Antimicrobials, Shrimps and the Law: Recent Environmental Struggles around Aquaculture in India

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Abstract

In India, animal farming is often presented as the main cause of the development of Antimicrobial Resistance (AMR) in the environment. On top of being one of the pillars of global pharmaceutical production, India is also a major provider of food animals at the global scale. The importance of pharmaceutical manufacturing and the large scale of animal farming have turned the presence of antibiotic residues and resistant genes in the environment into a worrying phenomenon. In this paper, our team focuses on the shrimp industry in Tamil Nadu. Beyond AMR, shrimp cultivation has also been implicated in ecological degradation and the dispossession of local farmers, and has produced a landscape that visually invokes quite literal ruination. Due to the saline water that is piped in to fill shrimp ponds, soil salinity levels are often so high as to not only preclude any other farming activity, but also to kill trees and other remaining plant life. Multiple struggles have emerged in Tamil Nadu around this ruination and led to new legislation on coastal aquaculture and AMR in August 2023. This paper will focus on this new legal development and the controversies around it in Tamil Nadu, India.

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Introduction

Aquaculture has become the fastest growing sector of food production in the world.[1] Much like other sectors of animal husbandry, the farming of aquatic organisms relies on intensive practices. Animals are packed in small spaces of water, thus substantially increasing the risk of contagious diseases. To reduce this risk and to sustain the growth of the industry, antibiotics are widely applied, especially in low- and middle-income countries. Since there are no antibiotics specifically designed for aquaculture, authorised products developed for other areas of veterinary medicine are used. These drugs are most of the time mixed with feed ingredients in sub-therapeutic quantities to maintain water quality and reduce bacterial fauna. Some studies suggest that approximately 70–80% of the antibiotics applied in aquaculture are dispersed into water systems (Santos and Ramos, 2018). Aquaculture contributes to environmental antibiotic resistance through its connection with natural environments such as rivers, lagoons and mangroves, which then become reservoirs and dissemination routes for antibiotic resistance into humans. Studies from Bangladesh, India, Indonesia, and Thailand have reported antibiotic residues in aquaculture products and aquaculture water (Embeti et al., 2023; Vignesh et al., 2011).

In aquaculture, shrimp has been for many years the most highly traded food commodity by value.[2] The vast majority of shrimp production occurs in countries where the antibiotic infrastructure is widely unregulated. This aquatic pool-based industry offers many opportunities for human, animal and environmental bacteria to come into close contact, as untreated waste is directly eliminated into local water sources. The risks associated with shrimp farming are very different from those associated with salmon, the other major internationally traded aquaculture commodity, because salmon is produced in higher income countries and consequently subject to greater levels of regulation (Thornber et al., 2020). Assessing the true scale of the risk of AMR dissemination in the shrimp industry is a considerable challenge, because reliable data on antibiotic usage is scarce, but also because farmers currently have no easy alternatives to prevent crop failure. India is one of the largest exporters of shrimp, and the largest to the USA. The continued detection of salmonella and banned antibiotics in Indian shrimp by the US FDA draws attention to the development and spread of antimicrobial resistant pathogens in the shrimp farming industry. The southern states of Andhra Pradesh, Kerala and Tamil Nadu have emerged as multi-drug-resistant hotspots. However, neither resident and grassroots mobilisations nor research and development on the issue of AMR management have received much attention in the context of Indian aquaculture. This paper intends to fill this gap by assessing the current regulation and controversies around shrimp farming in India, with specific law cases and fieldwork sites in South India.

This article is part of a collective research effort that started more than a decade ago at the French Institute in Pondicherry (IFP) to work on coastal changes in South India. The authors of this paper have been involved in successive research projects hosted at the IFP and focusing on the evolution of the fishing industry and commercial activities on the south-east coast of India.[3] For this specific paper, we combined scientific literature, reports, and media from the past twenty years about aquaculture in India with ethnographic materials (interviews, site observations, informal conversations) collected between 2022 and 2025 at different fieldwork sites in Andhra Pradesh and Tamil Nadu, the heart of the Indian shrimp industry. In coastal villages in the Thiruvallur, Cuddalore, Nagapattinam, Pudukottai, Rameswaram, and Thoothukudi districts of Tamil Nadu, and along coastal villages of the West Godavari, East Godavari, and Kakinada districts in Andhra Pradesh, we interviewed forty individuals all directly involved in shrimp industrial activities. These in-depth conversations with owners, managers, technicians, and workers of hatcheries, shrimp farms, processing and export companies, researchers, and former officers of the Center for Brackishwater Aquaculture (CIBA) and the Marine Products Exports and Development Authority (MPEDA) contributed to our understanding

[1] https://www.fao.org/fishery/en/fishstat

[2] FAO, 'FishStatJ', 2020. [Online]. Available: https://www.fao.org/figis/pdf/fishery/statistics/

[3] Especially ANR FISHERCOAST Coastal transformations and fisher well-being (2019–2022) and ANR STATIC Sustaining the Antibiotic Infrastructure (2024-2027).

of each stage of the shrimp industry value chain. The environmental and socio-economic impacts of shrimp aquaculture were fleshed out through a dozen interviews with local agriculture farmers and fishers, activists, leaders, and villagers engaged in social movements and litigation around aquaculture in these two South Indian states.

