Distributional Performance of a Small-scale lobster Fishery Managed Under a TURF Scheme

R. Villanueva-Poot, M. Headley, J.C. Seijo

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Distributional performance

It involves the implications related to how the benefits (and the costs) of a management action spreads among individuals, groups or even communities

(Clay *et al*., 2014)

Concerns about distributional effects: its inherent equity or inequity can affect the acceptability, the possible success and the outcomes of management systems

(Guyader & Thébaud, 2001; Sumaila, 2010)

Distributional performance and fisheries governance

- Distributive justice has been acknoweldge as an important concern in the pursuit of good and effective governance approaches

(Loomis & Ditton, 1993; Hernes *et al*., 2005; Bundy *et al*., 2008)

- Uneven income distribution or rising inequity can threats the governance of fishery management schemes (especially the collaborative ones)

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

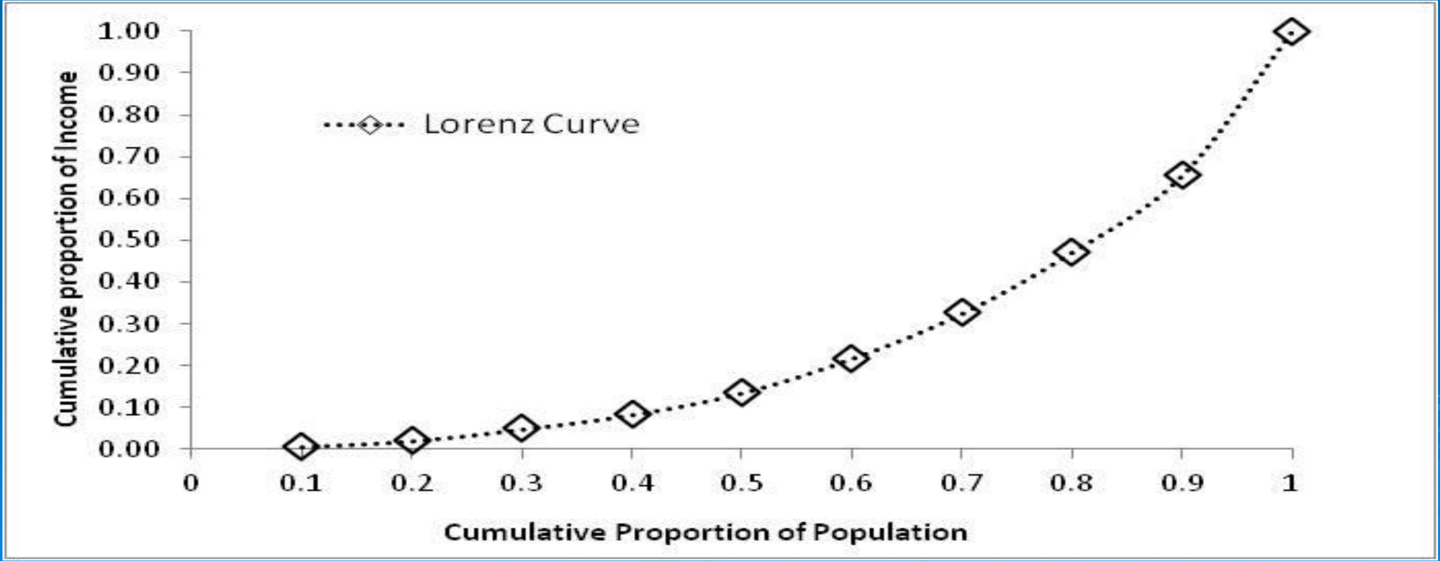
- Rights based fishery managements concernings: rising consolidation in the holding of fishing rights. Opposite to equity/social justice, stressor element to governance and contrary to sustainability objectives

(Sumaila, 2010; Chuenpagdee & Jentoft, 2011; Clay *et al*., 2014)

Measuring benefits distribution

Lorenz curves

- Cumulative proportion of population ranked by income level
- Range (0,1)
- Unit less



