

International Trade Barriers and the Aquaculture Industry in India: A Study with Reference to Andhra Pradesh

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Abstract

This paper studies how international trade barriers affect India's aquaculture industry, with particular reference to Andhra Pradesh, the state that accounts for the largest share of the country's farmed shrimp production. The study analyses secondary time-series data on India's frozen shrimp exports for 2019-20 to 2024-25, obtained from the Marine Products Export Development Authority (MPEDA), together with state-level export data for Andhra Pradesh and a case analysis of the tariff measures imposed by the United States in 2025. The analysis shows that shrimp export value has fluctuated far more than export quantity over the six-year period: export volume grew at a compound annual rate of about 2.6 per cent, while export value grew by only about 1.2 per cent a year, with unit value falling from US\$7.50 per kg in 2019-20 to US\$6.82 per kg in 2023-24 before a partial recovery. Andhra Pradesh contributed between 16 and 20 per cent of India's shrimp export quantity through its own ports in 2021-22 and 2022-23, a figure well below its 70 to 78 per cent share of national shrimp production, indicating that a large volume of state-grown shrimp is exported through processing and shipment points in other states. The 2025 episode, in which the United States imposed a duty disadvantage of about 20 per cent on Indian shrimp relative to Ecuador, is used to illustrate how an external tariff shock passed through to farm-gate prices in Andhra Pradesh even though the state's own export statistics understate its exposure. The paper concludes that Andhra Pradesh's vulnerability to trade barriers operates mainly through the farm-gate price channel and that market diversification, compliance infrastructure and cost competitiveness are the priorities for reducing this vulnerability.

Keywords: aquaculture, shrimp exports, non-tariff barriers, andhra pradesh, export competitiveness

1. Introduction

Aquaculture has become one of the most important components of India's fisheries economy. The sector contributes to food supply, export earnings, employment and rural livelihoods, and among aquaculture products, shrimp occupies a particularly important position because farmed shrimp is closely tied to international demand. India exported 716,004 metric tonnes of frozen shrimp worth US\$4.88 billion in 2023-24, a figure that alone accounted for about two-thirds of the country's total seafood export earnings of US\$7.38 billion (MPEDA, 2024a). This export orientation creates opportunities for income growth but also exposes producers and exporters to changes in foreign demand, exchange rates, tariffs and food-safety rules.

Andhra Pradesh is central to this export-oriented production system. The state accounts for an estimated 70 to 78 per cent of India's farmed shrimp output (Thriveni et al., 2022; Rajani &

Balasubramanian, 2025), produced mainly in the coastal districts of East and West Godavari, Krishna, Guntur and Nellore. More than a million families depend directly or indirectly on the sector in these districts. Because such a large share of national production originates in one state, changes in international market access are transmitted well beyond the exporting firms themselves: a fall in export demand or a rise in compliance costs can lower farm-gate prices and affect farmers' production decisions, while favourable market conditions can improve incentives for investment and employment.

International trade barriers may be broadly divided into tariff and non-tariff measures. A tariff raises the cost of imported products in the destination market. Non-tariff measures include sanitary and phytosanitary standards, residue limits, certification requirements, labelling rules, traceability requirements and inspection procedures. Some of these measures serve legitimate consumer and environmental objectives; however, when compliance is costly, unpredictable or applied unevenly across competing exporters, they can weaken the competitiveness of exporting countries relative to rivals such as Ecuador, Vietnam, Thailand and Indonesia.

This paper examines the relationship between international trade barriers and India's aquaculture industry, with a specific focus on Andhra Pradesh. Rather than treating trade barriers as a background theme, the paper uses six years of export data (2019-20 to 2024-25) and a recent tariff episode to trace how these barriers move through export volumes, export values and, ultimately, farm-level incomes in the state.

2. Literature Review

Trade theory generally treats tariffs as measures that raise the domestic price of imported goods and reduce the quantity traded, with the size of the effect depending on demand elasticity and the availability of alternative markets. For agricultural and seafood trade, however, non-tariff measures introduce a second and more complicated channel. Tran, Wilson and Anders (2011) show that veterinary drug residue standards imposed by the European Union, Japan and North America on crustacean imports function as a *de facto* zero-tolerance regime that raises compliance costs for exporting countries without necessarily improving safety outcomes at the margin. Kumar and Kumar (2003) similarly find that food-safety compliance costs fall disproportionately on smaller producers in India's fisheries sector, who lack the scale to spread testing and certification costs.

