From risk to resilience: Innovative crop insurance solutions for securing shrimp aquaculture in India

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Brackishwater aquaculture has emerged as a highly promising sector within the aquaculture industry due to its considerable development potential. India's extensive coastline offers substantial scope for brackishwater aquaculture, which remains underutilised despite its promise. The country has an estimated potential of 1.2 million hectares for brackishwater farming, of which only 155,598 hectares have been developed—representing just 12.96% of the total potential area (DoF, GoI, 2017).

Shrimp farming, in particular, is attractive due to its high market value and steady global demand. India ranks second in global shrimp production, with an output of 1.184 million tonnes, and exported approximately 711,000 tonnes of frozen shrimp in 2023, earning around USD 5.83 billion (MPEDA, 2023). More than 90% of shrimp production in India comes from small-scale farmers operating on holdings of less than two hectares (CAA, 2021), underscoring their key role in the sector.

Small-scale shrimp farmers in India face numerous challenges, including poor farm management, crop losses, low yields, limited resources, and a lack of access to credit or insurance. In addition, many continue to rely on unscientific practices and have limited exposure to innovative solutions that could support their resilience and growth (Ravisankar et al., 2020). The development of shrimp aquaculture in India has seen both significant achievements and major setbacks. In this context, the introduction of shrimp crop insurance is vital for mitigating risks, protecting livelihoods, and promoting stability and growth within the industry.

This article highlights the importance of crop insurance as a risk management tool against losses caused by disease outbreaks and extreme weather events in shrimp farming.

Risks associated with shrimp farming

Climate and Weather Risks: Shrimp farming is vulnerable to a range of climatic and weather-related risks, including floods, droughts, storm surges, heavy rainfall, extreme temperatures, and prolonged cloud cover. These

Training program on "Risk Management Survey and Loss Assessment in Shrimp Farming" held at ICAR-CIBA, Chennai

factors can severely disrupt farming operations. Over the past two decades, the frequency of extreme weather events has nearly doubled compared to the period from 1980 to 1999. Events such as cyclones and floods—including Nisha, Aila, Thane, and Phailin—have caused significant damage to shrimp farms along India's coastal regions (UNDRR, 2021).

Disease Risks: Disease outbreaks are a major threat to shrimp farming, with significant production losses and economic impacts. Key viral pathogens include white spot syndrome virus (WSSV), *Macrobrachium rosenbergii* nodavirus (MrNV), which causes white tail disease (WTD), infectious hypodermal and haematopoietic necrosis virus (IHHNV), and infectious myonecrosis virus (IMNV). In addition, microsporidian parasites such as *Enterocytozoon hepatopenaei* (EHP), bacterial pathogens like *Vibrio* spp., and disease syndromes such as white faecal syndrome (WFS) and running mortality syndrome (RMS) contribute to substantial losses. Annual production losses due to shrimp diseases are estimated at 34.4% (Patil et al., 2021).

Market volatility: Shrimp farming is highly sensitive to fluctuations in market prices, which can affect both profitability and long-term sustainability.

Financial challenges: Rising input costs, limited access to affordable credit, high interest rates, and increasing labour expenses present significant financial barriers for shrimp farmers.

Regulatory and policy changes: Changes in environmental regulations, international trade restrictions, import/export policies, and evolving standards for aquaculture practices can disrupt farming operations and increase the complexity of regulatory compliance.

Risk management strategies in shrimp aquaculture

Risk management in shrimp aquaculture involves a multifaceted set of strategies aimed at early detection and mitigation of threats to crop survival and market value. The risk assessment and management process comprises four key components: Risk perception, risk prioritisation, risk management, and risk communication.

The process typically starts with farm-level surveys and group discussions to identify potential risks. These are then analysed and categorised based on their likelihood and potential impact. Expert input is used to develop risk prevention and mitigation strategies at both individual and institutional levels.

Capacity building through training programmes, practical handbooks, and mobile applications supports effective communication and the adoption of best practices. These efforts collectively help to reduce risks and enhance the sustainability of shrimp farming (Anand et al., 2021).

Above, below: Training program on "Shrimp Crop Insurance and Loss Assessment" held at ICAR-CIFE, Mumbai.

