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

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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 acknowledged 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 threaten the governance of fishery management schemes (especially the collaborative ones)
  
  (Nash, 1953; Balland & Plateu, 1999; Agrawal, 2001; Adger et al., 2002)

- Rights-based fishery management 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

$0 \leq G \leq 1$
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, $0 \leq H \leq 1$

(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
- \( q \pi \) quasi-profits of the variable costs
- \( \pi \) profits
- \( \Pi \) Resource rent

Inequality metrics Gini/Hoover indexes

(ii) Compare with the distributional performance of other fisheries
Materials and Methods: Fishery geographic area

Ecological characteristics

- Sian Ka´an Biosphere Reserve
- Shallow karst bay
- 740 km²
- Extensive sea grasses
- Important influence 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
  - Minimum size
  - No capture of BF
  - Limit to HP

- Community self-agreed regulations
  - Forbid:
    - SCUBA
    - Hooka
    - Traps/nets
  - Individual Transferable Grounds ≈ 120

- The most successful lobster cooperative in Mexican Caribbean
- Recognized as an example of successful 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 questionnaires)

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 ($F$): 

$$q\pi_i, t = \sigma f F (p_x y_{i,f,x,t} - c_{i,f,t})$$

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

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

Where: $(bm)$, boat maintenance

$(es)$ preventive and corrective engine services,

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

*($mc$), cooperative membership payment*
Materials and Methods: fishing benefits

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

$$\Pi_{i, 2013-2014} = \pi_{i, 2013-2014} - \text{oc}(b, e, g, s_i)$$

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

(b) the boat,

(e) outboard engine

(g) the GPS

($s_i$) artificial shelters by campo owner $i$

$\text{oc}$: according to net bank rate (CETES**).

** Mexican federal treasures funds
Materials and Methods: Parameters

**Table 1.** Price and cost parameters used to calculate the quasi-profits of the variable cost of a fishing trip

<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tail lobster price</td>
<td>25.72</td>
<td>US$·kg⁻¹</td>
</tr>
<tr>
<td>Whole lobster price</td>
<td>14.79</td>
<td>US$·kg⁻¹</td>
</tr>
<tr>
<td>Gasoline cost</td>
<td>1.00</td>
<td>US$·L⁻¹</td>
</tr>
<tr>
<td>Two stroke engine oil cost</td>
<td>6.43</td>
<td>US$·L⁻¹</td>
</tr>
</tbody>
</table>

*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

<table>
<thead>
<tr>
<th>Item</th>
<th>Acquisition/fee (US$)</th>
<th>Average life span (years)</th>
<th>Annualized cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assets</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boat</td>
<td>3,500</td>
<td>20</td>
<td>175</td>
</tr>
<tr>
<td>Boat modifications</td>
<td>1,608</td>
<td>20</td>
<td>80</td>
</tr>
<tr>
<td>Out-board engine</td>
<td>9,646</td>
<td>5</td>
<td>1,929</td>
</tr>
<tr>
<td>GPS</td>
<td>220</td>
<td>3</td>
<td>73</td>
</tr>
<tr>
<td>Other expenses</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boat maintenance</td>
<td>514</td>
<td>1</td>
<td>514</td>
</tr>
<tr>
<td>Preventive and corrective engine services</td>
<td>1,200</td>
<td>1</td>
<td>1,200</td>
</tr>
<tr>
<td>Free diving gears</td>
<td>113</td>
<td>1.2</td>
<td>74</td>
</tr>
<tr>
<td>Harvest gears</td>
<td>51</td>
<td>0.25</td>
<td>204</td>
</tr>
<tr>
<td>Cooperative membership</td>
<td>2,058</td>
<td>1</td>
<td>2,058</td>
</tr>
</tbody>
</table>

Opportunity cost of the capital parameters

<table>
<thead>
<tr>
<th>CETES (1 year)*</th>
<th>Gross rate (%)</th>
<th>Inflation (%)</th>
<th>Net rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.47</td>
<td></td>
<td>2.6</td>
<td>1.87</td>
</tr>
</tbody>
</table>

*Banxico (Central Bank of Mexico) consulted: 06/17/2016
Community distribution benefits: Revenues

* : Villanueva et al., 2017
** : preliminary results
Distribution benefits: quasi-profits $q\pi$

<table>
<thead>
<tr>
<th></th>
<th>$G$</th>
<th>$H$</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007-2008</td>
<td>0.419</td>
<td>0.299</td>
</tr>
<tr>
<td>2008-2009</td>
<td>0.383</td>
<td>0.272</td>
</tr>
<tr>
<td>2009-2010</td>
<td>0.394</td>
<td>0.275</td>
</tr>
<tr>
<td>2010-2011</td>
<td>0.390</td>
<td>0.275</td>
</tr>
<tr>
<td>2011-2012</td>
<td>0.417</td>
<td>0.305</td>
</tr>
<tr>
<td>2012-2013</td>
<td>0.414</td>
<td>0.289</td>
</tr>
<tr>
<td>2013-2014</td>
<td>0.372</td>
<td>0.272</td>
</tr>
</tbody>
</table>

*x* : Villanueva et al., 2017

** : preliminary results
Distribution benefits: $\pi$

$G^* = 0.467, 0.454, 0.477, 0.432, 0.486, 0.474, 0.427$

$x (\pm sd) = 0.460(0.02)$

* : 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

Full length article

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

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A R T I C L E I N F O

ABSTRACT

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 refuge for lobsters, reduce predation mortality, and facilitate harvesting by free diving and the use of hand nets. Data from the fishing cooperative logsheets 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.
Thanks
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

\[ H = \frac{1}{2} \frac{\sum_{i}^{n} |x_i - \bar{x}|}{\sum_{i}^{n} n x_i} \]

Where \( x_i \) is the income of the \( i \) th person/element of the analyzed population and \( \bar{x} \) 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 shelters deployed, with a mean of 230 ±190 per 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