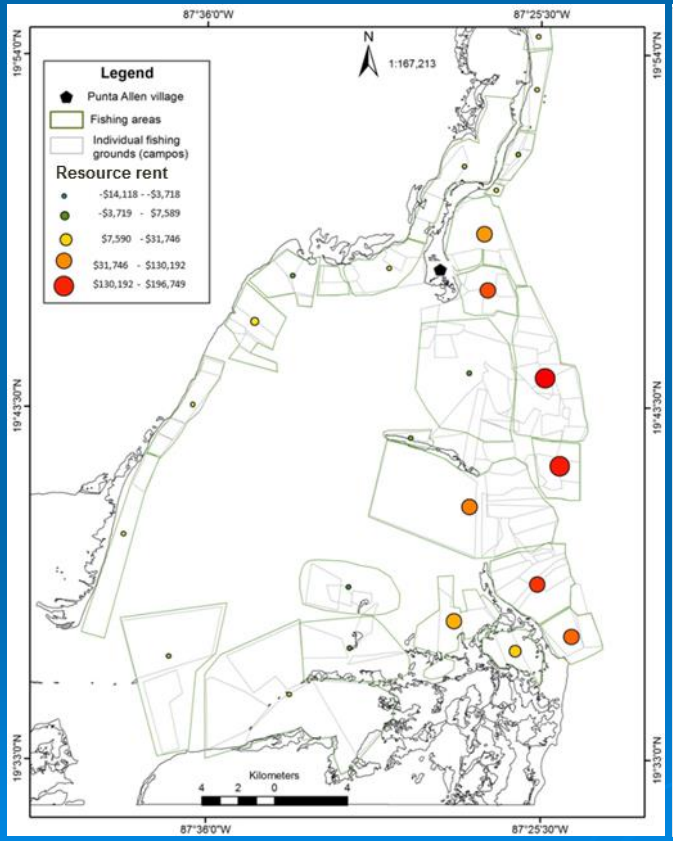


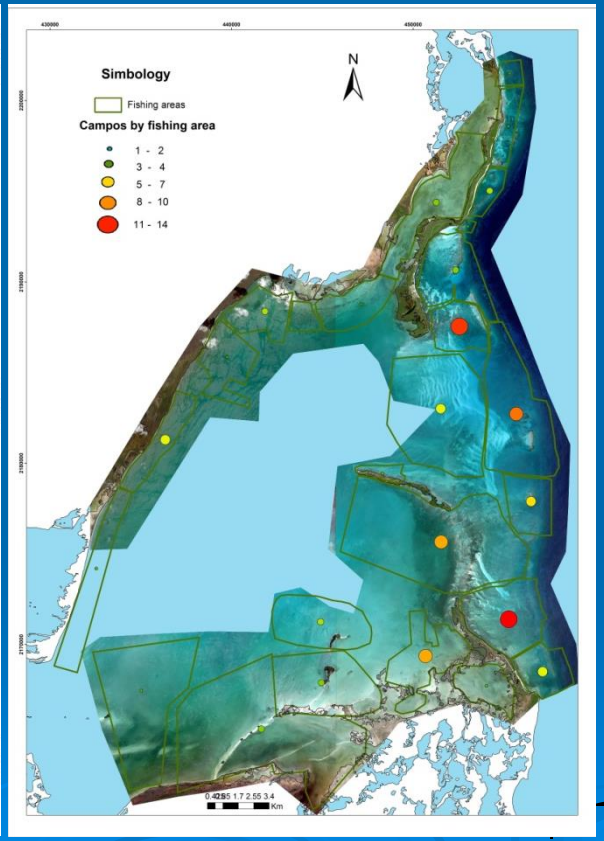


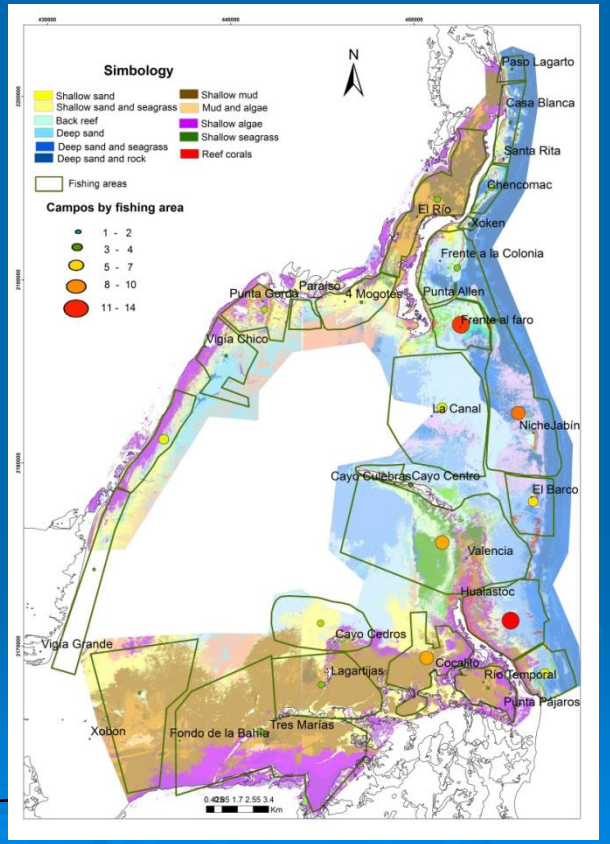


	Revenues	Profits	Resource rent
G	0.60	0.64	0.72

Resource rent, geographic areas and ecosystems







Final remarks

- There is relatively low inequality in fishing benefits by campo (ITG) owners based analysis in the Punta Allen lobster fishery
- When the inequality is analyzed by a fishing area (spatial) approach, the inequality reach higher levels.
- These results may indicate the presence of remarkably more productive areas in the zone accompanied by equity rights access to harvest those areas by most of the cooperative members.

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