This paper also seeks to contribute to an emerging field of research called 'social sciences of AMR' (Frid-Nielsen et al., 2019), which explores how uses are determined by collective structures such as public policies, markets, institutions, organisations, and professions. Like our colleagues, we think that the individual factors of antimicrobial overuse must always be thought of in relation to structural factors (Broom et al., 2021; Chandler, 2019). Their research shows that healthcare and agrifood systems have been built in such ways that they have become dependent on the overuse of antimicrobials (Kirchhelle, 2020; Podolsky, 2015). More generally, these studies highlight that this particular class of pharmaceuticals has been designed in many settings as a 'quick fix' for unsustainable modes of development guided solely by principles of efficiency, productivity and profitability (Willis and Chandler, 2019).

In line with the social sciences of AMR, we try to understand how antibiotic uses are determined by collective structures such as public policies, markets, institutions, organisations, and professions, and not only by individual behaviours. The first part of this paper focuses on the regulatory framework of shrimp farming in India. The second part analyses the recent environmental battles that led to a new set of rules for aquaculture in India, showing that the environmental debate is the only counterpart in the regulation of industrial aquaculture in India; AMR and associated health issues are not yet part of the conversation. The concluding part focuses on the very recent CCA amendment act, which displays a whole section on AMR regulation and governance. We demonstrate how changes in aquaculture regulation provide a remarkable illustration of the evolution of Indian environmental policy. Since the start of 'ecological modernisation', an institutional legacy of Indira Gandhi in the 1970s, the judiciary has taken on a policy-making role (Kohli and Menon, 2022). Aquaculture-related court cases, which we describe in the first part of the paper, became a forum for voicing the grievances of the community, and issued quasi-legislative remedies. Yet, these orders and innovative jurisprudence were not enough to curb the unbridled development of intensive shrimp farming. The story of shrimp farming regulation underscores that environmental law is not the fruit of a rational legislator but a battleground where competing values are negotiated among conflicting constitutional actors. The recent decisions show that ecological activism remains inspirational for the judiciary, but the story told here in the second part of the paper demonstrates that it can be easily circumvented by the government to protect industrial interests.

Part I – A Short History of Shrimp Farming in India

This part of the paper delineates the development of shrimp farming in India and the role of the state in the regulation of this industry, with a focus on the control of antibiotic use. The first subsection gives a broad outline of the conditions under which the production of shrimps has developed and has been promoted by the Indian government. The second subsection maps out the legal framework established to regulate this activity since the 1990s.

The Political Economy of Shrimp Farming in India

In the last four decades, Indian shrimp farming has transformed into a very lucrative industry. The ancestral tradition of aquaculture serving local consumption underwent a sea change and transformed into a profitable business catering to a growing global demand for shrimps. Since the 1970s, India has progressively established itself as one of the main exporters in this flourishing market, with an all-time high export figure in 2023.[4] The relationship between the shrimp economy and the Indian state is complex. The remarkable development of this industry owes much to the public authorities, which intensively incentivised shrimp farming through

[4] MPEDA, Annual Report 2022-2023, p 45, URL : https://mpeda.gov.in/?page_id=2365

research and development programmes as well as training schemes.

From Traditional Fishing to Industrial Shrimp Farming

Since 2014, the aquaculture industry has set this mark both in terms of value and export and has managed to establish a top position globally, next to China. A recent report released by the Ministry of Commerce and Industry notes a 26.73% increase in the quantity of exports and a considerable 4.31% hike in value during 2022–2023 compared to 2021–2022. India pegged an all-time high shipment of 711,099 MT of frozen shrimp, yielding a revenue of Rs 43,135.58 crore (US$ 5,481.63 million).[5] This figure provides a comparison of the significant growth the industry has attained from a position when India, for the first time in 1953, exported 13 tonnes of captured shrimp from Kerala to the United States (US) (Kurien, 1985). Over the years, total aquaculture production in India increased from approximately 0.63 million tons in 1985 to 7.8 million tons in 2019. In 2019–2020, the contribution of total cultured fisheries comprised 88%, of which 74% belonged to brackish water aquaculture.[6]

The global demand for Indian shrimp and the dearth of foreign exchange created a situation where economic operators could not rely solely on captured shrimp fishing, but rather gradually moved to cultured shrimp (Immanuel and Narayanan, 2022). During the initial period, when not many complicated processes in shrimp aquaculture were involved, broodstock were collected by fishers from the sea, creeks, or backwaters for local hatcheries, which then, after spawning, nurtured them until the post-larval stage and then distributed them to different shrimp farms for cultivation. The demand of the export market and target-oriented production to maintain it brought in many innovations, changes, and technical advancements. However, this soon resulted in practices of easy and faster profit-making. New technologies and the rush to cope with international competition brought in many adaptive processes, leading to poor and unregulated farm practices such as increasing the density of seed culture, crowding ponds along the coast, and giving less attention to the hygiene of the ponds (Salunke et al., 2020). In the 1990s, infections caused by viral diseases, especially white spot disease, forced operators to abandon shrimp farms in all coastal states, causing massive economic loss. This collapse of the industry did not last, however. New tolerant species were found to have a rapid growth rate and much more resistance to disease, and in the last ten years, India's seafood exports have flourished with an exponential increase.

With a Little Help From the Government

The remarkable development of industrial shrimp farming owes much to the Indian government. In the early 1970s, a major research effort to support aquaculture activity was launched, and shrimp culturing was given high priority (Silas, 2003). Under what was still a planned economy, a project on brackish water aquaculture was initiated during the Fifth Five-Year Plan Period (1974–1979). Since then, various schemes have been initiated, including surveys of potential areas for shrimp farming, pilot projects for testing technologies, and guidelines for state governments.[7] Externally aided programmes funded by agencies such as the United Nations Development Programme and the World Bank also contributed to the construction of facilities, either as demonstration centres or shrimp farms.[8] With the constant cries from industry apologists invoking daydreams of a blue revolution, large-scale studies, research projects and programmes devised strategic plans that encouraged targeted production. These recommended several decentralised training and extension programmes converting the brackish water resources of small-scale fishers to shrimp farms along the coast.