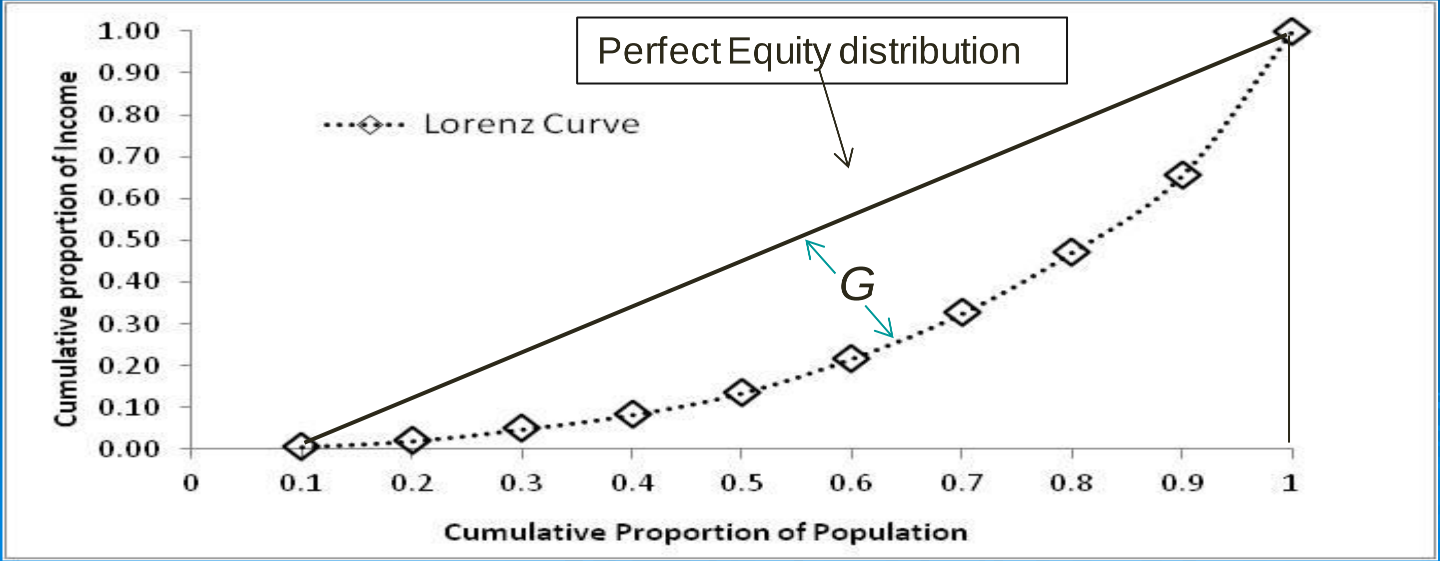
Measuring the distribution of community benefits

Gini inequity index ***G*** :

The extent in which a distribution differs from Perfect Equity

The area between uniform equity and the analyzed Lorenz curve

0 ≤ *G* ≥ 1



(Gini, 1912; Blackwood & Lynch, 1994)

Measuring benefits distribution

Hoover index ***H*** :

More information can be inferred knowing the gap between the higher and lower levels of the income distribution

Measures the proportion of the analyzed variable that would need to be redistributed to achieve an equal distribution of that variable.

Robin Hood Index

Higher values indicate more inequality, and more redistribution is needed to achieve income equality.

As the Gini index, $0 \leq H \geq 1$

(Hoover, 1941; White, 2000)

Research Question

- What is the distributional performance of a sustainable co-managed (TURF) small scale fishery?

(i) distribution of fishing incomes earned by the lobster fishing teams in seven lobster fishing seasons:

r	revenues	Inequality metrics Gini/Hoover indexes
$q\pi$	quasi-profits of the variable costs	
π	profits	
Π	Resource rent	

(ii) Compare with the distributional performance of other fisheries

Materials and Methods: Fishery geographic area

Ecological charahcteristics

- Sian Ka´an Biosphere Reserve
- Shallow karst bay
- 740 km^2
- Extensive sea grasses
- Important inflluence of continental freshwater
- Reef barrier outside the bay
- Reef lagoon at the bay «mouth»

Arellano-Méndez, et al., 2010; Medina, 2011.

Socio-economic context of the fishing Community

- Punta Allen

- ≈ 600 inhabitants

- Main source of income:

Spiny lobster *Panulirus argus* fishery

INEGI, 2010
Velez, et al., 2014

Fishery organization and co-management (TURF)

Fishery management & regulation

Government

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

Community self-agreed regulations

- Forbiden: SCUBA
  Hooka
  Traps/nets
- Individual Transferable Grounds ≈ 120

- The most succesfull lobster cooperative in Mexican Caribbean

- Recognized as an example of sucessful and sustainable small-scale fishery

- Certified by MSC (2012)

Seijo, 1993; Sosa-Cordero, et al., 2008; Méndez-Medina, 2015

Artificial shelters use in the fishery

Artificial shelters: ≈ 27,000

Headley et al., 2017

Fishing and harvest operation

Methods: Data collection

Interviews to fishers (semi-structured questionaires)