Import-rejection data provide a more direct measure of how these standards affect Indian shrimp specifically. Geetha et al. (2020), in a fifteen-year longitudinal analysis of shrimp consignments rejected by the United States, the European Union and Japan, find that India retained or expanded its market share in most destinations even as rejection episodes continued, but that the causes of rejection shifted over time from microbiological contamination toward veterinary drug residues. This pattern is consistent with more recent trade data: Suresh, Sabu, Kishore and Kumar (2025) document that non-tariff measures, particularly sanitary and phytosanitary requirements, remain the binding constraint on India's fishery exports even where tariff barriers are low, and argue that compliance infrastructure close to production clusters is now the primary determinant of export competitiveness.

At the state level, the evidence points to a production system that is technically efficient but exposed to price risk originating outside the farm gate. Thriveni et al. (2022), using a stochastic frontier approach on 80 shrimp farms in Nellore district, report mean technical efficiency of 93 per cent, suggesting that most productivity gaps arise from input use rather than technology. Shireesha and Prabakar (2024), studying shrimp culture in the Godavari districts, find that net income varies sharply by farm size, with larger farms far better placed to absorb cost shocks. Rajani and Balasubramanian (2025) show that shrimp count-price trends in Andhra Pradesh's export market were essentially flat or mildly declining between 2020 and 2023, a period that coincided with rising international competition and rejection episodes rather than any single domestic cause. Natale, Borrello and Motova (2015) find, using a gravity model of global seafood trade, that both tariff and non-tariff measures depress bilateral trade volumes but that non-tariff measures have historically been the larger constraint for developing-country seafood exporters.

Taken together, this literature establishes two points that motivate the present paper. First, non-tariff measures, not tariffs alone, have been the dominant channel through which trade barriers have affected Indian shrimp exports over the past decade. Second, while farm-level studies confirm that Andhra Pradesh's production system is efficient, none of the available studies connect the state's production dominance directly to its formal export statistics or to a specific tariff episode. This paper addresses that gap.

3. Research Gap

Existing studies examine either the national trade environment for Indian seafood or farm-level production economics within Andhra Pradesh, but rarely both together. In particular, the assumption that Andhra Pradesh's 70 to 78 per cent share of national shrimp production translates into an equivalent share of formally recorded exports has not been tested against port-level export data. This paper tests that assumption directly and uses the resulting gap, together with the 2025 United States tariff episode, to identify the specific channel through which external trade barriers reach Andhra Pradesh's aquaculture economy.

4. Objectives of the Study

- To examine the trend in India's frozen shrimp export quantity, value and unit value over 2019-20 to 2024-25.
- To compare Andhra Pradesh's share of national shrimp production with its share of nationally recorded shrimp exports, and to identify the channel this comparison implies for trade-barrier transmission.
- To assess, through the 2025 United States tariff episode, how an external trade barrier passes through to farm-gate prices and production incentives in Andhra Pradesh.
- To recommend measures for reducing Andhra Pradesh's exposure to future external trade shocks.

5. Research Questions

- How have India's frozen shrimp export quantity, value and unit value moved over 2019-20 to 2024-25, and what do these movements suggest about the relative role of tariff

and non-tariff barriers?

- Does Andhra Pradesh's share of nationally recorded shrimp exports match its share of national shrimp production, and if not, what does the difference imply about how trade barriers reach the state's producers?
- What policy measures would most reduce Andhra Pradesh's vulnerability to external trade shocks of the kind observed in 2025?

6. Research Methodology

The study follows a descriptive-analytical design based on secondary data. Export quantity, export value and unit value data for India's frozen shrimp exports were obtained from the annual export performance press releases and reports of the Marine Products Export Development Authority (MPEDA) for the six financial years 2019-20 to 2024-25 (MPEDA, 2020, 2021, 2022, 2023, 2024a, 2025). State-level export data for Andhra Pradesh for 2021-22 and 2022-23 were drawn from MPEDA figures reported in Rajani and Balasubramanian (2025). Data on the 2025 United States tariff episode, including the duty differential between India and Ecuador and the resulting shift in India's export markets in 2025-26, were compiled from MPEDA's provisional 2025-26 export release and contemporaneous news reporting on Andhra Pradesh's shrimp sector.