The research and programmes materialised into a separate research institution under the Indian Council of Agriculture Research (ICAR): the Central Institute for Brackish Water Aquaculture (CIBA) was established

[5] https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1932317
[6] https://www.fao.org/fishery/en/fishstat
[7] Aquaculture Authority, Shrimp Aquaculture and Environment: An Environment Impact Assessment submitted to the Supreme Court of India, 2001, 93 et seq.
[8] Ibid.

in 1987 to serve as a nodal agency for brackish water aquaculture in India.[9] The growing global demand for shrimps and the dearth of foreign exchange prompted attempts to grasp the possibilities of the world market by the Indian state, which intensively incentivised the overall industry and created a conducive environment for the production of shrimp aquaculture. Yet, the federal government initially fell short of regulating what quickly transformed from a traditional activity into a highly intensive industry. Indeed, according to the Indian constitution, the power to make laws on fisheries (and by analogy on aquaculture) belongs to the states, not the Union.[10] Eventually, as shrimps turned into an exportable commodity, the Union had to establish quality standards to meet the sanitary requirements of importing states. The observation of ecological devastation caused by coastal shrimp farming provided another opportunity for the federal government to establish a new public body in charge of aquaculture and mandatory guidelines under its environmental protection mandate. It did so under pressure from the Supreme Court of India, which banned non-traditional shrimp farming in India's coastal zone in a path-breaking decision in 1996.[11] The ruling was hailed by environmentalists but it dangerously threatened the industry and ran counter to development objectives (Puthucherril, 2016). Subsequently, the executive branch of the government and the Indian parliament collaborated to establish a fully-fledged regulatory framework in a series of damage control operations aimed at salvaging the shrimp economy.

The Regulatory Framework of Shrimp Farming

Shrimp farming is now the object of several statutes enacted by the Indian Parliament. It is also the subject of a flurry of secondary regulations, some very general, others narrower, laid down by the Central Government and public authorities established at the federal and state levels. While many of these rules have a national scope, such as those applicable to shrimps reserved for export, others only apply to specific areas. Thus, most Union environmental regulations regarding aquaculture only apply to activities carried out in brackish waters. Freshwater shrimp farming is to be dealt with by states, most of which lack provisions to safeguard sustainable inland aquaculture. The following paragraphs focus on the national framework designed to promote the development of shrimp exportation and the legal instruments which aim more generally at reducing the environmental impact of shrimp farming.

Export Regulation

The regulation of shrimp export finds its origin in two parliamentary statutes: the Export (Quality Control and Inspection) Act 1963, and the Marine Products Export Development Authority Act 1972. The former aims explicitly 'to provide for the sound development of the export trade of India through quality control and inspection'. It gives power to the Central Government to notify commodities which shall be subject to quality control or inspection prior to export, to specify the type of quality control or inspection which will be applied to a notified commodity, and to establish standard specifications for a notified commodity (Section 6). The latter provides for the establishment of the Marine Products Export Development Authority (MPEDA), the function of which is, inter alia, to fix standards and specifications for marine products for the purposes of export and to carry out inspection where such products are kept or handled, for the purpose of ensuring the quality of such products (Section 9). A series of regulations, orders and procedures have been established under these two parent statutes.

This legal regime only applies to the share of the shrimp industry devoted to export. It creates a de facto segregated market model whereby only aquaculture farms with an enrolment number provided by MPEDA can supply farmed shrimp for export. The registration is designed to ensure the traceability of produce from export-oriented aquaculture farms and comes with the obligation to abide strictly by all the guidelines prescribed by MPEDA, including the prohibition of any prohibited antibiotics or pharmacologically active substances

[9] https://ciba.icar.gov.in/
[10] Constitution of India, Art. 246 and Seventh schedule, List II: State List.
[11] S. Jagannath v Union of India [(1997) 2 SCC 87] (Jagannath)

notified by the Government.[12] To ensure that the exported shrimps meet the regulatory requirements of the importing countries, all export-oriented aquaculture farms are covered under a National Residue Control Plan (NRCP) designed to monitor the presence of residues of veterinary medicinal products. This plan is carried out by the Marine Products Export Development Authority and its regional division offices, which are responsible for collecting and analysing samples at processing establishments, aquaculture farms, hatcheries and feed mills. The plan contains documented procedures in case of non-compliant results.[13] It has been implemented since 1998 to comply with EU Regulation, which sets precise requirements to ensure the safety of aquaculture exported to Member States of the EU. In addition to the NRCP, establishments approved for export must also participate in two other residue monitoring programmes, namely the Pre-Harvest Testing and Pre-Export Testing programmes.

