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The impact of communication as a tool for the sustainable resource use

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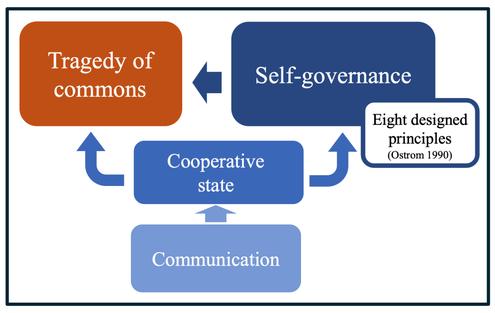
Abstract

The Sustainable Development Goals (SDGs), consisting of the 17 goals which should be achieved by 2030, are targets for realizing a sustainable world. The research and activities are actively conducted around the world to achieve these goals. One of these goals is '14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development'. To utilize marine resources sustainably, one issue that must be resolved is “The Tragedy of the Commons”, suggested by Hardin in 1968. This refers to a situation which describes the depletion of a shared resource due to excessive fishing by many parties. Several conditions for functioning autonomous management of common lands have been described in previous studies. In these conditions, it is assumed that communication between individuals is active and the connections continue to be maintained. However, studies investigating the effect of communication on “The Tragedy of the Commons” are scarce. Therefore, we conducted a game experiment with groups of 4 to 5 individuals assuming fishing communities. Players are required to utilize resources sustainably and maximally. We tested whether communication could be a solution to “The Tragedy of the Commons” by using data from this experiment. In the process, it also tested whether income was stable at a high level in order to examine economic sustainability. The study may highlight the importance of communication in fishing communities. On the other hand, it may suggest limitations of communication.

Introduction

■ Tragedy of the Commons（Hardin 1968）

When managing shared resources, if all resource users act to maximize their own benefits, each individual will utilize as much of the resource as they can, leading to the problem of overexploitation of the resource as a whole.



■ How to avoid Tragedy of the Commons

Establishing private property rights or public ownership are the only solutions. (Hardin 1968)
↔ Supporting self-governance in managing common resources. (Ostrom 1990)

- Ostrom identified eight “design principles” common to successful self-governance. (Ostrom 1990)
- **Communication is a powerful tool for self-governance.**
  → Reduces transaction costs, promoting to cooperative state.
  = Turn a social dilemma into an assurance game in the game theory. (Runge, 1984)
- Communication is necessary for cooperation but not sufficient.
  (Wade, 1988, Siy, 1982; McKean, 1986, and E. Ostrom, coming)

■ A past field experiment examined whether communication is effective in avoiding the tragedy of the commons.

1. An initial resource was set.（ 20 candy = 20 Fish ）
2. Each player could take 0 to 5 units at a time.（ 4 players ）
   ※ Players could not see how much of the resource others used
3. The remaining resources were doubled.
4. Cycle ended.
5. The game ended after 15 cycles, or when the resource was depleted or grew so much that the prepared candy ran out.

Yukihira, 2019. "A Comparative Field Experiment Study on Resource Use Behavior in Fishing Communities of Indonesia and Vietnam." Undergraduate Thesis, Department of Marine Resource Science, Faculty of Fisheries Sciences, Hokkaido University. (Unpublished)

Then:

- **Family size and Cost of living**
  For expanding the unit of the community from a collection of fishers to a collection of fisher's families.
- **Environmental variability**
  For observation of players' responses to uncertainty.

Objectives

Under more realistic experimental conditions, we aim to clarify how…

- **The presence of communication**
- **The quantity and quality of communication**
- **The background of individuals forming the community**

Affects the decision making process and the state of resource management ?

Methods

- Determination of family size (1 to 6 people, randomly assigned).
- Each player is given an initial balances of 7 FIS（currency）.

Catch
- Catch 1 to 16 fish
- Players tell the GM the amount of fish they desire to catch
- The GM tells the players of the actual amount caught
  (Reflecting the Difficulty to Catch based on resource density)

Sell
- Sell all fish
  1 Fish = 1 FIS（currency）

1 Fishing Season Cycle

Recovery of Resource
- Reproduction relation
  = Logistic model
- Environmental variation
  (strong / weak)

Pay Cost of Living
- More than Family number

Continue with 15 Fishing Seasons
The player with the highest per capita cost of living wins.

Resource depletion
All players lose.

Cannot pay for cost of living
The player with the highest per capita cost of living , excluding those who cannot pay their cost of livings, wins.

- 2 phases
  ① Without communication ② With communication
- The number of players is 4 to 5.
- Players are required to Sustainable and Maximize Profits

We recorded a summary of the conversation and found out some features of each group.

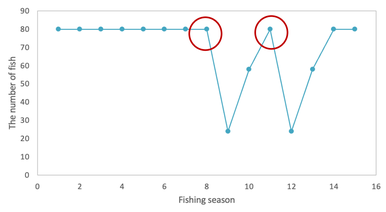

FIS（Currency）


Calculated and recorded the catch volume, resource amount, and cost of living using Excel.

