

Revisiting conservation farming : substantial gains and little downside from farming of *Totoaba Macdonaldi*

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June 27, 2024

Meet *Totoaba Macdonaldi*



(a) Totoaba and Vaquita



(b) Totoaba swim bladder

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(c) Totoaba and Vaquita



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(e) Totoaba and Vaquita



(f) Totoaba swim bladder

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- Fished with gillnets, destroying vaquita population as bycatch (≈ 10 individuals remaining)

Policy context

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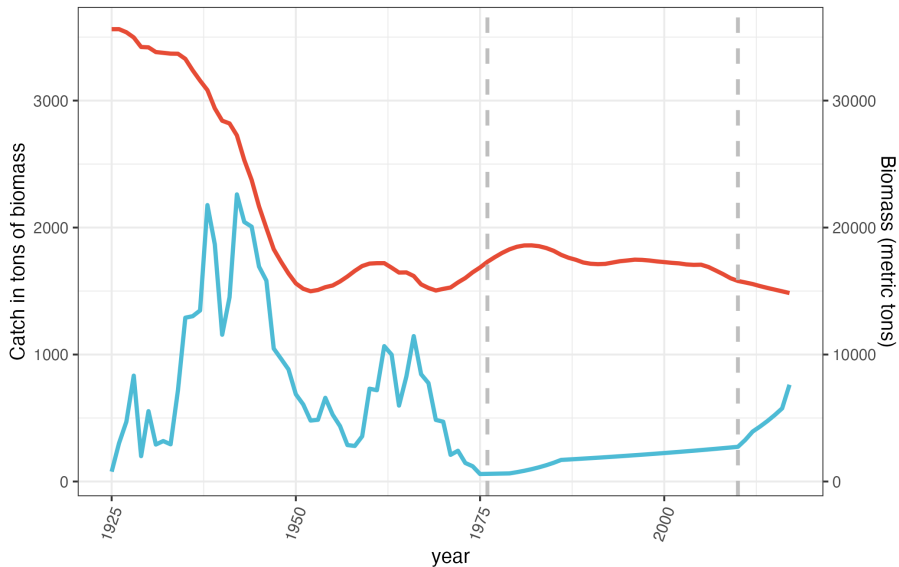
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- Need a specific export permit

Evolution of stock



Cocaine of the sea



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Braconnage massif de totoaba, "cocaïne des mers" prisée ...

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'Cocaine of the Sea' Worth \$1M Seized in Arizona

Oct 18, 2023 at 9:45 AM EDT

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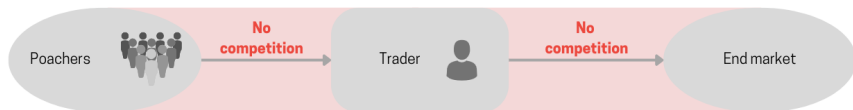


Figure: Supply chain

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- Curb poaching and increase population size
- Decrease illegal profits

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- Legal trade may make laundering easier, lowering illegal transaction costs- for reptile trade in Asia, many species sold as captive-bred could not be found in breeding facilities during inspections (Nijman and Shepherd, 2009)

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- Species may not be competitive - Rhinos for example : low reproductive rate and horn growth (Patton et al., 1999; Swaisgood et al., 2006; Pienaar et al., 1991)
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What we do :

- Revive an industrial organization, bioeconomic model (Damania and Bulte, 2007) and prove different result
- Apply them in the case of Totoaba to gauge the opportunity - **not going over new and rich data, but happy to discuss it!**

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- 3 We assume a linear demand function, and account for imperfect competition later on

$$P(q) = \alpha - \beta q \quad (3)$$

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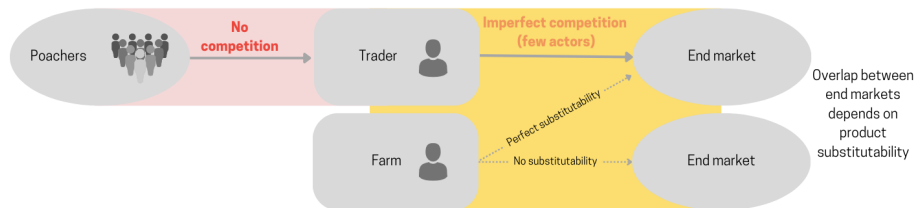
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- 3 $s(x)$ clears the market and the steady state catch is:

$$q_M^W = \frac{\sigma^2 x^2 (\alpha_m - c) - W_1 \sigma x}{2(\sigma^2 x^2 \beta^m + W_2)} \quad (6)$$