Coastal Protection Regulation

The other dimension of shrimp farming regulation is distinct from export policy. It has been designed in the wake of a coastal protection policy framed under the Environment (Protection) Act of 1986. In 1991, the Union government provided for the categorisation of the coast into different zones and prohibited various activities.[14] At the time, no mention of aquaculture was made, and the legal status of this activity remained shrouded in uncertainty. In a 1996 high-profile decision, the Supreme Court required the federal state to take action to protect the environment from the impact of shrimp farming.[15] An Aquaculture Authority was temporarily established in 1997 by the Ministry of Environment and Forests in order to deal with 'relevant environment issues pertaining to coastal areas with respect to shrimp culture'.[16] Parliament then passed the Coastal Aquaculture Authority Act 2005, which was complemented by secondary legislation issued by the Central Government. Some of these norms explicitly tackle the issue of AMR. For example, the Coastal Aquaculture Authority Rules 2005 have required the newly set agency to "fix standards for all coastal aquaculture inputs *viz*., seed, feed, growth supplements and chemicals/medicines for the maintenance of the water bodies and the organisms reared therein"[17] and to "direct the owners of the farm to carry out such modifications to minimise the impacts on coastal environment including stocking density, residual levels/use of antibiotics, chemicals and other pharmacologically active compounds"[18]. The rules have also authorised the Authority to "take samples of water, soil and the farmed animal for the purpose of detection of banned antibiotics (...) compounds and to adopt appropriate procedures for collection, analysis, reporting and follow up action."[19]

In addition, the rules contain guidelines stating that "antibiotic, and other chemical treatment should be done in accordance with recommended practices and all national and international regulations should be complied with."[20] The guidelines stressed that 'antibiotics can accumulate in the flesh of shrimp and represent a potential health hazard' and 'strictly prohibit' their use as this "might result in the development of resistance in human pathogens."[21] The guidelines then enumerate 20 antibiotics banned for use in shrimp culture and set Maximum Permissible Residual levels for various pharmacologically active substances. It is unclear to what extent these norms have had an impact on shrimp farming practice. In 2020, the Comptroller and

[12] Standard specifications for Fresh, Frozen and Processed Fish and Fishery Products as set out in Schedule I amended by Order S.O.722 (E) dated 10th July, 2002.
[13] Export Inspection Council, India National Residue Control Plan for Aquaculture Products - Year 2023, URL : https://www.eicindia.gov.in/WebApp1/pages/menuInfo/ResidueMonitoringPlans.xhtml
[14] Coastal Regulation Zone (CRZ) Notification, S.O. 114(E) 19th February, 1991.
[15] S. Jagannath v Union of India [(1997) 2 SCC 87] (Jagannath)
[16] Aquaculture Authority Notification, S.O. 88(E) 6th February 1997.
[17] Coastal Aquaculture Authority Rules, 2005, Section 5 (v).
[18] Coastal Aquaculture Authority Rules, 2005, Section 5 (xii).
[19] Coastal Aquaculture Authority Rules, 2005, Section 8 (1), Annexure I. 10.3 & Annexure I. 11.7
[20] Coastal Aquaculture Authority Rules, 2005, Annexure I. 10.3
[21] Coastal Aquaculture Authority Rules, 2005, Annexure I. 11.7

Auditor General of India[22] issued a compliance report on the Coastal Aquaculture Authority.[23] According to the supreme audit institution in India, the whole regulatory mechanism proved 'deficient':[24] the Authority did not set limits in respect of antibiotics and other inputs used in the process of shrimp production[25] and did not frame a proper plan for inspection and monitoring of shrimp farms.[26] These observations, along with continuing international scrutiny on the issue,[27] have undoubtedly contributed to maintaining the issue on the regulatory agenda, as evidenced by recent legislative tidying-up carried out by the Coastal Aquaculture Authority (Amendment) Act 2023 and the Coastal Aquaculture Authority Rules 2024 in supersession of the Coastal Aquaculture Authority Rules 2005.

Part 2 – When Zonation Takes Over Pollution: Strategic Ignorance and Environmental Controversies around Shrimp Farming in India

Divan and Rosencranz observed that 'the development of environmental law in the 1990s is largely the story of India's judiciary responding to the complaints of its citizens against environmental degradation and administrative sloth', showing the central role of social movements in driving legislative changes in India (Divan and Rosencranz, 2001, p. 110). When examining environmental struggles across industrial farming in India, resistance to genetically modified (GM) seeds stands out. Civil societies and farmers' movements have raised concerns about seed monopolies, agrarian distress and rising production costs while opposing Bt cotton (Shiva, 2000; Stone, 2012). Likewise, resistance to Bt brinjal culminated in a nationwide mobilisation involving farmers' movements, civil societies, academics and consumer collectives, resulting in a moratorium on its commercial release in 2010 (Herring, 2015). In contrast, there have been limited and fragmented struggles against industrial poultry farming in India (Narayanan, 2016).

The literature indicates that numerous struggles against industrial shrimp aquaculture have emerged in other parts of the world. For instance, the World Rainforest Movement[28] documents growing opposition to industrial shrimp aquaculture in Mexico. Similarly, the International Collective in Support of Fishworkers[29] reports on an open letter jointly issued by civil societies from multiple countries, protesting the WWF certification for shrimp aquaculture, which they argue legitimises the conversion of mangroves and coastal zones into industrial shrimp farms. This part of the paper sheds some light on the struggles that have happened in India between local people and civil societies on one side, and the shrimp aquaculture industry and its supporters on the other.

Broadly, there are three subsections in this part: the first subsection explores the production of knowledge around AMR and shrimp farming in India and its strategic (non)usage. The second subsection shows the influence of market forces on the legislature and the decline of civil society movements. The last subsection highlights local mobilisations and reasons for the enactment of the Coastal Aquaculture Authority (Amendment) Act,

[22] Mandated by the Constitution, the Comptroller and Auditor General is the supreme audit institution in India. It promotes accountability, transparency and good governance through auditing and accounting and provide independent assurance that public funds are being collected and used effectively and efficiently.