Preliminary results and discussion

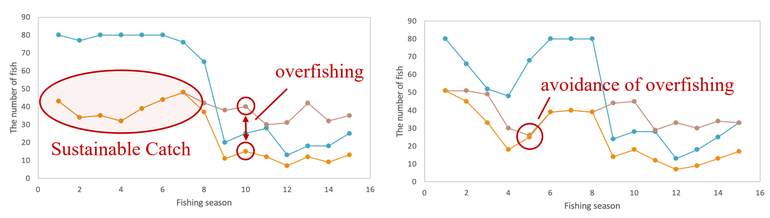
Groups with communication problems may be more likely to fall into the tragedy of the commons.

No Fishing Pressure

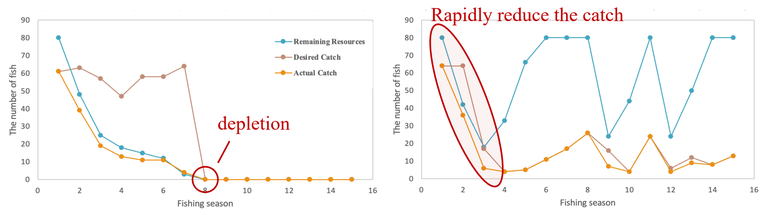


Environmental variation occurs twice.

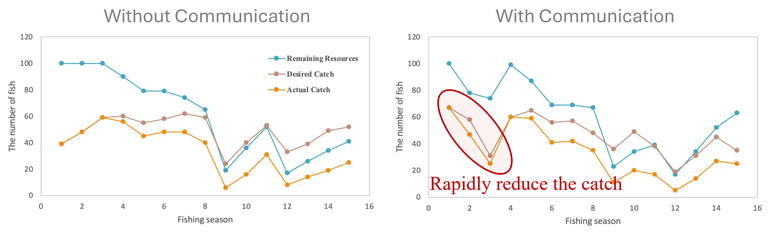
Japanese Student ①



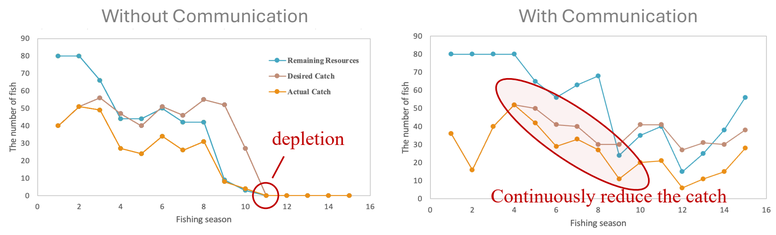
Japanese Student ②



International Student



Participants of JICA program



■ Through communication （＋） …

Promotes collaborative behavior by reducing the psychological costs of cooperation through understanding each other's strategies.

■ Even with communication （－） …

1. Communication does not always lead to cooperative state.

- Players did not follow the pre-determined rules.
  → This is because there is **no social punishment**, one of the eight design principles .
- Revealing family sizes does not necessarily lead to resource sharing.
  → While appearing to pursue group benefits, **ultimately individual benefits are prioritized**.
- Differences in experience and cultural background cause friction during communication.
  → **Communication is not a sufficient condition** for transitioning into cooperative state.

2. Even when cooperative state evolves, optimal decision-making is not achieved.

- Rather than focusing on maximizing catches, sustainability is given greater emphasis.
  Players miss the opportunity to catch when they can, resulting in some players lose.
  → The group's interests are prioritized over individual profits.
- Players may mistakenly believe that a point above the equilibrium is the equilibrium, leading to overfishing.
  → It is **groupthink**, where the influence of a strong leader pushes the group towards a poor decision.
- Asymmetry in the amount of speaking (**authority gradient**) affects the overall quantity and quality of communication within the group.

Various phenomena related to communication and the tragedy of Commons, which were pointed out in previous studies, were observed in this game experiment.

	The period after they met for the first time	The quantity of communication	Characteristics
Japanese Student ①	**2 years**	**high**	• They tried to find the equilibrium point. • They created rules to catch based on family size.
Japanese Student ②	**6 months or first time** One participant was an acquaintance with him, while others were meeting for the first time.	**high** it was awkward.	• They tried to find the equilibrium point. • Proposals from player with larger families were not easily accepted, leading one person to drop out.
International Student	**1 years**	**a little**	• Although they shared family sizes, they did not establish any enforceable rules.
Participants of JICA program	**10 days**	**high**	• They created rules to catch based on family sizes, although some players did not follow them. • Differences in experience and cultural background cause friction during communication.

Expectations

Improvements for more rigorous setting of the methodology

- There are no costs associated with fishing.
- The system does not evaluate balances quantitively.
- A larger number of participants makes it closer to reality.
- Use something that incentivizes participants to pursue maximum profit instead of FIS（original currency）

Participation Form