Adaptation of better management practices and biosecurity measures

Implementing better management practices (BMPs) and biosecurity measures in shrimp farming (Fig. 1) is crucial for ensuring sustainability. BMPs should be adapted to suit different farming systems and local conditions, focusing on practical actions that are cost-effective and simple for small-scale farmers to adopt. These practices should address all stages, from pond preparation to shrimp health management. Farmer associations and cooperative groups can help improve compliance, enabling shared resources and better water management.

Educating farmers about BMPs and developing certification frameworks can promote widespread adoption, thereby sustaining economically viable shrimp production. Effective extension services and support systems, including national health programmes and diagnostic laboratories, are essential to improve awareness and biosecurity measures. These efforts help to prevent disease outbreaks and maintain long-term farm productivity and health (Poornima et al., 2022).

Contingency plans for risk management

Contingency planning in shrimp aquaculture involves comprehensive strategies covering disease management, environmental resilience, financial safeguards, emergency responses, and risk mitigation. Regular farm audits and bioeconomic scenario modelling strengthen these plans by forecasting potential challenges and enabling proactive adjustments. The use of advanced technologies and collaborative efforts further supports effective risk management. Together, these measures ensure the sustainability and resilience of shrimp farming operations in rapidly changing environments.

Insurance and risk management

Insurance plays a pivotal role in shrimp aquaculture by protecting farmers from a range of uncertainties, including disease outbreaks, extreme weather events, market price fluctuations, and operational disruptions.

- It provides a financial safety net by compensating farmers for losses, stabilising income, and supporting business continuity.
- It improves access to credit and strengthens the supply chain, thereby enhancing the overall resilience and sustainability of the shrimp farming sector.
- The initiative to reintroduce shrimp crop insurance was led by the Indian Council of Agricultural Research–Central Institute of Brackishwater Aquaculture (ICAR-CIBA), with support from the National Fisheries Development Board (NFDB), which offered a 20% premium subsidy.
- Under the Pradhan Mantri Matsya Sampada Yojana (PMMSY), ICAR-CIBA and NFDB have developed two shrimp crop insurance products in partnership with Oriental Insurance Company Ltd. (OICL) through Alliance Insurance Brokers Private Ltd., and with the Agriculture Insurance Company of India Ltd. (AICL).

Training program on "Shrimp Crop Insurance and Loss Assessment" held at ICAR-CIFE, Kolkata.

Significance of shrimp crop insurance

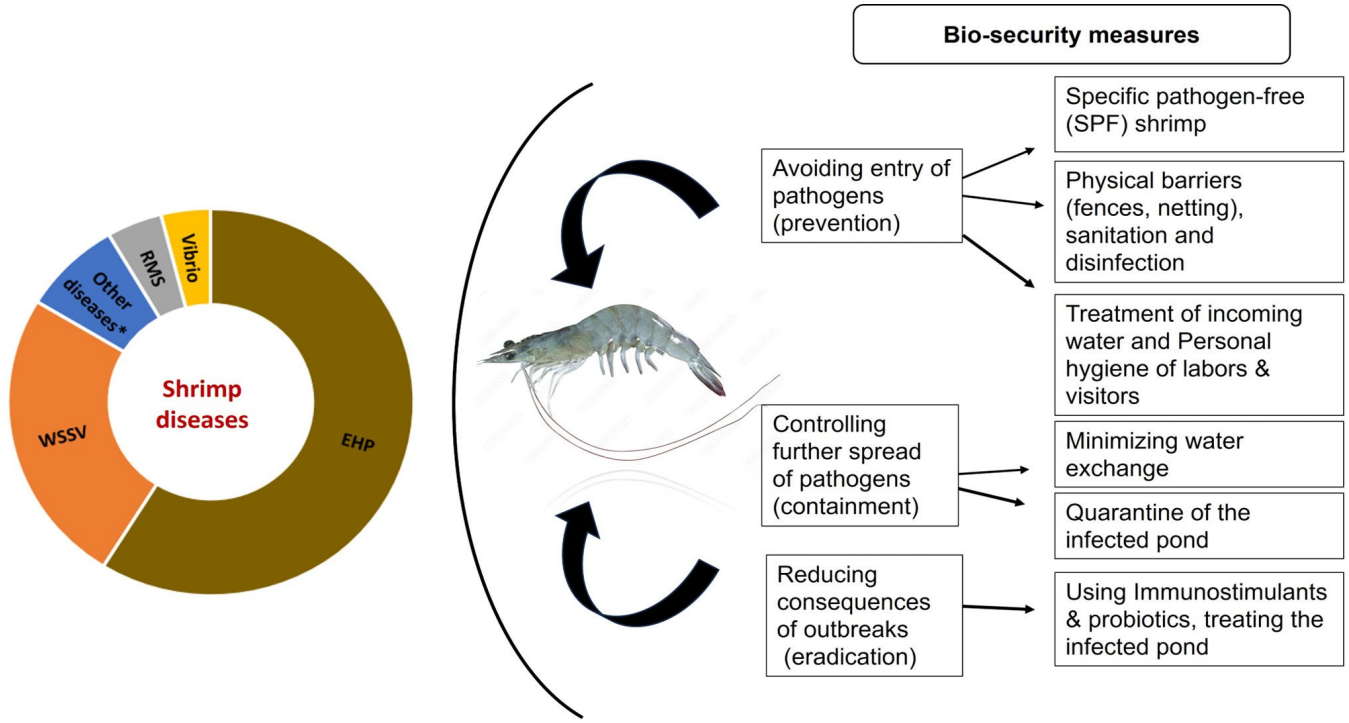
Risk management against extreme climatic events