Aquaculture

We include aquaculture and evaluate the following policy scenario :



Aquaculture

- Adapt demand to account for imperfect substitutability:

$$P^i(q^i, q^j) = \alpha^i - \beta^i q^i - \gamma q^j \quad (7)$$

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$$\Pi^F = (P^F - v)q^F \quad (8)$$

With v the unit cost corresponding to the capitalized sum of annual costs

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⇒ Depending on model parameters, poaching can increase or decrease in steady state.

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- Fleet data from INAPESCA and on the ground interviews : number of vessels, days per month, cost of totoaba gearset, gear replacement cost, bribing costs
⇒ Reconstruct total cost and estimate linear quadratic cost function

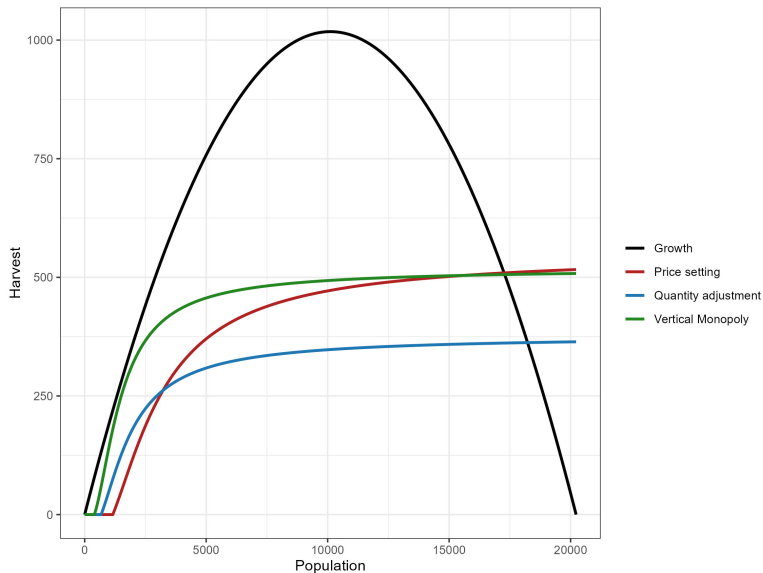
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- No data on vertical monopoly transaction costs : set them at 0 to have a conservative result e.g. assume *no existing law enforcement*