Fishing logbooks and cooperative´s records

Materials and Methods: fishing benefits

- quasi-profits ($q\pi$) of the variable costs earned by fishing team *i* in the lobster fishing season *t* [2007/2008-2013/2014] from the first trip (*f*) to the last one (*F*) :

$$q\pi_{i,t} = \sum_{f}^{F} (p_x y_{i,f,x,t} - c_{i,f,t}) \quad (1)$$

calculated according to the landed catch type *x*, its quantity y_x and the corresponding price p_x

The fishing trips costs (*c*) determined by the quantity of oil and gas used

Materials and Methods: fishing benefits

- Profits (π) in season *t* [2007/2008,2013/2014], subtracting from the quasi-profits the additional expenses involved in the fishing operation as:

(2)

$$\pi_{i,t} = q\pi_{i,t} - (bm + es + dg + hg + mc)$$

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*

*a fixed fee paid by all fishing cooperative members to cover the organization administrative expenses

Materials and Methods: fishing beneffits

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

$$\prod_{i\,2013-2014} = \pi_{i\,2013-2014} - oc(b, e, g, s_i) \qquad (3)$$

Where: (oc) the opportunity cost of investment on:

(b) the boat,

(e) outboard engine

(g) the GPS

(s_i)artificial shelters by campo owner *i*

oc : according to net bank rate (CETES**).

** Mexican federal treasures funds

Materials and Methods: Parameters

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$·kg^{-1}
Whole lobster price	14.79	US$·kg^{-1}
Gasoline cost	1.00	US$·l^{-1}
Two stroke engine oil cost	6.43	US$·l^{-1}
*Exchange rate (April, 2015)	15.55	MXP$·US$$^{-1}$

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

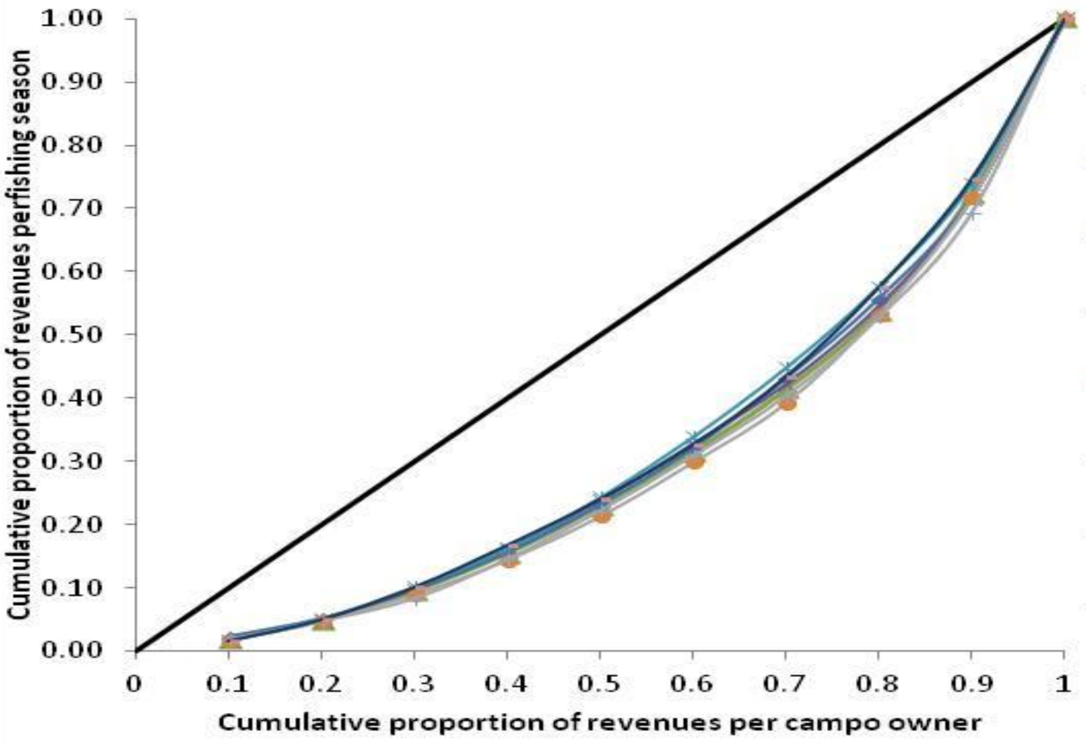
Item	Acquisition /fee (US$)	Average life span (years)	Annualized cost
Assets			
Boat	3,500	20	175
Boat modifications	1,608	20	80
Out-board engine	9,646	5	1,929
GPS	220	3	73
Other expenses			
Boat maintenance	514	1	514
Preventive and corrective engine services	1,200	1	1,200
Free diving gears	113	1-2	74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