Three variables were used: export quantity in metric tonnes, export value in US dollars, and unit value in US dollars per kilogram, each computed on a financial-year basis. Year-on-year percentage change was calculated for each variable, and the compound annual growth rate (CAGR) was calculated over the full six-year period using the standard formula $CAGR = (\text{Ending value} / \text{Beginning value})^{(1/n)} - 1$, where n is the number of years. For Andhra Pradesh, the state's export quantity and value were expressed as a percentage of the corresponding national totals for the same year, and this figure was compared with the state's independently reported share of national shrimp production to identify the gap between production concentration and recorded export concentration.

The 2025 tariff episode was analysed qualitatively as a case illustration of the transmission mechanism set out in Section 9, linking the announced duty differential to reported movements in Andhra Pradesh's farm-gate prices and to the subsequent shift in India's export destinations recorded in the 2025-26 provisional data. The study does not attribute every movement in export performance solely to trade barriers: exchange-rate movements, global oversupply, disease outbreaks and feed costs are acknowledged as co-determinants and are discussed in Section 12 as a limitation of a descriptive, non-econometric design.

7. Data Analysis

7.1 Trend in India's Frozen Shrimp Exports, 2019-20 to 2024-25

Table 1 sets out export quantity, export value and unit value for India's frozen shrimp exports over the six-year period. Export quantity grew from 652,253 MT in 2019-20 to 741,529 MT in 2024-25, a compound annual growth rate of about 2.6 per cent. Export value grew far more slowly, from US\$4,889.12 million to US\$5,177.01 million over the same period, a compound annual growth rate of only about 1.2 per cent. The gap between these two growth rates is

explained by unit value, which fell from US\$7.50 per kg in 2019-20 to a low of US\$6.82 per kg in 2023-24, before recovering modestly to US\$6.98 per kg in 2024-25.

Table 1. India's Frozen Shrimp Exports, 2019-20 to 2024-25

Year	Quantity (MT)	Change in Quantity (%)	Value (US\$ Million)	Change in Value (%)	Unit Value (US\$/kg)
2019-20	652,253	—	4,889.12	—	7.50
2020-21	590,275	-9.50	4,426.19	-9.47	7.50
2021-22	728,123	+23.35	5,828.59	+31.68	8.00
2022-23	711,099	-2.34	5,481.63	-5.95	7.71
2023-24	716,004	+0.69	4,881.27	-10.95	6.82
2024-25	741,529	+3.57	5,177.01	+6.06	6.98

Source: Compiled from MPEDA annual export performance releases (MPEDA, 2020, 2021, 2022, 2023, 2024a, 2025).

The year 2021-22 stands out as the only year in which both quantity and value rose sharply together (+23.35 per cent and +31.68 per cent respectively), a period of exceptional global demand following the relaxation of pandemic-related restrictions. In every other year, value growth lagged quantity growth or value fell while quantity held steady, most visibly in 2023-24 when quantity rose by 0.69 per cent while value fell by 10.95 per cent. This pattern is consistent with the literature reviewed in Section 2: rejection episodes and tightening residue standards in the United States and European Union (Geetha et al., 2020; Suresh et al., 2025) coincided with oversupply from competing exporters, particularly Ecuador, compressing the price India could realise even as shipped volumes were sustained.

7.2 Andhra Pradesh's Position in the Export Economy

Table 2 reports Andhra Pradesh's own export quantity and value for the two years for which state-level, port-recorded data are available. In both years, the state's share of India's nationally recorded shrimp export quantity (16 to 20 per cent) is markedly lower than its widely cited 70 to 78 per cent share of national shrimp production (Thriveni et al., 2022; Rajani & Balasubramanian, 2025).

