POLICY BRIEF #59

From Adversity to Opportunity:
Inland Shrimp Farming in Haryana

Authors:

RAYA DAS
SANCHIT GUPTA
ASHOK GULATI

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Raya Das
Sanchit Gupta
Ashok Gulati

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Abstract

Over-extraction of groundwater has led to increased soil salinity in India's north-western states, particularly in western Haryana, reducing crop productivity and making traditional paddy crop cultivation less viable. Since 2020, capital investment subsidies under the *Pradhan Mantri Matsya Sampada Yojana* (PMMSY) have encouraged farmers in Sirsa district, Haryana to adopt shrimp aquaculture as a high-value diversification strategy in saline-affected lands. This policy brief examines the economic viability, scalability, and sustainability of shrimp aquaculture in Haryana, drawing on primary field insights from Sirsa district and comparative evidence from West Godavari, Krishna and Kakinada districts in Andhra Pradesh, India's leading shrimp-producing state. The analysis reveals that in Sirsa, even with a single shrimp cycle per year, farm-level profitability is 4 to 5 times higher than the prevailing paddy-wheat cropping system. In contrast, Andhra Pradesh, where two shrimp cycles per year dominate records about 10 times increase in profitability compared to paddy–paddy cultivation. However, shrimp aquaculture entails substantially higher capital investment and working-capital requirements. Also, the risks are much higher and that makes the entry of new players difficult. Our risk simulation models estimate a high probability of farmers exiting the business due to production risks induced crop failures. This calls for better production system, access to finance, market, and insurance mechanism to be in place so that scaling up of shrimp farming can be viable. Policy measures such as local feed and processing infrastructure, vertical value-chain integration, IoT-enabled resource-use efficiency, and stronger FPO-led market access are essential to ensure long-term sustainability. If appropriately supported, shrimp aquaculture can transform salinity-induced agrarian distress into a high-value economic opportunity for farmers in Haryana.

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Author's email: *rdas@icrier.res.in, sgupta@icrier.res.in, agulati115@gmail.com*

List of Abbreviations

AAGR	Average Annual Growth Rate
ASC	Aquaculture Stewardship Council
BAP	Best Aquaculture Practices
BMP	Best Management Practices
CACP	Commission for Agricultural Costs and Prices
CGWB	Central Ground Water Board
CIFE	Central Institute of Fisheries Education
CSSRI	Central Soil Salinity Research Institute
EC	Electrical Conductivity
FAO	Food and Agriculture Organization of the United Nations
FPC	Farmer Producer Company
FPO	Farmer Producer Organisation
GPN	Global Production Network
ICAR	Indian Council of Agricultural Research
IoT	Internet of Things
ISW	Inland Saline Water
KCC	Kisan Credit Card
MMT	Million Metric Tonnes
MPEDA	Marine Products Export Development Authority
MT	Metric Tonnes
NABARD	National Bank for Agriculture and Rural Development
NACSA	National Centre for Sustainable Aquaculture
PIB	Press Information Bureau
PL	Post Larvae
PMMSY	Pradhan Mantri Matsya Sampada Yojana
PPT	Parts per thousand
RAS	Recirculatory Aquaculture System
SAS	Salt Affected Soils
SPF	Specific Pathogen Free
TE	Triennium Ending

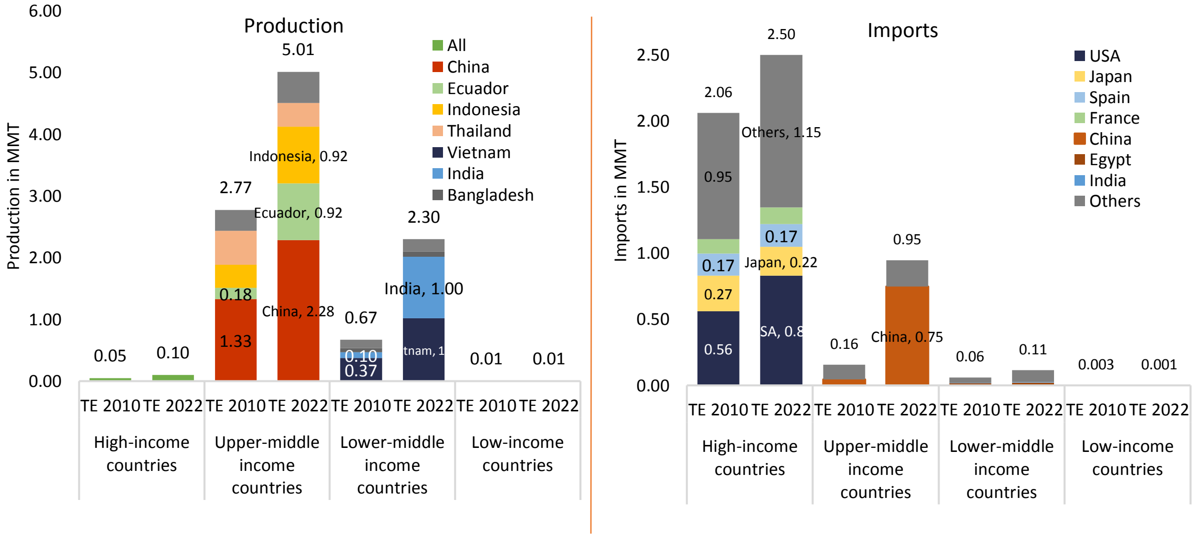
From Adversity to Opportunity: Inland Shrimp Farming in Haryana

Raya Das, Sanchit Gupta and Ashok Gulati

1. Introduction

Shrimp[1] is the second largest seafood product in global trade after salmon. The nutritional benefits of shrimp, which is high in protein, essential fatty acids, calcium, and micronutrients, continue to drive global demand. Valued at around USD 72.6 billion in 2023, the global shrimp market has grown quickly and is expected to increase at a rate of 6.6 percent annually through 2030 (FAO, 2023). Although demand is majorly concentrated in the Global North, most shrimp production is distributed in the Global South **(Figure 1).** Hence, shrimp farming has become a key source of rural jobs, income diversification, and growth in export-focused processing industries in Global South countries. From Triennium ending 2012 (TE 2012) to TE 2022, global shrimp production increased from 3.96 million metric tonnes (MMT) to 7.68 MMT, registering an average annual growth rate (AAGR) of 7 percent (FAO, 2023). This growth is primarily driven by the adoption of Specific Pathogen Free (SPF) *Litopenaeus Vannamei* (hereafter *L. Vannamei*) after disease outbreaks in *Penaeus monodon*, the dominant Asian shrimp species, in the late 1990s. Globally, production of *L. Vannamei* grew from 0.28 MMT in 2001 to 6.83 MMT in 2022 with an AAGR of 21.3 percent, accounting for 83 percent of global farmed shrimp production today (FAO, 2023). This species can survive across a wide range of water salinity levels, making it suitable for brackish water and potentially suited for inland saline ground waters (ISW) offering significant livelihood resilience opportunities (Ansal & Singh, 2025).

