Right-based fishery management programs in Chile: How it was done & how it has worked

Julio Peña-Torres
Associate Professor of Economics
Faculty of Economics & Business
Universidad Alberto Hurtado
(& Ilades/Georgetown Graduate Programs)
Santiago-Chile
E-mail: jpena@uahurtado.cl
Website: <http://www.fen.uahurtado.cl/>

Coastal Pelagic Species Catch Share Workshop/ S. Francisco, Feb 2010
Small pelagic fisheries in Chile

Annual Catch 2004 (million tons)

**Northern pelagic fisheries**

- Anchovy: 1.36
- Jack Mackerel: 0.15
- S. Sardine: 2.7
- Mackerel: 0.15

Total: 4.36

**Southern pelagic fisheries**

- Anchovy: 0.4
- Jack Mackerel: 1.21
- Sardine: 0.36
- Mackerel: 0.37

Total: 2.34

Coastal Pelagic Species Catch Share Workshop/ S. Francisco, Feb 2010
General Regulatory Context

• ITQs: since **February 2001** and valid until **December 2012**

  • **Industrial fleets:** *de jure* ITQs. Initially only for 2 years
  • **Artisanal fleets:** Gradual transition since early 2000s
    • collective quotas assigned to fishermen Organizations
    • *de facto* IQs & partial quota transferability.
    • Organization’s discretion to decide on quota distribution, use & control

• **ITQs for industrial fleets:**
  • Individual (%) catch quotas: per firm, per Fishery Unit
  • Fishery Unit = Species, Area & Fleet (restricted entry)
  • **Only Operational Transferability.** No ITQ ownership transfers
  • Industrial fleets prohibited to do fishing within first 5 nm

• **Initial allocation criteria:**
  • based on historical records (catch & fishing capacity)
  • Increase in vessels’ annual (lump-sum) license payment
Industrial Fisheries: ITQs coverage (data for 2003-04)

• 75% of national industrial (fish) landings
• 19 Fishery Units (12 fish species)
• US$ 500 million of Exports
• 50-60% of yearly production value from Chilean extractive fishing industry
Political Economy behind the Enactment of a New Fisheries Law (early 2001)

- Increasing problems in fishing yields (small pelagics & others): since mid-1980s

- A protracted period of regulatory controversies & political negotiations:
  - 15 years to finally enact a new Fisheries Law (allowing for ITQs)
  - 4 big Proposed Bills of Reform (first 3: totally failed)

- Critical negotiations:
  a) stock sharing between ≠ industrial fleets (≠ fishing zones)
  b) accommodate *de facto* (oversized) growth of artisanal fleets
     - areas’ exclusivity
     - gradual & voluntary quota allocations to fishermen’s Organizations
Rent taxation: Chile vs other Fishing Countries

(Management Costs & Private sector Funding)

<table>
<thead>
<tr>
<th></th>
<th>N. Zealand</th>
<th>Island</th>
<th>Canada</th>
<th>Chile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average annual values valid for → (approx. values valid for late 1990s) (2003)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1) ITQs since…</td>
<td>Late 1970s</td>
<td>1979</td>
<td>1980s</td>
<td>2001</td>
</tr>
<tr>
<td>(2) Fisheries under ITQs:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• # of species</td>
<td>40</td>
<td>21</td>
<td>19</td>
<td>12</td>
</tr>
<tr>
<td>• % Total annual landings</td>
<td>85</td>
<td>95</td>
<td>90</td>
<td>75</td>
</tr>
<tr>
<td>(3) Gross value&lt;sup&gt;a/&lt;/sup&gt; commercial fisheries under ITQ (in US$ mills.)</td>
<td>400</td>
<td>1283</td>
<td>1400</td>
<td>500</td>
</tr>
<tr>
<td>(4) Annual Management Cost (US$ mills.), fisheries under ITQs</td>
<td>36</td>
<td>32</td>
<td>154</td>
<td>14</td>
</tr>
<tr>
<td>• Research</td>
<td>59 %</td>
<td>56 %</td>
<td>31 %</td>
<td>52 %</td>
</tr>
<tr>
<td>• Monitoring &amp; Enforcement</td>
<td>30 %</td>
<td>25 %</td>
<td>30 %</td>
<td>40 %</td>
</tr>
<tr>
<td>• Others</td>
<td>11 %</td>
<td>19 %</td>
<td>39 %</td>
<td>8 %</td>
</tr>
<tr>
<td>(5) Cost Recovery: % of (4) financed by private sector</td>
<td>45 %</td>
<td>100 %&lt;sup&gt;b/&lt;/sup&gt;</td>
<td>18 %</td>
<td>74 %</td>
</tr>
<tr>
<td>(6) % Manag. Costs financed by private sector (as % of (3))</td>
<td>4 %</td>
<td>2.5 %</td>
<td>2 %</td>
<td>2 %</td>
</tr>
</tbody>
</table>