Community distribution benefits: Revenues

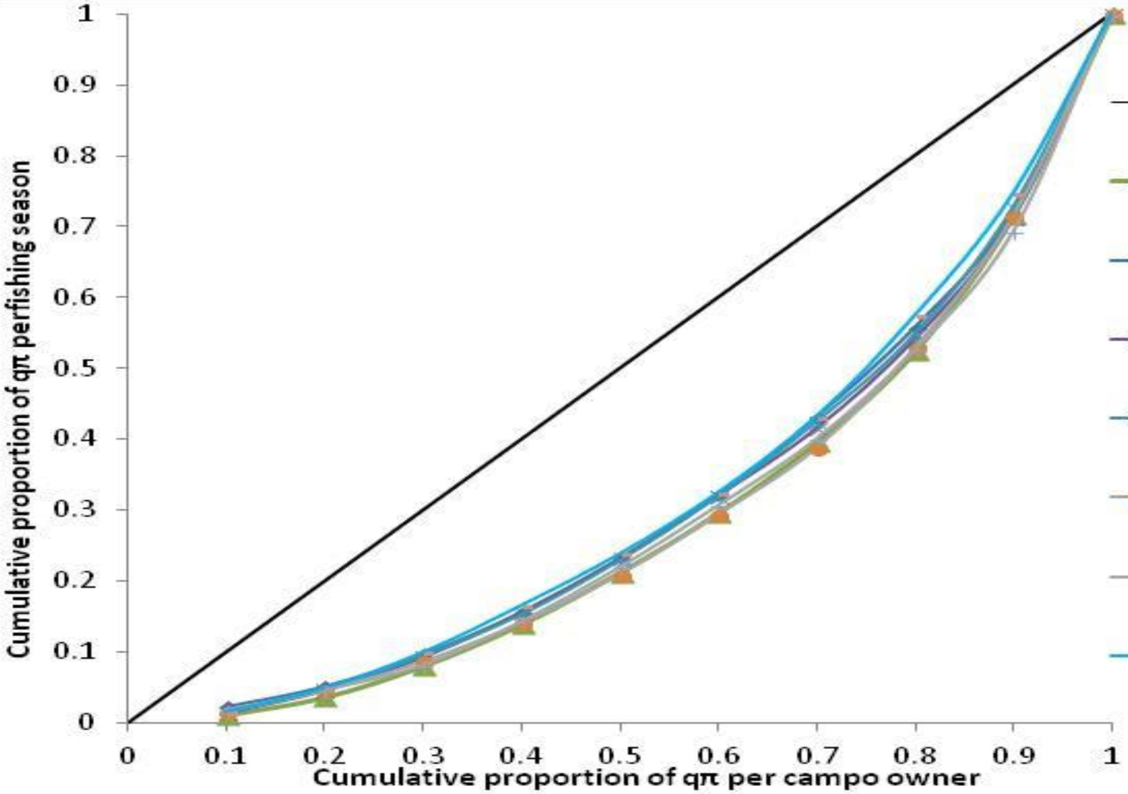


	G *	*H* **
Perfect equity		
2007-2008	0.393	0.280
2008-2009	0.383	0.272
2009-2010	0.385	0.268
2010-2011	0.364	0.256
2011-2012	0.409	0.300
2012-2013	0.409	0.286
2013-2014	0.368	0.269
$\bar{x}$ (±sd)	0.387(.02)	0.276(.01)

