



Caleta Carelmapu-Región de Los Lagos, Chile

Photo: Proyecto Fondecyt Regular 1140502

# **Managing and Defending the Commons: Applications to Territorial User Rights in Fisheries (TURFs) using Field Experiments in Chile**

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MESSH Days –”Complexity in Bio-Economics of Marine Fisheries”

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# Agenda

1. Space-based rights: Basic elements
2. One example: Chile's nearshore TURFs
3. Managing and Defending the Commons: Lab-in-the-Field Experiments in Chile:
  - Managing and defending CPRs from poaching  
(+ Extension: variation in mechanism for providing monitoring and enforcement)
  - Coalition formation: how the ability to deter outsiders affect the formation of CPRs groups
4. Conclusions and future work

# 1. Space based rights: Basic elements

- ◆ The presence of rivalry and non-exclusion might generate over-exploitation of natural resources.
- ◆ A potential solution to the problem is to allow groups of agents to have **the right of using and exploiting the resource**, define organisational and operational rules, and be responsible for the management of the resources **in a given geographical area**.

## Space-based rights...

- Area-based property rights schemes assign rights to a specific geographic area to a specific group of users.
  - Collective land titles
  - Local use of protected forests
  - **Territorial use rights fisheries (TURFs)**
- Confront the open access problem by limiting access rights.
- Allow groups to confront the internal coordination problem.

...the *ability to limit and enforce resource access to control exploitation*, which requires the establishment of some form of property right—either private or common property...

(Ostrom 1990, 2000).

# **Space-based rights in fisheries, or TURFs**

(Wilens et al., 2012-*REEP*; Quynh, et al., 2017-*MP*)

## ***What a TURF is?***

Allocation of rights to use all or part of the resources in a particular geographical space.

## ***How to designate a TURF?***

TURFs may be designated as rights to the surface, the midwater zone, or the bottom, or some combination of these.

## ***Rights for whom?***

TURFs may be granted to single individuals, to groups of individuals, to corporate structures, to communities, or to larger political entities such as states or nations (example: economic exclusive zone, EEZ).

## Space-based rights...TURFs...

- Most TURFs do not convey full ownership rights to resources.
- Access rights are granted on behalf of the nation's citizens.

*What the potential gains from a TURF is?*

Generation of new net economic value associated with the TURF creation (mitigate the potential economic rent dissipation from open access).

# Space-Based Rights, or TURFs....

## What is needed for a success of TURFs

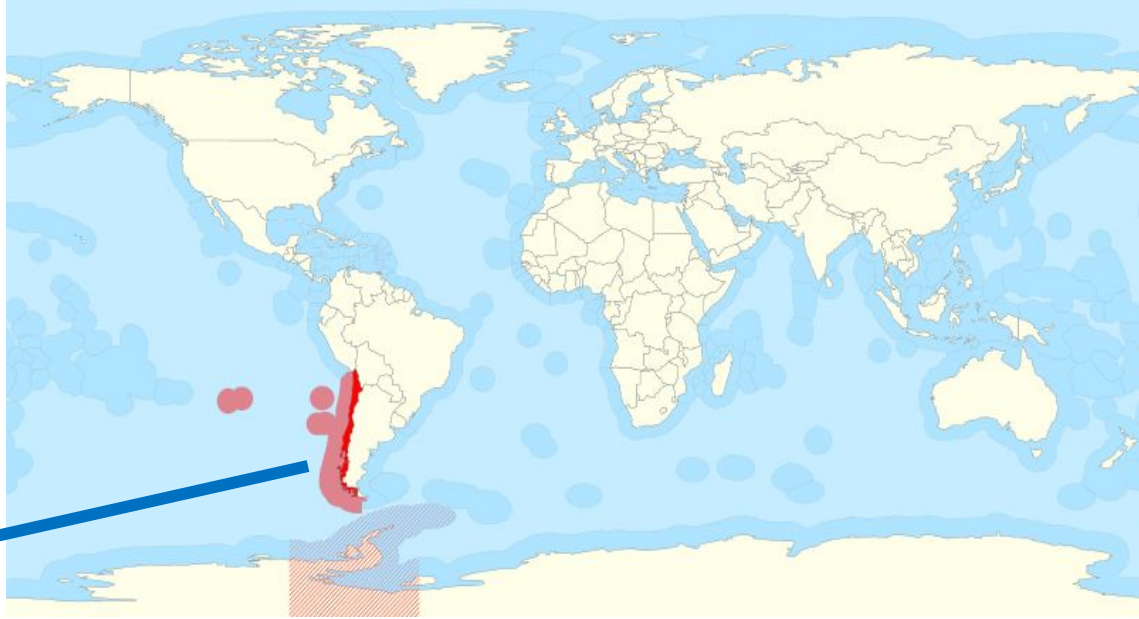
1. Identification of a closed class of users.
  2. Enforcement.
  3. Adoption of rules of use.
  4. Security of tenure.
- Quynh et al. (2017) report the use of TURFs in Argentina, Australia, Brazil, Canada, Chile, Ecuador, India, Indonesia, Japan, Mexico, Korea, Philippines, Spain, United States, and Vietnam, among other countries.
  - The performance of TURFs depends mainly on enforcement and contextual factors [Quynh et al. (2017)].



## **2. One example-Chile's nearshore TURFs (Benthic Resource Management Areas)**

# Overview: marine user rights in Chile

Chile (+ EEZ); 5,000 km of coast



(1) TURFs

(2) ITQs

(3) Collective fishing quotas

(4) Marine aquaculture concessions

(5) Special permits

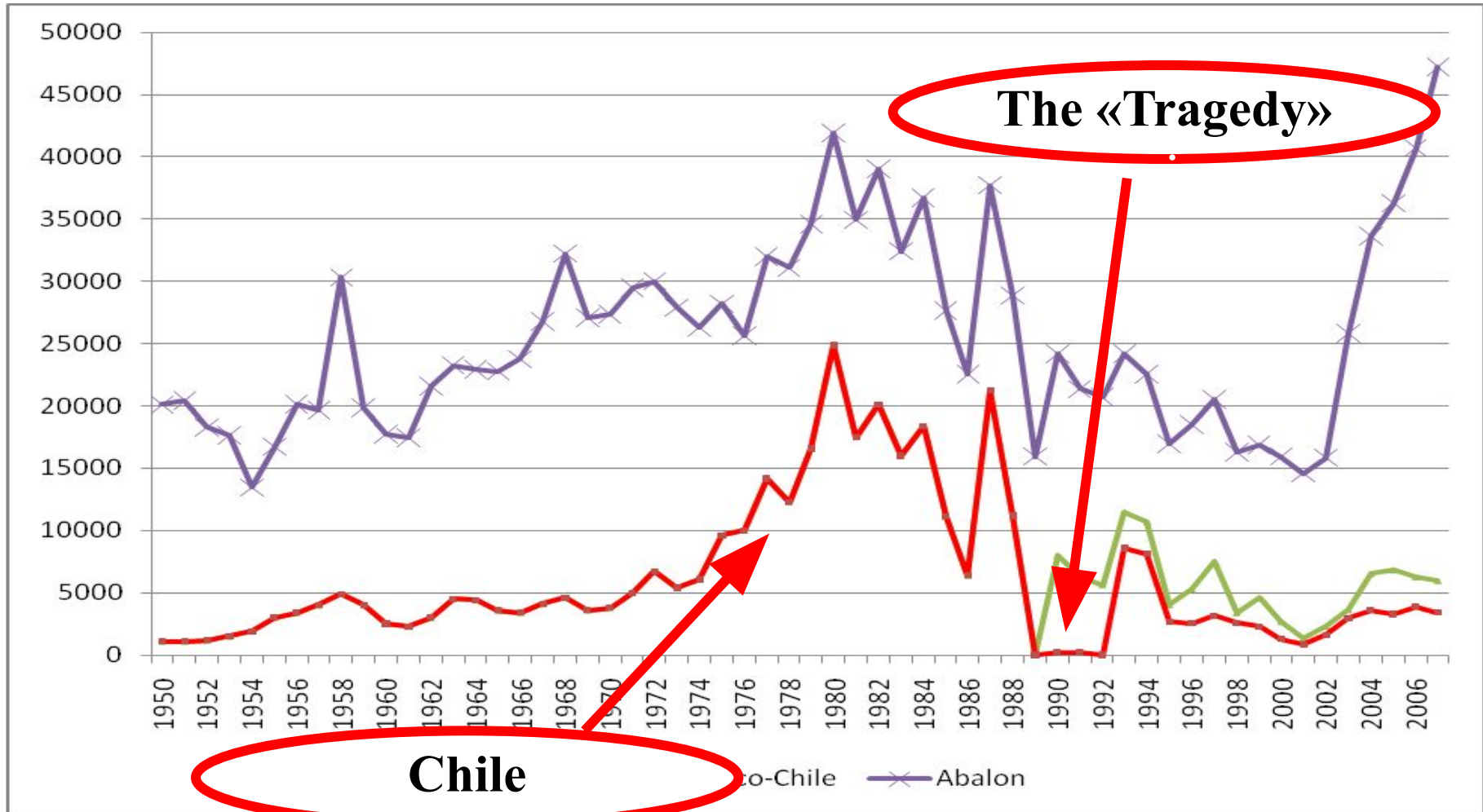
(6) Indigenous People's Marine Coastal Territories

# *TURFs in Chile*

## *Loco Fishery*

### *(Concholepas-concholepas) - Chile*

World Production/Extraction Abalone and Loco in Chile (tons.)



Source: Quiroga, M. et al (2010), Proyecto FIP 2008-31.

# **The Chilean Benthic Resource Management Areas (TURFs)-Law of Fisheries and Aquaculture, 1991**

- Management system based on the creation and allocation of TURFs has been implemented in Chile since the 1997. (Supreme Decree 355, 1995, Artic. 1).
- The system is applied in Benthic fisheries, and it is known as **Benthic Resource Management Areas (BRMAs) (Áreas de Manejo y Explotación de Recursos Bentónicos-AMERBs)**.
- The BRMA gives local fishermen responsibility for the regulation and administration of benthic resources, their organization, conflict control, and planning.



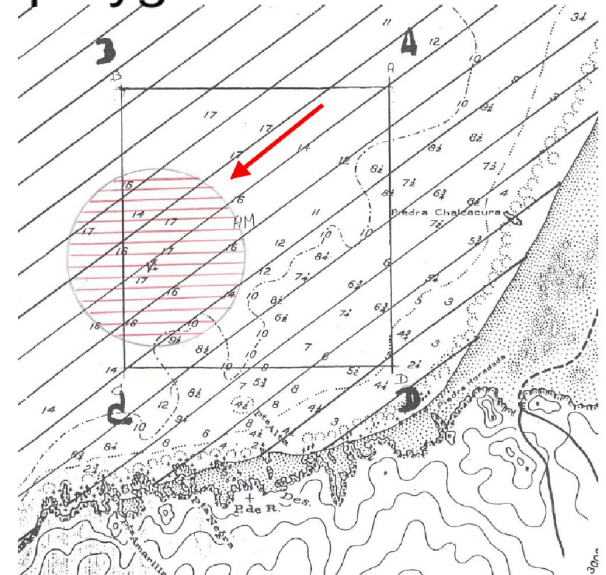
# Regulatory System: Chilean TURFs



ORGANIZATION  
OF ARTISANAL  
FISHERMEN

- Right to manage and exploit the area
- Planning over time

Example: Requested area for concession, polygon ABCD





## *BRMA in the Chile*

# BRMAs with decree: 800+ (aprox. 122,000 ha.)

# BRMAs with decrees and allocated: 550+ (75,000 ha.)

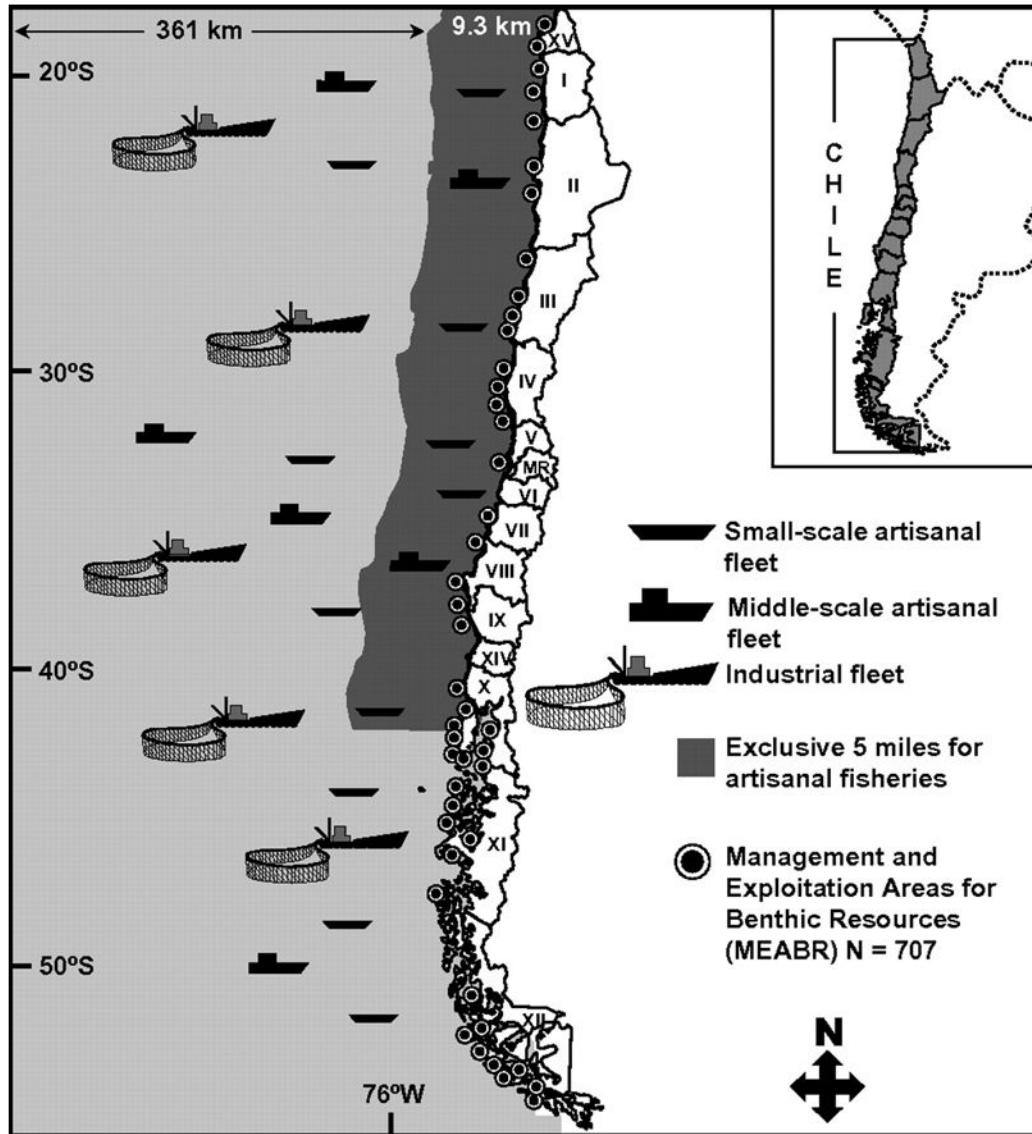
# BRMAs under application process: 360+ (60,000 ha.)

AMERBs are located along the 5,000 km coast line, within the nearshore zone out of 5 nautical miles.



Photos: Proyecto Fondecyt Regular 1140502

# Schematic representation of fisheries zoning in Chile.



The main benthic species.....*Chilean abalone*.