[23] Comptroller & Auditor General of India, *Union Government (Civil) Compliance Audit Observations*, Report No. 6 of 2020. URL : https://cag.gov.in/en/audit-report/details/112156

[24] Ibid. p. 14.

[25] Ibid. p. 20.

[26] Ibid. p. 25.

[27] See, for example, the European Commission (Directorate-General for Health and Food Safety) Final report of an audit carried out in India in order to evaluate the control of residues and contaminants in live animals and animal products including controls on veterinary medicinal products (DG(SANTE) 2022-7490) URL: https://ec.europa.eu/food/audits-analysis/audit-report/details/4607

[28] World Rainforest Movement. (2001, October 27). Mexico: Growing opposition to industrial shrimp farming. World Rainforest Movement Bulletin 51. https://www.wrm.org.uy/bulletin-articles/mexico-growing-opposition-to-industrial-shrimp-farming

[29] International Collective in Support of Fishworkers (ICSF). (2012, April 29). Thousands join industrial shrimp aquaculture protest: WWF standards denounced as greenwash. ICSF. https://icsf.net/newss/thousands-join-industrial-shrimp-aquaculture-protest-wwf-standards-denounced-as-greenwash/

2023. While assessing the politics behind this amendment, the existing data prove that the legislature has been continuing the act of diluting the progressive environmental verdicts of the judiciary.

AMR Knowledge Production on Aquaculture in India

A wide range of scholars from the social sciences have begun to explore the socio-political issues involved in the distribution and strategic uses of not knowing. The works of Lindsey McGoey on strategic ignorance and David Hess on undone science and social movements are helpful for understanding how some particular actors influence state priorities and research topics while also ignoring certain issues (which may, nevertheless, be seen as crucial by both local professionals and civil society organisations) (Hess, 2016). As they point out, the systems that produce ignorance and knowledge are interlinked: 'Ignorance in this historical sense is socially produced through underlying changes in the political economy of the scientific field' (Gross and McGoey, 2015, p. 142). Regarding AMR in aquaculture in India, we identified a tendency towards 'selective ignorance' – to produce or disseminate specific sorts of information about a topic or entity while failing to produce or emphasise other information about it (Elliott, 2015, p. 165) – and even forms of 'strategic ignorance' – deliberately not doing particular research (McGoey, 2014). Through the focus on overuse of antibiotics, antimicrobial resistance and antibiotic residues have gained some attention in the legislature (especially in the Union government) and the executive (such as the Department of Fisheries and the Coastal Aquaculture Authority); however, the discussion has not yet moved beyond human health into animal and environmental health.[30]

Furthermore, AMR-related research framed exclusively in technical terms – rather than social and political – can be a reason for weak national AMR governance. The current distribution of research funds is targeted at specific issues (antibiotic residues in exported shrimps, for instance), which does not favour a multi-pronged approach to strengthening the antibiotic infrastructure and research in India.[31] The lack of coordination and harmonisation between the different regulating authorities – as explained in this paper – also contributes to producing knowledge that is not the most relevant according to the local actors we met. Vishnu Bhat, a former joint director of MPEDA, told us that manpower and financial allocations for the Coastal Aquaculture Authority, the main regulating body, had been weaker in comparison to the MPEDA, the main export-promoting organisation in India.[32] The multiplication of 'verticalised' data systems run by different actors collecting information separately on antibiotic residues or water pollution can also contribute to the lack of consolidated knowledge on AMR in aquaculture in India. In short, the funding, methods, themes and fragmentation affect the very possibilities of AMR knowledge production on aquaculture in India.

Researchers, activists and lawyers we met during our fieldwork told us that the production of knowledge around the shrimp industry is fragmented and incomplete. For instance, Saravanan,[33] co-author of the 'Below the Radar' report,[34] highlighted that research on shrimp hatcheries is non-existent, as hatcheries are difficult to access and run by bigger industrial players than shrimp farms; consequently, the environmental impacts of these hatcheries are not documented. The Centre for Science and Environment carried out a study in which it documented widespread overuse and misuse of antibiotics in brackish water and freshwater aquaculture in West Bengal and openly accused the current framework of being only 'focused on export-oriented brackish-water culture' (Khurana and Sinha, 2016). Regarding the difficulties of researchers in India, Sunita Narain says that rather than research institutions, individual researchers 'who refuse to prostitute their science to suit the [interest of] industry' are directly attacked by industries filing multiple court cases against them – the aim

[30] Ministry of Health & Family Welfare, 'National Action Plan on Antimicrobial Resistance', Government of India, 2017.
[31] Abdul Ghafur., "Kerala takes a pioneering step to curb antimicrobial resistance," The Hindu, February 24, 2024. [Online]. Available: https://www.thehindu.com/sci-tech/kerala-takes-a-pioneering-step-to-curb-antimicrobial-resistance/article67878803.ece
[32] Bhat, personal interview, February 05, 2024.
[33] Saravanan, personal interview, November 25, 2023.
[34] Chaitanya, S.V. K., "Shrimp hatcheries along ECR operating without CRZ clearance, authorities turn blind eye: RTI," The New Indian Express, December 19, 2020. [Online]. Available: https://www.newindianexpress.com/states/tamil-nadu/2020/Dec/19/shrimp-hatcheries-along-ecr-operating-without-crz-clearance-authorities-turn-blind-eye-rti-2238468.html

here is not to obtain justice but to gag, threaten and intimidate knowledge producers (Narain, 2017, p. 34).

