

Coqueiral Raft Fishery, Brazil

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1. Static Analysis - Collective action

The Coqueiral raft fishery was located in the village of Coqueiral (present-day Pontal do Coruripe in the state of Alagoas in northeast Brazil). The key resource appropriated that relates to the commons dilemma is fish of various species. The original case takes place between 1961 and 1967 and concerns approximately 85 fishermen and the other residents who either support, exploit, or regulate the fishing economy. The success of the case is inconclusive as the fishery was not overexploited during the study. Overexploitation was prevented due to both the reliance on primitive fishing and navigation methods and artificial suppression of the fishing market by local regulators. However, introduction of new technologies enabling greater harvest suggest that overexploitation of the resource is a potential threat in the years following the study.

1.1 The Commons Dilemma

While overappropriation is a potential threat to the resource system, the key commons dilemma concerns economic competition between fishermen which is exacerbated through oppression by powerful local actors. A fisherman's catch is limited by the technology they can afford, and profit from the catch is artificially suppressed by local regulators. Fishermen are heavily exploited by local regulators who limit their economic mobility through price ceilings of desirable fish species and a refusal to provide loans for fishing equipment. Additionally, wealthy locals provide boats and equipment to crews of fishermen who must then return the largest share of a catch to the gear owners. Fishermen have little recourse due to the corruption of local regulators and the lack of alternative economic opportunities.

1.2 Biophysical Context (IAD)

- Natural infrastructure: the fishery consists of a diverse array of inshore and offshore environments with a wide variety of species. It extends from inshore estuary and reefs to the offshore continental shelf (about 30km offshore) along about 40km of shoreline. Mackerel, dogfish, sea turtles, lobster, shellfish, and various other species are commonly targeted. The species distribution is determined by distance from shore, ocean depth, bottom composition, and proximity to reef habitat, among other factors. Availability of species and effectiveness of fishing methods are also dependent on seasonal changes in ocean temperatures, currents, winds, and waves.
- Hard human-made infrastructure:
 - Boats: wooden jangada rafts and hull sailboats.
 - Nets: beach seines and gill nets made of either vegetable fiber or nylon mesh.
 - Storage houses: buildings where beach seines and other large nets are stored for

- maintenance.
- Weigh station: building on the beach where the fishermen's guild weighs fish for regulatory enforcement.

1.3 Attributes of the Community (IAD)

- Social infrastructure:
 - Navigation: the fishermen use a common system of navigation that allows them to identify and return to certain fishing zones. This system involves using prominent landmarks to identify a location perpendicular to the shore and its distance from shore. Particular fishing zones are further identified by testing the ocean floor composition. While this system is not accurate enough to identify precise fishing spots, the zones are reasonable indicators of which species will be present.
- Human infrastructure: approximately 85 fishermen, 12 retired fishermen, 21 fish hawkers, and 4 fishing industry bureaucrats. All fishermen and bureaucrats are male, while 11 fish hawkers are female.

1.4 Rules in Use (IAD)

1. **Position Rules:**
 - Commercial fishermen: harvest fish for sale, frequently alternate between independent trips or serving as crew members.
 - Subsistence fishermen: harvest fish for household consumption.
 - Fish hawkers: buy fish from the fishermen and sell them in the Guaiaumu market.
 - Fishermen's guild officials: regulate prices of fish, collect taxes and dues from fishermen, and enforce regulations.
 - The fishermen's guild president is supposed to be elected, but this rule has not been followed in recent years.
 - Local "bigwigs": wealthy residents lend fishing gear and boats to fishermen in exchange for a share of the catch.
 - Captains: leaders of raft fishing trips with at least one additional crew member. Captains do not always fish themselves.
 - Crew: members of raft fishing trips who take direction from the captain.
2. **Boundary Rules:**
 - Fishermen must pay annual dues to be members of the fishermen's guild and receive retirement benefits.
 - Fishermen's guild members must pay 10% of their earnings in taxes to the guild, although this is poorly enforced.
3. **Choice Rules:**
 - Offshore and inshore raft fishing operate on a first-in-time, first-in-right system each day, where the first raft gets a choice of fishing location. Rafts crews can choose to stay in their own position or occupy new positions as other rafts vacate them.
4. **Aggregation Rules:**
 - Price ceilings for desirable fish species are set by the Guaiaumu mayor and the fishermen's guild president. Neither fishermen nor hawkers can earn more than the established profit margin.
 - Every fisherman eighteen years of age or older is required by Brazilian law to register with the local port captain, receive from him a license to fish, and register with the local

fishermen's guild. This rule is poorly enforced.

