



The political ecology of shrimp aquaculture in Tamil Nadu: A case study from Mayiladuthurai District

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Abstract

This article uses a political ecology lens to analyze the impact of shrimp aquaculture in Tamil Nadu, with a case study of a coastal village in the Mayiladuthurai district of Tamil Nadu, India. The article first looks at the shrimp industry in the coastal village as a case that illustrates how global capitalism influences the local economy. Second, it identifies ecological degradation due to the commodification of nature and analyzes the social origins of degradation. Commodification alienates nature and people from each other, and its impacts are unevenly felt across social strata, especially class, gender and caste lines. The article finally discusses the intersectionality of social differences and differentiates how the impacts of commodification are experienced and responded to.

Key-words

Shrimp aquaculture, Political ecology, Environment, Social relations, Food security, Dalits

1. Introduction

International development and financial institutions promote the development of indebted coastal countries and help them earn foreign exchange earnings for paying off external debt in numerous ways (Shekhawat *et al.*, 2020). The promotion of industrial shrimp aquaculture is a major route for this. The aquaculture industry in India underwent substantial growth in the 1990s when shrimp farming became an intensive practice (Kurien 1997). In general, in the context of liberalization policies, export-oriented aquaculture is associated with improving food security, reducing poverty, and facilitating economic growth (Primavera, 1997). However, the promotion of export-oriented production is mostly in the hands of big corporations, which can have detrimental consequences for the livelihoods of local populations and the environment (Rivera-Ferre, 2009). Therefore, the broad objective of this article is to examine the social origins of environmental degradation through a political ecology lens, emphasising how power relations influence the access to resources and how they are managed (Peet & Watts 1996, Bryant 1998).

A coastal village² located in the Sirkazhi Block of the Mayiladuthurai District in Tamil Nadu was chosen to study shrimp aquaculture activities in Tamil Nadu. The village has a total population of 6,853 and an area of 801.08 hectares (Census of India, 2011). A caste group belonging to Most Backward Classes (MBC) constitutes most of the village's population, whereas the Scheduled Caste group (Dalits) constitute 9.5 per cent.

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² The name of the village is not mentioned due to ethical concerns.

The MBCs are the traditional landowners of the village, while Dalits were primarily employed as agricultural laborers. The village comprises seven hamlets in which agriculture, fishing and shrimp farming are the major sources of livelihood. The study mainly concentrated on the primary data from four hamlets where shrimp aquaculture is highly prevalent. The study area was selected based on its coastal agro-ecosystem, issues related to soil and water salinization, and conversion of substantial agricultural land into aquaculture farms. The Central Ground Water Board (2020) has classified Sirkazhi Block as "over exploited" due to excessive groundwater extraction. The Central Water Commission (2017) recorded that 59% of the Block has been affected by saltwater ingress. The total cultivated area of the village under study was reduced from 440.8 hectares to 211.6 hectares in twenty-eight years, marking a drop of 52 per cent (Census of India, 1991; VAO, 2019). More than 57 hectares of this uncultivated agricultural land has been converted into aquaculture during this period. Concomitantly, the number of main cultivators has also dropped by 35 per cent (Census of India, 1991 & VAO, 2019).

An exploratory research methodology was employed. Qualitative data collection methods including in-depth interviews and focus group discussions were used to study the impact of shrimp aquaculture on the socio-economic life of the villagers and its implications for local livelihoods. In addition, large and small shrimp farms in the village were visited using the transect walk method, and field notes were made based on the observation method. Snowball sampling was used to identify informants including agriculturists, shrimp farmers, shrimp farm laborers, feed dealers, buyers and residents of the Dalit hamlet. Women constitute 45 per cent of our sample.

The article is divided into six sections. The subsequent section draws attention to the history of shrimp aquaculture's introduction, growth, and development of shrimp aquaculture in the village and reviews how it is moulded through the intervention of state and multinational funding agencies. Next, the article analyzes the changes in social hierarchies due to the introduction of shrimp aquaculture and investigates how some private players take hold of immense profit by monopolizing the industry at the village level. The rest of the article adopts a political ecology approach, which frames an analysis of the roots of social unrest and environmental degradation on the ground of how global forces of state and market alienate nature and people from each other. This section intersects along the axes of environmental degradation, household food security, class, gender and caste. The last section concludes the study.