# Performance of TURFs in Chile

- A lot of heterogeneity in terms of recovering of wild abalone stocks and economic performance (TURFs' profits).
- Management of TURFs is an important aspect: there is room for improvements.
- New applications for TURFs, but biological productivity of remaining sites is declining.
- Other effects...

# Challenges...TURFs

*New rights...new problems...*

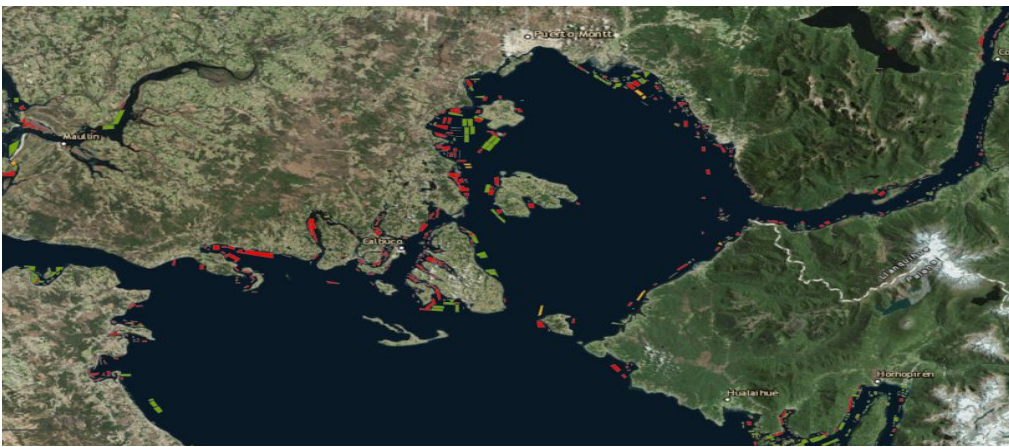
- How to deal with the increasing pressure/competition for space (geographical areas)?
- Monitoring and Enforcement: controlling insiders and outsiders.

# Conflict space-Puerto Montt

**Aquaculture  
concessions**

**Aquaculture  
concessions  
+  
TURFs**

**Aquaculture  
concessions  
+  
TURFs  
+  
Indigenous People  
Marine Coastal  
Territories**



# Let us look the problem of enforcement...

- **Management and protection** of a common-pool resource (from poaching by insiders and outsiders).
- Success depends upon:
  - (a) ability to resolve **collective action problem**, and
  - (b) **prevent poaching** by “insiders” and “outsiders”.

[Creation of TURF may exclude individuals who have a history o harvesting from that zone – they become “outsiders”].

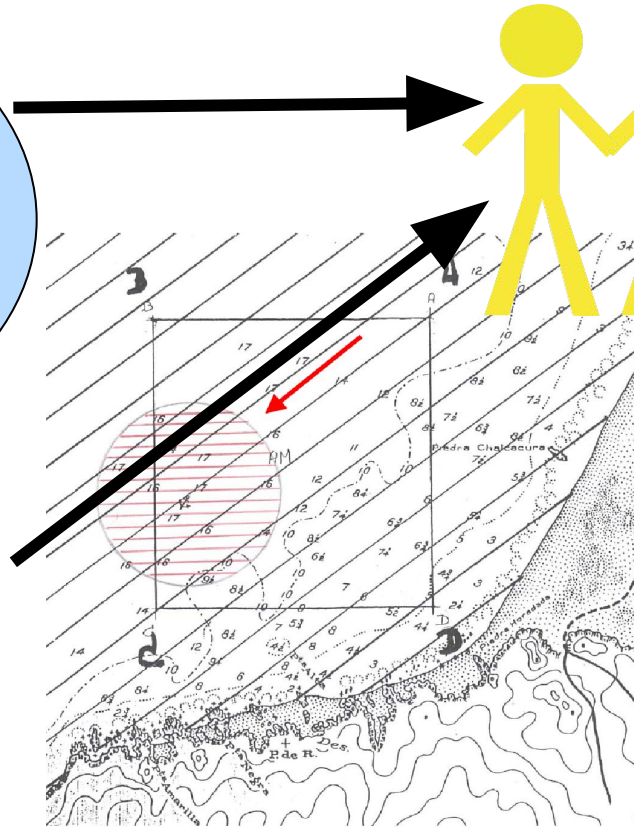
Insiders



Outsiders



Authority



*conflicts related to the use of territory and illegal extraction!!*

### *Monitoring and Enforcement of Chilean TURFs:*

- Chilean Navy and National Fisheries Service responsible for monitoring, **but rare.**
- TURF members can monitor themselves or hire a 3<sup>rd</sup> party



# Poaching

- Estimates suggest that the illegal harvest may be as much as the legal harvest (Bandin and Quiñones, 2014; Gonzales et al, 2005).
- • 3 sources of illegal harvesting
  - Outsiders entering a TURF
  - Insiders harvesting more than their share
  - Harvesting outside of a TURF



Photo: Proyecto Fondecyt Regular 1140502



## Robo de locos en las áreas de manejo causa estragos en los Sindicatos de Pescadores Artesanales de la Región de los Ríos

La denuncia fue realizada por los presidentes de los sindicatos de pescadores artesanales de Isla del Rey 1 y 2 Miguel Benavente y Gerardo Flores, además se suma a esta denuncia el presidente del sindicato de Huiro Luis Alfredo Antillanca.

Por Equipo El Navegable  
644 Lecturas  
14 de Julio, 2015 22:07  
Comentar

La situación es grave, producto del robo en las áreas de manejo hoy la extracción de locos (Concholepas Concholepas) ha disminuido ostensiblemente causando una grave crisis económica al sector. Gerardo Flores del sindicato N° 2 de Isla del Rey indicó que el año 2014 en esta fecha su sindicato había cosechado más del 50 por ciento del recurso, y hoy solo han conseguido extraer un 30% por la falta del recurso.



"Las áreas de manejo deben ser monitoreadas día y noche, con presencia de la armada, y evitar que entren estos individuos a apoderarse de algo que no es de ellos. Yo he escuchado que en otros sectores se usan sistemas de

## Pescadores artesanales denunciaron robo de locos en áreas de manejo

"Estamos teniendo problemas de colapso de la pesquería", dijo la presidenta de la Confepach, Zoila Bustamante, en Cooperativa.

Acusó que se trata de "una flota que está identificada que viene de Ancud".

Publicado: Viernes 14 de febrero de 2014 | Autor: Cooperativa cl



## Familia del pescador ancuditano asesinado en Los Muermos clama por justicia

Datos entregados por Sernapesca:

### Pesca ilícita extrae hasta el cuádruple de recursos marinos que la actividad legal

• Autoridades aseguran que un proyecto de ley que endurece las sanciones a quienes pescan fuera de las cuotas permitidas ayudará a combatir el fenómeno.

• "Nadie hasta el momento había fallecido; en enero hubo algunos jóvenes heridos, incluso, uno de ellos muy grave a raíz de los incidentes, que ahora le costaron la vida a una persona".

# **3. Managing and Defending the Commons: Lab-in-the-Field Experiments in Chile**

(join work with Jim Murphy, John Stranlund, and Felipe Quezada)

- Managing and defending CPRs from poaching.  
(+Extension: variation in mechanism for providing monitoring and enforcement)
- Coalition formation: how the ability to deter outsiders affect the formation of CPRs groups.



# “Managing and Defending the Commons: Experimental Evidence from TURFs in Chile”

Chávez, C., J. Murphy, and J. Stranlund. (2018). *Journal of Environmental Economics and Management* 91: 229-246.

- Research focus:  
Protection of a common-pool resource from poaching by outsiders.
- We examine how the ability of a group to manage their resource is affected by:
  - their ability to monitor and deter encroachment
  - the government’s role in enforcing CPR boundaries

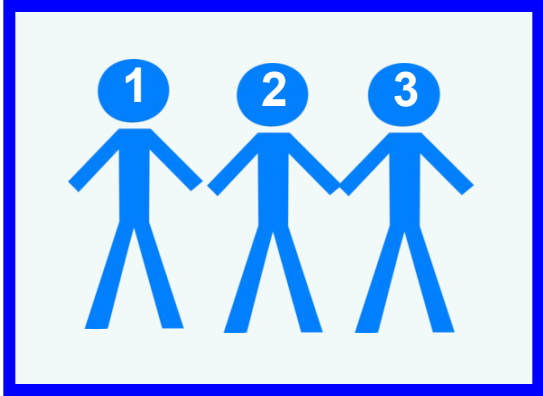
# Experimental design and Procedures

-The analysis is based on a framed field experiment conducted with artisanal fishers in central-southern Chile (problem of extraction of *loco*, **wild abalone**). (*Replicated with university students*).

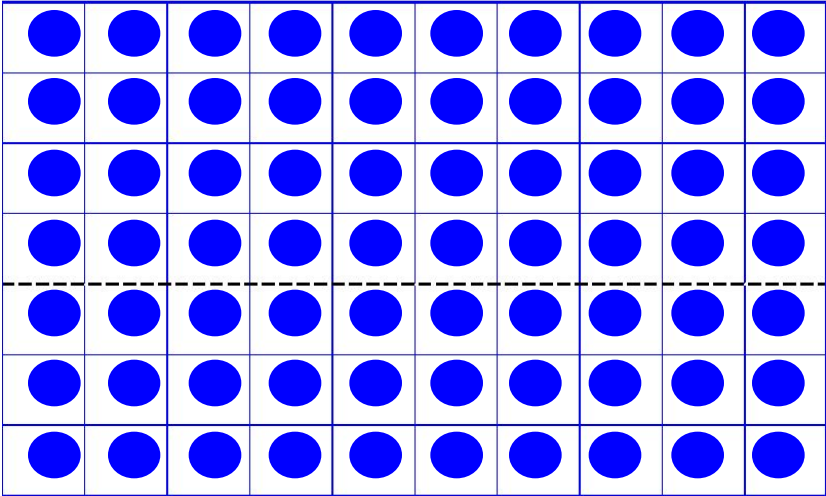
-The experiment considers:

- 2 exogenous groups of fishers (“insiders” (blue)/“outsiders” (yellow) and 2 zones of extraction.
- “Insiders” manage a TURF
- “Outsiders” can poach from TURF
- Renewable resource in both zones;  $S_{t+1} = F(S_t) - H_t$
- Vary the mechanism for monitoring and enforcing poaching

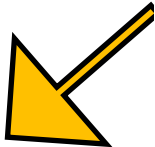
# T1. Baseline Treatment



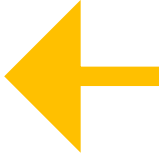
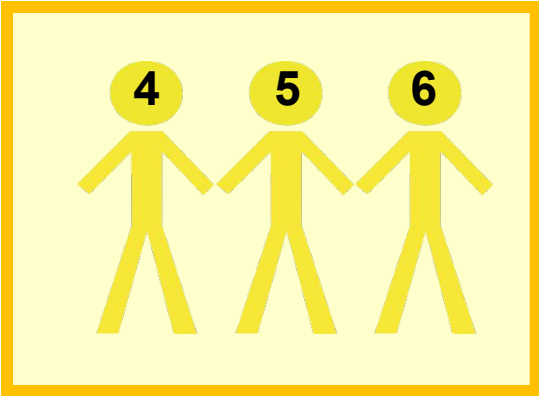
Blue



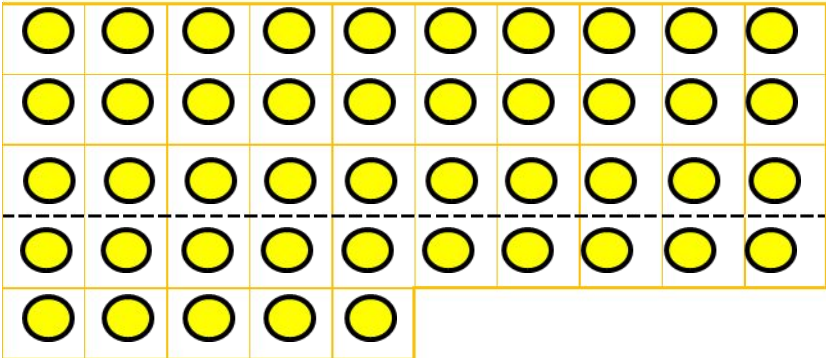
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extracción clandestina  
("poach")



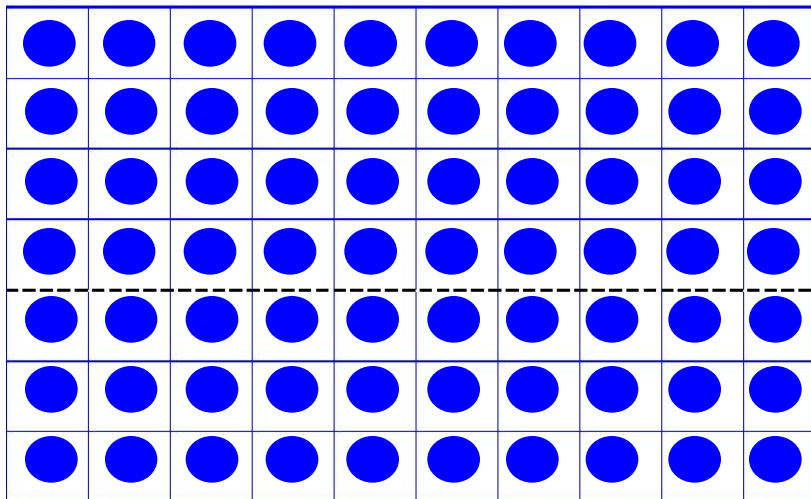
Yellow



45

●	\$ 500
● ●	\$ 1.000
● ● ●	\$ 1.500
● ● ● ●	\$ 2.000
● ● ● ● ●	\$ 2.500

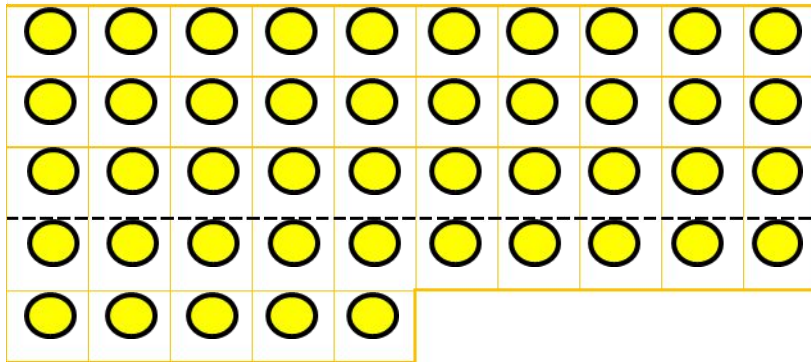
Blue



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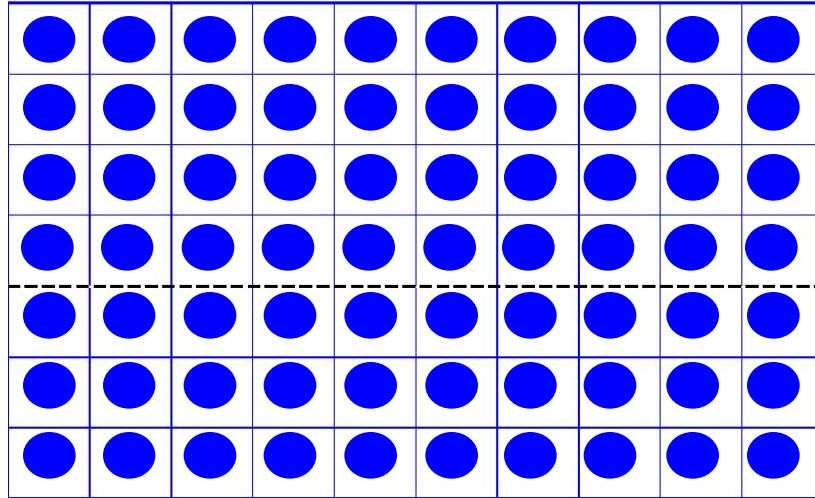
●	\$ 500
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Yellow