* : Villanueva et al., 2017

** : preliminary results

Distribution beneffits: quasi-profits qπ

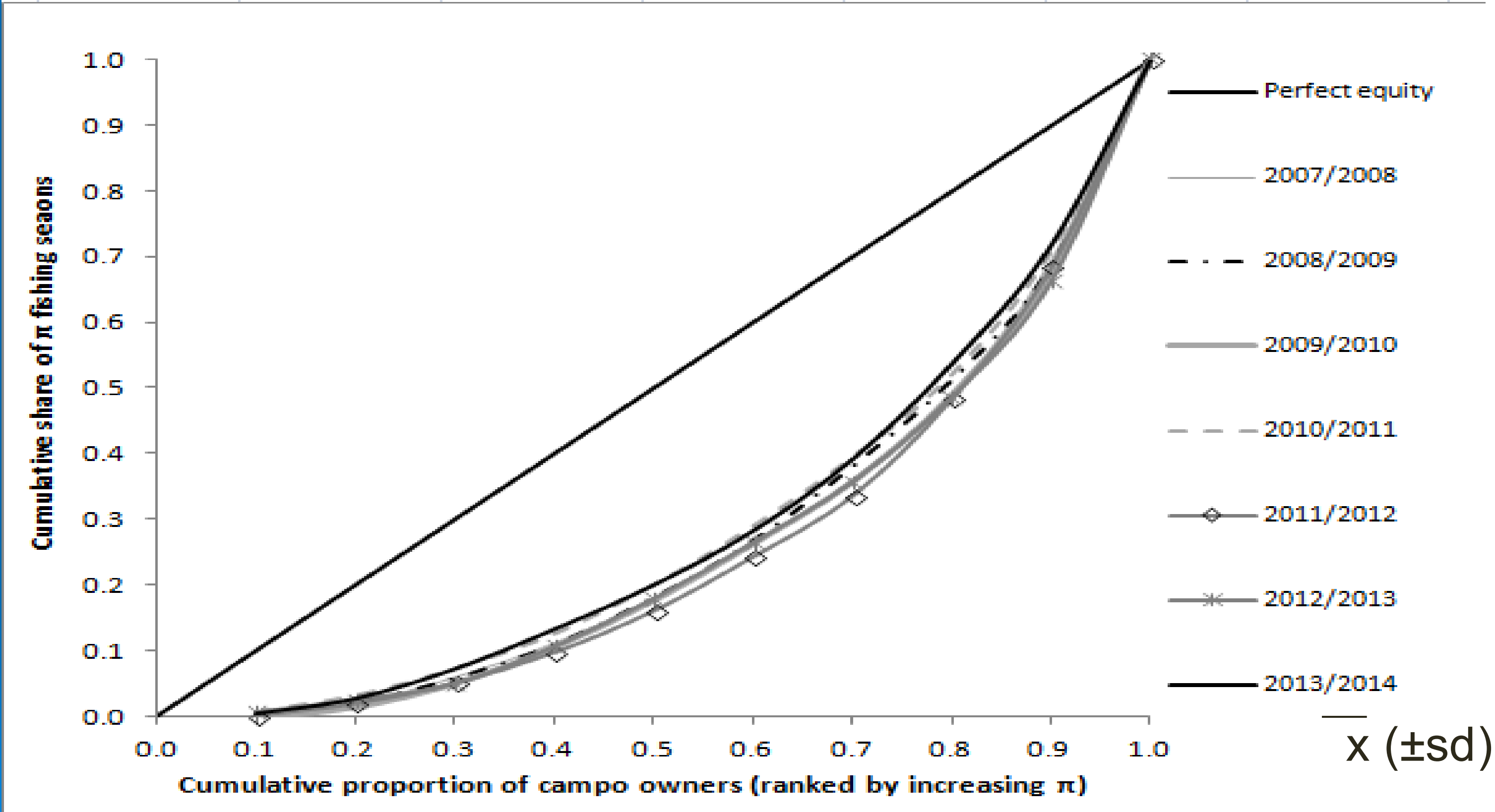


	G *	*H* **
Perfect equity		
2007-2008	0.419	0.299
2008-2009	0.383	0.272
2009-2010	0.394	0.275
2010-2011	0.390	0.275
2011-2012	0.417	0.305
2012-2013	0.414	0.289
2013-2014	0.372	0.272
$\overline{x}$ (±sd)	0.398(.02)	0.284(.01)