2. Reverberations of global power relationships at village level

The Aquaculture Development and Coordination Programme (ADCP), a project under the United Nations Development Programme (UNDP) and the Food and Agricultural Organization (FAO), came up with a National Aquaculture Development Plan (NADP) for the decade 1976-1985. They set an overall targeted production of 3 million tonnes, to which India pledged to contribute a maximum of 41 per cent (FAO, 1976). The Indian fishers who released shrimp back into the waters until the 1970s started recognising their export potential and brought them to landing sites. When fishers started to overexploit natural shrimp stocks, India faced stagnation in shrimp exports immediately after the boom. As a result, the Indian government began to devote attention to aquaculture as an alternative source for shrimp. They developed an interest in coastal land that had previously been left to be managed by local communities. The most crucial aspect of this transformation from artisanal fishing to an agricultural model for shrimp has been the necessity of gaining secure access to land. A study by Hall (2003) indicates that the establishment of shrimp ponds has involved significant shifts in land relations across Southeast Asia.

Meanwhile, in the 1970s and early 1980s, the coastal village we studied subsisted on agriculture and fishing. It experienced extreme summers for six years between 1984 and 1990, and the flow of water through the Cauvery River was considerably reduced due to a water dispute between Tamil Nadu and Karnataka. Hence farmers started to depend extensively on bore water, which caused seawater to move in to take up the space previously occupied by underground freshwater, and it made the groundwater saline. This adversely affected agriculture, especially since summer crop cultivation was stopped for nearly five years from 1985, and the land was kept barren. The state, which had already developed an interest in coastal land, capitalized on this situation to introduce shrimp aquaculture in drought-affected villages. The Marine Products Export Development

Authority (MPEDA) started its first office in Thanjavur district in 1988 to develop the unutilized arable-turned-saline tracts into potential lands for shrimp aquaculture. Among the marine items exported by India in 1992-93, shrimp formed 35.7 per cent by volume and 66.8 per cent by value (Mukul, 1994). The enticement of the exploitable profits in the industry fostered by the enabling environment of liberalization policies, research institutions, and multilateral consultancies attracted two corporates, Spencer and Sri Ram, to start large-scale shrimp aquaculture projects in the village in 1993. Spencer bought 300 acres (121 ha) in the village, and Sri Ram 400 acres (162 ha) near the village boundary, which included both unutilized agricultural land and residential areas. Although MPEDA did not encourage small-scale shrimp aquaculture during this phase, some villagers took a chance by investing in it on their few acres of land. It is also far simpler for members of the agriculture community to switch to aquaculture than it is for fisher folk, since agrarian communities possess more land. Several infrastructure development programs, along with better technology dissemination and fiscal incentives, were launched to boost the shrimp industry during this period. The sector witnessed concurrent growth in associated services such as hatcheries, processing plants, ice plants and shrimp depots, as well as the increase in shrimp farms (Hoque, 2017).

However, the sudden boom in profits in the first half of the decade was immediately busted in the middle of 1998 with infections caused by several viral diseases, especially the white spot syndrome.³ The disease was previously reported in other countries and is argued to have spread to India through the illicit import of seeds (ostracoda) from Thailand to the farms of Andhra Pradesh (Sangamaheswaran & Jeyaseelan, 2001). Consequently, the European Union and Middle Eastern countries imposed a ban on marine products from India, stating quality reasons, and incurring losses for both corporates and local shrimp farmers. The disease continues to be alive in consecutive shrimp cultures; while local farmers adapt quickly to the changing conditions, corporates are unable to survive the colossal loss of harvest. In a volatile disease environment, small farmers with more expertise in local ecologies can better micro-manage and take advantage of a trial-and-error approach (Vandergeest *et al.*, 1999). Because of their strict organizational structure, corporates find it challenging to make timely decisions. Thus, both Sri Ram and Spencer were liquidated by the year 2000. The 7 to 10 per cent annual increase in exports that the industry was experiencing every year in the 1990s had come down to an average of a 0.41 per cent increase in quantity and a 0.47 per cent increase in value in the export markets post-2000 (Immanuel & Narayanan, 2022). But the absence of big corporates created a void in the employment opportunities that previously existed, and increased the demand for local shrimp farmers who could produce more shrimp for export markets. Hence shrimp farmers in the coastal village get good returns even when the price of shrimp fluctuates in the global market—higher demand for shrimp, and their ability to micro-manage has motivated more villagers to enter into shrimp aquaculture.