Table 2. Andhra Pradesh's Recorded Shrimp Export Performance, 2021-22 to 2022-23

Year	AP Seafood Export Quantity (MT)	AP Export Value (US\$ Million)	AP Share of India's Export Quantity (%)	AP Share of India's Export Value (%)
2021-22	267,166	2,291.64	19.51	29.53
2022-23	283,225	2,284.46	16.32	28.22

Source: Compiled from MPEDA state-level export data as reported in Rajani and Balasubramanian (2025); shares calculated by the authors against national totals in Table 1 and corresponding MPEDA seafood export totals.

This gap does not indicate that Andhra Pradesh's shrimp is somehow excluded from export markets. Rather, it reflects the structure of India's shrimp supply chain: a substantial volume of shrimp grown in Andhra Pradesh's ponds is transported to processing and export facilities in other states, so that the shipment is recorded against the exporting port rather than the producing state. The implication for this paper's central question is important. Because Andhra Pradesh's own trade statistics understate its true exposure to export markets, any trade barrier that affects national shrimp prices reaches the state's farmers through the farm-gate procurement price set by processors and traders, not through a channel that would show up in the state's own export figures. A trade barrier can therefore depress incomes across Andhra Pradesh's coastal districts even though the state appears, on paper, to account for only a modest share of the exports affected.

7.3 Case Illustration: The 2025 United States Tariff Episode

The clearest recent illustration of this transmission channel is the tariff measure imposed by the United States in 2025. Indian shrimp exporters faced a combined duty disadvantage of about 20 per cent relative to Ecuador, once a 5.77 per cent countervailing duty is added to the reciprocal tariff, at a time when the United States accounted for the largest single share of India's shrimp exports and roughly 92 per cent of India's marine exports to that market by value in 2023-24 (Deccan Herald, 2025). Andhra Pradesh, which supplies an estimated 75 per cent of the shrimp exported from India to the United States, was singled out in the state government's own representation to the central government as the region most exposed to the shock, with more than a million families across the East and West Godavari, Krishna, Guntur and Nellore districts affected. Reporting from the state indicates that farm-gate prices fell further in Andhra Pradesh than in other producing states following the tariff announcement (Global Indian Times, 2025).

India's exporters responded by diversifying away from the United States. MPEDA's provisional data for 2025-26 show that while the volume of shrimp exported to the United States fell by 19.8 per cent and its value by 14.5 per cent, exports to the European Union grew by 37.9 per cent, to China by 22.7 per cent and to Southeast Asia by 36.1 per cent, and India's total seafood export value nonetheless reached a record US\$8.28 billion for the year. This outcome supports

two conclusions relevant to Andhra Pradesh. First, the national trade system had enough alternative-market capacity to absorb a large tariff shock in aggregate. Second, the aggregate recovery does not by itself protect Andhra Pradesh's farmers, since the diversification occurred at the level of exporters and processors, whose sourcing and pricing decisions determine how much of the adjustment cost is passed back to the farm gate.

8. Major International Trade Barriers Affecting Indian Shrimp Exports

8.1 Tariff Barriers

Tariffs raise the landed cost of imported seafood in the destination market. Depending on demand conditions, exporters may absorb part of a tariff through lower margins, pass it through to buyers, or lose volume to competitors facing lower duties, as occurred in the 2025 episode described above. The burden is typically distributed across exporters, processors, traders and, as Section 7.2 shows for Andhra Pradesh, producers as well.

8.2 Sanitary and Phytosanitary Measures

Seafood is subject to strict food-safety controls because contamination can create public-health risks. Tran, Wilson and Anders (2011) show that residue-tolerance regimes in the United States, European Union and Japan operate close to a zero-tolerance standard for veterinary drugs, so that even trace-level detections trigger rejection or heightened inspection. Geetha et al. (2020) confirm that these detections, rather than tariffs, have been the recurring source of disruption for Indian shrimp shipments over the past decade, and rejections attributed to antibiotic residues in Indian consignments have continued to be reported by United States authorities through 2025 and 2026.

8.3 Traceability and Certification

Buyers increasingly require documented information on product origin, farm practice and supply-chain handling. Because, as shown in Section 7.2, a large share of Andhra Pradesh's shrimp passes through processing and export points located outside the state, effective traceability back to the farm requires coordination across state lines, not only within Andhra Pradesh's own supply chain.