Figure 1: Global Shrimp Trade Dynamics: Production in the Global South, Consumption in the Global North



Source: FishStatJ, FAO

[1] Shrimps can be farmed or wild caught. Within all farmed species of shrimp, Litopenaeus Vannamei (L. Vannamei) dominates with an 83 percent share in farmed production globally and almost 95 percent share of India's shrimp exports. This brief's focus is *L. Vannamei* (also called whiteleg shrimp or pacific white shrimp).

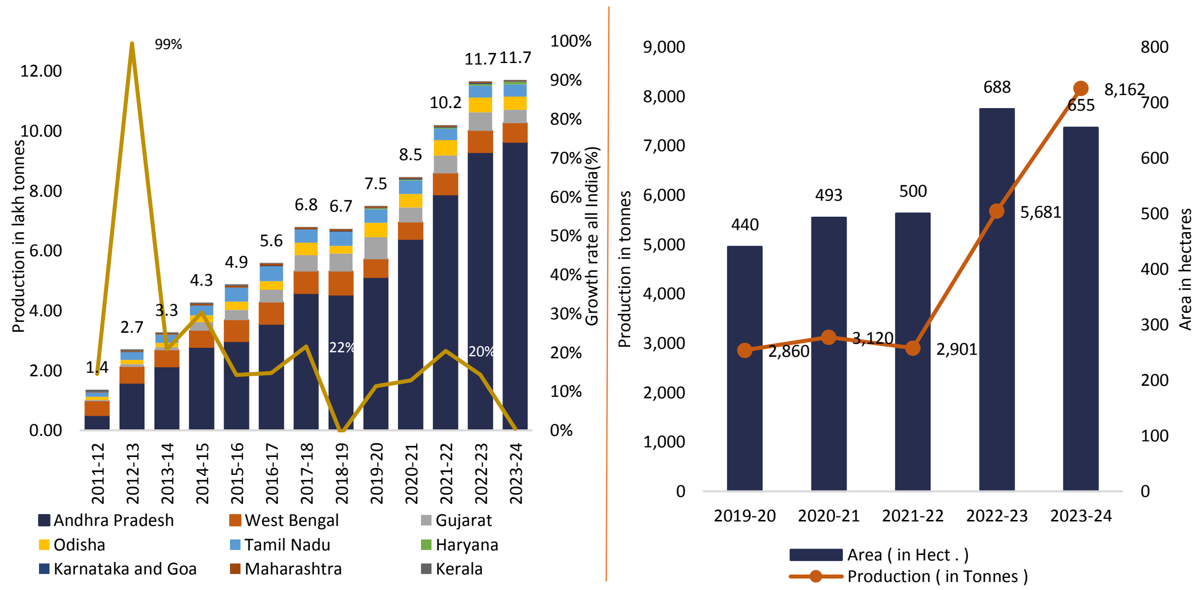
In India, the government approved imports of *L. Vannamei* broodstock in 2009, with large-scale farming starting in 2011, surpassing global growth rate thereafter. This species has better yield, feed conversion efficiency, and survival in semi-controlled environments compared to the traditional *Penaeus monodon* (black tiger shrimp) leading to its widespread adoption. In 2022, India had become the second largest shrimp exporter in the world following Ecuador (FAO, 2023) but recently the sector is coping with Trump's punitive tariffs and tracing alternative export markets (Das, Gupta, & Gulati, 2025).

Global production network (GPN) of farmed shrimp value-chain is largely integrated, with US as the primary developer and supplier of broodstock to the production clusters in Global South countries. Within these countries, value chains are sufficiently integrated enabling farmers to reap export opportunities (Shrimp Insights, 2022). Global market for shrimps is competitive and demands technological adoption at every stage of value chain particularly in production systems and management practices such as RAS (Recirculatory Aquaculture Systems) shrimp farming, temperature-controlled shrimp industry in China, use of IOT (Internet-of-things) feeders, aquavoltaics for aerators, and waste water treatment. This translates into large investment requirements and need for a component of vertical integration in the value chain.

In India, Andhra Pradesh has led the expansion of *L. Vannamei* shrimp production in the brackish waters of the Krishna-Godavari Delta, developing into a major cluster, supported by public subsidies and robust private sector participation across the value chain. With the launch of *Pradhan Mantri Matsya Sampada Yojana* (PMMSY) in 2020-21, the momentum has extended into non-traditional regions like Haryana, where shrimp culture is gaining ground **(Figure 2)**. Sirsa district in Haryana—bordering Rajasthan—has emerged as a pioneer in inland saline aquaculture, supported by institutions such as Central Institute of Fisheries Education (CIFE) at Rohtak. The district has been declared as a dedicated cluster for inland saline aquaculture by the central government (PIB, 2025).

The key question is whether the adversity of low crop yields caused by soil salinity in Haryana can be transformed into an opportunity for small farmers by diversifying towards shrimp aquaculture. We examine this by understanding and drawing lessons from the inclusivity in prevalent business models in Andhra Pradesh value chain and estimate and compare farmers' profitability and its sustainability in the Haryana context. This policy brief aims to outline strategic directions for sustainably scaling up shrimp aquaculture in salinity-affected regions of Haryana and list out key challenges and potential solutions that need to be considered for an enabling policy environment for small farmers.