Results

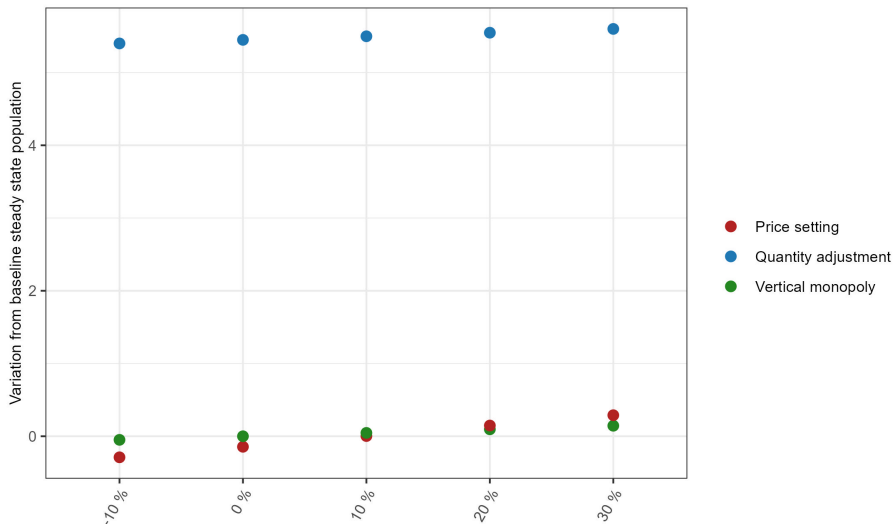


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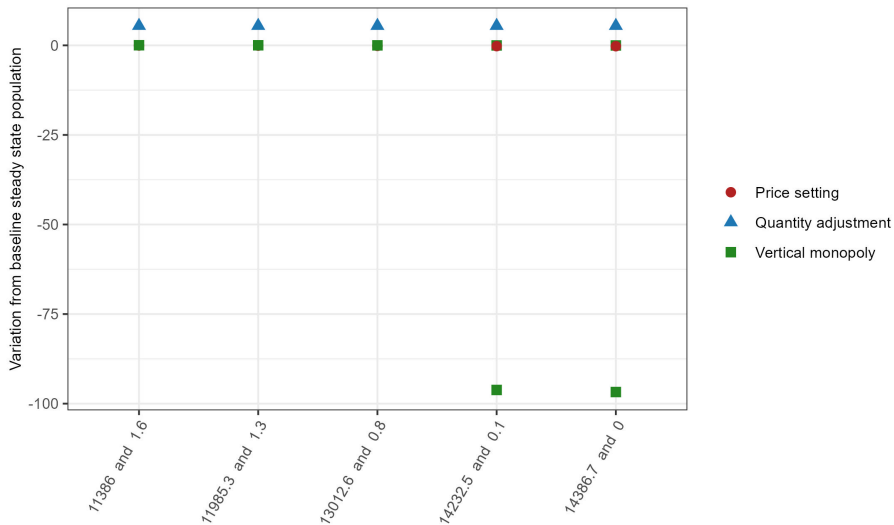
Scenario	Poached harvest (in mt)	Farmed harvest (in mt)	Steady state population (in mt)	Illegal profit (in million USD)	Farming profit (in million USD)	Fishing profit (in million USD)	Aggregate profit (in million USD)	Illegal profit change (in million USD)	Variation in ss. pop.	Poaching change (%)
Vertical Monopoly	505.81	0.00	17286.0	400.08	0.00	1.60	401.68	0.00	0%	0%
Quantity adjustment	362.46	334.15	18228.0	205.44	174.60	0.74	380.78	-194.63	5.45%	-28.34%
Price setting	536.94	432.53	17257.5	84.27	57.26	4.41	145.94	-315.81	-0.16%	6.15%

Bioeconomic performance

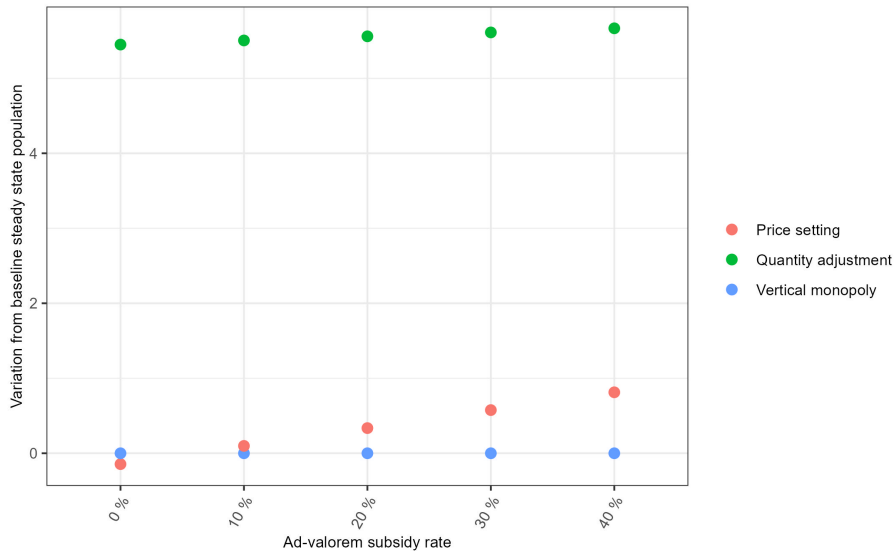
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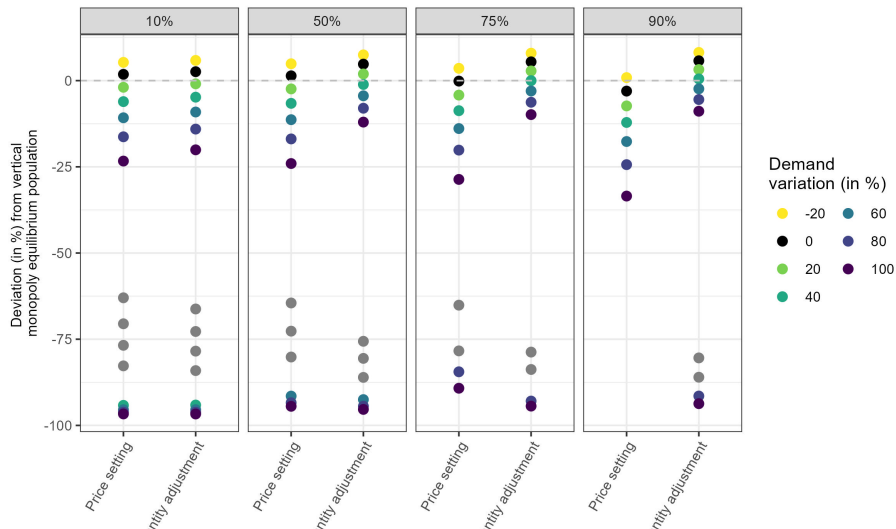
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Would subsidies work?