5. **Information Rules:**

- Individual fishermen keep specific fishing spots secret, even if the zones in which these spots are located are known.
- The fishermen's guild keeps a log of registered members in the chapter region.

6. **Scope Rules:**

- None specified.

7. **Payoffs Rules:**

- Fishermen who partner with a fish hawker must agree to only sell fish through hawkers.
- Fishermen who partner with a fish hawker must agree to fish at every opportunity.
- Hawkercs must buy anything fishermen want to sell.
- Hawkercs must pay fishermen immediately after returning from selling fish at the market.
- Catches for rafts with multiple crew members are divided based on the number of crew and who owns the gear used (boats, nets, etc.). The share allocated to captain and crew varies based on fishing method (types of net or hook-and-line). Generally, captains have priority for choice of catch, followed by other gear owners, then crew members. Captains are often owners of the fishing gear. Captains generally receive a larger share of fish than crew members, and often the first choice of fish.
- Shares of fish are determined by estimated size rather than actual weight of fish.

1.5 Summary

Fishermen in Coqueiral use a variety of techniques and equipment in an effort to exploit the local fishery to the fullest extent possible. However, their ability to appropriate the resource is severely limited by the technology available to them. Predominant jangada rafts limit the distance that fishermen can safely venture offshore, thus limiting the potential size of their catch. Lack of precise navigational equipment makes it impossible to consistently return to productive fishing spots. Equipment that enables larger catches, such as hull sailboats or nets, is prohibitively expensive for most fishermen. As a result, fishermen frequently serve as crew members borrowing gear from wealthy locals who keep a large portion of the catch in return. Fishermen are also suppressed by the local fishermen's guild which places artificial price ceilings on desirable species, limiting profit margins. All of these factors contribute to the relative stability of the fishery but greatly limit the economic mobility of the fishermen.

2. Dynamic Analysis - Robustness

2.1 Shocks, Capacities, Vulnerabilities

Shocks that were successfully overcome:

- There is no evidence of shocks that have been successfully overcome.

Shocks that changed the system structure:

- Increases in the price of fish have not kept pace with rampant inflation as a result of the price ceilings imposed by the local fisherman's guild and the Guaiamu mayor. This has further restricted the economic mobility of the fishermen.

Potential vulnerabilities:

- Introduction of gill nets offers potentially large increases in fishing production and fishermen's earnings. This could increase the economic mobility of fishermen, allowing them to gain more autonomy in fishing and keep a greater share of their catch and profits. However, this also raises the risk of overappropriation.

2.2 Robustness Summary

There does not appear to have been a later study of the Coqueiral fishery following the original source document. However, it seems likely that the fishery no longer exists in its 1960s form. Most names of towns (Coqueiral is now Pontal du Coruripe) and geographic landmarks (the Guaiamu River is now the Coruripe River) have changed, suggesting significant political changes that may have influenced the local economy and fishing industry. Additionally, Pontal du Coruripe, while still a small town, appears to cater much more towards tourists than it did in the 1960s, which may have lessened the importance of the local fishing industry. It is also reasonable to assume that as fishing harvests have increased in the region, outside fishing operations with more sophisticated technologies would outcompete the traditional jangada methods. Some of these improved technologies (e.g., nylon nets and hull sailboats) provided benefits to local fishermen in the short term. But technological improvements and increased fishing operations by exogenous actors would also risk overappropriation of the resource, as mentioned in the source documents. Furthermore, the case repeatedly demonstrates that fishing is not a desirable activity due to the strenuous labor, uncertainty of catches, cost of equipment, and artificially imposed price ceilings that limit profit. Fishermen are repeatedly taken advantage of by more powerful regional actors such as the fishermen's guild leadership and local bigwigs, who have a vested interest in limiting the economic mobility of the fishermen. It is reasonable to assume that the fishermen would work in other industries if given the opportunity, but lack alternative options at the time of study. While the source document recognizes that these conditions make the system robust to social changes, and the limited technology at the time prevents overappropriation, it also acknowledges that potential shocks are on the horizon. The system therefore appears likely to have been affected by exogenous shocks including introduction of the improved fishing technologies, a diversifying local economy, and increased resource appropriation from outside actors.

3. Case Contributors

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