The representatives of civil society need this knowledge in order to build cases and challenge industries on solid grounds. In January 2024, a selective set of civil society representatives (from the National Fishworkers' Forum) organised a consultation in Chennai, Tamil Nadu, on the implications of the recent CAA amendment on shrimp aquaculture. The representatives came from different coastal states of India to discuss a subject that they had dealt with (collectively) about two decades ago, during the 1990s Jagannath case in the Supreme Court. One of us attended the consultation as a representative of the Coastal People's Right to Life Movement (CPRM). He was asked by the organisers to make a presentation on industrial shrimp farming and AMR, as many representatives were not aware of the issues related to AMR. The major themes of this gathering were zonation[^35] and the changes brought by the CAA amendment. Based on our observations during the meeting, civil society has a lot to catch up in terms of accumulating new knowledge around pollution and AMR and finding resources to mobilise and re-energise organisations. This movement, which was dynamic in the 1990s, looked worn out in 2024. Access to knowledge is not the sole reason for this fatigue; NGOs and civil society representatives are struggling in India because of structural and institutional reasons.

Influence of Market Forces

If state-led efforts to improve culture fisheries have been in existence since the late 1940s, the major momentum came in the 1990s in conjunction with the liberalisation of the Indian economy. This momentum is stated as the Blue Revolution 2.0, the second wave of the Blue Revolution of the 1960s. Importantly, both these revolutions catered to the development of the export economy of shrimp (Immanuel and Narayanan, 2022). The processes of capital accumulation have become more sophisticated in the last decade or so with the import of broodstock from corporations, the opening of hatcheries, and the expansion of the feed industry. Civil societies and left political parties were able to put forward diverse struggles, during the 1990s, against the interests of the capitalist class and for the rights of traditional farmers and fishers. As an example, Vandana Shiva accused the legislature and capitalist class, during that struggle, of undermining the judiciary, the constitution of India and environmental legislation in order to develop industrial aquaculture farms (Shiva, 1997). Stonich and Bailey also lamented that there was a concerted effort from the supporters of this industry (both at national and international levels) to undermine the judiciary and make the Indian Parliament bid on their behalf (Stonich and Bailey, 2000). These industrial pressures on the executive and the legislature are still very present and contribute to the recent success of industrial powers over the most recent litigation around aquaculture in India in 2023.

Fishing communities witness these pressures and local conflicts on a daily basis. Balu,[35] a local fisher from Ramanathapuram district, Tamil Nadu, informed us that the locals lacked the energy to build another movement against this industry, as the economic cost that they paid during the first wave was considerable. Further, he disclosed that this industry was able to financially influence bureaucrats (at various levels) and politicians (of different ideologies), including some leaders of left parties.[36] Similarly, there is written evidence of how economic powers make decisions on projects in ecologically sensitive areas. For example, the minutes of a meeting to frame regulations for hatcheries in 2014 clearly revealed that the Expert Group had caved in under the pressure of the Association of Shrimp Hatcheries. The buffer zone for opening/running hatcheries was reduced from 500 m to 200 m.[37] The same association has openly stated that the CAA Amendment, 2023, was brought primarily to circumvent the National Green Tribunal (NGT) verdict on hatcheries. This amendment allowed hatcheries to function on the beach front and removed the 200 m buffer zone that was there before.[38] The analysis of speeches made by legislators in Parliament during the passage of this amendment could further reveal the influence of the shrimp industry.

[35] His name is changed here as he does not wish to reveal his identity.

[36] Balu, personal interview, September 20, 2023.

[37] A reply to a Right to Information application, October, 2023.

[38] NavJeevan., "Shrimp hatchery industry welcome CAA Act amendment by Parliament," Navjeevan Express, August 11, 2023. [Online]. Available: https://navjeevanexpress.com/shrimp-hatchery-industry-welcomes-caa-act-amendment-by-parliament/

Since the beginning of the blue revolution, there have been two talking points that industry supporters systematically put forward: (1) aquaculture is an agricultural practice, and (2) it is a fundamental right of industrialists (Shiva, 1997). Except for a legislator from the Telugu Desam Party, all the others who spoke on the 2023 CAA bill repeated these talking points. Many said that this bill would benefit marginalised farmers and fishers. The lone legislator, Kanakamedala Ravindra Kumar, who spoke on the environmental issues of this industry, was castigated as an associate of foreign agencies who are working against the industrial growth of India. This accusation was made by the Minister of Fisheries, Parshottam Rupala.[39] The influence of supporters of this industry is visible through written traces, multiple examples and testimonies in the literature and through the interviews we conducted on this subject.

In the past two decades, the opposition has not been able to put together considerable struggles. There are various reasons for this situation. Looking at the efforts of civil society, especially NGOs, their condition has been dire for some years. The fear of scrutiny from the Union government by squeezing the flow of foreign funds is causing many not to venture into programmes related to environmental advocacy or rights-based mobilisation.[40] Using disinformation campaigns, industries are also able easily to paint civil society as evil entities. For example, the NGO that represented the above-mentioned NGT case was disparaged as follows:

> *"Some unscrupulous elements in the society interpreted this point in the CAA act in their favour and started threatening the hatcheries to extort money, though the hatcheries are licensed and monitored by the Coastal Aquaculture Authority."*[41]

Despite the importance of industrial interests and their upper hand over the legislature in the recent debates around aquaculture in India, environmental mobilisation has been important and should be acknowledged and analysed as a driving force of the recent court cases and judgements against the shrimp industry.