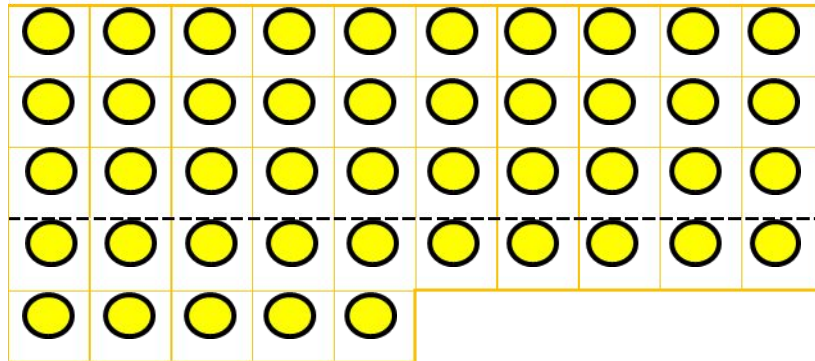
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Blue



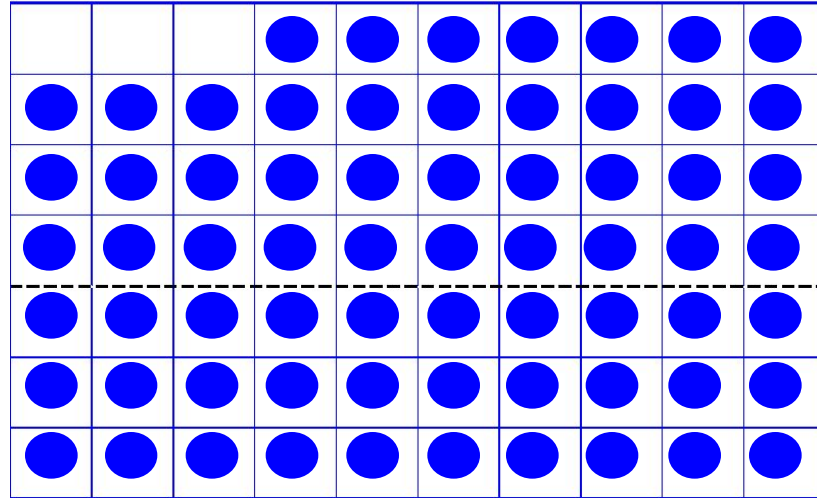
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Yellow



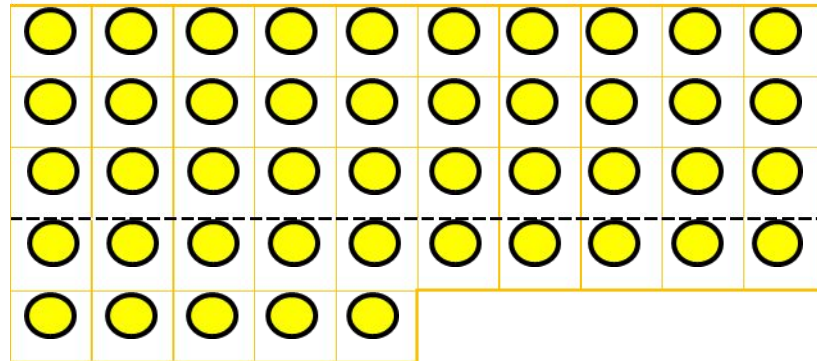
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Blue



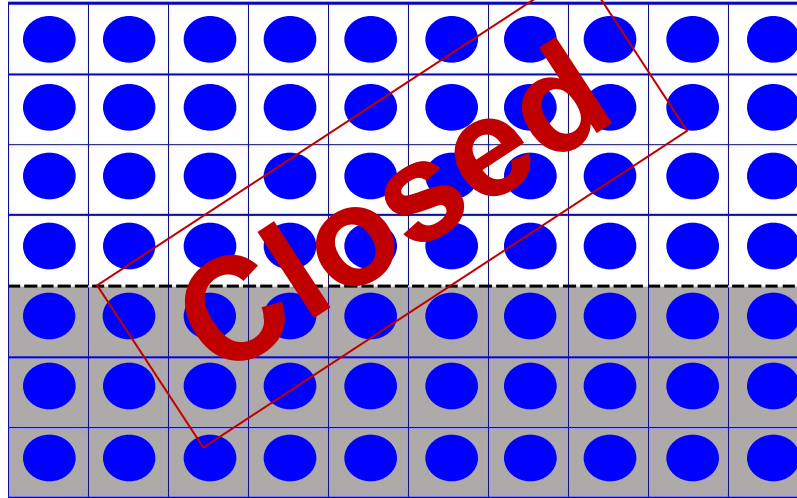
67

Yellow



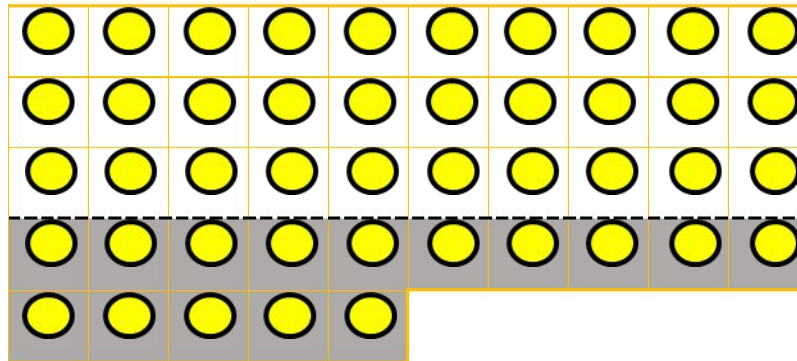
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Blue



20

Yellow



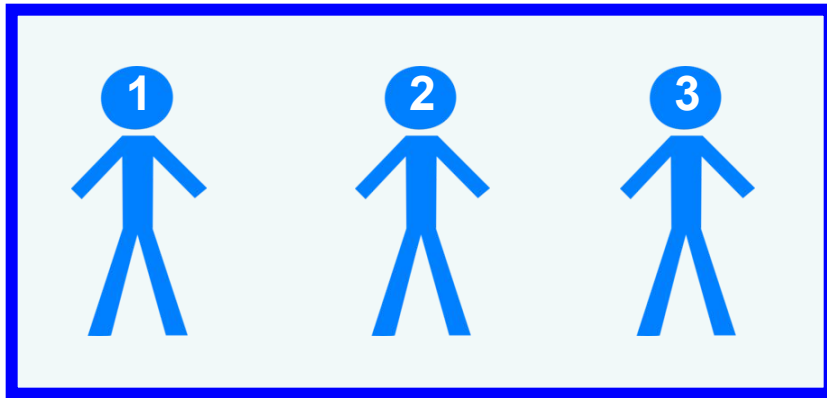
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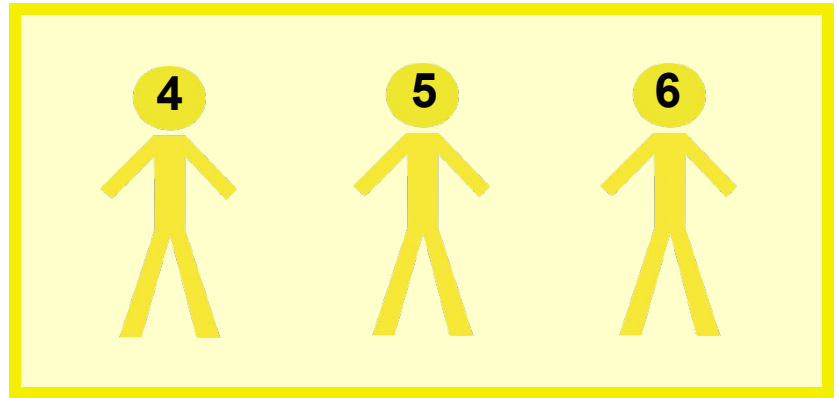
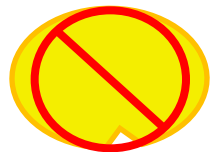
Hola

Hola

Hola



Blue



Yellow



# T1. Baseline: key features

- 6 subjects per group: 3 blue + 3 yellow
- Each person can harvest up to 5 *locos* per round from his/her own zone
- Each *loco* is worth Ch\$ 500
- Renewable resource
- Critical stocks: fishery could be closed permanently
- Max 10 rounds
- Blue can communicate, yellow cannot

# Treatments...

***T1-Baseline:*** 2 groups, 2 zones; no poaching/no enforcement.

***T2-Poaching/No enforcement:*** Similar to T1, but yellow can harvest blue locos, no enforcement.

***T3-Poaching with external enforcement:*** Similar to T2, authority can “patrol” de blue zone with some probability (1/9) and impose sanctions (\$ 2,000 Ch\$ per unit) conditional on detection of a yellow fisher wih blue locos.

***T4-Poaching with local enforcement:*** Similar to T2, “insiders” (blue fishers) could pay for monitoring and impose sanction.

- \$250 □ 1/6 probability that one of the 3 outsiders is monitored
- \$500 □ 2/6 probability that one of the 3 outsiders is monitored

***T5-Combination of external and local enforcement.*** If someone monitored by both only pay one fine.

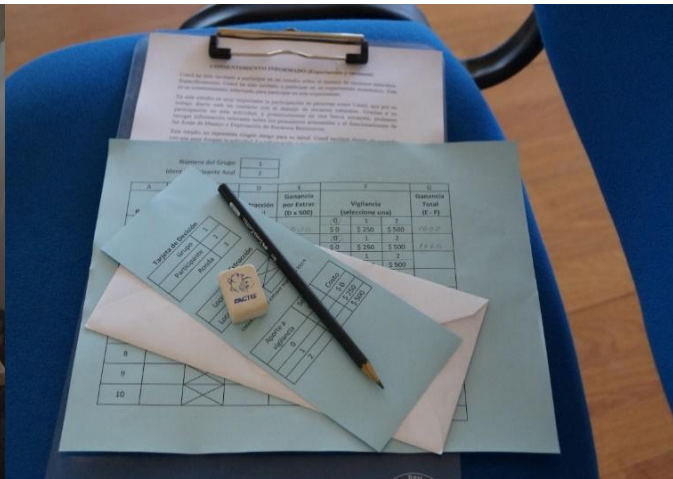
# • Hypotheses

- H1:** Relative to the Baseline treatment, insiders' earnings in the Poaching treatment will be lower and the blue resource will not last as long.
- H2:** We should observe no difference in insider and outsider behavior in the External Enforcement treatment relative to the Poaching treatment.
- H3:** The insiders will invest in monitoring in the Local Enforcement treatment. Relative to the Poaching treatment, there will be lower poaching, higher insider harvests, and higher insider earnings.
- H4:** Poaching will not be higher in the External + Local Enforcement treatment and may be lower.

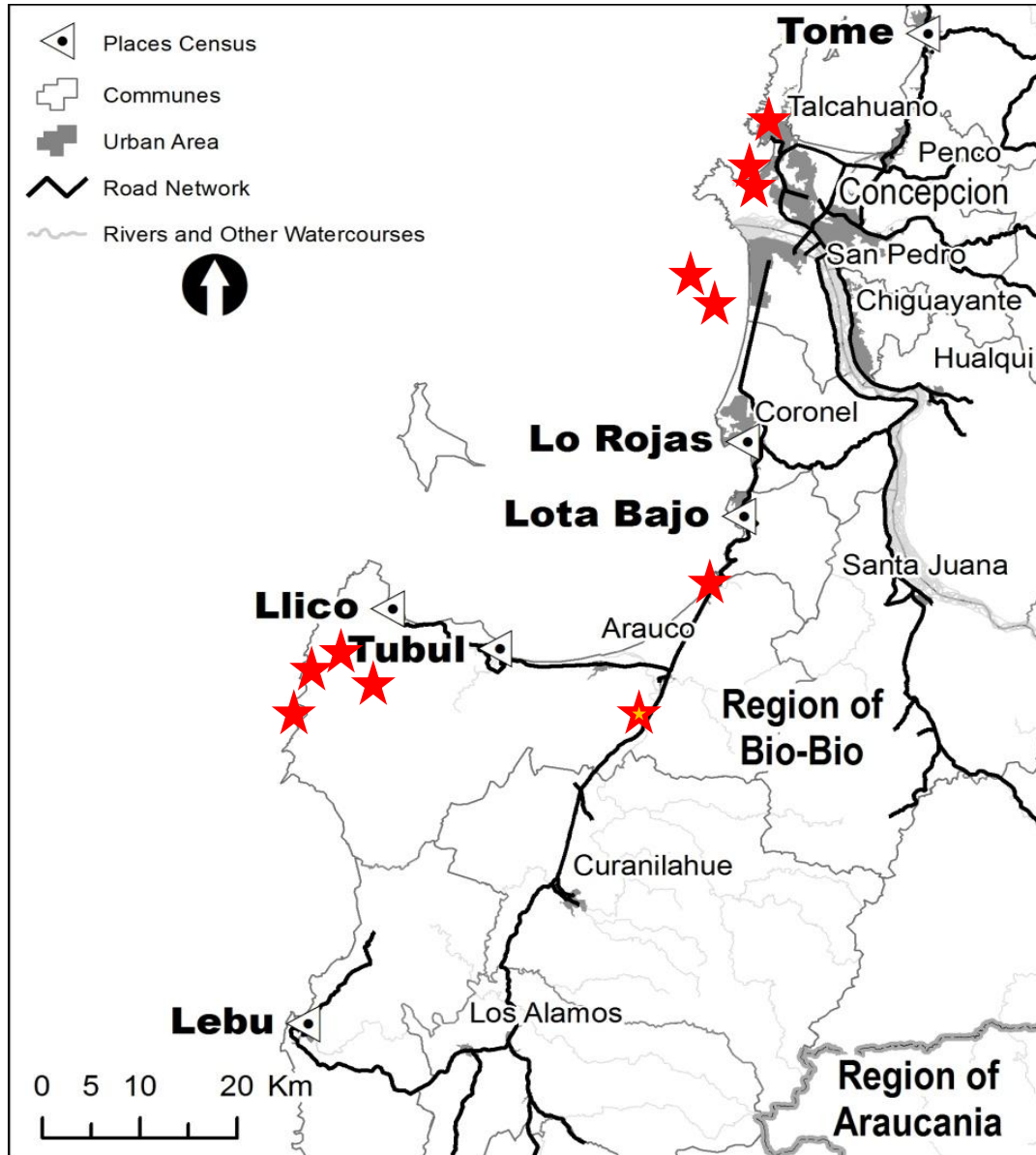
# Experimental procedures

- Participants lives in 11 fishing villages in central-southern Chile. All members of organizations having TURFs.
- 210 fishermen participated in the experiments. Individuals were assigned to **35 groups**. (*Replicated with 204 university students, 34 groups*).
- Each sesion consisted of a treatment with a maximum of 10 rounds.

