

Fermeuse Cod Fishery, Canada

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1 Static Analysis - Collective action

Fermeuse Harbor is located on Newfoundlands Avalon Peninsula, the eastern-most coastline of Canada. Fermeuse Harbor consists of three communities: Fermeuse, an inshore fishing community situated in the west part of the bay; Port Kirwan, located in a cove near the inset of the harbor, in the north part; and Kingmans, a small hamlet placed on the south bank of the harbor.

The key resources (natural infrastructure) in the system are the marine food web. The key shared resource relevant to the commons dilemma faced by the community is the capelin (the small fish that cod feed on) and cod fish stocks and their productivity (common-pool).

The boundary for the system is 3 nautical miles of offshore, bounded to the east institutionally and to the western is bounding by the shore, this offshore extends for kilometers on both sides of the Fermeuse Harbor.

The original study carried out in 1972 catalogs an action situation involving approximately 56 fishermen and 24 fishing units of boats and crew; the resource units are cod and salmon. Allocation of fishing spots depends on the season. The commonly used allocation processes are "first-in-time, first-in-right", lottery, and division of the grounds depending on the technology used. This case study is part of the original Common-Pool Resource (CPR) database.

In 1891, Fermeuse supported an inshore fishery comprising some 97 units. Local fishermen felt constrained to local grounds for handlining (traps had not yet been introduced). During 1911, the pressure on available space had become so great that even the two most productive trap locations in the community were reserved for handlining and jigging only. In 1962 (during World War II), 34 fishing units composed the fleet of fishermen in Fermeuse and trawl fisheries had become dominant, such that the handline sanctuary had been reduced to less than half of its original size.

1.1 The Commons Dilemma

The appropriation problem is due to the method of extraction and poorly-coordinated appropriation as well as free-riding of some fishermen when the

Fisheries' competition in Fermeuse Harbor is indirect and overtly aggressive competition is avoided. Intense competition takes place on the fishing grounds and aggressive behavior is disguised by the speculation as to whether a competitor was aggressive or the other incompetent. Because the fishing space is limited and not randomly distributed, the only way the fishing unit can successfully complete the desired fishing goal is by keeping information about how to optimize the fishing technique and location secret, or by bending the established rules when circumstances make it propitious.

Potential under-provisioning of public infrastructure is part of the commons dilemma, Fermeuse Harbor has a fisheries officer acting as a communication channel between local fishermen and fisheries authorities in the management of local fishing grounds. If fishermen feel their interests are being affected, departmental policies allow them to request another officer from a different district, thus the role of the fishery officer is essentially passive. The fishery officer is expected to be an enforcer of existing space- management rules, however he maintains a passive role regarding the enforcement and does not involve himself in any dispute or violation of fishery regulations unless someone complaints specifically to him.

Trawl fishermen capture all size fish, not allowing the population to reach an optimum state for fisheries, which disrupts the ecological equilibrium of the system. Although hand-line fishers also capture fish of all sizes, the proportion of fish handliners are able to catch is less, so the impact is also less as compared with the fishers using trawls. Fishers using technology to over fish in restricted areas, has led to a reduction in the mean size of cod captured over the years due to years of overloading the natural renovation rate of the resource. The industry is leading itself to collapse due to the increasing scarcity of mature fish, which ultimately prevents the natural renovation cycle of the resource.

1.2 Biophysical Context (IAD)

Natural Infrastructure

The resource in the SES is caplin and cod fish. Inshore fisheries waters with extension of about three miles length and offshore waters, makes monitoring complicated and although the boundaries of fishery ground are institutionally well defined, fishermen usually do not follow the rules and cheat in order to get the maximum possible benefit.

Hard Infrastructure

The hard human infrastructure required by the Fermeuse Harbor fishing consists of four distinct types of gear used during the fishery season: jigger, handline, trawl and stationary traps. Jigger fishery is accomplished with the boat drifting over the desired area, using a piece of lead, weighing about a pound and molded into the shape of a small bait fish with two large barbed hooks protruding from the head end. Trawl which is about 300 lbs test, consist of a cotton or nylon line or groundline about seven-thirty seconds of an inch in diameter, to which baited hooks are attached at intervals of about three feet. The entire trawl is divided into fifty fathom lines of about eighty hooks each. The number of lines in a trawl varies with the fishing context from as little as two or three to perhaps twenty-five or thirty lines in one string.

1.3 Attributes of the Community (IAD)

Social Infrastructure

The Fermeuse Harbor fisheries competition is indirect, the idea is to avoid overtly aggressive competition. Particularly Fermeuse community is maintained by a conspicuous avoidance of overt conflict under the idea that open hostilities are too costly because the constant interactions between citizens. Thus when an aggressive act occurs, these kind of acts are often not reported, as part of the social function and the continuous stress of the fact that you need your neighbors and their goodwill as an insurance policy against the unforeseen. In that concern and avoiding peer to peer confrontation when an improper act is detected, significant retribution like reporting the violator to the fishery officer prevent

future improper acts. However at the end of the dispute friendship is maintained as a general public appearance in the community at all times.

Human Infrastructure

Human infrastructure in Fermeuse Harbor consist of fifty six local fishermen and twenty four private fishing units and their crews, villagers with high developed fishing knowledge and skills, these have been transmitted from father to son through many generations. Although citizens of Fermeuse have in general only basic secondary level education, they have extremely precise knowledge of local fishing areas, and how to exploit them efficiently.