<sup>a/</sup>: Processed products valued at export (fob) price.

<sup>b/</sup>: Since late 2003, a new quota user fees has been approved (gradual increase, 3-5 years)
Effects from introducing ITQs (industrial fleets)

- Fleets: Greater Operational Efficiency
- Greater Product Diversification
An indirect measure of pre-ITQs overinvestment

(Number Operating Vessels / Total Number Licensed Vessels): %
(year 2003)
Fleet’s operational efficiency with ITQs: Present Value Gains
(J. Mackerel industrial fishery; all areas)

• Econometric model + Long-run Numerical Simulations (2001-2020)
  • Recruitment function:
  • Population Dynamics (age-structured)
  • Fleet Operation:
    • Annual Catch
    • Yearly fishing effort
    • Fleet composition (≠ vessel types): Ongoing fleet renewal process
    • Total number of operating vessels (per year)

• Present Value of increased (fishery aggregate) Producers’ Surplus:
  Comparing scenario “with ITQs” versus “without ITQs”
  (TAC= constant at current levels; unchanged production structure)
Product Diversification at small pelagic fisheries
Greater Value Added (Fish Meals)
(Annual exported volumes, thousand tons)
Product Diversification

New market niches: Higher value added (Jack mackerel)

(especially frozen products)

Exported tons

Coastal Pelagic Species Catch Share Workshop/ S. Francisco, Feb 2010
Artisanal fishing sector: Gradual & Voluntary Introduction of Share Quota Management Programs

1. “Research fishing Trips” (PI) scheme: A flexible regulatory instrument
   - TAC + entry & effort controls + vessel-specific quotas
   - Quota allocated for a given area & fleet
   - Register & Control of Quota Use: contracted with private firms
   - ‘de facto’ operation since late 1990s; formally since early 2000s.

2. RAE (‘Artisanal Extractive Regime’): further consolidation of right-based fishery management
   - Collective quotas: per Area & per fishermen’s Organization
   - Greater autonomy to fishermen Organizations: decide how to distribute, use & control the collective quota
   - Small pelagics: since 2004
     (Austral hake since 2005; Hake (gayi) since 2003)
Artisanal small pelagic fisheries (VIII r.): Fleet participation in RAE Programs (2004)

<table>
<thead>
<tr>
<th>VIII Región, 2004</th>
<th>Anchovy</th>
<th>Common Sardine (clupea bentincki)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RAE</td>
<td>no RAE</td>
</tr>
<tr>
<td>Total N of boats</td>
<td>209</td>
<td>620</td>
</tr>
<tr>
<td>lanchas (length: (\geq 16) mt)</td>
<td>208</td>
<td>196</td>
</tr>
<tr>
<td>Nº Bote a remo</td>
<td>0</td>
<td>109</td>
</tr>
<tr>
<td>Nº Botes a motor</td>
<td>1</td>
<td>315</td>
</tr>
</tbody>
</table>

- Anchovy & Sardine: 1/4 of total N boats
- Greatest participation: bigger vessels (lanchas)
- de facto transfers of quotas between fishermen Organizations
  - C. Sardine (2005): 4 transfers \(Q_{\text{max}}\) per transfer = 6600 tons
  - Anchovy (2005): 7 transfers \(Q_{\text{max}}\) per transfer = 4400 tons
Artisanal small pelagic fisheries: RAE coverage as % of regional TACs (year 2004)