Figure 2: State-wise shrimp production in India (left) and Production in Haryana (right)



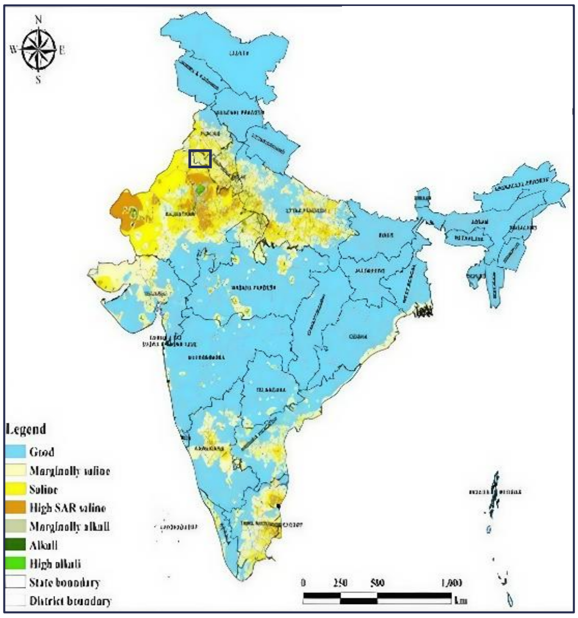
Source: MPEDA and Statistical handbook, Haryana

2. Turning Adversity into Opportunity: What is the scope?

Soil salinisation, a major constraint to agricultural productivity in arid and semi-arid regions, is increasingly threatening India's agrarian economy. Of the 6.74 million hectares of salt-affected soils (SAS) in India, 2.2 million hectares are in Rajasthan, Punjab, Bihar, Uttar Pradesh, and Madhya Pradesh. Haryana alone accounts for 2.32 lakh hectares, much of which suffers from secondary salinisation due to decades of groundwater over-extraction and canal irrigation since the Green Revolution leading to seepage and waterlogging (CSSRI, Chopra & Krishan, 2014). In districts like Sirsa, Fatehabad, and Hisar, high salinity levels (EC > 3000 µs/cm) render conventional crop agriculture increasingly unviable (CGWB, 2024). Amid this adversity, shrimp aquaculture offers a transformative alternative. Recognizing this, pilot initiatives by the CIFE and Haryana's Fisheries Department in the 2010s demonstrated that inland saline lands could match coastal shrimp productivity, achieving 7–8 tonnes/ha/cycle (ICAR, 2014). This success catalysed government support through PMMSY, which helped convert marginal lands into profitable aquaculture clusters.

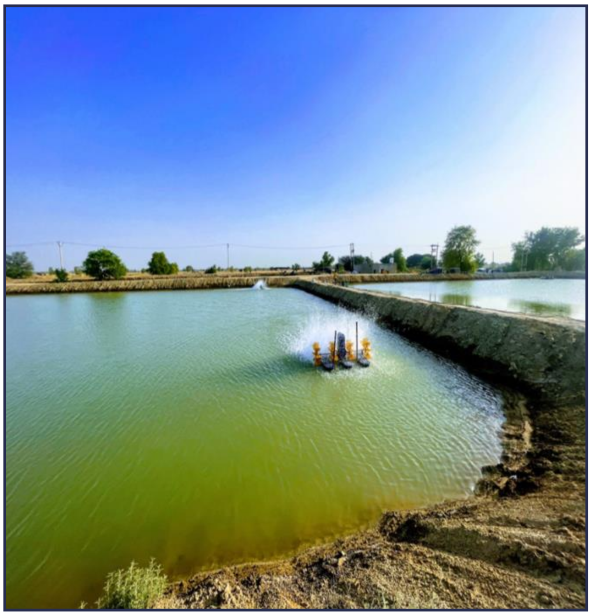
The case of Sirsa district is an important case illustrating this diversification **(Figure 3a and 3b)**. Between 2020–21 and 2023–24, shrimp farming in Sirsa expanded from just 18 ha to 678 ha, with production increasing five-fold (as reported by the District Fisheries Department). The region's saline groundwater (5–20 ppt) and loamy soils are ideal for shrimp culture, enabling average net profits of INR 5.2 – 8 lakhs per hectare per cycle, significantly outpacing returns from traditional wheat-paddy or wheat-cotton crop systems.