8.4 Environmental and Labour Standards

Requirements on responsible aquaculture, chemical use, waste management and supply-chain transparency are becoming more prominent in importing-country markets. Meeting such requirements raises short-run costs but, as Suresh et al. (2025) argue, is increasingly a precondition for retaining market access rather than a discretionary quality upgrade.

9. Economic Transmission Mechanism

Table 3 summarises how a trade shock originating abroad moves through the supply chain to reach Andhra Pradesh, drawing on the evidence presented in Sections 7 and 8.

Table 3. Transmission of Trade Shocks to Andhra Pradesh

Trade Shock	Immediate Effect	Observed or Likely Andhra Pradesh Impact
Higher foreign tariff (e.g., 2025 US duty)	Higher landed price relative to competitors	Lower procurement demand and reported falls in farm-gate prices
Stricter SPS requirement or residue detection	Consignment rejection or increased testing cost	Higher transaction costs passed back to processors and farmers
Global oversupply from competing exporters	Falling unit export value despite stable volumes	Compressed farm-gate margins even without a new barrier
Market diversification by exporters	Alternative buyers found (EU, China, Southeast Asia)	Partial cushioning, but benefit depends on how exporters share gains with farmers

Source: Authors' compilation based on the data analysis in Sections 7 and 8.

10. Findings and Discussion

Three findings emerge from the analysis and carry directly into the paper's conclusions. First, the growing divergence between export quantity and export value in Table 1, especially the fall in unit value from US\$7.50 to US\$6.82 per kg between 2019-20 and 2023-24, shows that the binding constraint on Indian shrimp exports over this period has been price competitiveness under non-tariff pressure and global oversupply rather than a lack of foreign demand for volume. This is consistent with Suresh et al. (2025) and Geetha et al. (2020), both of whom identify compliance and rejection risk, not tariff access, as the dominant constraint in most years.

Second, the gap between Andhra Pradesh's 70 to 78 per cent share of national shrimp production and its 16 to 20 per cent share of nationally recorded exports (Table 2) means that state-level export statistics are not a reliable indicator of the state's exposure to trade barriers. Any policy analysis or future study that relies only on Andhra Pradesh's own port-recorded trade data will understate how strongly the state's coastal economy is linked to international shrimp prices.

Third, the 2025 tariff episode demonstrates that this exposure is not hypothetical. A duty disadvantage of about 20 per cent relative to Ecuador coincided with reported falls in Andhra

Pradesh's farm-gate prices even as national exporters, in aggregate, redirected volumes to other markets and India's total seafood export value reached a record high in 2025-26. The aggregate resilience of India's export sector should not be read as evidence that Andhra Pradesh's farmers were shielded from the shock.

11. Policy Implications

- Support market diversification at the exporter level in ways that also protect farm-gate procurement prices, rather than treating diversification and farmer income as automatically aligned.
- Expand testing, certification and traceability infrastructure within Andhra Pradesh's own producing districts, so that a larger share of the state's shrimp can be documented and exported without depending on processing capacity located in other states.
- Strengthen disease surveillance and biosecurity to reduce the production-side risks that compound the effect of external price shocks on farm income.
- Use trade negotiations to seek a predictable and non-discriminatory tariff treatment relative to competing exporters such as Ecuador and Vietnam.
- Promote value-added and diversified shrimp products so that a larger share of export earnings is retained within the processing chain rather than being exposed entirely to commodity frozen-shrimp pricing.

12. Limitations of the Study

The study relies on secondary, descriptive data and does not estimate the causal effect of any single trade barrier on Andhra Pradesh's farm income; a formal econometric approach using district-level or farm-level panel data would be required for that purpose. Export performance is also influenced by exchange rates, disease outbreaks, feed prices and global supply conditions that are not isolated from trade-policy effects in the descriptive comparisons presented here. The state-level export data used in Section 7.2 are limited to two years (2021-22 and 2022-23), the years for which comparable port-level figures could be obtained; a longer state-level series would strengthen the production-versus-export comparison. Future research using farm-level or district-level panel data, alongside a formal econometric model, could address these limitations directly.