* : Villanueva et al., 2017

** : preliminary results

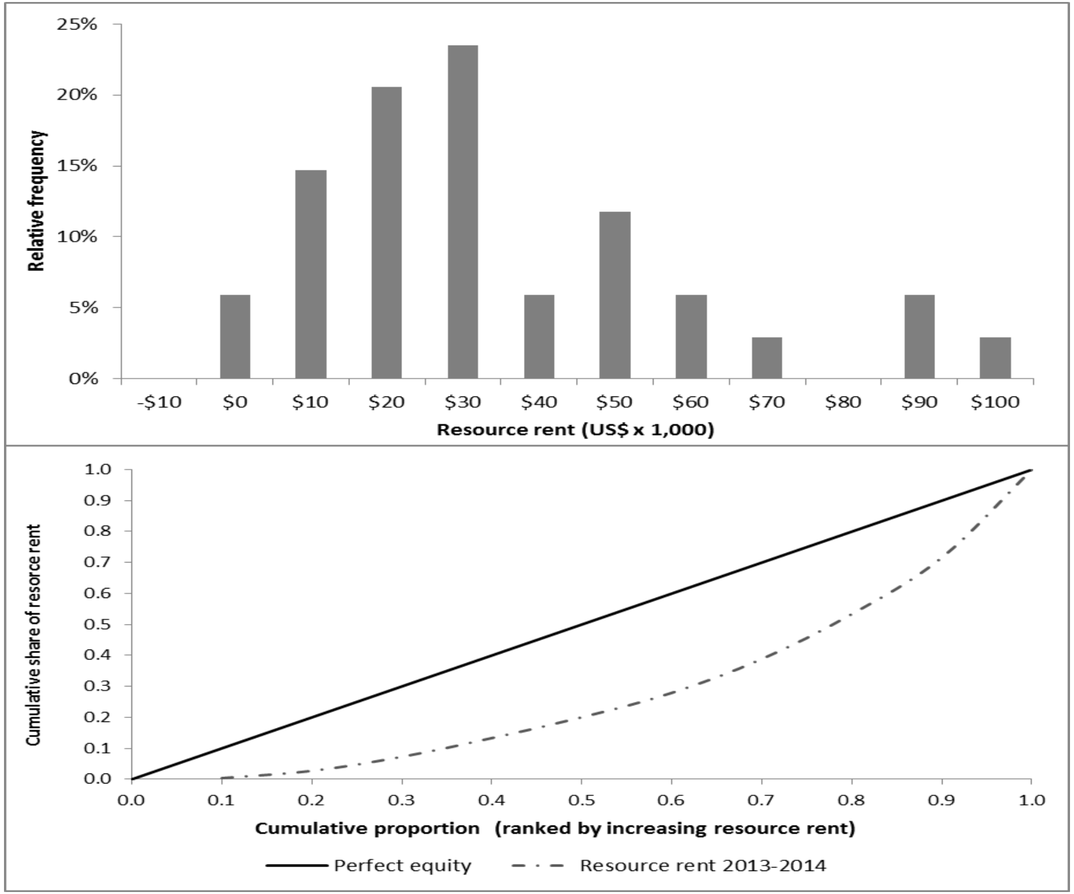
Distribution beneffits: π



	G *
2007/2008	0.467
2008/2009	0.454
2009/2010	0.477
2010/2011	0.432
2011/2012	0.486
2012/2013	0.474
2013/2014	0.427
$\bar{x}$ (±sd)	0.460(.02)

* : Villanueva et al., 2017

Results. Resource rent



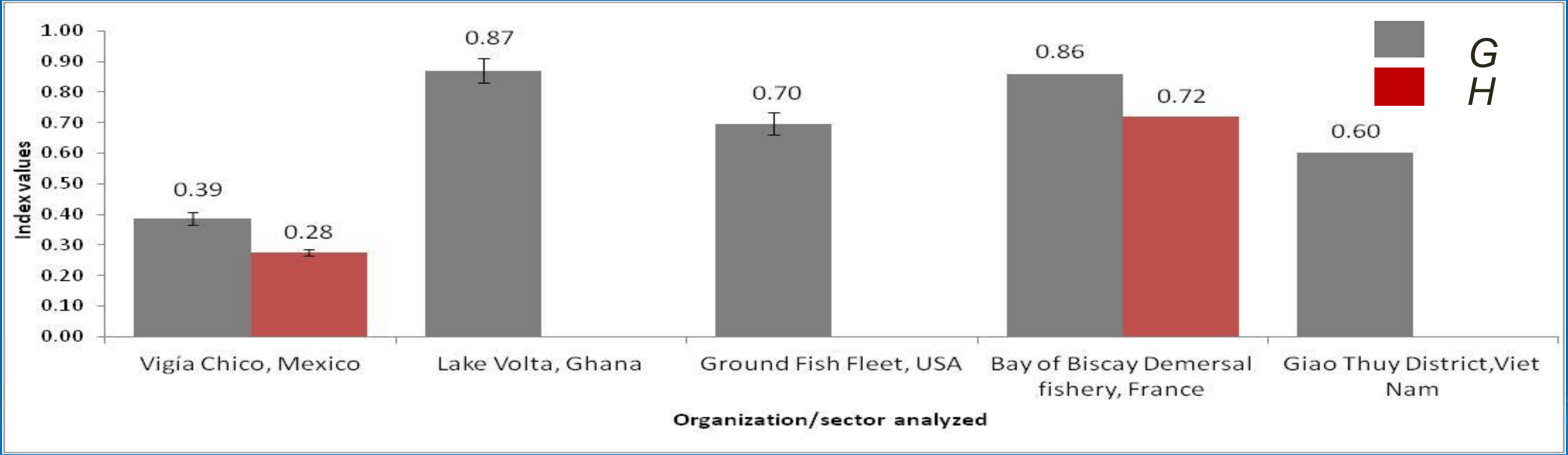
Resource rent

Fishing lobster season 2013-2014

G = 0.490 *

* : Villanueva et al., 2017

Comparing Punta Allen's *G* and *H* indexes with other fishing communities and industries



(Adger *et al*., 2002; Béné & Obirih-Opareh ., 2009;Clay *et al*., 2014; Bellanger *et al*., 2016)

Final remarks

- The distributive performance of the Co-managed lobster fishery of Punta Allen presents lower inequality levels than the other world wide fisheries cited in this study.
- There are no signs of increasing levels of consolidations of the fishing benefits in the Punta Allen lobster fishery.
- The results suggest that the Punta Allen fishery success of sustaining community livelihoods could be explained in part by the equity in the distribution of fishing benefits.