Figure 3a: Groundwater Map for irrigation purposes highlighting Sirsa Cluster



Source: CSSRI Press Release 2024

Figure 3b: Aquaculture Site Sirsa, Haryana



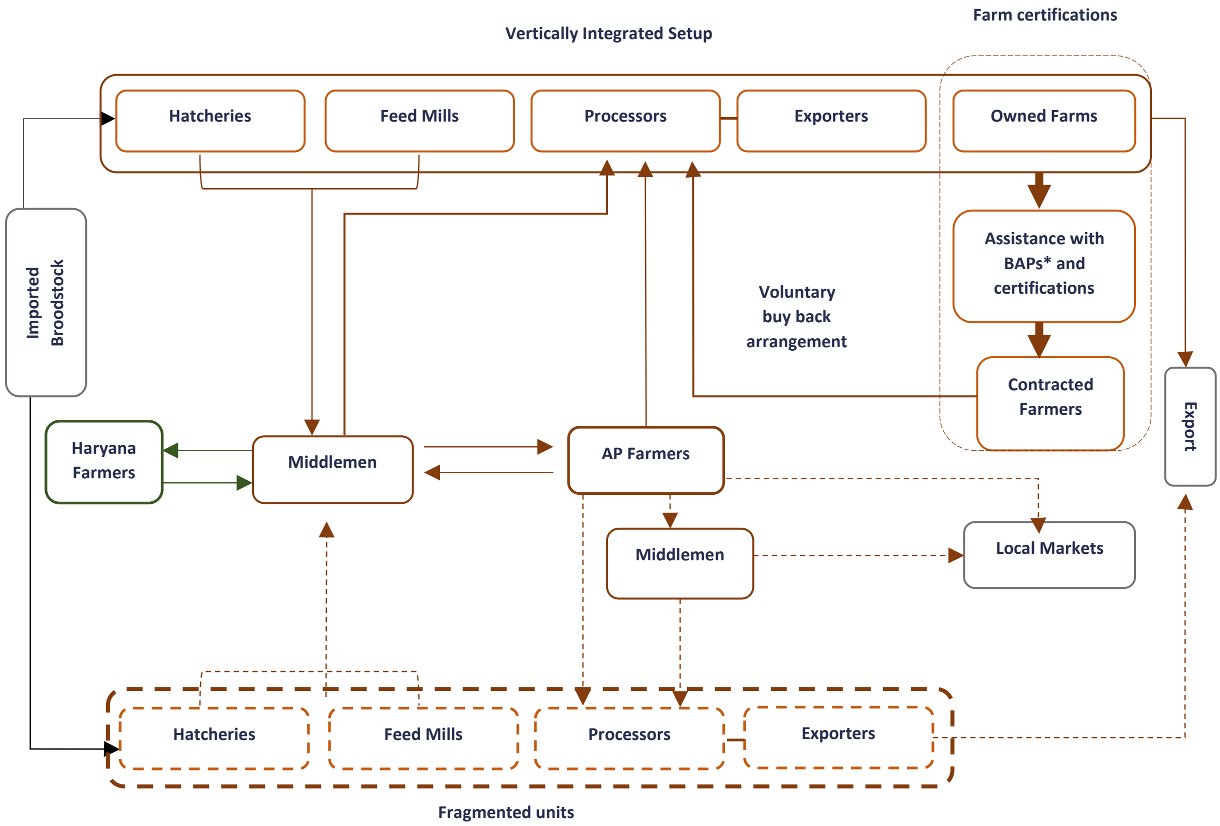
Source: Captured by authors, April 2025

Sirsa serves as a scalable cluster model for Haryana, where total output reached 8,162 MT in 2023–24. Despite the promising gains, infrastructure gaps remain. Sirsa lacks local hatcheries, feed mills, processing units, and nurseries requiring inputs to be sourced from the coastal states. However, the establishment of three cold storages and a testing lab marks early progress. Crucially, inland shrimp farming also presents a scalable model for climate-resilient livelihoods and inclusive rural employment. A single hectare generates up to 32 jobs across the value chain. Nationally, the inland shrimp sector has the potential to create 18.24 lakh production-linked jobs, with an additional 1.7 lakh at the pond level. If just 25 percent of Haryana's ISW area is harnessed, it could generate over 20 lakh livelihood opportunities. Inland saline aquaculture, thus, is not merely a coping mechanism for degraded lands it is an opportunity for agricultural diversification, green economic transition, and sustainable rural transformation in ecologically fragile zones of India. To provide meaningful policy direction for scaling up shrimp aquaculture in Haryana, it is essential to understand the structure and dynamics of the shrimp value chain in Andhra Pradesh. As the leading state in shrimp production, Andhra Pradesh offers critical lessons in institutional support, infrastructure development, and value-chain integration, while also highlighting the need to remain mindful of environmental consequences through effective regulatory oversight and adoption of sustainable practices.

3. Andhra Pradesh Leads India's Shrimp Sector: What lessons can be drawn?

Shrimp is the second largest agricultural export from India with Andhra Pradesh as the leading state. Because of the comparatively cheaper labour force, frozen peeled shrimp (major exporting variety with a 56 percent share) from India is competitive globally. In 2023-24, Andhra Pradesh with 0.96 MMT accounted for 82 percent of India's total farmed shrimp production (MPEDA, 2024). In terms of *L. Vannamei* production, the share is higher at 87 percent. The state's dominance is driven by its entrepreneurial history in fisheries inducing robust private participation in shrimp value chain, geographic advantage of the brackish waters of the delta, established hatcheries, and government support; overtime incentivising large private investments into developing vertically integrated value chains (Belton, Padiyar, Ravibabu G, & Rao K, 2017).

Figure 4: Value chain map of shrimp Andhra Pradesh vs. Haryana



**Best Aquaculture Practices*

Source: Authors' own depiction

Over the last decade, Andhra Pradesh has developed an ecosystem for shrimp aquaculture, anchored by a dense network of over 360 hatcheries, more than 30 feed mills, thousands of small and large farmers, and integrated processors-exporters. The state dominates India's shrimp seed supply, with 79 percent of total hatcheries, offering genetically diverse PLs (post-larvae) suited to regional climatic conditions. Shrimp feed, accounting for 45–60 percent of total farming costs, is supported by large and medium feed mills supplying through more than 2,000 dealers (Shrimp Insights, 2022). Demand for stringent traceability and sustainability standards from major importing countries and efficiency requirements induced from global competition have led to successful development of vertically integrated channels in the state as well.

However, the market is not entirely vertically integrated like Ecuador, it has both integrated and fragmented channels **(Figure 4)**. Integrated firms like Devi Seafoods and Sandhya Aqua demonstrate how structured input-output linkages, certifications compliance (ASC[2], BAP), and technical assistance to farmers can improve traceability, better market access, and consequently higher profitability. Sandhya Aqua's full integration from hatchery to export and Devi Seafoods' flexible contract farming highlight two viable yet contrasting approaches. Key lessons include the importance of traceability, farmer training, and decentralized processing. However, contract farming in vertical integration generates incentives for reducing transaction costs and hence excluding small farmers (Swinnen & Maertens, 2007). Vertical integration nevertheless brings in required infrastructure and augments income for the participants (Birthal, Joshi, & Gulati, 2005).

