Impact of Shrimp Farming and Government Policy Implications on Rice Production in Navsari District of Gujarat, India

ABSTRACT

Aquaculture, especially shrimp farming, is rapidly expanding and crucial for meeting global seafood demand. In 2022, shrimp production hit 9.4 million tons. This industry provides significant employment and income, notably in India, where it supports over 14 million people. However, shrimp farming has environmental impacts, including mangrove degradation and freshwater depletion. In Andhra Pradesh, converting paddy fields to shrimp farms has led to soil salinization and reduced freshwater availability. The study "Assessing the Influence of Shrimp Farming on Rice Growers and Analyzing Policy Implications in Navsari District of Gujarat" examined rice growers' socioeconomic profiles, shrimp farming's impact on them, and policy implications. Data from 60 farmers revealed that most shrimp farmers are aged 31-40, own small land parcels, and have secondary education. Sixty-five percent reported increased soil and groundwater salinity, affecting crop productivity and environmental health. Policy analysis highlighted issues with subsidy access and untreated water discharge. Effective training schemes exist, but larger farms often neglect effluent treatment, causing environmental harm. Improved subsidy access, stricter effluent regulations, and sustainable practices are needed to balance economic benefits with environmental protection.

Keywords: *Shrimp, Aquaculture, Policy Constraints, rice growers, environmental impacts*

1. INTRODUCTION

Aquaculture worldwide has grown rapidly, and while this has undoubtedly brought benefits in the form of increased food supplies and employment creation, it has also been matched by concern over its environmental impact and sustainability. Expansion of marine aquaculture is seen as especially problematic, not least because it has to compete for resources and space with other coastal activities, and the scope for conflict generated by this growing pressure is thus considerable (Bailly and Paquotte, 1996) [1]

The shrimp farming industry is rapidly expanding due to high profits and strong demand in both national and international markets. Brackish water shrimp farming, in particular, boosts coastal economies. Since 1975, shrimp farming has significantly grown, previously holding just 2% of the global market. Coastal states in India, such as Gujarat, Andhra Pradesh, and West Bengal, are enhancing their economies through shrimp farming, benefiting from favourable ecological conditions. However, successful shrimp culture requires substantial maintenance, varying by species and farming methods (Das et al., 2020) [2]

The shrimp farming industry is rapidly expanding due to high profits and strong demand in both national and international markets. However, it has also had negative environmental impacts, including mangrove destruction and secondary salinization.

Its effects on rice cultivation are notable in Bangladesh and southern Indian states like Andhra Pradesh. Issues such as seepage, salt accumulation on the soil surface, and other related problems have been caused by shrimp farming.

Limitations and Challenges

Activities like fry catching, fry import, and pond construction contribute to mangrove destruction. Additionally, shrimp feed waste, water exchange, antibiotics, lime, and fertilizers make the water more vulnerable and unsuitable for other types of cultivation.

The study was conducted on the following objectives:
1.To study the perceived impact of shrimp farming on rice growers
2. Policies and their implications on shrimp farming in Navsari district

2. METHODOLOGY

2.1 Research Methodology

In Navsari district, a survey was conducted with a total of 60 respondents who are engaged in rice farming near shrimp ponds.

2.2 Analytical Tools

- Garrett's ranking technique [3]

Percentage position = $\frac{100\,(Rij-0.5)}{Nj}$

Where Rij = Rank given for the i^{th} variable by j^{th} respondents
Nj = Number of variables ranked by j^{th} respondents

- Weighted Average Mean [4]

Weighted Arithmetic Mean (X)= $\frac{(FIX1+F2X2+F3X3+F4X4+F5X5)}{Xt}$

Where, F = Weight given to each response
X = Number of responses
Xt =Total number of responses

3. RESULT AND DISCUSSION

3.1 Perceived Impacts of Shrimp Farming on Soil and Water

The study identifies farmers' perceptions of the effects of shrimp farming. Among the respondents, 65% agree that the soil in their farmland is saline and that the groundwater used for irrigation is also saline. Over the last decade, 65% believe that groundwater salinity has increased, and 62% are convinced that soil salinity has risen. However, only 37% reported an increase in their expenditure for soil amendment.