Fisheries activity is done using two main techniques/technologies: handline and trawl, depending of the zone, inshore or offshore; these inequalities in extracting the common produces a high competitive environment between local fishermen. Some of the inshore fishermen have noticed the reduction of the mean size of captured cod fish by handline, they argued that this may be an insight of the detrimental impact of bad leading fisheries industry in Fermeuse Harbor, while offshore fisherman disagree and sometimes pass over the rules using trawl in a strictly handline zone.

A fishery officer is the local extension of the Canadian Department of fisheries, he acts as a communication channel between local fishermen and fisheries authorities on matters pertaining to the management of local fishing grounds.

1.4 Rules in Use (IAD)

• *Position Rules*

- Fermeuse Harbor accounts for different positions according to the fisheries technique used and the fishing zone. Fifty-six local fishermen and their twenty-four fishing boats, divided into small-boat and long-boat owners. All member of their crews as co-op members as well as fishermen from other communities.

• *Boundary Rules*

- Trap locations are regulated by controlling the allotment of fishing sites by means of a lottery held after the first of each new year and supervised by a selected committee of three or five local fishermen, only local boat owner fishermen are allowed to participate in the lottery. Foreign fishermen are not and cannot be legally excluded of perform fisheries activities out of the sanctuary waters but they are forced to observe local fishery regulations. Offshore waters are permitted to all fishermen.

• *Choice Rules*

- Foreign fishermen are permitted to set gear in those locations not being used by local fishermen and locations not included in the lottery or locations that have not been occupied by July 1. The exception is that trap locations are reserved exclusively for local fishermen. No fishermen are allowed to perform fisheries activities using a different technology than handline in the sanctuary and reserved region. Trawl locations once taken in the morning are considered to be occupants until the end of the day and is not permitted to set gear nearby.
- The zones assigned as sanctuary are restricted to the use of handline.

- ***Aggregation Rules***

- Individual boat owning fishermen have total control over where, what, and how they fish within the limits of the choice rules. Non boat owning fishermen are dependent on boat owning fishermen and subject to their decisions. Local fishing grounds reserved for handlining, jigging and traps are usually requested by a petition that the most powerful group of fishermen circulate.

- ***Scope Rules***

- The fishery unit is allowed to act just in the zone assigned for that type of fisheries and is prevented to invade someones else working area. Once a fisheries zone is occupied, set a gear in the same zone is considered dirt and overtly an aggressive act

- ***Information Rules***

- Local fishermen participating in the lottery for traps placements and those who are not participating should know about the restricted zones for handlining fisheries only. Foreign fishermen are forced to observe local fishery regulations.

- ***Payoff Rules***

- When an improper act is detected, significantly retribution like reporting the violator to the fishery officer prevent future improper acts.

1.5 Summary

Sociologically, the regulations preserve highly valued and ecologically functional interpersonal relations between citizens of Fermeuse Harbor. This in an economic setting where exploitative opportunities are both limited and potentially unequal. The fishery officer is particularly important as the local representative of the outside authority, he represent the safe powerful and impersonal method for sanctioning those whose act illegally. This saves the community members to avoid a dangerous situation in a peer to peer conflict.

2 Dynamic Analysis - Robustness

2.1 Update of the commons dilemma

The cod catch peaked in 1968 at 810,000 tons, approximately three times more than the maximum yearly catch achieved before the super-trawlers. Nowadays there is no commons dilemma in Fermeuse Harbor, simply because the industry collapsed entirely in the early 1990s owing to overfishing and debatably, greed, lack of foresight and poor local administration. By 1993 six cod populations had collapsed, forcing a belated moratorium on fishing. Spawning biomass had decreased by at least 75% in all stocks, by 90% in three of the six stocks, and by 99% in the case of northern cod, previously the largest cod fishery in the world.

2.2 Shocks, Capacities and Vulnerabilities

Based on the static analysis, the system is vulnerable primarily to an over appropriation of the fisheries resources (caplin and cod fish) due to lack of regulation and monitoring of the fishing grounds. The system is also vulnerable to shocks on the natural infrastructure, as the local ecosystem might have changed, one possibility being that greater numbers of caplin, which used to provide food for the cod fish, might be eating the juvenile cod, avoiding them of reaching a reproductive age and reestablish the under-provided cod population. A competitive environment most likely led to the collapse of cod fish population in 1960s and nowadays the waters appeared to be dominated by crab and shrimp rather than fish.

In order to develop capacity to overcome the collapsed system due to the vulnerabilities of the system, Newfoundland government imposed a 10-year moratorium on fishing that begun in 1992. Although the cod had still not returned in 2002, the Fermeuse Harbor system seems to have been able to recuperate itself totally. By 2011 it became apparent that the fisheries were returning to their original abundance, albeit more slowly than had been anticipated.

2.3 Robustness Summary

Currently the Fermeuse Harbor fishery seems to have overcome the shock of overfishing after 30 years of the collapse of the system. This is due to strict policies the government of Newfoundland have actively imposed over the course of the last decades which have allowed the cod fish population reach its original population. The system also seems to be able to overcome the endogenous shock of a degraded ecosystem for cod fish populations due to the natural competition intra-species.

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