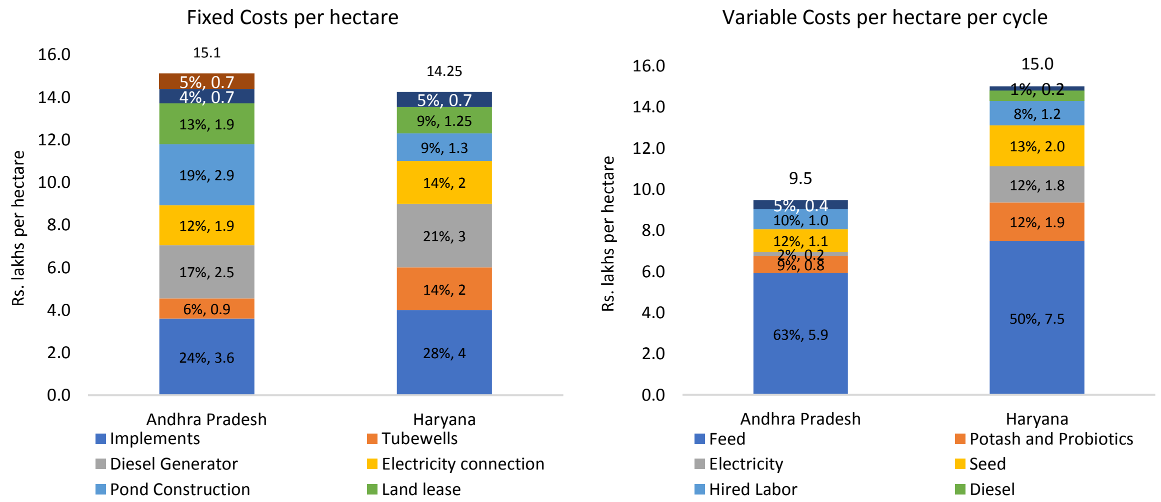
This infrastructure is essential in Haryana for maintaining competitiveness. There are constraints to developing hatcheries inland as of now due to certain ionic properties of sea water that are essential to broodstock spawning. But, private investments in remaining infrastructure will pour in only with sufficient production in the region guaranteeing economic feasibility of those projects. In Andhra Pradesh, farmers with culture area of less than 2 hectares have led this revolution. Overtime they have partially integrated themselves in the export value chains. Dealers or middlemen have complemented this integration. But most importantly, farmers have learned by doing and learned amongst themselves (Foster & Rosenzweig, 1995) the best management practices for meeting export quality standards. However, it is not the case that the farmers in Andhra Pradesh face no challenges. Shrimp farming by its nature is a high investment, high risk and high reward activity. Access to formal and cheap credit significantly improves economic sustainability. Experience and technical know-how of this culture is key to reducing risks (Umesh, et al., 2008). Lack of training and extension services to new farmers increases risks of failure of initial crops pushing farmers into debts, business exit and more likely, both.

4. Is Shrimp Aquaculture Economically Viable in Haryana?

For export competitiveness, shrimp aquaculture in Haryana needs to compete with Andhra Pradesh and other coastal states. Shrimp aquaculture in Haryana faces critical economic constraints due to elevated input costs and logistical disadvantages. While fixed capital investments per hectare are comparable to Andhra Pradesh, variable costs in Haryana are 58 percent higher (**Figure 5**)**.** The principal cost drivers are feed, seed and electricity.

[2] Aquaculture Stewardship Council

Figure 5: Fixed (left) and Variable (right) Costs in shrimp farming in Andhra Pradesh and Haryana



Source: Interviews with farmers and stakeholders on the field

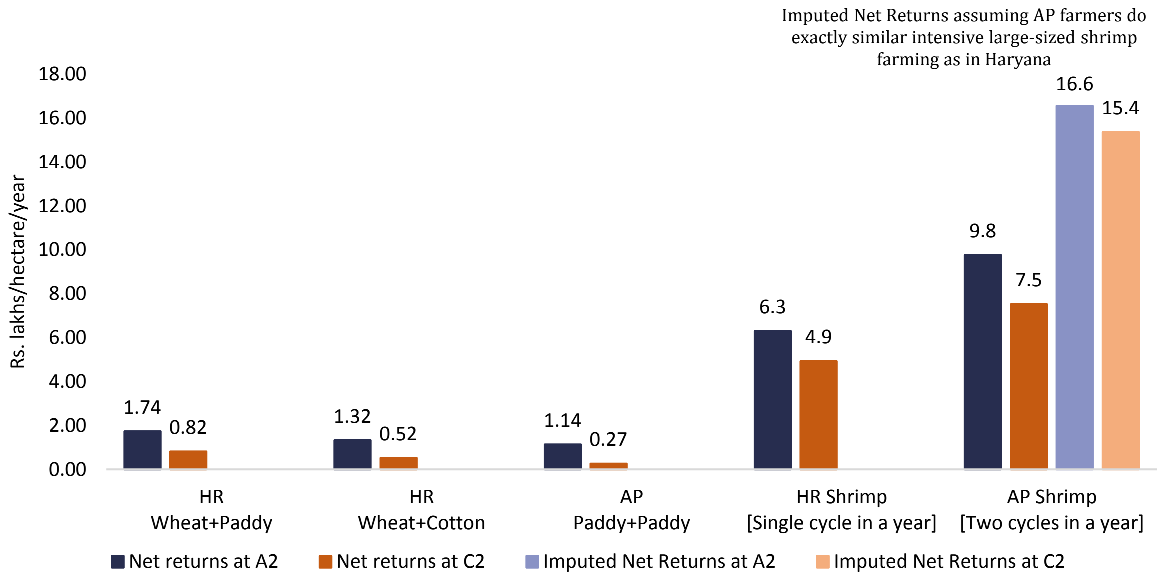
Shrimp farmers in Haryana face significant cost disadvantages due to dependence on Andhra Pradesh for feed, seed, and processing—incurring a round-trip distance of about 4,500 km. This logistical overhead adds INR 20–30 per kg to production costs and undermines competitiveness. Feed constitutes 50 percent of total variable costs per cycle in Haryana and is 12 percent higher per kg than Andhra Pradesh, accounting to INR 1.6 lakhs more per cycle per hectare. Our field result indicates that seed cost is almost double in Haryana compared to Andhra Pradesh. Post-larvae (PL 9–12 days) in Andhra Pradesh are priced at INR 0.30 to 0.35 per unit, whereas in Haryana, farmers pay INR 0.60 to 0.65 per unit, largely due to reliance on distant hatcheries and associated air freight. Another major cost difference is due to electricity. Haryana farmers incur average electricity expenditures of INR 1.8 lakh per hectare per cycle, compared to INR 0.25 lakh per hectare per cycle in Andhra Pradesh. The disparity arises from both higher unit charges and greater energy requirements due to groundwater extraction and intensive aeration requirements. Andhra Pradesh state government provides subsidized electricity to aquaculture farms at INR 1.50 per unit[3], Haryana shrimp farmers typically pay subsidized rates of INR 4.65 per unit under FPO pricing. Aquaculture farmers in Haryana are not treated at par with crop farmers in terms of electricity subsidization. These structural disadvantages reduce the price realization and profit margins of Haryana farmers. Due to the absence of localised processing units, shrimp harvested in Haryana is sold to buyers in coastal states at a lower price often INR 30 to 50 per kilogram less than prevailing rates in Andhra Pradesh for comparable sizes and quality.