Zonation of Environmental Politics

The environmental mobilisation that happened in the year 2019 on the Coromandel coast seems to be the point of origin for the discussion on the enactment of the Coastal Aquaculture Authority (Amendment) Act, 2023. Locals from a few settlements in Tamil Nadu were protesting against the pollution from shrimp hatcheries, and their claims went to the National Green Tribunal (NGT) of the Southern Zone, where they received a favourable verdict.[42] A newspaper article exposing unauthorised shrimp hatcheries on the Coromandel coast played an instrumental role in the taking of the Suo Motu case by the NGT. This article used two sources: a reply to a Right to Information (RTI) application filed by Pooja Kumar and a report, 'Below the Radar', published by the Coastal Resource Centre, Chennai.[43] Saravanan, co-author of this report, told us that the impetus to write this report came from the environmental mobilisation in Chengalpattu district, Tamil Nadu, in 2019. He and Pooja came to know about these mobilisations through newspaper articles.[44]

Of the 65 hatcheries that this report studied, about 62 were functioning within 200 m of the High Tide Line, which is a violation under the provisions of the Coastal Aquaculture Authority Act, 2005. None of the hatcheries investigated obtained clearance from the authority of CRZ. Likewise, they did not obtain consent

[39] Supriya Vohra., "It's official: Aquaculture can now be practiced unabated across India's coastline," Fishy Water, August 11, 2023. [Online]. Available: https://fishy-waters.ghost.io/4-its-official-shrimp-farms-can-now-grow-unabated-across-indias-coastline/

[40] The Hindu Bureau., "'Increased scrutiny has put NGO sector under siege'," The Hindu, February 18, 2024. [Online]. Available: https://epaper.thehindu.com/ccidist-ws/th/th_chennai/issues/71772/OPS/GPVCE2V4T.1.png?rev=2024-02-18T01:14:13+05:30&cropFromPage=true

[41] NavJeevan., "Shrimp hatchery industry welcome CAA Act amendment by Parliament," Navjeevan Express, August 11, 2023. [Online]. Available: https://navjeevanexpress.com/shrimp-hatchery-industry-welcomes-caa-act-amendment-by-parliament/

[42] Owners of shrimp hatcheries have taken this case to the Madras High Court and received (temporary) injunction against this verdict.

[43] Chaitanya, S.V. K., "Shrimp hatcheries along ECR operating without CRZ clearance, authorities turn blind eye: RTI," The New Indian Express, December 19, 2020. [Online]. Available: https://www.newindianexpress.com/states/tamil-nadu/2020/Dec/19/shrimp-hatcheries-along-ecr-operating-without-crz-clearance-authorities-turn-blind-eye-rti-2238468.html

[44] Saravanan, personal interview, November 25, 2023.

to operate under the Air and Water Acts. It also revealed that hatcheries were releasing effluent waters into ecologically sensitive areas.[45] This NGT Suo Motu case on hatcheries unravels the struggle between the executive (also rifts within the executive) on one side and local representatives with environmental activists on the other. The tribunal appointed a joint committee to re-examine the allegations and submit factual and action taken reports. The Coastal Aquaculture Authority also produced an independent report. The committee plainly quoted the narration of representatives of hatcheries as truth without any due diligence. In one section, it said: 'Since the brooder, post larvae and algae are very sensitive to changes in water quality it was informed by the hatchery operators that they could not afford to use any chemicals including antibiotics."[46] Though the committee informed that the regulation of hatcheries is part of the responsibilities of the Coastal Aquaculture Authority, the independent report submitted by the Coastal Aquaculture Authority differed in this position and passed the ball to the MPEDA (the export agency). Also, it asserted that hatcheries had a free pass under the present coastal regulation: "... the establishment and operation of hatcheries was always and consistently been excluded/exempted activity from the prohibited activities in the CRZ areas."[47]

Pooja intervened in the case to challenge some of these arguments. Her application stated that prior clearance by the Coastal Aquaculture Authority is essential to establish and operate hatcheries. She quoted various provisions[48] to substantiate this point. The tribunal accepted her arguments in the verdict and asked the Coastal Aquaculture Authority to remove all the hatcheries that were operating in the prohibited zone along the coast of Pondicherry and Tamil Nadu. Further, it asked the authorities to 'ensure that there are no discharges of any chemical effluent in the "InterTidal Zone" affecting the health of intertidal life and also polluting the shore waters."[49] Yogeswaran,[50] the lawyer representing Pooja in the Suo Motu case, told us that the judiciary has not seen pertinent cases in relation to environmental concerns and the aquaculture sector, except these two cases: the above-mentioned Suo Motu case and S. Jagannath v. Union of India. For him, the main focus of both these cases was on zonation. In the latter, civil society representatives used the provisions in the Coastal Regulation Zone Notification, 1991, to argue that aquaculture farms should not be operating within 500 m of the High Tide Line. Likewise, by using provisions in the Coastal Regulation Zone Notification, 2011, and the Coastal Aquaculture Authority Act, 2005, the Suo Motu case argued that the No Development Zone and (landward) 200 m from the High Tide Line are off limits for hatcheries. He added that the burden of proof was the main reason for parties (who challenged the shrimp sector) not to enlarge the scope of court cases beyond zonation to pollution, antibiotic residues and adverse environmental changes.[51]

In the above Suo Motu case, the joint committee took two samples from the effluent treatment plants and gave a clean chit to the hatcheries – let us remember, these samples were taken during their informed visits.[52] A researcher who has experience in testing water samples and is part of a well-regarded college in Chennai, Tamil Nadu, shared that these results should be accepted with a pinch of salt, as staging sampling processes and data manipulation are practices that stakeholders follow when stakes are high.[53] The literature also substantiates this point. For example, Eban's work on drug regulation in India talks at length about data fudging (Eban, 2018). The Comptroller and Auditor General of India published an official document accusing the Coastal Aquaculture Authority of not taking appropriate actions based on their own test results.[54] The lack