In 2009, most Southeast Asian countries started shifting toward the culture of the white-leg shrimp (*Litopenaeus vannamei*), which was introduced in the village in 2012. Though local farmers resisted the culture of exotic species like *vannamei* initially, soon they replaced native tiger shrimps (*Penaeus monodon*) with *vannamei* as the new species had several advantages for the farmer's operations. *Vannamei* can be stocked at high densities due to their less aggressive nature, leading to much higher production for the same unit of land. MPEDA also promoted the culture of *vannamei* by introducing subsidies to importers of *vannamei* seeds. The shrimp industry contributed 74.3 per cent of India's US\$ 5.96 billion seafood exports as of 2020–2021 (MPEDA, 2021). India's shrimp exports increased from 15,762 MT in 1961 to 590,275 MT in 2021, an increase of 3,745 per cent (MPEDA, 2021). Corresponding prosperity was also reflected at the village level. The absence of big corporates was utilized as an opportunity by the local shrimp farmers to catch hold of the economy of the village completely.

Shrimp could have been considered a fictitious commodity, according to Karl Polanyi. Fictitious commodities are defined as "goods or services that are treated as commodities for exchange in the market but that are not actually produced for sale or exchange" (Polanyi, 1957[1944]). The shrimp as a species has been largely insignificant in the cultural life of villagers until very recently, when its status has changed to a 'real' commodity (Hall 2003). It has now become a highly sought-after due to its increasing popularity in global

³ A highly lethal and contagious viral infection that kills the shrimp quickly.

markets. The market mechanism has also driven the expansion of shrimp farming into new areas, often at the expense of other land uses and natural resources. As detailed below, this has caused environmental deterioration, economic instability, and social inequity.

3. New social hierarchies

Since members of MBC were the traditional landowners of the village, most shrimp farmers belonged to MBC, who converted their traditional agricultural land into shrimp farms. Despite the fact that the shrimp industry improved the local economy and has generated employment opportunities through the establishment of related industries, most of the income has been enjoyed by a handful of powerful entrepreneurs. These entrepreneurs, who are large landowners from the relatively well-off sections of farmers from MBC, emerged as a new elite class in the village. Though the data from Village Administration Office indicates that 25 per cent of shrimp ponds in the village were owned by four major shrimp farm owners, their actual share is substantially higher. It is understood from the in-depth interview with two major shrimp farm owners that these two alone own 35 per cent of the total shrimp ponds in the village.

Another class of resource-poor farmers from MBC that do not have enough capital to start shrimp farming, turned into an intermediate class by making use of employment opportunities in the shrimp farms and allied industries or by doing small-scale shrimp aquaculture on their few acres of land. Hence it is observed that the land ownership patterns severely constrain the potential of the resource-poor to engage in aquaculture as producers. Shrimp aquaculture has promoted a shift away from individual entrepreneurship in the form of agriculture towards wage employment in shrimp farms, meaning fewer owners and more laborers.

If I am doing shrimp farming in a pond of one-acre area with two lakhs (0.2 million) seeds and able to harvest at 40 or 50 counts per kilogram, the total harvest will be about 5 tons ideally. In order to get a harvest of 5 tons, the same 5 tons of feed supply is required. On average, the total amount spent on one kilogram of shrimp will be about Rs.260-290 (3.14 - 3.50 US\$). Such that if I get Rs.400 (4.83 US\$) as the selling price, then my profit is likely to be Rs.600,000 (7,246.4 US\$) per culture.⁴