<table>
<thead>
<tr>
<th>Area</th>
<th>N Org.</th>
<th>% RAE (área)</th>
<th>% RAE (región)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Anchovy</td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>2</td>
<td>96.0%</td>
<td></td>
</tr>
<tr>
<td>VIII</td>
<td>14</td>
<td>94.6%</td>
<td></td>
</tr>
<tr>
<td>X</td>
<td>4</td>
<td>93.4%</td>
<td></td>
</tr>
<tr>
<td>X Norte</td>
<td>2</td>
<td>93.3%</td>
<td></td>
</tr>
<tr>
<td>X Sur</td>
<td>2</td>
<td>94.0%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Common Sardine</td>
<td>86.60%</td>
</tr>
<tr>
<td>V</td>
<td>2</td>
<td></td>
<td>94.60%</td>
</tr>
<tr>
<td>VIII</td>
<td>14</td>
<td></td>
<td>92.20%</td>
</tr>
<tr>
<td>X</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X Norte</td>
<td>2</td>
<td>91.30%</td>
<td></td>
</tr>
<tr>
<td>X Sur</td>
<td>2</td>
<td>96.50%</td>
<td></td>
</tr>
</tbody>
</table>
Effects from PI and RAE Management Schemes  
(Artisanal Austral Hake fishery)  
(Results from Econometric Analysis, Focus Groups & Fishermen’s Interviews)  

(1) More Cost Effective Fishing Effort:  
- less fishing days/boat & less operating boats  
- Shared use of vessel-allocated cuotas (econs. of scale) & Quota Renting  
- more stable landings per month  
- greater resource diversificación (new species caught)  

(2) Increases in ex-vessel (landing) prices (versus average Price under Olympic Race) 
(estimated effect from policy change, after controlling for other conditionants)  
- PI (XI r): $\Delta^+ 30\%$  
- RAE (XI r): $\Delta^+ 24\%$  

(3) More effective Quota Control  
- Fishermen Organization: greater participation in quota control efforts  
- Fishermen Organizations: now their representation at a more localized level.  

Coastal Pelagic Species Catch Share Workshop/ S. Francisco, Feb 2010
Fishermen’s Perceptions on Effects from Research Fishing (2000→) and RAE (2005 →) Management Schemes (Austral Hake artisanal fishery)

- 570 polls made to fishermen living in the further South of Chile (July-October 2007)

- Questions: fishermen’s perceptions on effects from policy changes (PI & RAE)

### Population & Sampling Size:

<table>
<thead>
<tr>
<th>Region</th>
<th>Universe</th>
<th>Boats' Owners</th>
<th>Vessels' Crew</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Universe</td>
<td>Sample</td>
<td>% poll error</td>
</tr>
<tr>
<td>X</td>
<td>1952</td>
<td>227</td>
<td>6.1</td>
</tr>
<tr>
<td>XI</td>
<td>631</td>
<td>71</td>
<td>11</td>
</tr>
<tr>
<td>XII</td>
<td>120</td>
<td>20</td>
<td>20.1</td>
</tr>
<tr>
<td>Total</td>
<td>2703</td>
<td>318</td>
<td>5.2</td>
</tr>
</tbody>
</table>

Coastal Pelagic Species Catch Share Workshop/ S. Francisco, Feb 2010
Under “Research Fishing Trips” (PI) Programs (2000→):

Is (was) the future of the Hake better protected than before year 2000?

Less positive perception. Related to initial quota allocation criterion.
Under the RAE Program (2005→; only XI region):
Is the future of the Hake better protected than under the Research Fishing Trips (PI) scheme?

Boat’s crew

- No: 8.7%
- Si: 78.3%
- Igual al sistema anterior: 13.0%

Boat Owners

- No: 16.9%
- Si: 73.2%
- Igual al sistema anterior: 9.9%

Total

- No: 13.6%
- Si: 75.3%
- Igual al sistema anterior: 11.2%

Seminario Cuotas Individuales de Pesca, Stgo. 26 Mayo 2009
More details & info. about the Chilean experience with ITQs at:

http://www.fen.uahurtado.cl/

(click: Publications, then Documentos de Investigacion)

- Gomez-Lobo, Peña-Torres & Barria (2009), ITQs in Chile: Measuring the Economic Benefits of Reform

- Peña-Torres (2002), Individual Transferable Fishing Quotas in Chile: Recent History and Current Debates

# Post-ITQs: Changes in Employment Composition

Direct Employment industrial fishing sector: Numbers of jobs

(VIII region, firms ∈ ASIPES Association)