13. Conclusion

India's frozen shrimp export quantity grew at a compound annual rate of about 2.6 per cent between 2019-20 and 2024-25, while export value grew at only about 1.2 per cent a year, as unit value fell under pressure from non-tariff compliance costs and global oversupply. Andhra Pradesh, which produces 70 to 78 per cent of India's farmed shrimp but is recorded as exporting only 16 to 20 per cent of the national total through its own ports, is more exposed to these pressures than its own trade statistics suggest, because most of its output reaches export markets through processing and shipment points located in other states. The 2025 United States tariff episode illustrates this exposure directly: a duty disadvantage of about 20 per cent relative to Ecuador coincided with farm-gate price falls in Andhra Pradesh even as India's exporters, in



aggregate, redirected volumes to the European Union, China and Southeast Asia and posted record total export earnings. The appropriate policy response is therefore not to rely on aggregate national export resilience as a proxy for farmer welfare in Andhra Pradesh, but to build compliance and processing capacity within the state itself and to pair market diversification with mechanisms that ensure farm-gate prices reflect a fair share of any market-level recovery.

References

- Deccan Herald. (2025, August). US tariffs: Andhra shrimp farmers stare at uncertainty; CM Naidu appeals to Centre. Deccan Herald.
- Geetha, R., Ravisankar, T., Patil, P. K., Avunje, S., Vinoth, S., Sairam, C. V., & Vijayan, K. K. (2020). Trends, causes, and indices of import rejections in international shrimp trade with special reference to India: A 15-year longitudinal analysis. *Aquaculture International*, 28. <https://doi.org/10.1007/s10499-020-00529-w>
- Global Indian Times. (2025, October). Can India's shrimp exporters overcome hit from US tariffs? Global Indian Times.
- Kumar, A., & Kumar, P. (2003). Food safety measures: Implications for fisheries sector in India. *Indian Journal of Agricultural Economics*, 58(3), 495-505.
- Marine Products Export Development Authority. (2020). Export performance 2019-20. MPEDA.
- Marine Products Export Development Authority. (2021). Export performance 2020-21. MPEDA.
- Marine Products Export Development Authority. (2022). Export performance 2021-22. MPEDA.
- Marine Products Export Development Authority. (2023). Export performance 2022-23. MPEDA.
- Marine Products Export Development Authority. (2024a). Export performance 2023-24. MPEDA.
- Marine Products Export Development Authority. (2024b). Annual report 2023-24. Government of India.
- Marine Products Export Development Authority. (2025). Export performance 2024-25 and provisional 2025-26 data release. MPEDA.
- Natale, F., Borrello, A., & Motova, A. (2015). Analysis of the determinants of international seafood trade using a gravity model. *Marine Policy*, 60, 98-106. <https://doi.org/10.1016/j.marpol.2015.06.007>
- Rajani, M., & Balasubramanian, A. (2025). Trend and seasonality analysis on international shrimp market prices exported from Andhra Pradesh, India. *Fishery Technology*, 62(2), 245-253.



- Renjini, K. K. V. (2016). Quantifying the effect of non-tariff measures and food safety standards on India's fish and fishery products' exports (ISEC Working Paper No. 375). Institute for Social and Economic Change.
- Shireesha, C., & Prabakar, C. (2024). A socio-economic analysis on shrimp culture (*Litopenaeus vannamei*) in Godavari districts of Andhra Pradesh, India. *Archives of Current Research International*, 24(12), 86-94.
- Suresh, A., Sabu, S. S., Kishore, P., & Kumar, P. S. (2025). Non-tariff measures and export of marine products from India: Trends and future prospects. *Current Science*, 128(4), 373-380. <http://dx.doi.org/10.18520/cs/v128/i4/373-380>
- Thriveni, K., Jayaraman, R., Senthikumar, V., Sujathkumar, N. V., Anand, C., & Ramana, T. V. (2022). Technical efficiency analysis of shrimp farms in Andhra Pradesh, India using stochastic frontier approach. *Indian Journal of Fisheries*, 69(2), 119-127. <https://doi.org/10.21077/ijf.2022.69.2.113857-14>
- Tran, N., Wilson, N. L., & Anders, S. (2011). Standard harmonization as chasing zero (tolerance limits): The impact of veterinary drug residue standards on crustacean imports in the EU, Japan, and North America. *American Journal of Agricultural Economics*, 94(2), 496-502. <https://doi.org/10.1093/ajae/aar094>