3.2 Perceived Impacts of Shrimp Farming on soil and water

Table 1. Perceived Environmetal Impacts of Shrimp Farming

Sr. No.	Attributes	WAM	Rank
1	Shrimp farming increases risk of salt-water intrusion	4.65	1
2	Shrimp farming causes secondary salinization of soil	4.03	2
3	Shrimp farming has led to destruction of mangroves	3.65	3
4	Shrimp farming has led to loss of biodiversity	3.36	4
5	Shrimp farming leads to pollution of water bodies due to release of untreated effluents	3.23	5
6	Shrimp farming has negatively affected traditional fishing	3.16	6
7	Shrimp farming has made groundwater saline	3.03	7
8	Shrimp farming has led to higher flooding risk	2.73	8
9	Shrimp farming leads to spread of new diseases	1.78	9
10	Shrimp farming leads to eutrophication	1.70	10

From the given statements, the farmers highlighted that shrimp farming increases the risk of saltwater intrusion, followed by secondary salinization of soil and destruction of mangroves. Additionally, many farmers pointed out that shrimp farming leads to a decline in biodiversity. Whereas, spread of new disease and eutrophication came in bottom of the table.

3.3 Reason of Salinity

Table 2. Reason of Salinity

Sr. No.	Attributes	Mean Score	Rank
1	Water logging in canal command areas	62.58	1
2	Sea-water Intrusion	55.36	2
3	Geogenic / Parent material	44.13	3
4	Secondary salinization due to shrimp farming	42.28	4
5	Climate Change	42.06	5

According to Table 2, waterlogging in canal command areas (62.58%) was the top concern among farmers, followed by seawater intrusion (55.36%), geogenic or parental material (44.13%), and climate change (42.06%), which received the least preference from farmers.

3.4 Indicators of Salinity

Table 3. Indicators of Salinity

Sr. No.	Attributes	Mean Score	Rank
1	Salt on soil Surface	64.73	1
2	Stunted Growth of leaves	57.6	2
3	Soil Tilth	42.28	3
4	Soil colour	36.38	4

According to Table 3, farmers identified salt on the soil surface (64.73%) and stunted growth of leaves (57.60%) as the major indicators of soil salinity.

3.5 Impact of salinity on livelihood

Table 4. Impact of salinity on Livelihood

Sr. No.	Attributes	Mean Score	Rank
1	Shift in cropping pattern	59.02	1
2	Loss of indigenous crops	57.97	2
3	Decline in crop productivity	56.53	3
4	Decline in cropping intensity	50.1	4
5	Decreased availability of drinking water and increase in cost of arranging the same	42.65	5
6	Shift to alternative livelihoods like shrimp farming	42.77	6
7	Decline in livestock population	40.97	7

To understand the impact of salinity on livelihoods, statements were given to farmers. The major impacts identified were a shift in cropping pattern (59.02%), loss of indigenous crops (57.97%), and a decline in crop productivity (56.53%).

3.6 Policy Constraints

Table 5. Different subsidies offered by Gujarat Government

Sr. No.	Name of scheme	Budget (lakh)	Information of scheme
1	Training for fisheries in brackish water	5	-
2	Purchase of Aerator	31.25	50% help
3	Pond construction for shrimp farming	30.75	On unit cost rupee 7 lakh's 50 %
4	Renovation of farm	25	Per ha rupee 20,000
5	Bird fencing and crab fencing	20	1. 5000 for (on unit cost of 10,000) basically 50% 2. 12,500 for (on unit cost of 25,000) basically 50 %
6	Shrimp Feed-Seed Purchase	90	1 ha 50% help (1.5 lakh for 3 lakh unit cost)
7	Infrastructure for shrimp farming	555.77	Road construction
8	See-weed culture	1	To develop employment options at seashore
9	Shrimp seed hatchery establishment	1	50% of total cost
10	ETS construction	1	50%

As shown in Table 5, there are substantial subsidies available for shrimp farmers, covering all major operations from training to harvesting. However, multiple issues hinder the implementation of these schemes. One major constraint is that only registered farmers are eligible for these subsidies. This excludes non-registered (illegal) farmers from benefiting.