Demand : evolution and substitutability



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- ⇒ Next paper on consumer preferences in Asian markets

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⇒ Smart tracking necessary

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- Trade liberalization with demand reduction policies can be welfare improving and yield conservation benefits
- Need of smart design to leverage asymmetric information for policy success

Thank you, happy to answer to any question!

Oligopoly

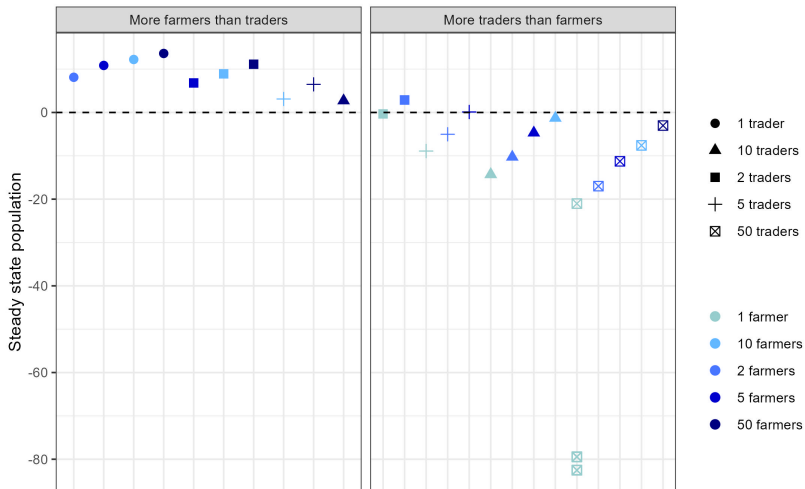


Figure: Steady state population in Cournot oligopoly

Oligopoly

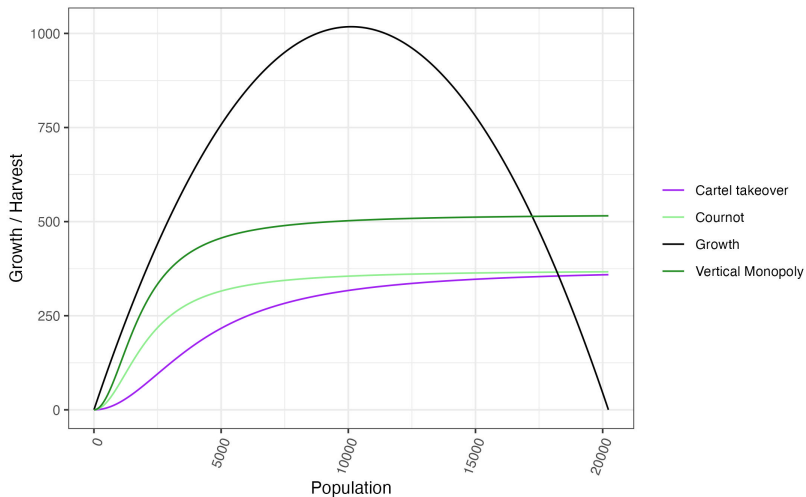


Figure: Equilibrium with cartel takeover

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