The absence of local processing units increases post-harvest losses and reduces freshness, impacting price realization by farmers. Farmers rely on dealers for input credit, but this

[3] Andhra Pradesh government is supplying power at power tariff of Rs. 1.5 per unit for all aquaculture farms with an area up to 10 acres, located in notified aqua zones, and other farms at Rs. 3.86 per unit (PIB, 2025)

informal system adds transaction costs and increases financial risks, especially in the event of crop failure. The lack of processing infrastructure, assured market linkages, and lack of value addition limits farmer bargaining power, and creates high vulnerability to price fluctuations or disease shocks.

Figure 6: Profitability Comparisons between crop cultivation and shrimp farming in Andhra Pradesh and Haryana



Note: Shrimp profits calculated at A2 and C2 costs from data collected during our field visits to Sirsa, Haryana and three districts in Andhra Pradesh. Sample not representative of population. Numbers verified from diverse stakeholders during the field visits. Net returns for crops calculated through data from CACP 2025-26 Kharif and Rabi reports (CACP, 2025-26)*. Data for paddy and cotton for TE 2023-24 and for wheat TE 2022-23.*

Nonetheless, inland shrimp farming continues to offer higher economic returns relative to traditional cropping systems. Inland shrimp aquaculture stands out for its income potential—offering returns that far exceed those from wheat, cotton, or paddy. A single cycle of shrimp farming in Haryana yields an average net return of INR 6.3 lakh per hectare, compared to INR 1.32 to 1.74 lakh from the wheat-cotton or wheat-paddy systems, respectively, based on Commission for Agricultural Costs and Prices (CACP) estimates. Shrimp farming offers a higher absolute scale of profitability (**Figure 6**).

However, profitability from shrimp culture is determined through various factors apart from costs, like targeted shrimp size, risk exposure, management practices, credit availability, market access and price volatility. There is a need to consider all associated factors that disincentivises farmers to diversify to shrimp culture.

5. Understanding Risk in Inland Aquaculture: Lessons from the Field

Shrimp cultivation, as discussed, is capital intensive and susceptible to multiple vulnerabilities. Field evidence suggests that one out of every five cycles in Haryana faces failure due to either biological or market shocks. Several structural and operational challenges underlie these risks. First, the high capital requirement acts as a formidable entry barrier. Access to affordable and timely credit remains a systemic challenge, especially for high-risk ventures like aquaculture. In Sirsa, few banks do provide working capital loans on owned land at general interest rates of around 10-12 percent per annum. Second, disease outbreaks can entirely wipe out a crop, making risk management a critical concern. Third, most farmers in Haryana are first-generation shrimp farmer, lacking the technical know-how and experience of their coastal counterparts. Fourth, the state's geographical distance from coastal aquaculture hubs reduces farmers' bargaining power due to the absence of proximate hatcheries, feed suppliers, and processing units.

To assess whether profitability is sustainable under these conditions, we undertake a Monte Carlo–based financial risk simulation comparing shrimp farming outcomes for Haryana. The simulation models 1,000 farmer-level scenarios over a five-year horizon and incorporates production risks, credit scenarios, and insurance coverage. We simulate five cycles over five years with one random crop failure. In Haryana, high variable costs make shrimp farming particularly vulnerable to shocks. A single crop failure can wipe out INR 10–15 lakhs in working capital, with an additional INR 15 lakhs needed to restart the next cycle. Even a successful subsequent harvest may not fully offset previous losses, forcing farmers to rely heavily on borrowing. As a result, 19 percent of farmers in our simulation exit the business over a five-year period.

There are three important points to understand in the simulation results. First, high variable costs which we discussed above. Second, number of cycles in a year. Andhra Pradesh farmers have 10 cycles to earn, optimise and recover losses although they face two shocks. Haryana farmers depend on single cycle a year, however interests need to be paid annually on borrowings. Third, the year in which a farmer faces shock. For Haryana farmers, a shock in the first or even second year is disastrous. In our simulation, a farmer who faces shock in the first year has a 0.68 probability of exiting the business over the five years while a farmer who faces shock in the fifth year has a 0.02 probability of exit.

This section presents two contrasting case studies that show how farmers' perception about production risks that affect their profitability. The cases highlight how adopting the Best Management Practices (BMPs) can help reduce yield losses and trace causes of farmer distress.

Case study I

Sumitra Devi, a resident of Karamsena village near the Rajasthan border in Sirsa, Haryana, transitioned from paddy farming to shrimp aquaculture after returning home during the COVID-19 pandemic. Rising soil salinity made traditional farming unviable, prompting her and her husband to explore shrimp farming—an innovative alternative enabled by government schemes and social networks.

In 2021, she began farming *L. Vannamei* shrimp over 2 acres, investing INR 14 lakh, of which INR 8.35 lakh was subsidized under PMMSY. Her first cycle yielded 25-count shrimp at INR 500/kg, generating profits of INR 12–13 lakh. Despite a 40% price drop in 2022–23, she expanded operations to 15 acres by 2024, maintaining viability through adaptive strategies and timely reinvestment. With survival rates of 70 percent and yields of 3.5–4 tonnes/acre, she sells to buyers from Gujarat, Odisha, and Andhra Pradesh. In 2023, she adopted IoT-based auto-feeders supported by NABARD and reduced feed and labour costs by 15–20 percent. Labour demand declined from 7–8 to 3 persons per cycle.

Facing early resistance as a woman entrepreneur in a male-dominated and predominantly vegetarian society, Sumitra gained acceptance through her success. Today, she is an active FPO member, benefiting from collective input procurement, knowledge sharing, and reliable seed sourcing. Despite challenges like high input costs and absence of local hatcheries or processing units, her crop management and credit linkages—especially with feed supplier Sheng Long Bio-Tech—ensure consistent operations and timely repayments due to the short shrimp cycle.

She has also created over 10-12 jobs. Her story exemplifies how farmers can overcome ecological adversity with livelihood diversification, adoption of BMPs, and accessing institutional networks, offering a replicable model for inland aquaculture-led livelihood transformation.

Case study II

Risk in inland shrimp farming arises from inherent uncertainties in biological production, market prices, and environmental factors. However, vulnerability reflects a farmer's exposure to these risks without adequate capacity, knowledge, or institutional buffers to absorb shocks and recover sustainably. The experience of Kuldeep Singh, a smallholder farmer from Badhaguda block in Sirsa district, illustrates this crucial distinction. Kuldeep Singh, a smallholder from Badhaguda block in Sirsa, Haryana, began inland shrimp farming in 2020, transitioning from wheat and cotton. Encouraged by early profits of INR 10 lakh from a polyculture model (shrimp and carp), he rapidly expanded to 12 acres by leasing land at INR 50,000/acre. However, in 2022, his operations faced complete crop failure—mortality exceeded 90 percent, and shrimp size remained suboptimal due to poor biosecurity, absence of diagnostic testing, and lack of technical know-how.