The expense of buying feed is the largest investment in shrimp aquaculture; about Rs.5,000 (nearly US\$ 600) must be spent daily on feed if the farmer expects 5 tons of harvest from 100,000 seeds. Considering the 164 aquaculture ponds in the village, a rough estimation is that nearly 800,000 rupees (9,663 US\$) are spent on the feed itself. Most small-scale shrimp farmers in the village depend on two feed dealers in the nearby town, both of whom are wealthy shrimp farm owners. These feed suppliers earn 20 per cent profit from each sale, and it is around 200,000 rupees per day (US\$ 2,444). They provide feed to the small-scale farmers without any immediate cash payment, and hence these farmers are obliged to 'hand over' their harvest to the same feed dealer with no or minimal bargaining (here, the feed dealer transforms into a sub-buyer⁵). When debt payments cannot be met, these small-scale shrimp farmers have no option but to sell or give up their land. As a result, many small farms have been slowly assimilated into the larger ones, making the rich more powerful. A similar observation was made by the Environment Justice Foundation (2003) that small-scale shrimp farmers in India, as in Vietnam, are deeply obligated to various feed and supply companies which advance their materials on credit.

By integrating feed supply and sub-buying, the elites can dominate shrimp aquaculture at the village level and earn huge profits. However, the outcomes are not limited to economic benefits. The disproportionate amount of control and dominance that the key players have over society, which is obtained through caste hegemony, is now being reinforced by shrimp farming.

⁴ A shrimp farmer responding to the question of capital investment and profit (6/2/2022).

⁵ The sub-buyers are those intermediaries who distribute the shrimp collected from farmers to exporting companies.

4. Environmental degradation

Local business ecosystem causes unsustainable intensification of shrimp aquaculture, leading to severe environmental degradation. The rate of water seepage is higher due to the sandy nature of the soil, and hence water must be continuously pumped from the bore well to the pond at least 15hrs a day. Shrimp farmers admitted that the excessive groundwater exploitation has led to the drawing down of local aquifers. Further, to stock at higher densities, they started digging the ponds deeply and lowering the depth of the water column. Over time, salts penetrate the water table, making the land and water shown in Figure 1 highly brackish. The water quality index of the village was tested to be 62 in 1995 (in India, classed as 'poor'); it worsened to 149 in 2018, which means the groundwater is unfit for drinking and domestic purposes (Paul Raj *et al.* 1995; Vijayachandran & Ravisankar, 2018). According to studies, the seepage of brackish water from shrimp ponds has led to the salinization of the surrounding soil, decreased agricultural productivity and stunted vegetation (Barraclough & Finger-stich 1996, Lewis *et al.* 2003).



Figure 1: Increase in the area under shrimp aquaculture between 2003 and 2022. Source: authors, using Google Earth basemaps. See also Pratheepa *et al.*, 2023.

In the wake of the adverse effect of aquaculture on the environment, the Supreme Court judgment mandated the formation of a monitoring authority for aquaculture by 1997, which was established later in 2005 with the enactment of the Coastal Aquaculture Authority (CAA) Act. Following the advice of the district-level committee (DLC), the CAA issues licenses to eligible shrimp farmers (MoA&FW, 2005). But the intervention of CAA in the village was found to be inadequate and too late. There are more than 80 shrimp farmers in the village; however, only 52 are registered. Violations were numerous, such as usage of bore water, setting up shrimp farms very close (less than 50 meters) from human settlements and fields and drinking water sources, leaving a large lateral water spread area, not using inner clay core in the dykes to prevent saline water intrusion, and not building effluent treatment ponds.

Thus, shrimp aquaculture has caused significant problems for local communities, and agriculture in particular, because of its thirst for water. The lands adjacent to the ponds become unsuitable for farming due to lateral seepage of saline water. As a result, farmers are obliged to either dispose of their land or leave it fallow. Notably, the district marked a 50 per cent increase in fallow land between 1999 and 2015 (Department of Agriculture and Cooperation, 1999, 2019). *Prosopis juliflora* trees proliferate in the fallow areas within one or two seasons of non-cultivation, which further degrades land quality. Another issue related to water usage has been dumping untreated shrimp farm effluent into communal waterways, degrading the water available for farming. Furthermore, the decline of agriculture has a detrimental effect on cattle rearing, another key source of income for the villagers. The rising trend of fallow land and lessened harvests per year restricts the fodder supply for cattle, affecting the viability of livestock rearing.