Photo:Proyecto Fondecyt Regular 1140502

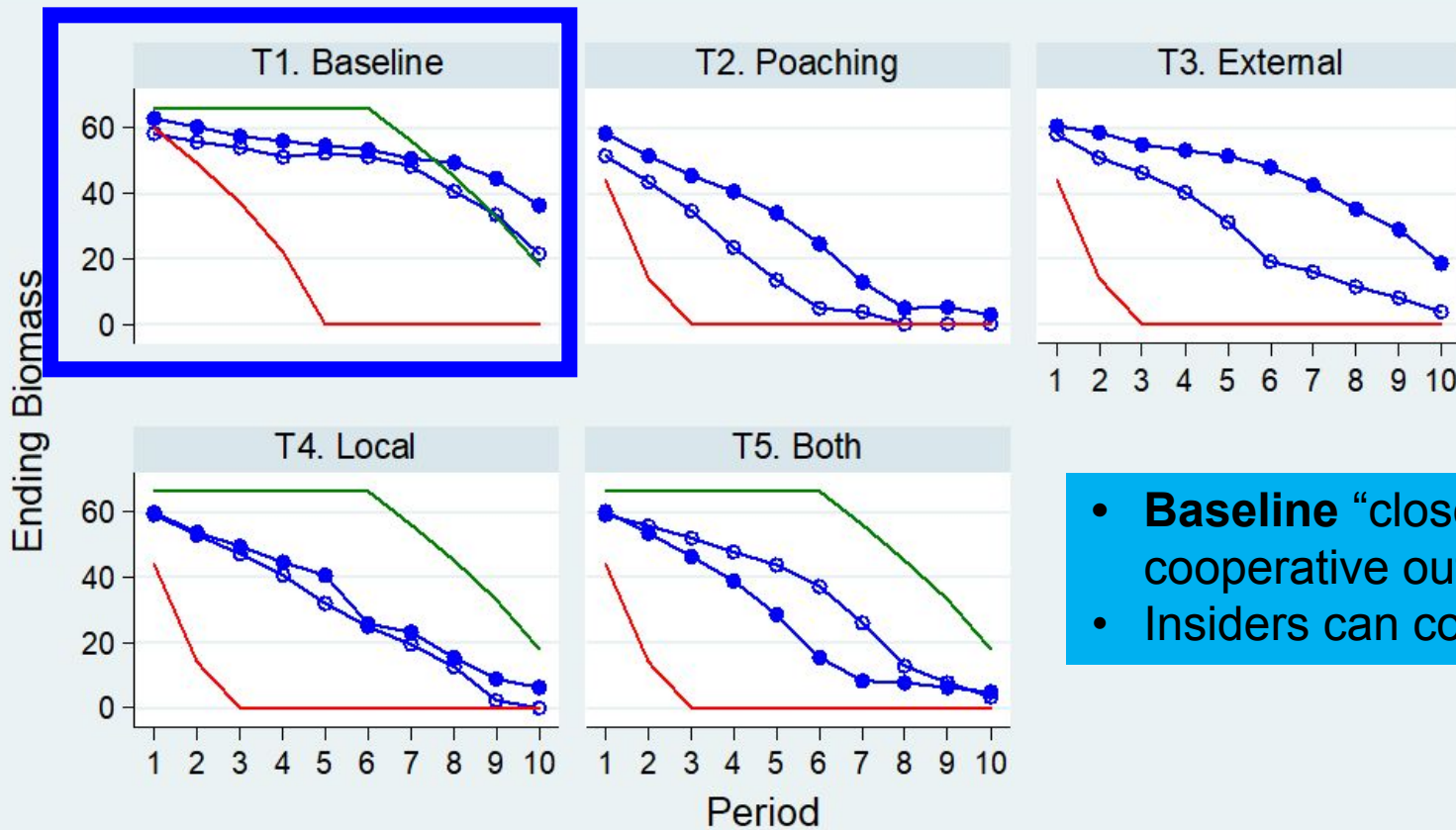


# Fishing Villages

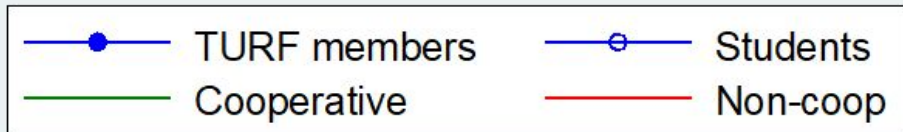


# Results

## Ending biomass-blue zone



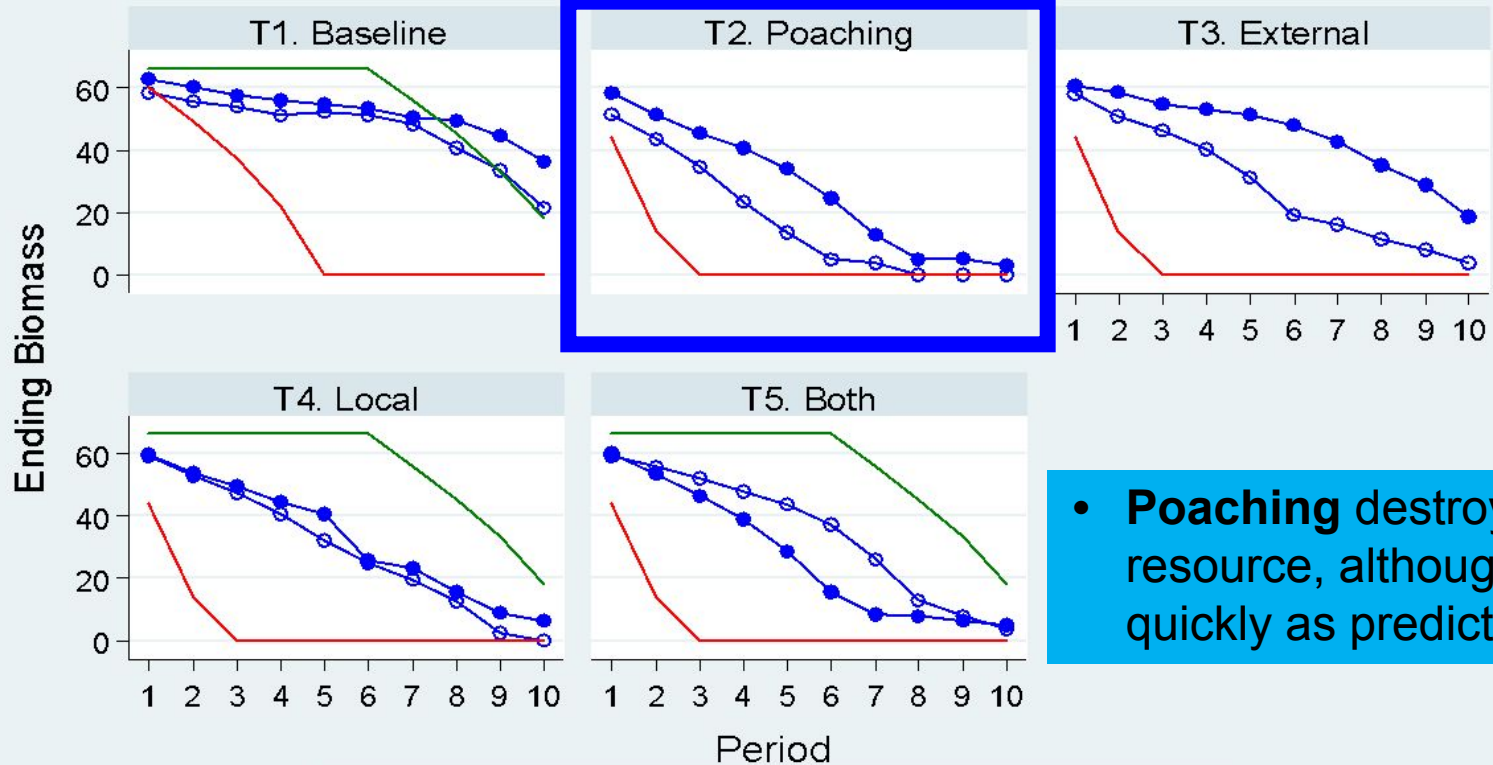
- **Baseline** “close” to cooperative outcome
- Insiders can communicate



Biomass=0 if zone was closed



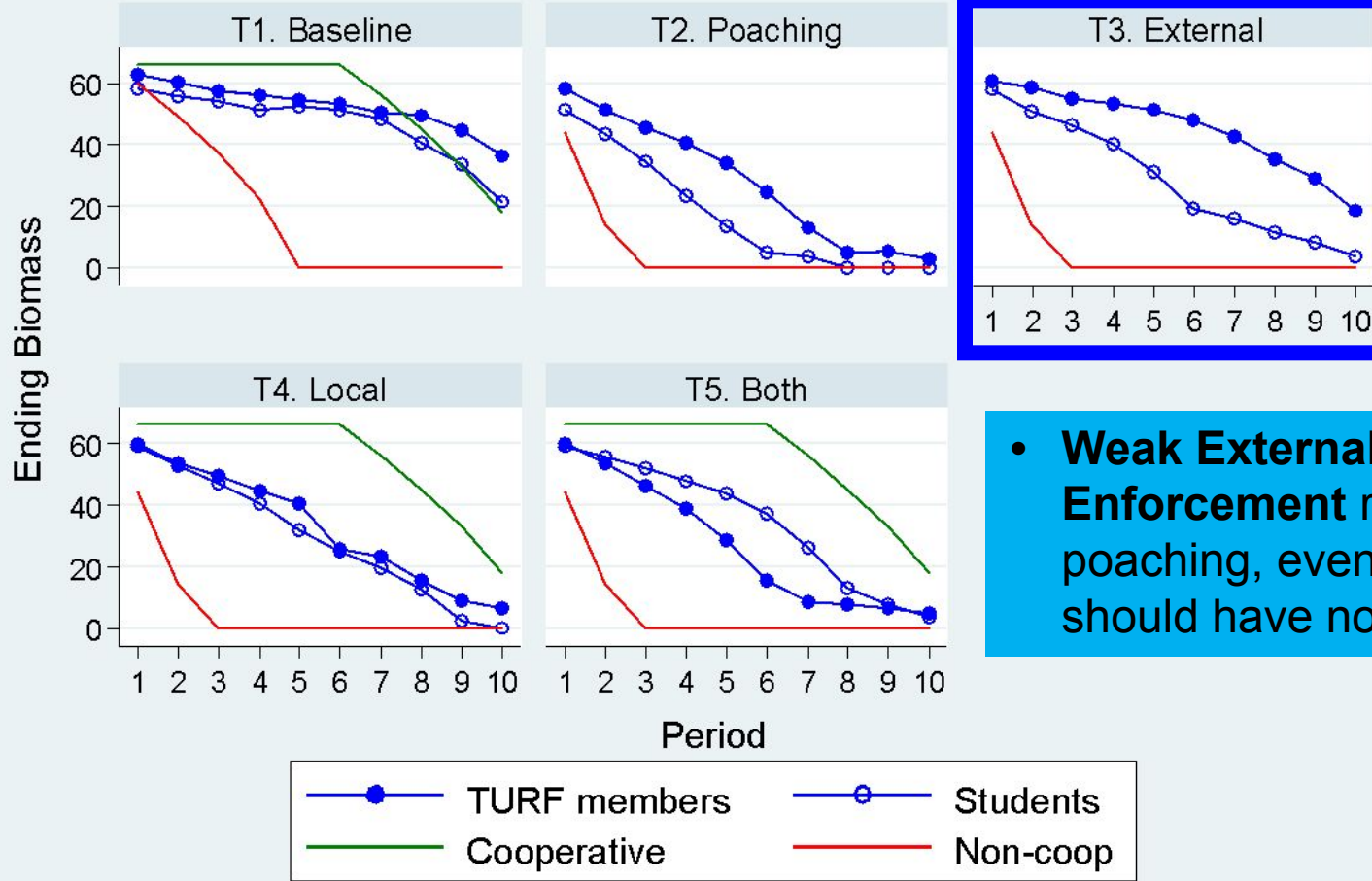
# Ending biomass-blue zone



- **Poaching** destroy the resource, although not as quickly as predicted.

Biomass=0 if zone was closed

# Ending biomass-blue zone

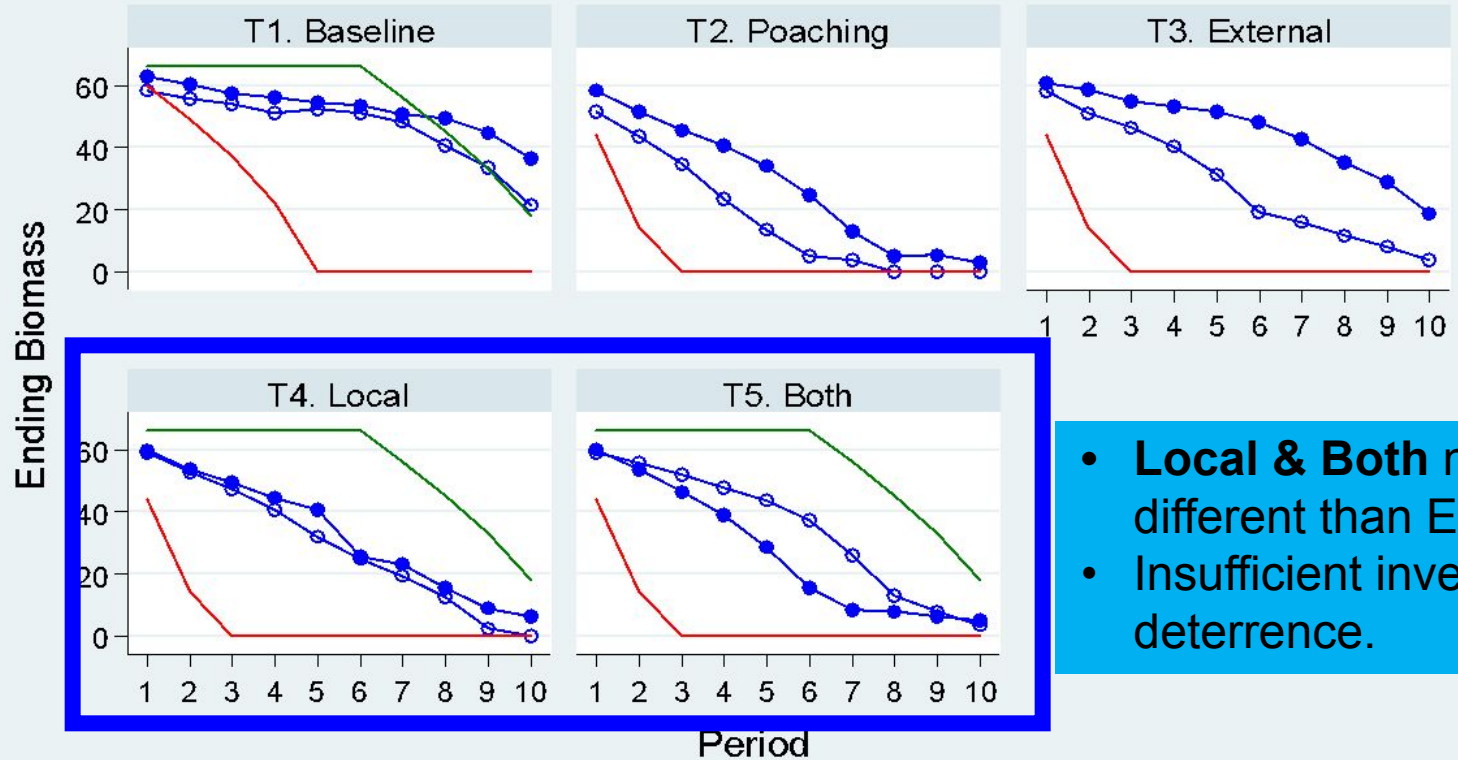


• **Weak External Enforcement** reduces poaching, even though it should have no effect.