<table>
<thead>
<tr>
<th>Year</th>
<th>Plants &amp; Management</th>
<th>Fleets</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dec – 2001</td>
<td>6.592</td>
<td>2.297</td>
<td>8.889</td>
</tr>
<tr>
<td>Dec - 2004</td>
<td>10.056</td>
<td>2.252</td>
<td>12.308</td>
</tr>
</tbody>
</table>

*Source: ASIPES*
<table>
<thead>
<tr>
<th>Initial allocation rule</th>
<th>Species</th>
<th>Fishery</th>
<th>Geographical area</th>
</tr>
</thead>
<tbody>
<tr>
<td>50% landings from 1997-2000 and 50% storage capacity</td>
<td>Jack Maquerel (Trachurus murphyi)</td>
<td>Central Southern Pelagic</td>
<td>V to X región</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Northern Pelagic</td>
<td>III to IV region</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Northern Pelagic</td>
<td>I to II region</td>
</tr>
<tr>
<td></td>
<td>Spanish Sardine (Sardinops sagax)</td>
<td>Northern Pelagic</td>
<td>I to II region</td>
</tr>
<tr>
<td></td>
<td>Anchovy (Engraulis ringens)</td>
<td>Central Southern Pelagic</td>
<td>V to X región</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Northern Pelagic</td>
<td>I to II region</td>
</tr>
<tr>
<td></td>
<td>Common Sardine (Clupea bentincki)</td>
<td>Central Southern Pelagic</td>
<td>V to X región</td>
</tr>
<tr>
<td></td>
<td>Hake (Macruronus magellanicus)</td>
<td>Central Southern demersal</td>
<td>V to X región</td>
</tr>
<tr>
<td>Landings from 1999 to 2000</td>
<td>Spanish Sardine (Sardinops sagax)</td>
<td>Northern Pelagic</td>
<td>III to IV region</td>
</tr>
<tr>
<td></td>
<td>Anchovy (Engraulis ringens)</td>
<td>Northern Pelagic</td>
<td>III to IV region</td>
</tr>
<tr>
<td></td>
<td>Hake (Macruronus magellanicus)</td>
<td>Southern demersal</td>
<td>XI to XII region</td>
</tr>
<tr>
<td></td>
<td>Southern Hake (Merluccius australis)</td>
<td>Southern demersal</td>
<td>41º28,6 L.S. to 57ºL.S.</td>
</tr>
<tr>
<td></td>
<td>Conger eel (Genypterus blacodes)</td>
<td>Southern demersal</td>
<td>41º28,6 L.S. to 57ºL.S.</td>
</tr>
<tr>
<td></td>
<td>Three finned Hake (Micromesistius australis)</td>
<td>Southern demersal</td>
<td>41º28,6 L.S. to XII region</td>
</tr>
<tr>
<td></td>
<td>Common Hake (Merluccius gayi)</td>
<td>Central Southern Demersal</td>
<td>IV region to 41º28,6 L.S.</td>
</tr>
<tr>
<td></td>
<td>Nylon prawn (Heterocarpus reedi)</td>
<td></td>
<td>II to VIII region</td>
</tr>
<tr>
<td></td>
<td>Yellow lobster (Cervimunida johni)</td>
<td></td>
<td>III to IV region</td>
</tr>
<tr>
<td></td>
<td>Red lobster (Pleuroncodes monodon)</td>
<td></td>
<td>I to IV region</td>
</tr>
</tbody>
</table>

\[
q_i = 0.5 \cdot q_i^L + 0.5 \cdot q_i^K
\]

\[
q_{ij}^K = \frac{k_{i2000}}{\sum_{i=1}^{I} k_{i2000}}
\]

\[
q_{ij}^L = \frac{\sum_{t=1997}^{2000} c_{itj}}{\sum_{i=1}^{I} \sum_{t=1997}^{2000} c_{itj}}
\]
All Industrial vessels: Annual (lump-sum) license payments
(US$, thousand)

Annual Fiscal Revenues

% FIP

Δ+100% vs 1997-99

Coastal Pelagic Species Catch Share Workshop/ S. Francisco, Feb 2010
Fleet’s Operational Efficiency:
Jack Mackerel Industrial Fishery (all zones)

(Annual Landings vs. Operating Fleet Hold Capacity)

Coastal Pelagic Species Catch Share Workshop/ S. Francisco, Feb 2010