Final remarks

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Full length article

Distributional performance of a territorial use rights and co-managed small-scale fishery

Raúl Villanueva-Poot[a], Juan Carlos Seijo[a,*], Maren Headley[a], Ana Minerva Arce[b], Eloy Sosa-Cordero[b], Daniel Bernardo Lluch-Cota[c]

[a] *Universidad Marista de Mérida, Periférico norte tablaje catastral 13941 Carretera Mérida - Progreso, C.P. 97300 Mérida, Yucatán, Mexico*
[b] *El Colegio de la Frontera Sur, Unidad Chetumal Av., Centenario km 5.5, CP 77014, Chetumal, Quintana Roo, Mexico*
[c] *Centro de Investigaciones Biológicas del Noroeste S. C., Carretera a San Juan de La Costa "EL COMITAN" Km. 1, Playa Palo de Santa Rita Sur, 23096 La Paz, B.C.S.*

A R T I C L E I N F O

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Rights-based small-scale fishery
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Gini index
Territorial use rights

A B S T R A C T

This work reports on how benefits are distributed among the owners of fishing grounds in the spiny lobster (*Panulirus argus*) fishery of Punta Allen, Mexico. This MSC certified (2012) small-scale fishery, has been co-managed as a Territorial Use Rights Fishery (TURF) since 1969. Members of the local fishing cooperative, have exclusive access to individual fishing grounds. The fishery is based on the use of artificial shelters. These bottom devices provide refuges for lobsters, reduce predation mortality, and facilitate harvesting by free diving and the use of hand nets. Data from the fishing cooperative logbooks were used to calculate fishing incomes indicators per fisher (revenues, quasi-profits of the variable costs, profits, and resource rent) achieved in seven lobster fishing seasons (2007–2014). Distributions statistics (shape parameters and log transformations), and inequality metrics (Lorenz curve and Gini index *G*) were applied to the income indicators. The analysis was complemented with a fishers' perceptions survey about the effectiveness of joint Government and cooperative regulations. The *G* index of the fishing revenues distributions showed low values (0.387 ± 0.017) and a stable trend in the seven lobster seasons analyzed. The calculated G values of the fishing income indicators increased from 0.387 to 0.490. There were no statistically significant differences in the resource rent earned by the age groups of campo owners. This finding could indicate intergenerational equity among current resource users. The results showed that in the lobster fishery of Punta Allen, the fishing incomes are spread more equally than most fisheries where distributional performance has been assessed.

- Fisheries Research 194 (2017) 135-145.

Thanks

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Gini index

$$G = 1 + \frac{1}{n} - \frac{2}{n^2 y} \sum y_i (n + 1 - i)$$

Where ***n*** are the proportions or strata of the analyzed population (deciles in this case), ***y*** is the average income of the strata (y_i the income of the strata ***i***), being ***i*** = ***1*** the strata with the lowest income and corresponding the highest income to strata ***i*** = ***10***.

Hoover index

$$H = \frac{1}{2} \frac{\sum_i^n |x_i - \bar{x}|}{\sum_i^n x_i}.$$

Where x_i is the income of the *i* th person/element of the analyzed populaton and x the average income, n are the total proportions in which the analyzed population was divided.

Interviews

•Each campo owner has a 2 ±1 fishers working as assistants [1,5]

•80% of the fishing teams include at least a family member

•80% of the campo owners own 3 campos or less with a mean of 3 ±2 [1,9]

•There are ~27,000 artificial sl

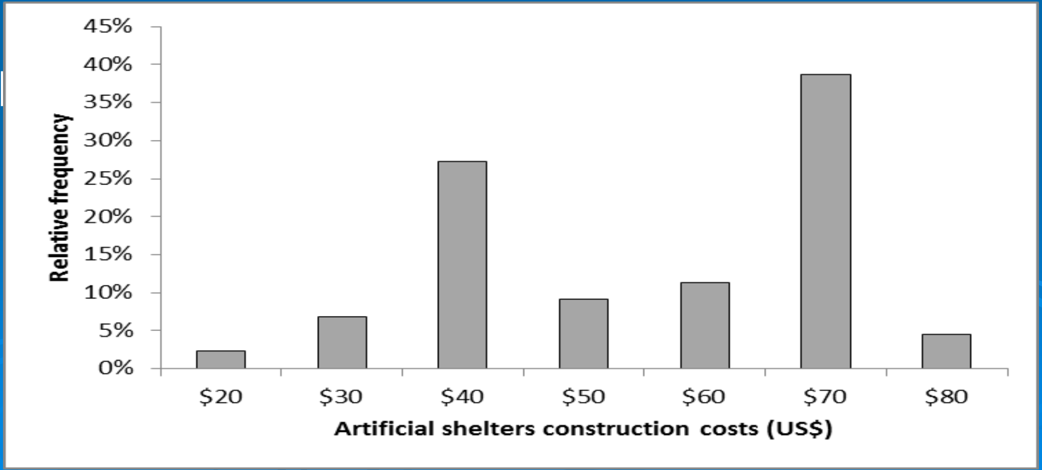
campo [30,1000]