Biomass=0 if zone was closed



# Ending biomass-blue zone



- **Local & Both** not much different than External.
- Insufficient investment in deterrence.



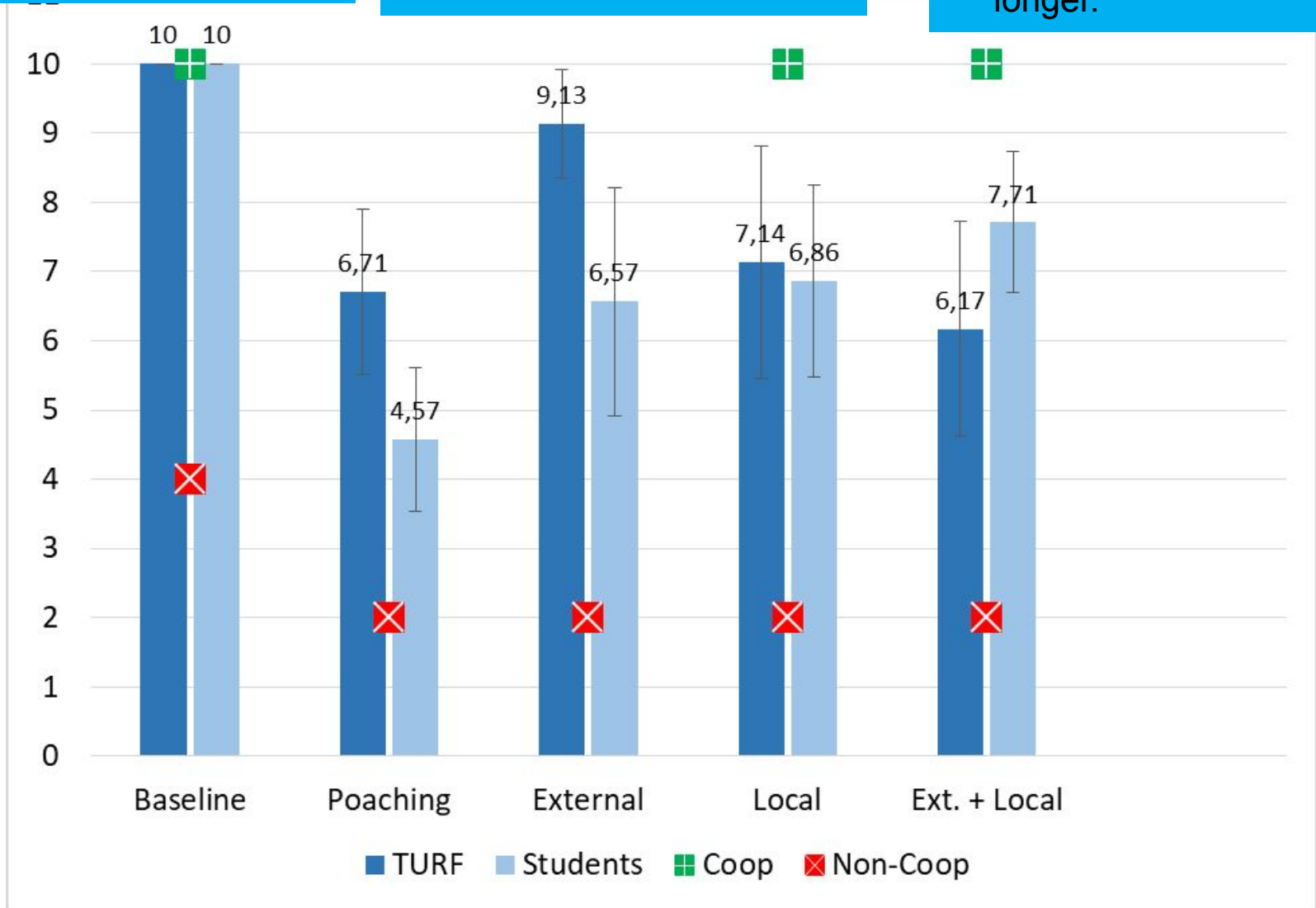
Biomass=0 if zone was closed

# Blue group mean terminal period

- **Baseline.** All groups sustained the resource for all 10 periods.

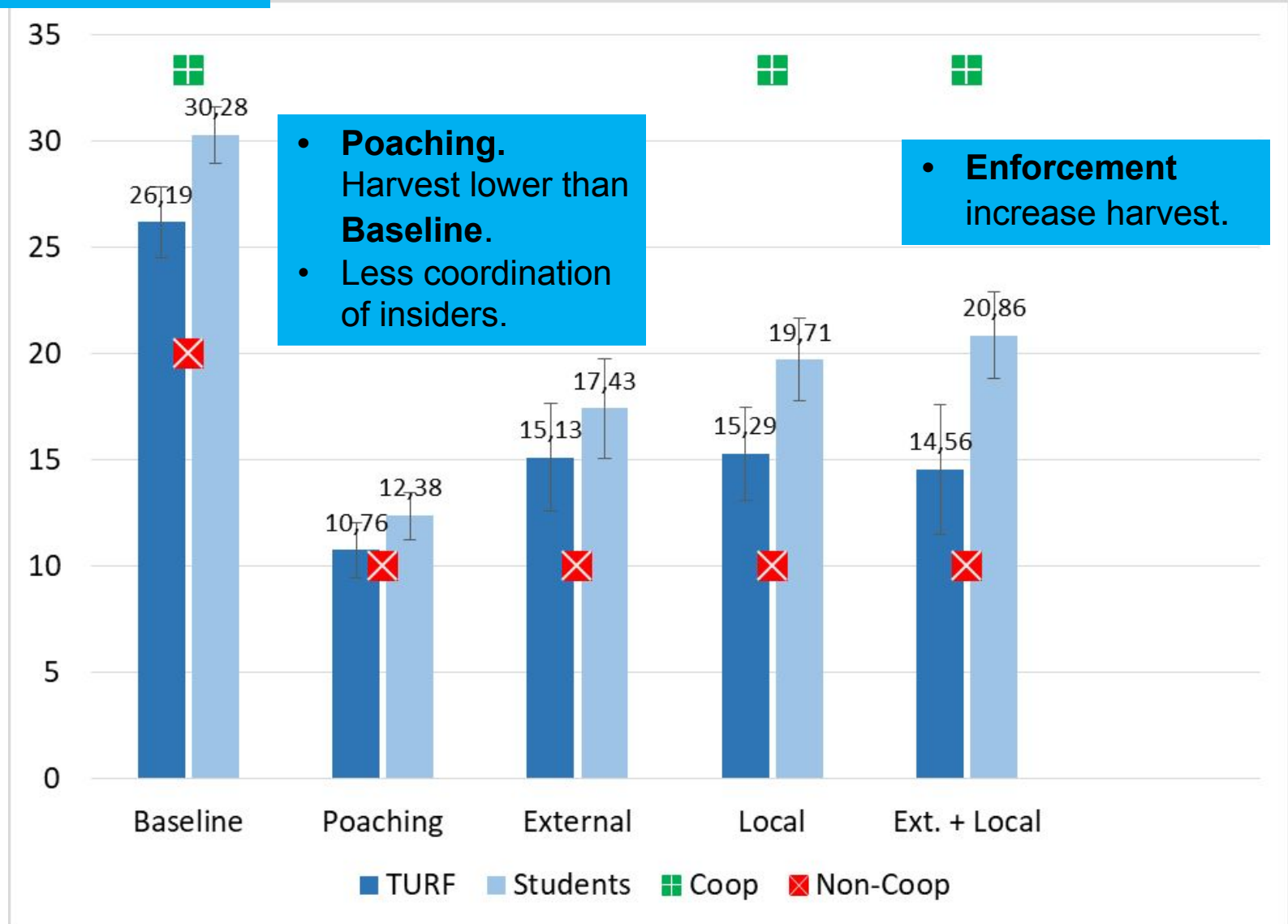
- **Poaching** depleted the resource sooner relative to **Baseline**.

- **External Enf** help to sustain the resource longer.

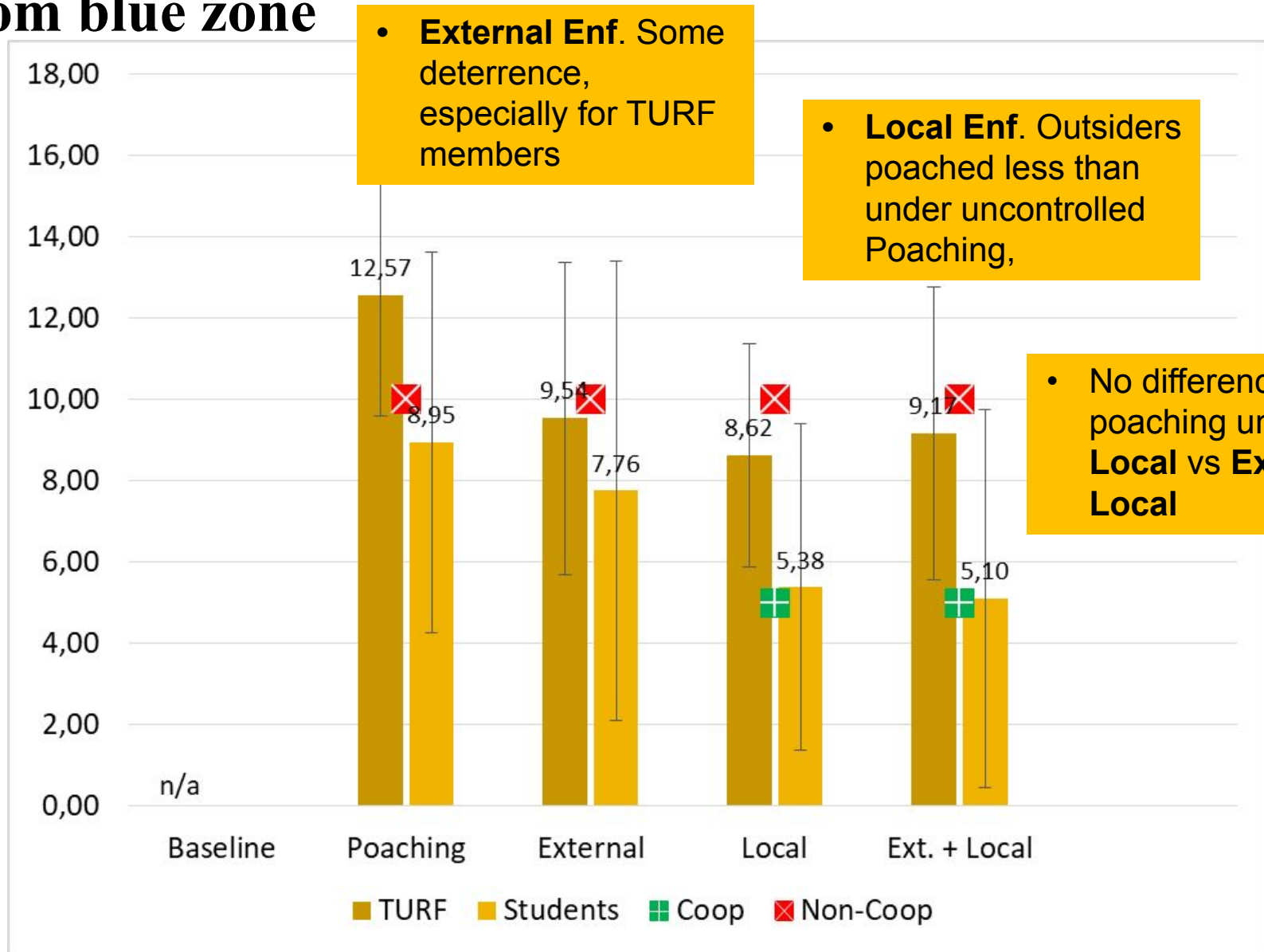


# Blue group mean individual cumulative harvest

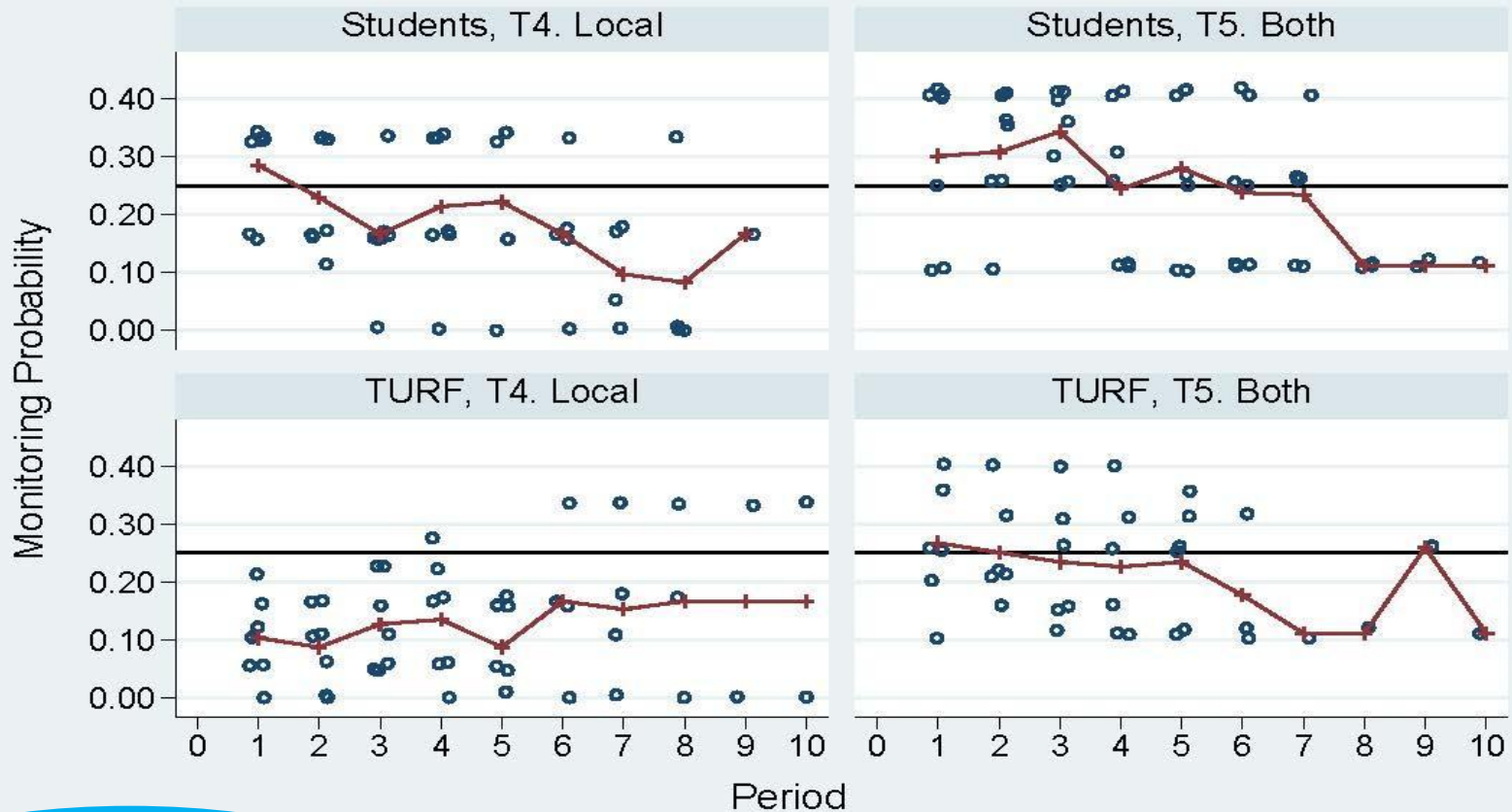
- **Baseline.** Harvest higher than non-coop outcome.