To recover, Kuldeep borrowed INR 30 lakh from a commercial bank at 11.2 percent interest, guaranteed by family assets. Despite reinvestment, his 2022-23 crop cycle coincided with a global shrimp price crash and further production losses. By 2023, he was forced to suspend operations under a debt burden of INR 60 lakh. Though he resumed shrimp farming on a smaller scale in 2024 with INR 15 lakh, his income remained volatile. He relied increasingly on Indian Major Carp cultivation, which provided modest but consistent returns of INR 1.13 lakh per hectare per cycle.

Kuldeep's case highlights the dangers of rapid expansion without adequate risk mitigation. Key vulnerabilities included lack of early warning systems, absence of processing infrastructure, over-reliance on distant hatcheries, and limited institutional support. The experience underscores the need for targeted policy interventions—such as BMP training, access to crop insurance, cluster-based diagnostics, and investment in local processing—to reduce systemic vulnerabilities in emerging inland aquaculture zones.

6. Environmental Considerations in Haryana

The first and primary consideration is of groundwater extraction. According to the National Compilation on Dynamic Ground Water Resources of India (2024) report prepared by Central Ground Water Board (CGWB), the total current annual groundwater extraction is 12.72 billion cubic metres (bcm) and annual extractable ground water resource is 9.36 bcm, i.e., stage of ground water extraction stands at 135.96 percent. Out of the total worthy recharge area in the state, 66.7 percent is classified as either over exploited or critical. But these statistics are for dynamic fresh groundwater resources which are annually replenishable.

Shrimp farming requires saline waters with salinity ranging from 5-25 ppt. According to the report on Aquifer Mapping and Management Plan of Sirsa district in Haryana (2017), the in-storage saline ground water resources up to fresh-saline interface[4] is estimated at 1.78 bcm while below fresh-saline interface, the saline water resources are estimated to be 26.3 bcm up to 300 metre depth. The concern is then not of volume of ground water utilised but its treatment after extraction.

Expansion of shrimp culture requires environmental regulations especially regarding saline water drainage and seepage to adjacent crop fields. Haryana needs to learn from the 1998-2006 case of Kolleru Lake in Andhra Pradesh where saline water aquaculture led to high salinity in adjacent soils triggering Supreme Court's intervention (CSE, n.d.). Some scientific studies are needed to determine the extent of saline water seepage from shrimp ponds to the ground water table and policy should incentivize farmers to adopt poly lining techniques to minimise these seepages. Regulation should be put in place regarding treatment of used saline water before drainage.

7. Policy Recommendations Matrix

	Intervention Points	Policy Gaps	Status	Recommendations
Production	Two crop cycles a year	Lack of extension services leaves gap for farmers' adoption of two cycles per year which is crucial for viability of investments in value chain infrastructure		Training for farmers incentivizing two cycles per year by adaptation of nursery bio-floc management.
Input Market	Feed	Absence of local feed mills		(50K–100K MT) to bring costs down up to INR 2 lakhs per cycle for farmers. Incentivise private investment in local feed mills

[4] The zone of contact between freshwater (e.g., rain-fed recharge) and saline water (e.g., seawater, deep mineralized water) in underground aquifers.

	Electricity	No comprehensive plan to incentivise solar powered aerators to bring down costs. Government subsidy on solar for aquaculture is ~60% of project cost.		A sustainable solution lies in the adoption of solar-powered aeration systems, which can significantly reduce electricity costs.[5]
Finance	Credit	Poor access to institutional credit. Leasehold land cannot be collateralised.		Expand KCC access and limit for aquaculture.
	Insurance	No crop insurance due to high risk in shrimp aquaculture		Undertake studies to estimate the willingness-to-pay for insurance and bundle credit and insurance. Replicate successful aquaculture insurance models from Andhra Pradesh
Risk	Price Risk	Farmers are price takers. Dependent on middlemen and Andhra Pradesh markets. Information asymmetry.		Market information systems for price discovery. Promote forward contracts and vertical integration models similar to AP.
	Production Risk	Lack of BMPs (biosecurity, stocking density, aeration, feed, physical barriers/nets, checking consumption pattern of shrimp). Lack of lab and diagnostic support		Specialised and targeted trainings. Fortified feeds to address K deficiency. Incentivise use of automatic feeder or feed trays than manual broadcasting. Incentivise investments in labs.
Environment	Waste water treatment	No mapping of salinity-prone zones for aquaculture. Possibility of uncontrolled saline water intrusion and drainage into crop fields.		Aquaculture zoning. Establish regulatory authority. Use of poly-lining to control seepage.
Value-	Processing	No processing unit leads to low price realisation at farmgate. Travel to coastal states deteriorates quality for exports.		Incentivise private investments in processing. Approach established firms. Export via Gujarat ports, decreasing travel distance.
Inclusivity	Shrimp FPC/ FPOs	Small farmers face informational asymmetry in prices, access to markets, technical information, technology adoption, best management practices, and low bargaining power. Currently one FPO is present with 190 farmers, mostly used to avail electricity subsidy.		Support functioning FPO, with potential for scale-up. Integration with market. FPC business driven model and processing unit expansion.

Source: Compiled by authors

[5] Aerators account for 55 percent of the INR 1.3 lakh electricity cost per crop cycle in shrimp farming. Installing a 10-kW solar system—priced at INR 6.5 lakh and subsidised up to 60 percent—is a viable option to reduce farmers' operational costs, with a payback period of 2–3 years.

8. Conclusion

The expansion of inland shrimp aquaculture in Haryana's salinity-affected regions offers a viable pathway to augment farmer's incomes and repurpose degraded lands. Government support through capital investment subsidies up to 60 percent of project costs under PMMSY has boosted the initial shift. While some farmers have successfully scaled up operations, others have struggled to sustain the enterprise due to risks in production, financial constraints, and market access. For shrimp aquaculture to be a viable and inclusive solution, higher investment in value-chain infrastructure and a policy framework that promotes environmentally and economically sustainable aquaculture is essential. This policy brief, drawing on extensive field visits and multi-stakeholder consultations, outlines key directions for scaling up inland shrimp farming in Haryana.