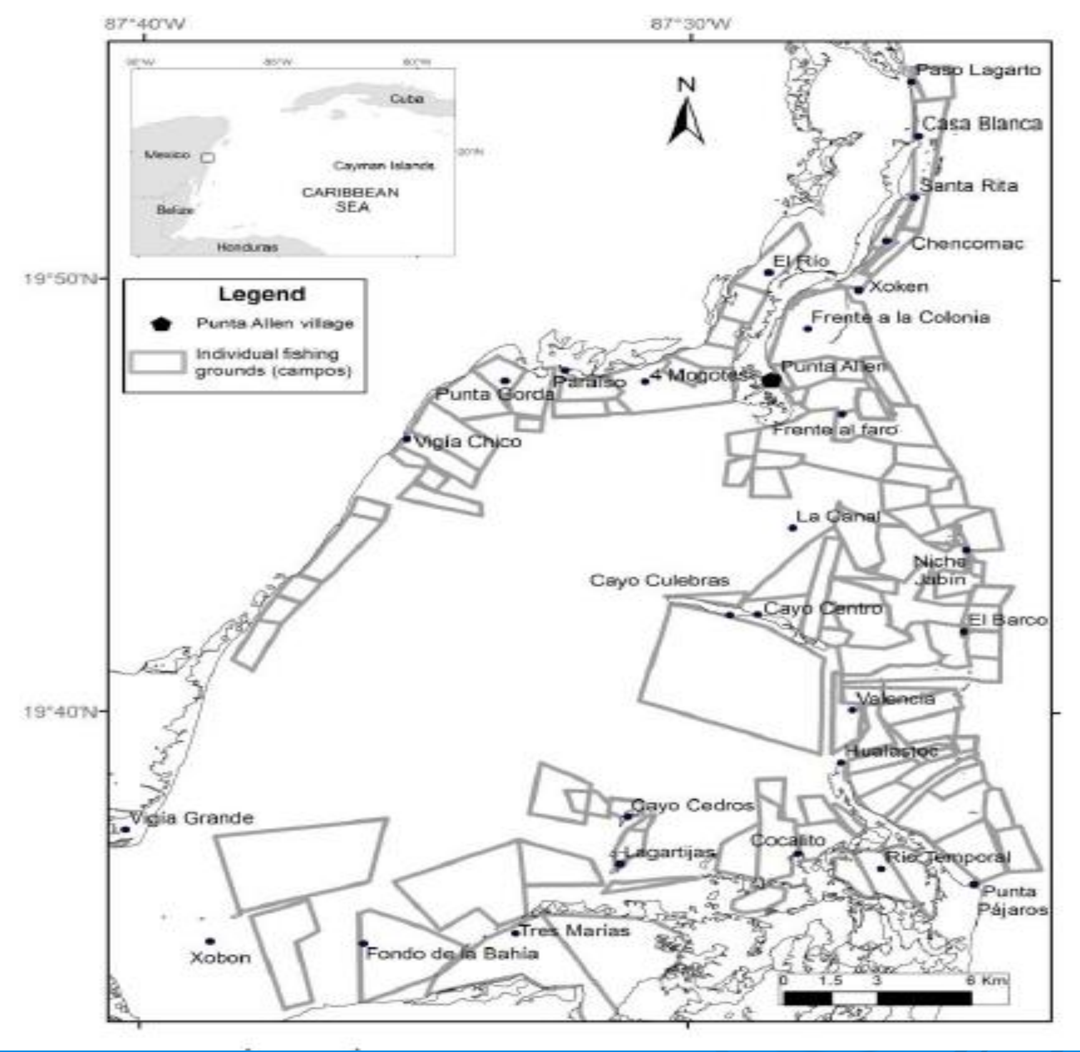
US$ 50 ±15

•Artificial shelters costs

[US$20-US$80]

$\bar{x} \pm sd$





Geographical location of lobsters Individual Transferable Grounds in Punta Allen fishery