# Yellow group mean individual cumulative poaching from blue zone



# Monitoring probabilities over time



**Under-investment  
in monitoring**

Figure only includes data from active groups. Note that in the later rounds, the number of active groups declines. The horizontal line at 0.25 represents the minimum probability needed to fully deter poaching.

# Summary of results

- ◆ Resource users could sustain their resource for the length of the experiment in the absence of a poaching threat. They were unable to do so in the presence of unmonitored poaching.
- ◆ External (weak) enforcement (T3) did reduce poaching.
- ◆ There is no much difference between local enforcement with respect to external enforcement. **There is under investment in local enforcement.**
- ◆ Poaching was not significantly different under combined enforcement than under weak external monitoring alone and under insider monitoring alone.
- ◆ Our main results are robust to differences in the subject populations.

# Extension: variation in mechanism for providing monitoring and enforcement

Chávez, Carlos, James Murphy, y John Stranlund. (2021). “Co-Enforcement of Common Pool Resources to Deter Encroachment: Evidence from a Field Experiment in Chile”, *Environmental and Resource Economics*, 80: 425-450.

We extended the design of Chávez-Murphy-Stranlund (2018) to study different mechanism to provide self-protection to deter poachers.

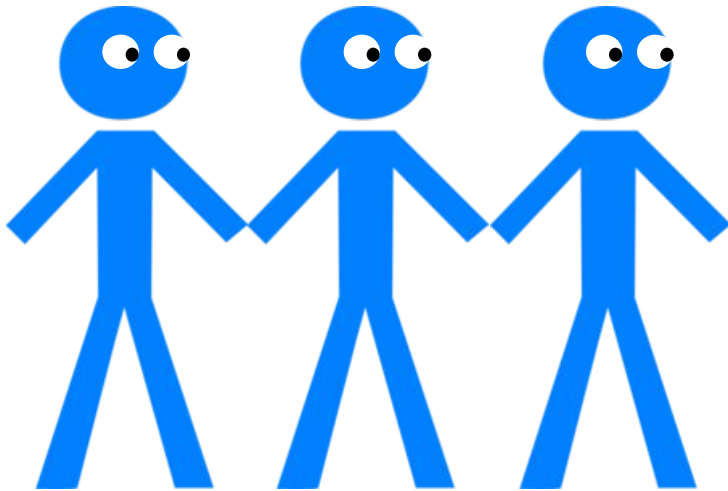
- Individual contributions to monitoring
- Voting mechanism
- Co-enforcement (sanction provided by Government: Low and High)



- There is always a total of 18 chips.
- Some will be green, some will be red.
- The blue group determines how many of the chips will be red.



Each blue player could buy up to 3 red chips. Cost \$100 per red chip.



	\$0
●	-\$ 100
● ●	-\$ 200
● ● ●	-\$ 300



## T2-T5. Enforcement treatments

	Low Fine	High Fine
Individual	T2	T4
Vote	T3	T5

- Low fine=650
  - To fully deter poaching, total red chips must be 6
- High fine=1300
  - To fully deter poaching, total red chips must be 3
- Individual: each Blue player decides how many chips she wants to put into bag
- Vote: Blue players vote on how many chips/person to put into bag. Majority rule decides outcome.

In theory, monitoring yields either full or no deterrence. No partial deterrence.

# Insider incentive to invest in monitoring

Treatment	Terminal Period	Individual Harvest	Individual Earnings	
Poaching	2	12	2400	
Low Fine (Indiv & Vote)	15	54	8060	] Difference due to higher monitoring costs with Low Fine
High Fine (Indiv & Vote)	15	54	9460	



Blue group communication.

Photo:Proyecto Fondecyt Regular 1140502

# Expected Results

- In all enforcement treatments, Blue group should invest enough to fully deter poaching.
- Voting treatments should improve outcomes vs. Individual Contributions to monitoring.

Voting removes free-riding and should improve coordination (it eliminates the possibility of unequal investment in monitoring).

# Experimental procedures

- Participants lives in 19 fishing villages in southern Chile. All members of organizations having TURFs.
- 234 fishermen participated in the experiments. Individuals were assigned to **39 groups**. (6 subjects per group).
- Each sesion consisted of a treatment with 2 stages and a maximum of 15 rounds.

**...Results**

# Monitoring probabilities over time-Low Fine

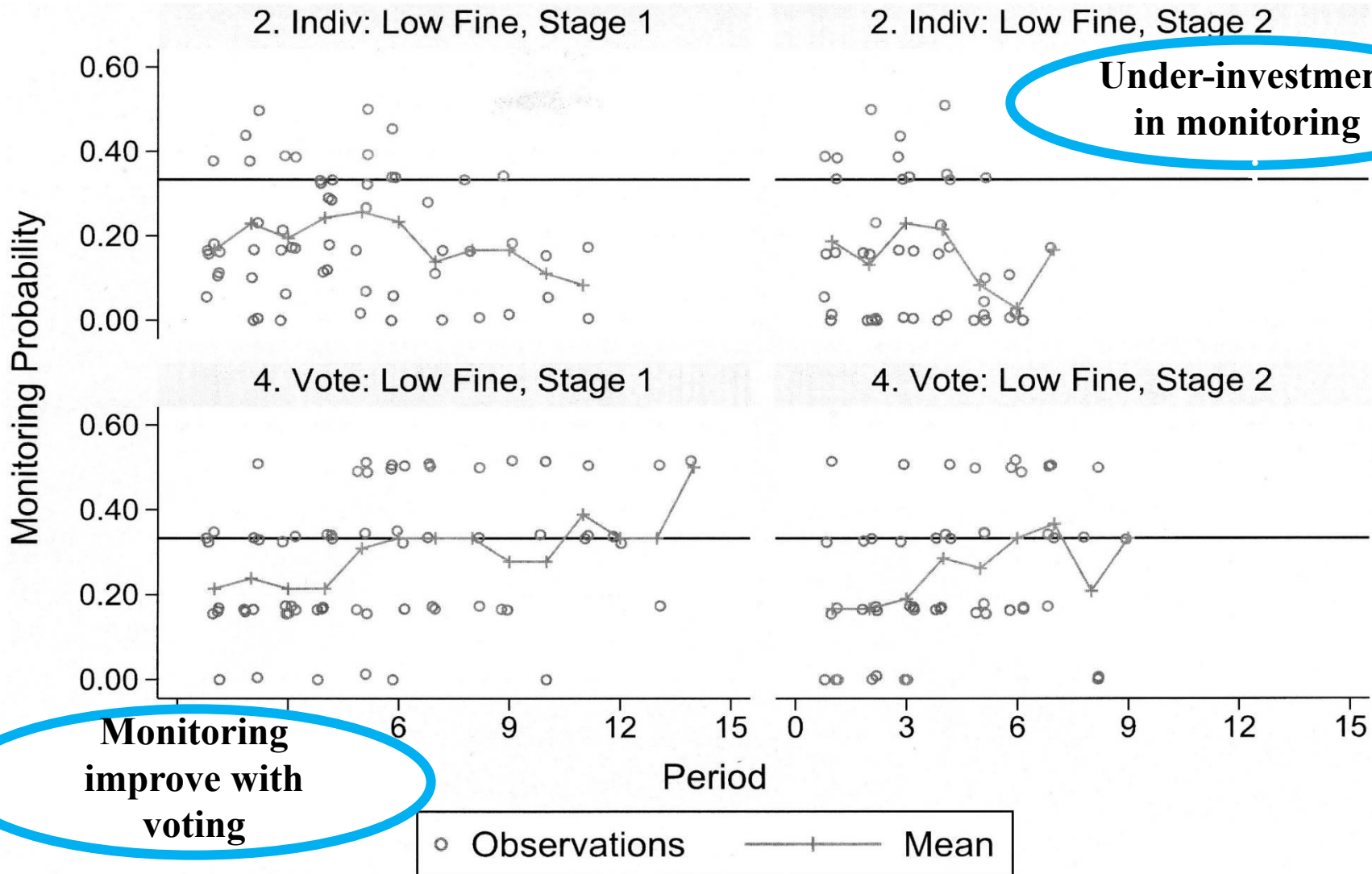


Figure only includes data from active groups. Note that in the later rounds, the number of active groups declines. The horizontal line at 0.25 represents the minimum probability needed to fully deter poaching.



# High Fine

Over-investment  
in monitoring

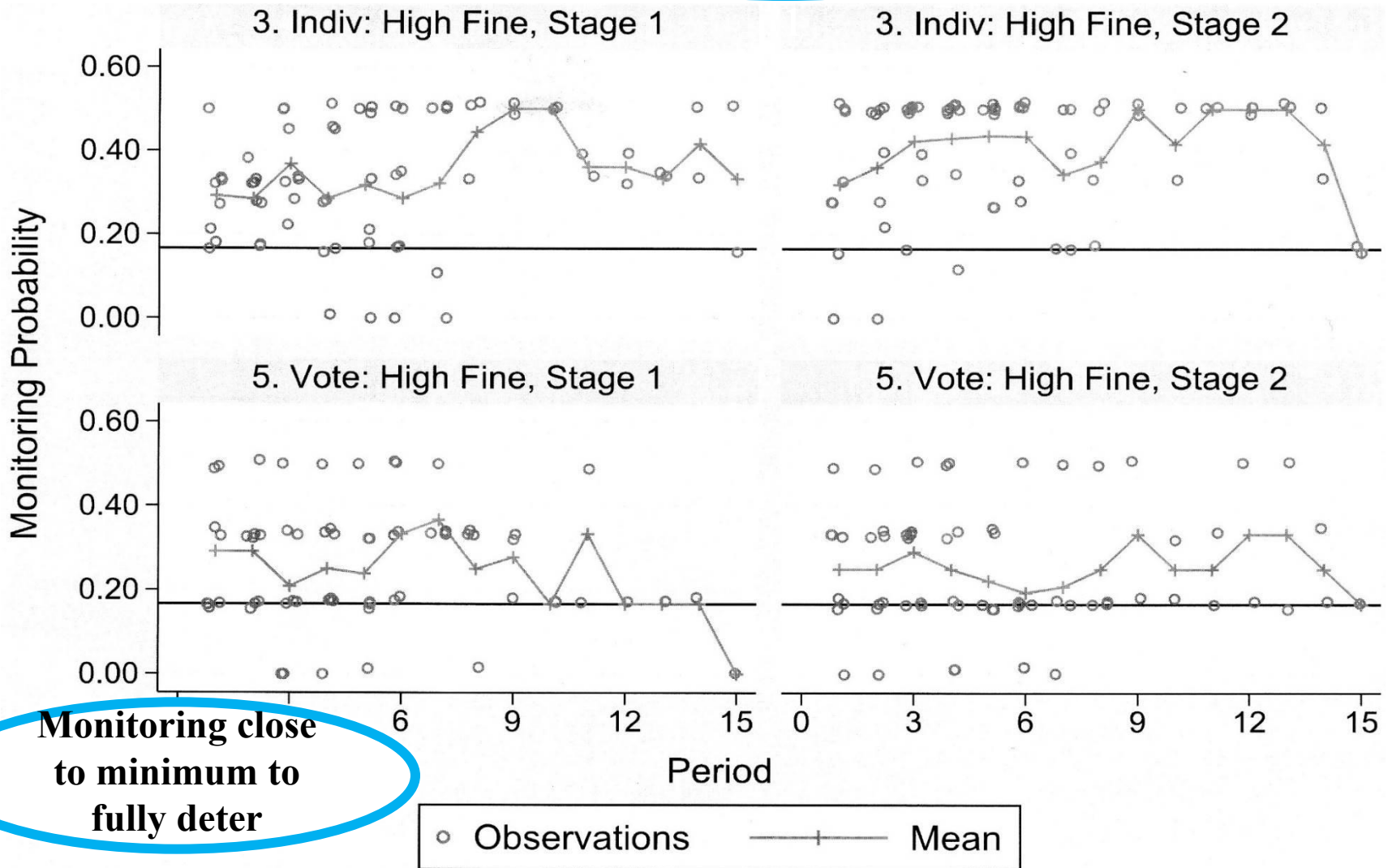


Figure only includes data from active groups. Note that in the later rounds, the number of active groups declines. The horizontal line at 0.25 represents the minimum probability needed to fully deter poaching.

# Summary main results

- Enforcement does increase insiders' harvest and does reduce poaching.
- Low fine: Blue does not enforce enough to fully deter poaching under T2 (Individual-Low fine). Voting improve enforcement.
- High fine: Blue over-invest in monitoring under T3 (Individual-High fine). Voting appears to better coordinate enforcement effort.

# The Endogenous Formation of Common Pool Resource Coalitions

Chávez, Carlos, James Murphy, Felipe Quezada, y John Stranlund. (2023). *Journal of Economic Behavior and Organization* 211: 82-102.

- There is a small number of studies of managing and defending CPRs from encroachment, **but these assume exogenous user groups.**
- We hypothesize that the **ability to deter outsiders affects the formation of these groups.**

Research question: how does the ability to deter poaching affect

- Formation of CPR coalitions
- Size of CPR coalitions
- Level of monitoring & poaching
- Conservation of the resource
- Welfare

- Draws from multiple literatures:
  - Self-governance and co-management of common pool resources
  - Enforcement of harvest rules within a CPR coalition
  - Deterring encroachment by poachers from outside CPR coalition
  - Coalition formation & coalitional stability

We develop a theoretical model with:

- Endogenous formation of a CPR user group (coalition)
- Outsiders may poach the resource
- Coalition members vote to invest in monitoring for encroachers
- An exogenous fine for encroachment as if imposed by a government authority

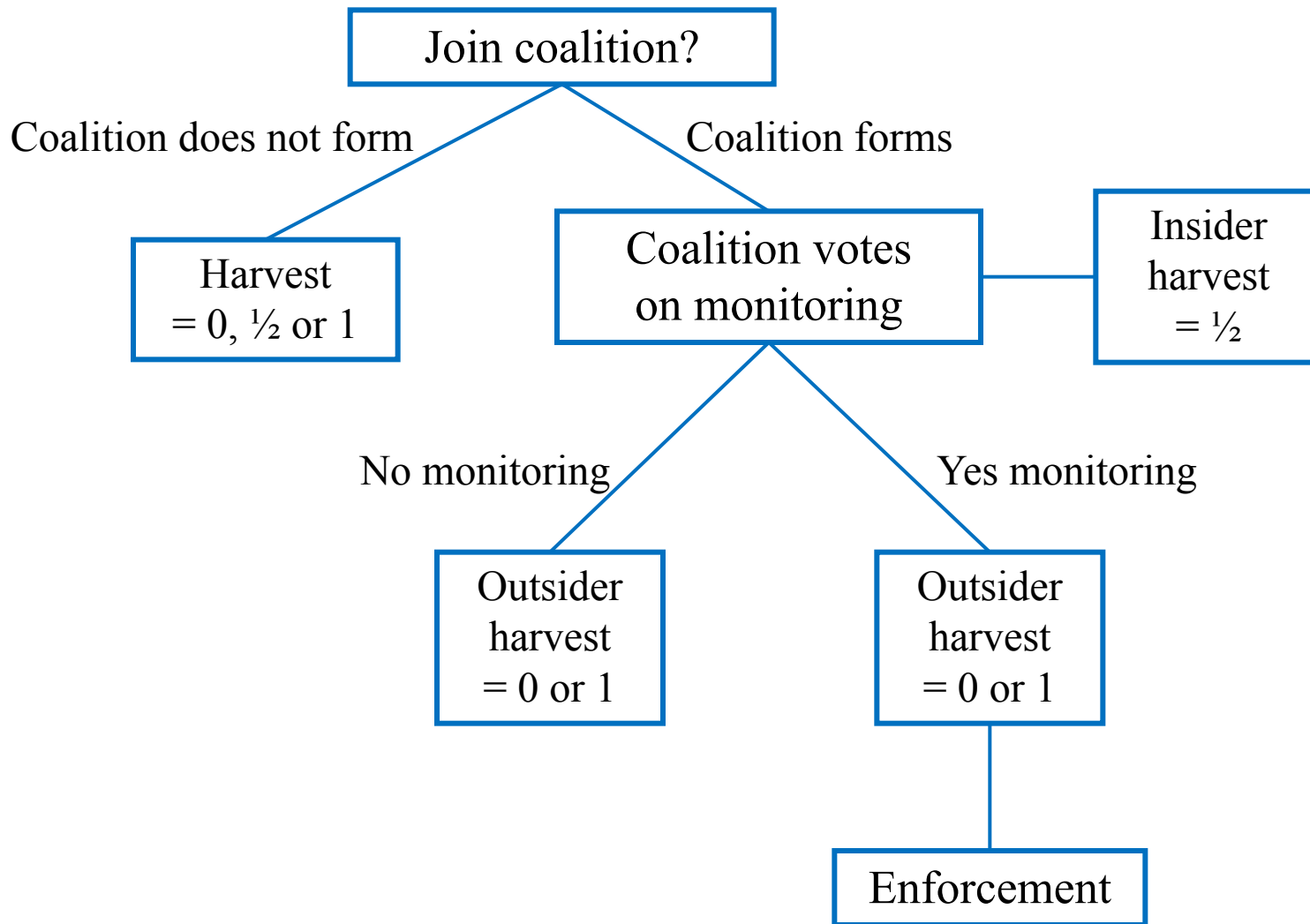
We test hypotheses from the theoretical model with:

- Members of Chile's TURF program for managing near-shore fisheries (Field).
- Chilean university students (Lab).