Consequently, shrimp aquaculture has led to social tension between the agriculturalists and shrimp farmers, who are both members of the same community. The ones regarded as "companions" when agriculture

was the major land use, are now perceived as "competitors." Although there is strong resistance from farmers and residents against unregulated shrimp aquaculture activities, no adequate preventive steps have been taken. This is despite concerns that aquaculture has transformed the village into what White (1995) called an 'Organic Machine.'⁶ The degradation of agricultural land contributes to the further expansion of the shrimp aquaculture industry. As Ray *et al.* (2021) explained, saltwater incursion works as a double-edged sword; it results in a decline in rice production and forces people to convert land to shrimp ponds. Poor agriculturists affected by salinization often have little option but to sell their fields at deflated prices to aquaculture operators, or join them:

My brother and I own 90 cents (3,642 m²) of family land on which we have traditionally grown rice. However, the yields are largely affected by the saline water intrusion as nearby lands were converted into shrimp farms. Although I continue cultivating rice on my 30 cents (1,215 m²), my brother has decided to convert the rest of the land into a shrimp farming pond. While a ditch was made to separate each other's land, it was unable to prevent the saltwater intrusion. So I sold my land to my brother and joined this shrimp farm as a worker.⁷

Interestingly, even the narratives of wealthy shrimp farm owners underscore the fact that they lacked autonomy in choosing alternate livelihood strategies. Hence, they have no option but to adhere to existing rules of shrimp farming with uncertainties about production given its long-term disease history. Despite the economic gain, most local shrimp farmers opined that shrimp farming is not their desired profession and worried about their traditional ancestral land being polluted:

Water scarcity is why our land becomes a mud puddle. I know our lands could no longer grow rice and groundnuts ever again. Yet, if my bore water becomes fresh today, I will seal all my ponds and restart agriculture again. We are agricultural people.⁸

5. Relationship between environmental degradation and social inequalities

Asymmetries in social power can cause trade-offs and distributional disparities by shaping social-ecological change, favoring certain players' interests over others (Ingalls & Stedman, 2016). When the transfer of land towards non-agricultural businesses is promoted as part of India's development agenda, it causes repercussions in 'Dalit ecologies', exacerbating existing inequalities (Prasad, 2022).

Shrimp farms are less labor-intensive than agricultural fields, and the labor opportunities are limited to men only. Farm owners opined that the nature of work in shrimp farms requires much physical labor and they are expected to work at night; hence women are not preferred as laborers. Shrimp farm owners only engaged the resource-poor people from their own caste groups to perform the work on these farms. As the agricultural lands were converted into shrimp farms, the traditional agricultural laborers of these lands (Dalits) were replaced correspondingly. Marginalization from the shrimp aquaculture sector and erosion of their resource rights left no alternate work for Dalits in their village. It forced them to migrate to take on informal sector works such as brick cutting and construction jobs in the neighbouring districts and states (Pratheepa *et al.*, 2023). We observed that at least one male member from each family in the Dalit hamlet migrated. While men were able to migrate, the women who were bounded mainly to domestic care work were forced to remain in the village. The decline of agriculture has disproportionately reduced Dalit women's capacity to earn, and they eventually lost their informal rights in the local economy. It has been reported that the Dalits borrow money

⁶ An analogy used by Richard White to demonstrate how native peoples and settlers have continually remade the Columbia River, treating it as a machine designed to churn out energy and sustenance (1995).

⁷ A shrimp farm worker shared how he joined the shrimp farm while in a focus group discussion (4/02/2022).

⁸ A shrimp farm owner concluded the interview (12/02/2022).

from local financiers at a very high rate of interest (up to 30 per cent) to meet their daily expenses and finally wind up in an endless poverty spiral.