[45] P. Kumar, and K. Saravanan, 'Below the radar: A case study of coastal aquaculture hatcheries in Chengalpattu and Villupuram districts, Tamil Nadu', Coastal Resource Centre, Chennai, 2020.
[46] Original Application No. 05 of 2021 (SZ) with Original Application No. 09 of 2021 (SZ), p. 5
[47] O.A. No. 05 of 2021 (SZ) with O.A. No. 09 of 2021 (SZ), p. 8
[48] From Coastal Regulation Zone Notification, 1991, case points of (1997) 2 SCC 87, S. Jagannath Vs. Union of India, and provisions in the Coastal Aquaculture Authority Act, 2005
[49] O.A. No. 05 of 2021 (SZ) with O.A. No. 09 of 2021 (SZ), p. 16
[50] Yogeswaran, personal interview, November 24, 2023.
[51] O.A. No. 05 of 2021 (SZ) with O.A. No. 09 of 2021 (SZ).
[52] O.A. No. 05 of 2021 (SZ) with O.A. No. 09 of 2021 (SZ).
[53] Researcher, personal interview, January 08, 2024. The name and affiliation of this researcher are withheld here as disclosing them may damage his career.
[54] Comptroller & Auditor General of India, Union Government (Civil) Compliance Audit Observations, Report No. 6 of 2020.

of availability of accredited data has pushed environmental activists to use zonation as their main argument in the courts in cases against aquaculture farms/hatcheries.

As a result, topics that are important to the working class, such as loss of livelihoods, pollution, soil erosion, health issues and environmental degradation, are subsumed under the zonation debate. Locals, civil society and environmental activists are at the heart of the debates on the regulation of the aquaculture industry in Tamil Nadu. Data on pollution, public health hazards (including AMR), and environmental changes are not yet actively included in these debates. On the one hand, the authorities set up by the State to regulate this industry are not living up to the expectations set by the provisions of various legislations. The supporters of this industry, on the other hand, desire to reduce the role of the State in their economy. These inequalities in the debates and actions taken or not taken by these authorities have greater consequences. As Yoganathan, a labour union leader from Thiruvarur district, told us, taking the example of Sengankadu hamlet, the fishers from Sengankadu hamlet petitioned the executive (at the Tahsildar and District Collector levels) on numerous occasions to take action against shrimp farms that were polluting the Muthupet lagoon and damaging their livelihoods. The total absence of response from the executive made desperate and unheard fishers intervene and damage the shrimp farms in order to preserve their fishing activities. About a hundred of them were implicated in sixteen different cases, and a section of them spent time in jail. This case illustrates how the executive was prompt in taking actions in favour of the shrimp industry and against the working class, whose livelihoods are directly endangered by the pollution of shrimp farms.[55]

Conclusion

Recent legislative adjustments show that the question of AMR regulation is getting some attention from the government of India. The AMR risk was highlighted in the 2023 report of the Coastal Aquaculture Authority, which states that "antibiotic usage in farm and hatchery operations has been a threat to the industry, especially during export."[56] Yet, although the Authority acknowledges its mandate "to take relevant measures to prevent the use of antibiotics in shrimp hatcheries and farms,"[57] it seems that until now it has confined itself to initiating a voluntary programme of issuing certificates of standards for antibiotic-free aquaculture.[58]

Indeed, this amendment could be seen as a starting point for more stringent regulation of AMR in aquaculture in India. The Bill seeks to prevent the use of antibiotics and pharmacologically active substances in coastal aquaculture. It introduces measures for analysing and preventing the risk of introducing or spreading harmful organisms such as viruses and bacteria within the coastal aquaculture unit. Though it was already part of the standards set by the Authority a few years ago, the CAA (Amendment) Act 2023 officially acknowledges it in the legislation and as a mission of the Coastal Aquaculture Authority 'to fix standards for all aquaculture inputs' (including antibiotics). The Act also assigns the agency the duty to "certify, monitor, regulate or prohibit coastal aquaculture inputs, including probiotics, therapeutants (...) as may be prescribed, for the prevention, control and abatement of detriment to the coastal aquaculture or coastal environment."[59] It remains to be seen whether the elevation of the antibiotics control issue in the hierarchy of norms will be accompanied by increased monitoring, or if this is only a token gesture addressed to the global market wary of AMR.

Many environmental activists are viewing this act adversely. The question of biosecurity or antibiotic governance is approached here primarily through the export lens. There are no microbe-level databases available to inquire into the ecological changes that are taking place because of this industry, and sewage treatment plants do not deal with microbes. By revising zonation, aquaculture actors will need less and less authorisation, even

URL : https://cag.gov.in/en/audit-report/details/112156

[55] Yoganathan, personal interview, June 07, 2023.

[56] Coastal Aquaculture Authority, Annual Report 2022-2023, p120. URL: https://www.caa.gov.in/annual_report.html

[57] Ibid. p. 161.

[58] Ibid.p. 130

[59] Coastal Authority (Amendment) Act 2023, Section 7, A iv.

if they are in sensitive coastal zones that were previously under compulsory licensing. For many, this act seeks to amend certain provisions of the Coastal Aquaculture Authority Act, 2005, to decriminalise offences in the name of 'promoting ease of doing business'.

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