# Experimental design

- Players,  $n=6$
  - Time endowment,  $x=1$
  - Time harvesting,  $e_j \in (0, \frac{1}{2}, 1)$
  - Linear payoffs
    - marginal benefit of harvesting  $a$
    - marginal benefit of outside activity  $w$
    - marginal congestion cost  $d$
  - Within a coalition (insiders)
    - $e_j = \frac{1}{2}$ , remainder goes to outside option
    - vote to invest in a single monitoring technology, cost evenly divided
  - Outside a coalition (outsiders)
    - $e_j \in (0, 1)$
    - encroachment fine,  $f$
- Players,  $n=6$
  - Time endowment,  $x=1$
  - Time harvesting,  $e_j \in (0, \frac{1}{2}, 1)$
  - Linear payoffs
    - = marginal benefit of harvesting  $a$
    - = marginal benefit of outside activity  $w$
    - = marginal congestion cost  $d$
  - Within a coalition (insiders)
    - =  $e_j = \frac{1}{2}$ ; remainder goes to outside option
    - = vote to invest in a single monitoring technology, cost evenly divided
  - Outside a coalition (outsiders)
    - =  $e_j \in (0, 1)$
    - = encroachment fine,  $f$

# Experimental Design



# Experimental design

- Treatments:
  - T1. Open access (OA)
    - Everyone “outsider”, no group formation or enforcement
  - T2. Coalition formation-No enforcement (NE)
    - Decide whether to join group, but no enforcement
  - T3. Coalition formation-Imperfect monitoring/Low cost (IM/LC)
    - $p = 0.50$
  - T4. Coalition formation-Imperfect monitoring/High cost (IM/HC)
    - $p = 0.50$
  - T5. Coalition formation-Perfect monitoring/High cost (PM/HC)
    - $p = 1.00$



# Experimental design

Treatment	Monitoring	Stable coalition size	Total harvest time	Individual earnings		
				Insiders	Outsiders	OA
T1. Open Access	---	---	6	---	---	720
T2. No Enforcement	---	3	4.5	760	1080	---
T3. IM/Low Cost	No	6	3	1120	---	---
T4. IM/High Cost	No	3	4.5	760	1080	---
T5. PM/High Cost	No	3	4.5	760	1080	---

# Experimental design

Treatment	Monitoring	Stable coalition size	Total harvest time	Individual earnings		
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Open access. Subjects spend all their time harvesting the resource.

# Experimental design

Treatment	Monitoring	Stable coalition size	Total harvest time	Individual earnings		
				Insiders	Outsiders	OA
T1. Open Access	---	---	6	---	---	720
T2. No Enforcement	---	3	4.5	760	1080	---
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Coalition formation but no enforcement.

- ✓ Only stable coalition is the smallest profitable coalition, 3 members.
- ✓ Insiders earn only a little more than in open access.
- ✓ Outsiders spend all their time poaching
- ✓ But, less pressure on the resource

# Experimental design

Treatment	Monitoring	Stable coalition size	Total harvest time	Individual earnings		
				Insiders	Outsiders	OA
T1. Open Access	---	---	6	---	---	720
T2. No Enforcement	---	3	4.5	760	1080	---
T3. IM/Low Cost	No	6	3	1120	---	---
T4. IM/High Cost	No	3	4.5	760	1080	---
T5. PM/High Cost	No	3	4.5	760	1080	---

High-cost monitoring is too expensive.

✓ Same outcomes as with no enforcement

# Experimental design

Treatment	Monitoring	Stable coalition size	Total harvest time	Individual earnings		
				Insiders	Outsiders	OA
T1. Open Access	---	---	6	---	---	720
T2. No Enforcement	---	3	4.5	760	1080	---
T3. IM/Low Cost	No	6	3	1120	---	---
T4. IM/High Cost	No	3	4.5	760	1080	---
T5. PM/High Cost	No	3	4.5	760	1080	---

- ✓ Stable coalition is the grand coalition (no need to monitor).
  - ✓ Being an outsider is not worth it.
  - ✓ Subjects are better off than in other treatments.

# Experimental design

- Lab-in-field experiment with artisanal fishers in Chile
  - 258 subjects, 43 groups
- Replicated with students from Universidad de Talca
  - 228 subjects, 38 groups
- The experiments were framed as deciding whether to form fishing coalitions to harvest *loco* (Chilean abalone)



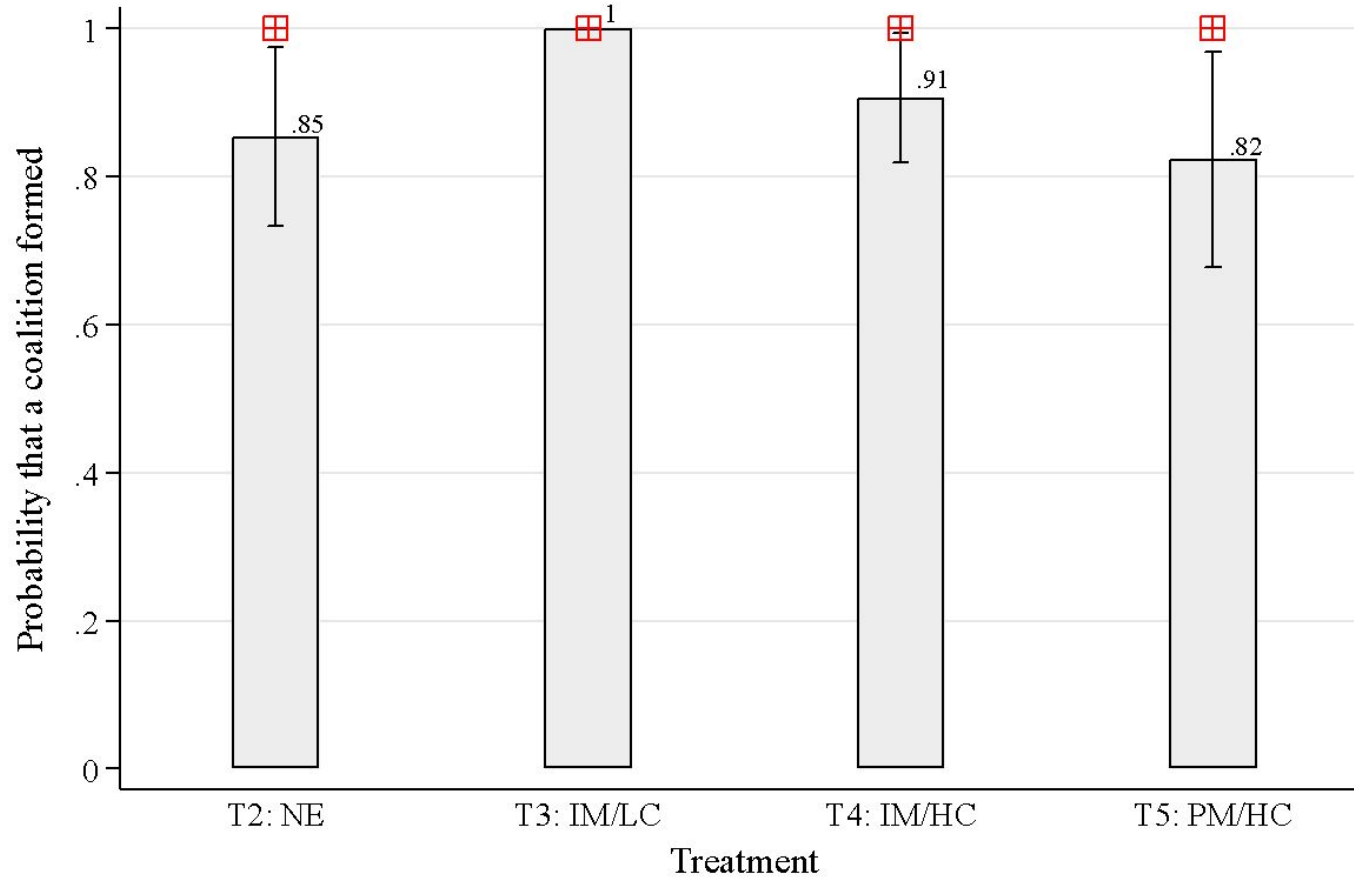




Photo:Proyecto Fondecyt Regular 1140502

**...Results (for artisanal fishers)**

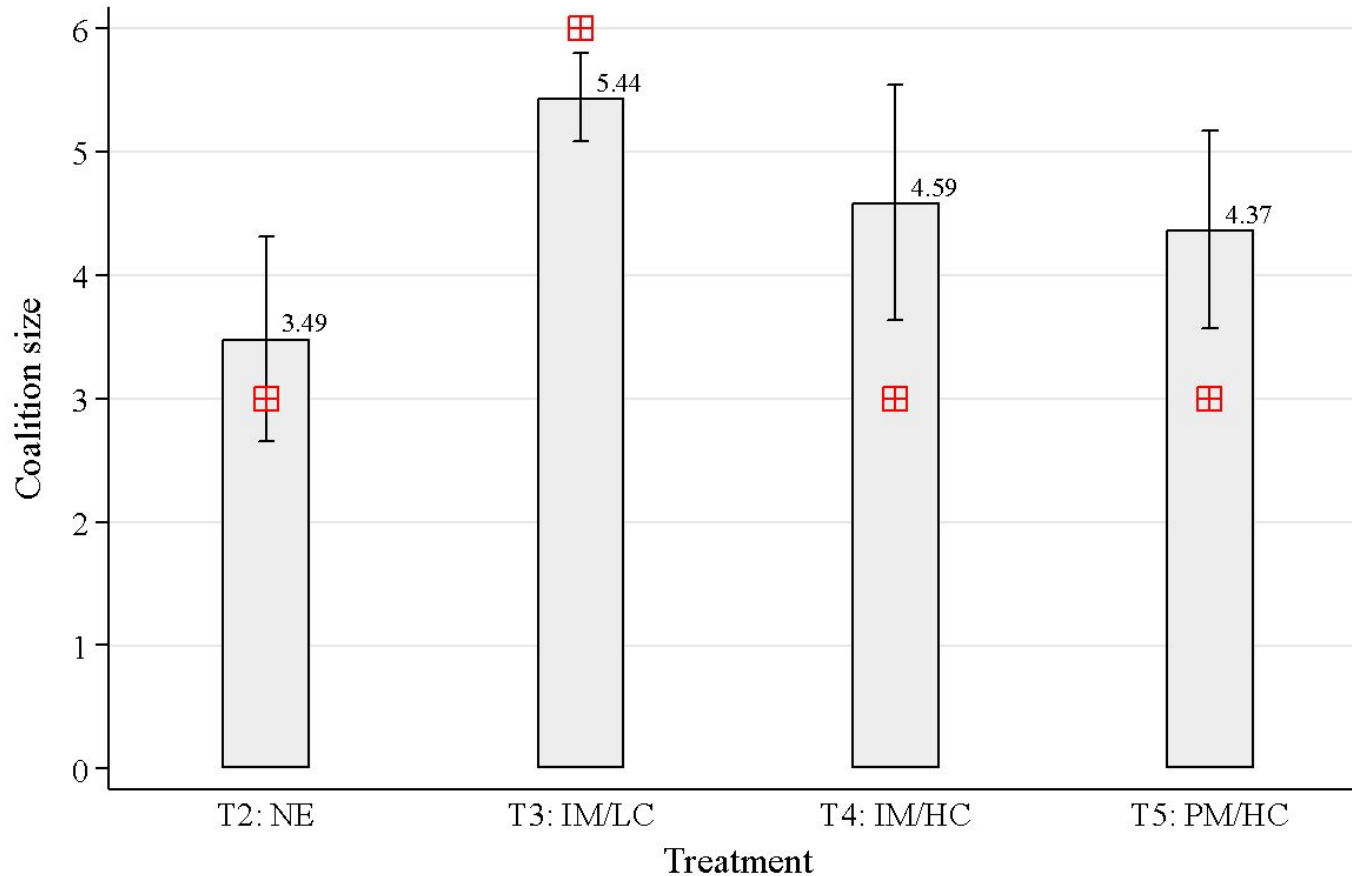
# Probability that coalition forms



- Coalitions usually form.