Shrimp were considered by villagers as a food of the rich, because of their high price; they are wholly exported and seldom ever eaten by the villagers. The positive income from aquaculture has enhanced the purchasing capacity of MBC people and thereby improved their access to healthy food. On the other hand, the decline of agriculture has distorted the traditional food supply chain. For instance, Dalits had access to rice, black gram (*Vigna mungo*, a legume), peas and all necessary vegetables while they worked as agricultural laborers. Because of their reduced capacity to purchase food from the market following the decline of agricultural production, Dalits were then forced to constrain their diet to articles obtained from Tamil Nadu's public food distribution (PDS) system. With their limited diet, women were found to be receiving the lowest share of available food, as men and children in the family are prioritized:

The cotton separating works only last for three months. During other months, we do not afford to buy vegetables from the shops. Nowadays, our children survive by consuming ration⁹ rice with a water-diluted one rupee pickle packet.¹⁰

Moreover, groundwater salinization has also led to severe water scarcity in the Dalit hamlet for domestic and consumption purposes, leading to Dalit women having to spend a lot of time and energy to fetch potable water:

There are three public taps in our hamlet, but none of them has access to water. So we have to walk 2 km in the early morning to the nearby *panchayat* to fetch drinkable water. Sometimes the water may be unavailable, and we are compelled to consume corrosive and saline water, which leads to many water-borne diseases.¹¹

A canal that ran through the hamlet was no longer cleaned as agriculture declined, turning it into a mud puddle. Once a boon, the canal became a bane for the people in the hamlet, since mosquitoes thrive in stagnant water, causing frequent illness. Thus, a cycle of social and environmental degradation exists in which socio-economic marginalization pushes people into ecologically marginal areas, eventually leading to a spiralling degradation of the landscape and increasing impoverishment (Robbins, 2004).

6. Conclusion

For the government, shrimp production allows joining the global value chain and earning foreign exchange. The introduction of shrimp aquaculture in the coastal village we studied is linked to the interest of global market forces to enhance profits through the commodification of nature. As the local economy has become increasingly integrated with global markets, sustainable local production systems undergo a transition to the overexploitation of natural resources, which results in loss of subsistence and, cyclically, increasing overexploitation. The consequences of ecological degradation due to overexploitation are experienced differently by groups with varying power, based on their divergent social and cultural roles.

For large shrimp farm owners, shrimp means dollars and social mobility. Shrimp farming is certainly appealing to many large-scale agriculturalists because of its short-term high economic benefits in the context of decreasing income from crop cultivation. The large landowners who are capable of investing a lot of capital in shrimp farming, have transformed into large shrimp farm owners. While a portion of the resource-poor farmers turned their agricultural land into small shrimp farms, others sold their land to the major owners, and

⁹ Public Distribution System.

¹⁰ A mother from the Dalit hamlet expressed her dejection (10/02/2022).

¹¹ As an adolescent girl in the hamlet explained (12/02/2022).

occupied the laboring work on these farms. This has created a major shift away in the land ownership pattern of the village and has resulted in fewer owners and more workers.

For small-scale shrimp farmers, shrimp means gambles and losses. They have become indebted to large shrimp farm owners for procuring feed and for marketing their products. The large farm owners monopolize them at the local level by integrating input supply and procurement chains, which deepens the vulnerabilities of small farm owners. When debt payments cannot be met, these small-scale shrimp farmers have no option for returning to agriculture, instead selling or give up their land to large shrimp farm owners.

For agriculturalists, shrimp is identified with pollution and infringement. Shrimp farming causes water scarcity due to the excessive use of bore wells, salinization of the soil and ground and surface water, and environmental pollution due to the use of pesticides and untreated runoff. Moreover, given current trends, unregulated shrimp farming will eventually lead to lower crop yields and permanent land degradation. Hence agriculturalists have limited options: abandon farming, or sell their land at deflated prices.

For Dalits, a shrimp is just a worm from the sea. They have been completely kept out of shrimp production, marketing and processing in the village. Their traditional livelihood has been completely lost with the decline of agriculture, forcing them to migrate from their village. The intersecting caste, class and gender structures position Dalit women as the most disadvantaged group within these power relations. Their environment has been strained, their subsistence way of living has been hindered, their informal rights in the local economy have been lost, and they have been pushed into a never-ending poverty spiral. The inherited vulnerabilities of Dalit women have been intensified by restricting their traditional land-based livelihood through the commodification of natural resources.

Drawing on insights from political ecology scholarship, Baglioni & Campling (2017) argues that there is a dialectical relation between environmental degradation and social inequalities, such that the different communities experience the degeneration of ecologies based on already existing social inequalities and this, in turn, generates new social contradictions which further intensifies land degradation and social inequalities. Shrimp farming in Tamil Nadu illustrates these dialectical relationships.

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