Moreover, farmers need perfect invoices and acknowledgments for transactions, but most shrimp farmers operate on a credit system. They purchase everything on credit and settle payments after harvesting with shrimp feed agents, often without proper bills or digital transactions. As a result, these farmers are also excluded from receiving subsidies. Only a small number of farmers who have cash on hand can benefit from these subsidies.

The subsidy process is not farmer-friendly. Farmers must take geo-tagged photos at different stages like pond construction and seed stocking. While taking photos is easy, ensuring the presence of government officials is challenging, especially since stocking often occurs at night.

Additionally, a major setback for farmers in Gujarat is the high electricity charges. Unlike in Andhra Pradesh and Maharashtra, where electricity costs ₹4 per unit due to its classification as an agricultural operation, in Gujarat, it is considered an industrial operation, leading to higher costs that can turn potential profits into losses.

Samapore Village Ground Reality

In Samapore, there are numerous illegal or unregistered farms compared to other villages. One contributing factor could be the political influence wielded by the people of Samapore. Many of these farms are situated within eco-regions. Unlike other villages where the government takes swift action upon detecting illegal farms, the situation in Samapore is different. Some of these farms have been operating illegally since 1992, indicating their longstanding presence. These illegal farming activities primarily rely on diesel, as obtaining electricity requires a license from the Coastal Aquaculture Authority (CAA).

Effluent Treatment Scheme Reality

Farmers are entitled to a 50% subsidy for an Effluent Treatment Plant (ETP), with a unit cost of ₹11 lakh, amounting to ₹5.50 lakh (CAA, 2024). Despite this subsidy, none of the 60 farmers surveyed in Navsari district have installed an ETP, raising significant concerns. According to CAA guidelines, farms larger than 5 hectares are required to have an ETP, while smaller farms (less than 5 hectares) are recommended to set up a common Effluent Treatment System (ETS) based on 10% of the total water spread area. [6]

Notably, larger farms, particularly in Mendhar village, such as one with 150 hectares of land, do not possess an ETP. There is a pressing need for regulatory measures, as the survey indicates that despite profitability, farmers are neglecting the installation of ETPs. While it may be understandable for small farmers to face challenges in setting up ETPs, it should be mandatory for large farmers to comply.

The untreated industrial water is discharged into creeks, which are sometimes utilized by other farmers for shrimp cultivation, potentially containing toxic elements. This poses a significant environmental and health risk, highlighting the urgency for stricter enforcement of ETP installation regulations.

4. CONCLUSION

A significant majority (65%) of farmers reported salinity in their fields and groundwater, though only 40% saw increased soil amendment costs. Primary causes identified were waterlogging in canal command areas and seawater intrusion. Indicators of salinity, such as salt deposition and stunted leaf growth, were observed. Salinity has led to shifts in cropping patterns, loss of indigenous crops, and declines in crop productivity. Increased soil salinity, decreased rainfall, and low profitability of rice crops have influenced farmers to move away from paddy cultivation. Environmental impacts of shrimp farming include increased saltwater intrusion, secondary soil salinization, and mangrove destruction. In Navsari district, illegal shrimp ponds lack regulation, and mandatory Effluent Treatment Plants (ETPs) have not been established, leading to untreated water being released into the sea. Despite available subsidies, accessing these benefits is challenging due to lengthy application processes and strict proof requirements.

To address the ETP situation, the government could use geo-tagging and traceability to improve oversight and ensure compliance. Reviewing and updating subsidies to ensure sufficient budget allocation for all shrimp farmers is essential. Implementing new technologies can streamline the subsidy application process, making it more efficient and accessible. Intermediary solutions with feed agents can facilitate timely invoicing for farmers operating under the credit system, ensuring they are

not excluded from subsidies due to lack of documentation. Farmers can adopt Integrated Multi-Trophic Aquaculture (IMTA), cultivating multiple species like seaweed alongside shrimp. This method uses waste from one species as nutrients for another, improving water quality and reducing environmental impacts.

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