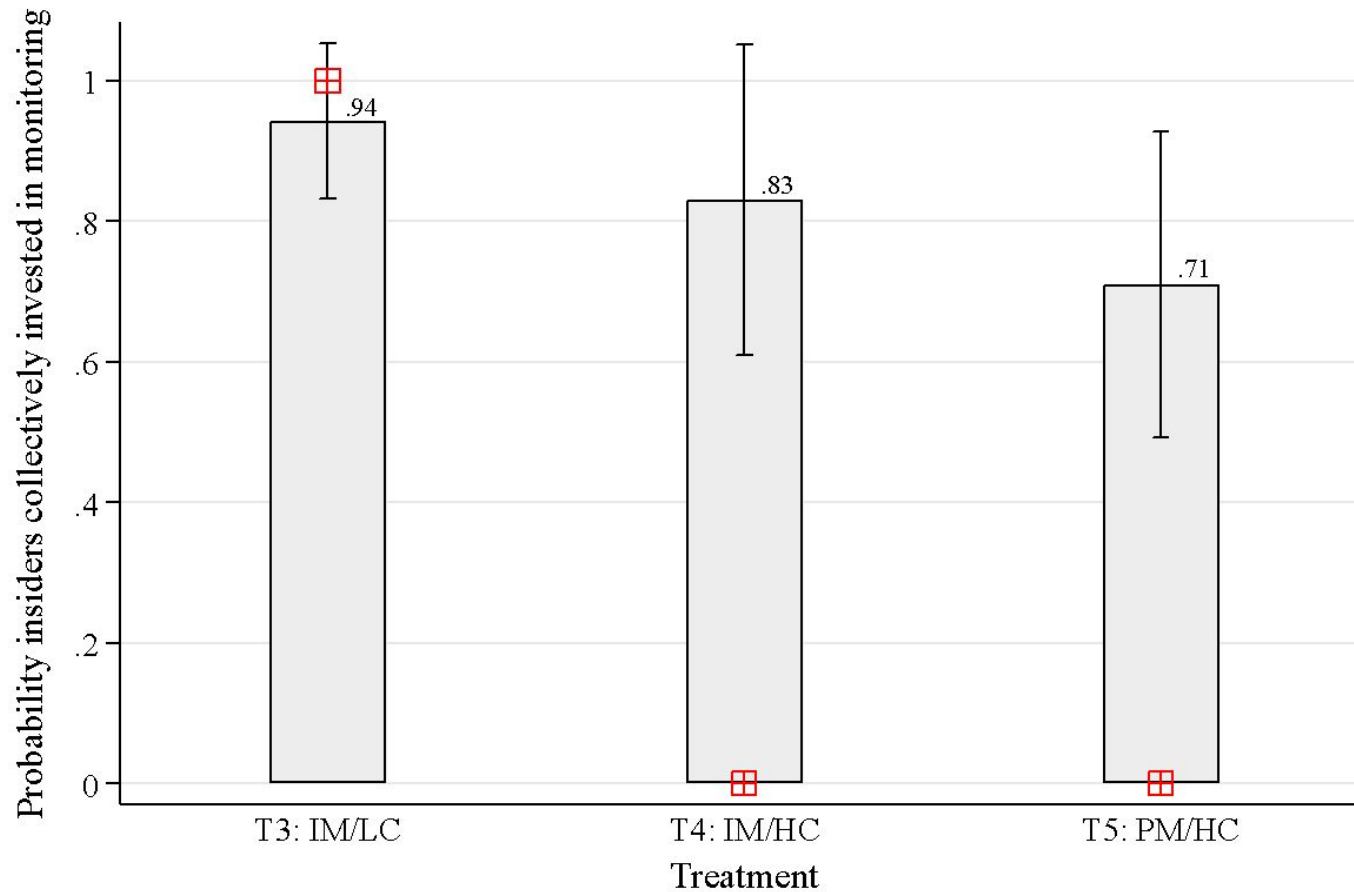


# Coalition size (conditional on formation)



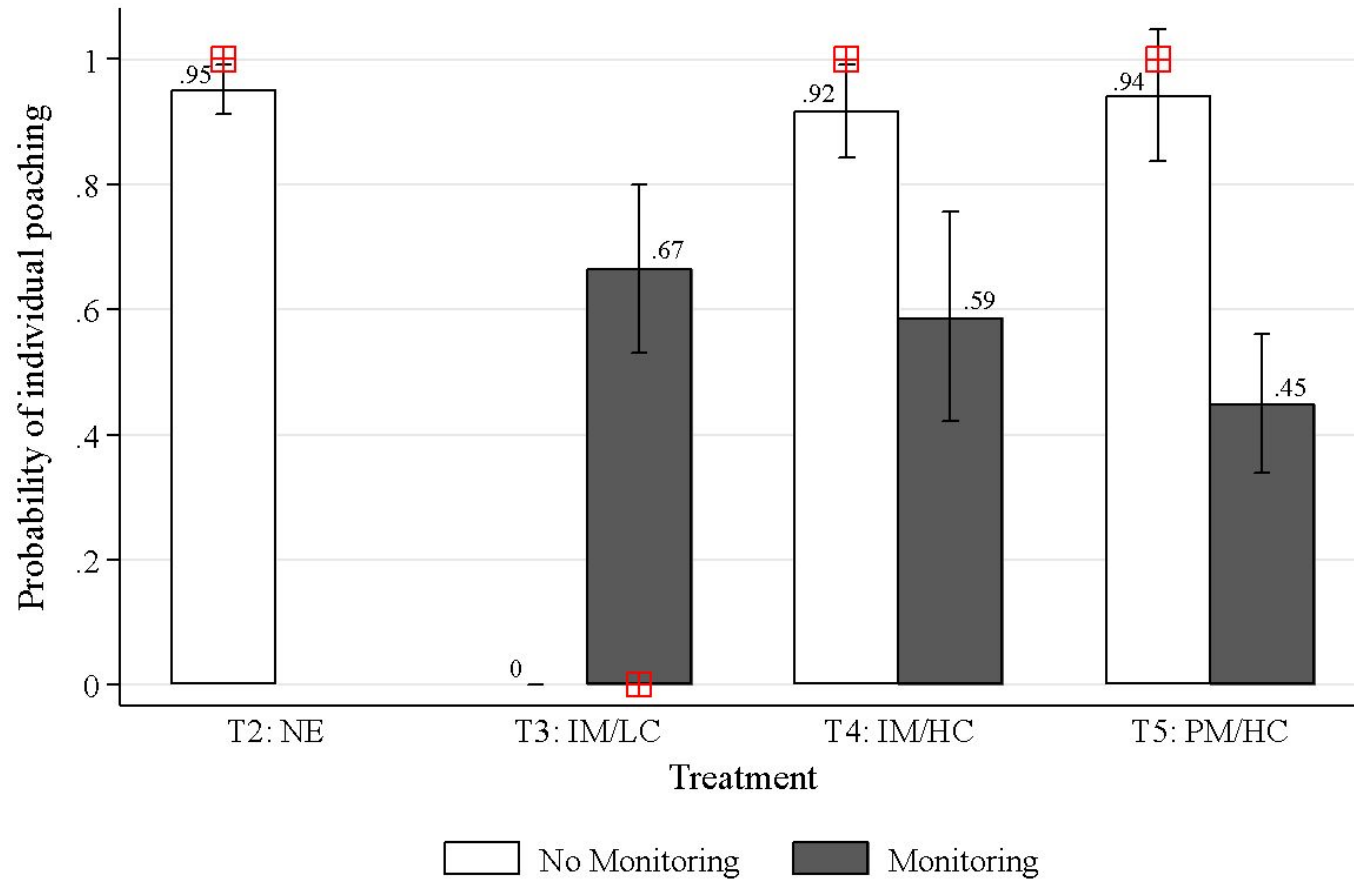
- Consistent with predictions with no enforcement and low cost.
- Larger than predicted with high cost.

# Probability insiders vote to monitor



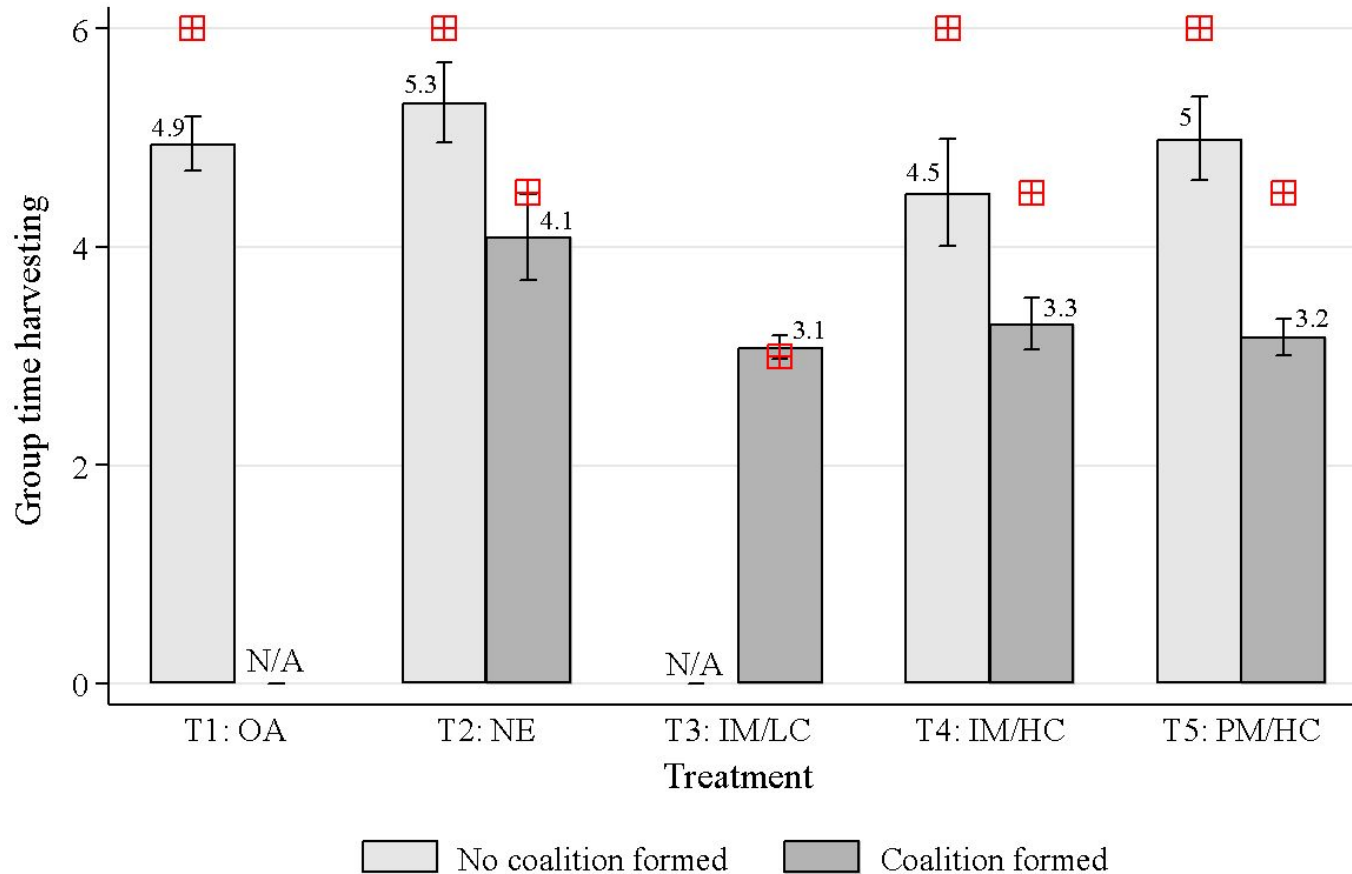
- Significant investment in monitoring even with high cost.

# Probability of individual poaching



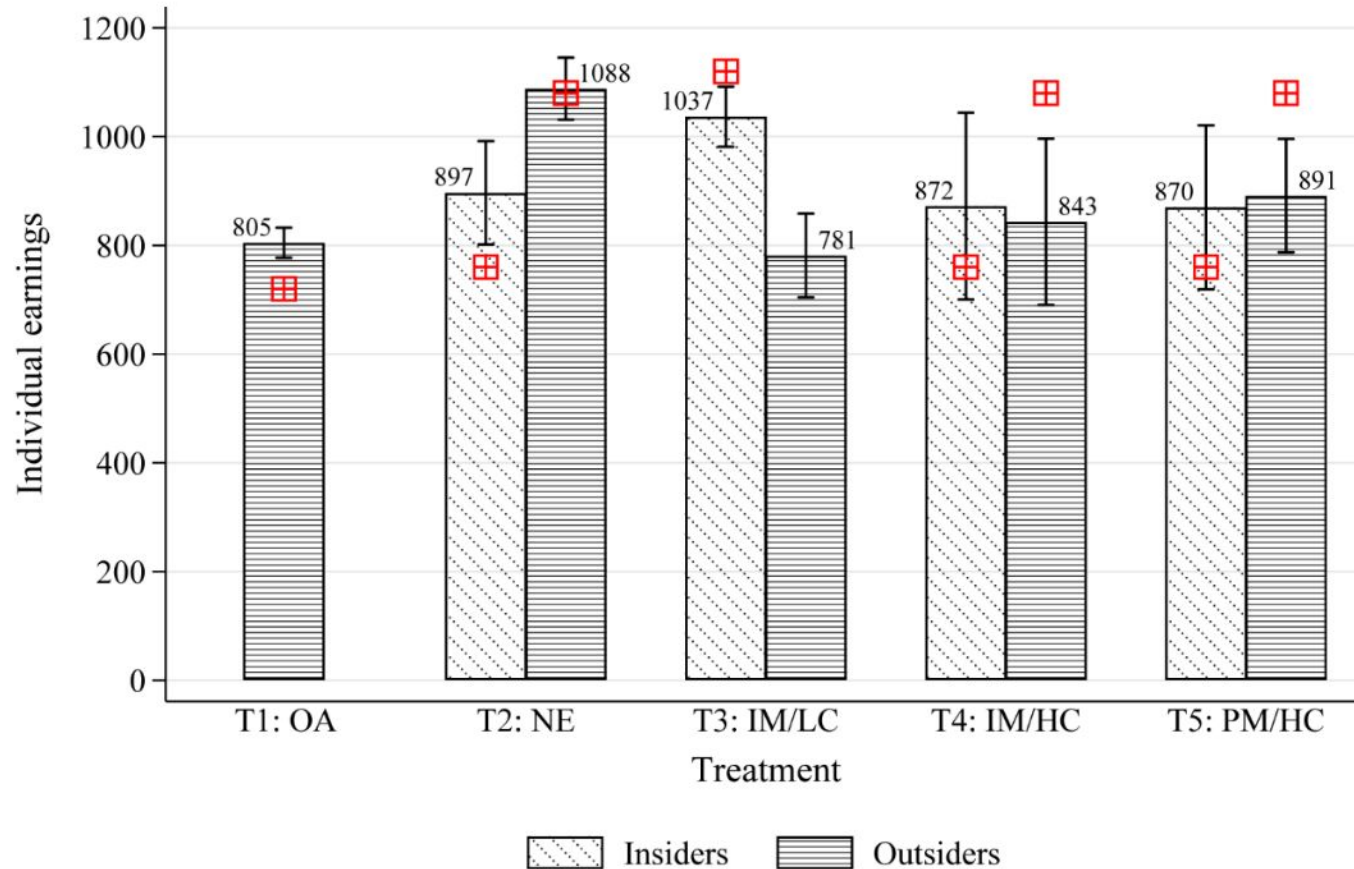
- Monitoring reduces poaching, but does not eliminate it.

# Total harvest (insiders + outsiders)



- When coalitions form, total harvest is reduced and conserves the resource.

# Earnings



- Relative to Open Access, insiders were:
  - better off when monitoring costs were low (T3)
  - about same in other treatments

## 4. Conclusions and future work

-Resource users could sustain their resource and extract a significant portion of the available harvesting surplus in the absence of a poaching threat.

-However, they were unable to do so in the presence of unmonitored and unsanctioned poaching.

-Even weak external monitoring lead to significantly lower poaching.

-Insiders made positive investments in monitoring which resulted in partial deterrence of poaching.

-Insiders could not coordinate their investments in monitoring well enough to fully deter poaching.

-CPR coalitions can form endogenously under conditions that enable CPR users to claim sole responsibility for a resource and to work with government authorities to prevent encroachment by outsiders.

## **...Conclusions**

- The ability to deter outsiders at reasonable cost positively affects the size of CPR coalitions, their management and defense of the resource, and profitability.
- When outsiders cannot be deterred—perhaps for technological, geographical or economic reasons—coalitions may form but they will be small and not very profitable. These coalitions are fragile.
- Finally, in addition to enabling the formation of CPR coalitions, government authorities may also aid in the defense of CPR boundaries to help make CPR coalitions more inclusive and profitable.

## **Future work...**

- Uncertainty (endogenous and exogenous)
- Exclusion

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-Yanina Figueroa y Oscar Santis (field work coordinators).

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Photos: Proyecto Fondecyt Regular 1140502



Thanks you for your attention!