Immediate policy focus should be incentivizing private investments in key value chain infrastructure like processing units, feed mills, cold storages, etc. At the farm level, increasing access to institutional credit, extension services for multiple production cycles, adaptation of BMPs are essential to reduce production risks. Equally important is the establishment of environmental safeguards and real-time water quality monitoring systems to ensure ecological sustainability. Strengthening FPCs for credit linkages, risk insurance, export market integration will be instrumental for scaling sustainable inland aquaculture and transforming it into a resilient livelihood option for farmers.

References

Ansal, M. D., & Singh, P. (2025). Shrimp Farming in Salt-Affected Degraded Lands in the North-Western Inland States of India: A Lucrative Savior to Be Saved. In P. Singh, A. Singh, A. Tyagi, & S. Benjakul, *Shrimp Culture Technology: Farming, Health Management and Quality Assurance* (pp. 37-55). Springer Nature.

Belton, B., Padiyar, A., Ravibabu G, & Rao K, G. (2017, March). Boom and bust in Andhra Pradesh: Development and transformation in India's domestic aquaculture value chain. *Aquaculture, 470*, 196-206. doi:https://doi.org/10.1016/j.aquaculture.2016.12.019

Birthal, P. S., Joshi, P., & Gulati, A. (2005, April). Vertical Coordination in High-Value Food Commodities: Implications for Smallholders. *MTID Discussion Paper No. 85*. IFPRI Division Discussion Papers.

CACP. (2025-26). *Price Policy for Kharif Crops: The Marketing Season 2025-26.* Commission for Agricultural Costs and Prices (CACP), Ministry of Agriculture and Farmers Welfare, GoI. Commission for Agricultural Costs and Prices (CACP), Ministry of Agriculture and Farmers Welfare, GoI. Retrieved from http://cacp.da.gov.in/

CGWB. (2017). *Report on Aquifer Mapping and Management Plan, Sirsa District, Haryana.* Government of India, Ministry of Water Resources, River Development and Ganga Rejuvenation. Northwestern Region, Chandigarh: Central Ground Water Board.

CGWB. (2024). *National Compilation on Dynamic Groundwater Resources of India.* Government of India, Central Ground Water Board, Department of Water Resources, River Development and Ganga Rejuvenation. Faridabad: CGWB.

Chopra, P. R., & Krishan, G. (2014). Analysis of Aquifer Characteristics and Groundwater Quality in Southwest Punjab, India. *Jornal of Earth Science and Engineering, 4*, 597-604. doi:10.17265/2159-581X/2014.10.002

CSE. (n.d.). *Cases on Protection of Lakes*. Retrieved from Centre for Science and Environment: https://www.cseindia.org/cases-on-protection-of-lakes-2564

CSSRI. (n.d.). *Extent and distribution of salt affected soils in India.* Retrieved from ICAR - Central Soil Salinity Research Institute: https://cssri.res.in/extent-and-distribution-of-salt-affected-soils-in-india/

Das, R., Gupta, S., & Gulati, A. (2025). *India's Shrimp Exports: Coping with US Tariffs.* Indian Council for Research on International Economic Relations. Retrieved from https://icrier.org/publications/indias-shrimp-exports-coping-with-us-tariffs/

FAO. (2023). *Food and Agriculture Organisation (FishStatJ)*. Retrieved from https://www.fao.org/fishery/en/statistics/software/fishstatj

Foster, A. D., & Rosenzweig, M. R. (1995, Dec.). Learning by Doing and Learning from Others: Human Capital and Technical Change in Agriculture. *Journal of Political Economy, 103*(6). doi:https://doi.org/10.1086/601447

ICAR. (2014, November 13). *Breakthrough in shrimp farming in inland saline areas.* Retrieved from Indian Council of Agricultural Research: https://icar.org.in/node/7152

MPEDA. (2024). *Marine Products Export Development Authority*. Retrieved from https://mpeda.gov.in/

PIB. (2025, March 12). *Intensive Aquaculture in Ponds and Tanks.* Retrieved from Press Information Bureau: https://www.pib.gov.in/PressReleasePage.aspx?PRID=2110680#:~:text=Government%20of%20Andhra%20Pradesh%20has%20reported%20that%20State%20Government%20is,3.86%2F%2D%20per%20unit.

PIB. (2025, July 10). *Union Minister Shri Rajiv Ranjan Singh, Ministry of Fisheries, Animal Husbandry & Dairying (MoFAH&D), launches 17 New Fisheries Clusters on the occasion of National Fish Farmer Day 2025 on 10th July 2025 at ICAR-CIFA, Odisha.* Retrieved from Press Information Bureau: https://www.pib.gov.in/PressReleasePage.aspx?PRID=2143904

Shrimp Insights. (2022, Dec). *The Global Shrimp Feed Manufacturing Landscape. A Helicopter Overview.* Retrieved from Shrimp Insights: https://www.shrimpinsights.com/blog/global-shrimp-feed-manufacturing-landscape-helicopter-overview

Swinnen, J. F., & Maertens, M. (2007). Globalization, privatization, and vertical coordination in food value chains in developing and transition countries. *Agricultural Economics, 37*(1), 89-102. doi:https://doi.org/10.1111/j.1574-0862.2007.00237.x

Umesh, N., Mohan, C., Phillips, M., Bhat, B., Ravibabu, G., Mohan, A. C., & Padiyar, P. (2008). Risk analysis in aquaculture – experiences from small-scale shrimp farmers of India. In M. Bondad-Reantaso, J. Arthur, & R. Subasinghe, *Understanding and applying risk analysis in aquaculture* (pp. 247-264). Rome: FAO Fisheries and Aquaculture Technical Paper No. 519.

Indian Council for Research on International Economic Relations (ICRIER)

Our Offices:
4th Floor, Core 6A, India Habitat Centre, Lodhi Road, New Delhi-110003

The Isher Building, Plot No. 16-17, Pushp Vihar, Institutional Area, Sector 6, New Delhi-110017

O: +91 11 43112400, **F**: +91 11 24620180 | **W:** www.icrier.org | **E:** info@icrier.res.in