Shrimp aquaculture is vulnerable to multiple risks, including disease outbreaks, adverse weather, poor water quality, and natural disasters. These can lead to substantial financial losses for farmers. Insurance serves as a risk mitigation tool by providing financial compensation when such events occur.

Investment protection

Insurance safeguards the considerable investments made in aquaculture infrastructure, helping to protect financial resources from unexpected losses.

Fig 1: Biosecurity in shrimp farming.



Market confidence

The availability of shrimp crop insurance boosts confidence among farmers and investors, encouraging further investment and expansion within the sector. This confidence also supports growth in related industries such as hatcheries, feed mills, and input supply chains.

Promoting sustainability

Insurance contributes to the long-term sustainability of aquaculture operations by enabling recovery from unforeseen setbacks. It also encourages the adoption of responsible and sustainable farming practices, which can help reduce both risk exposure and insurance costs.

SWOT analysis

A SWOT analysis was carried out to assess shrimp crop insurance, identifying key factors influencing its effectiveness and future potential. Strengths include strong government support and the provision of financial relief to farmers. However, weaknesses remain, such as relatively high insurance premiums and limited coverage scope. Opportunities lie in the use of advanced technologies and expanded farmer training initiatives. On the other hand, threats include the impact of natural disasters and changes in regulatory or policy frameworks. This analysis provides valuable insight into both the current status and the future development of shrimp crop insurance.

The details of the SWOT analysis are presented below.

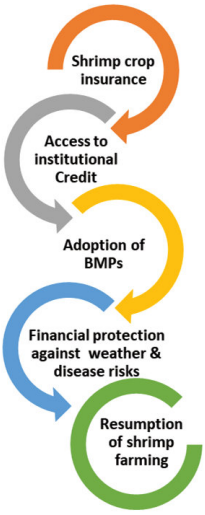
Strengths

- Financial support helps reduce economic losses caused by extreme climatic events and disease outbreaks.
- Sustainability is promoted through the adoption of better management practices.
- Farmers gain improved access to institutional credit.
- Strong government support through schemes such as PMMSY and PM-MKSSY.
- Technical guidance is available from ICAR-CIBA experts.

Weaknesses

- Shrimp farming is inherently risk-prone, making it vulnerable to falsified claims and moral hazards by unscrupulous individuals.
- Premium rates are relatively high.
- Insurance coverage is limited to specific periods.
- Disparities exist between farmers' expectations and the offerings of insurance providers.
- Lengthy and bureaucratic claims processes often lead to delays in payouts.

Fig 2. Significance of shrimp crop insurance.



- Shortage of fisheries professionals within insurance companies and limited understanding of the practical challenges faced by shrimp farmers.

Opportunities

- Use of technological advancements—such as remote sensing, artificial intelligence, and the Internet of Things—to improve risk assessment and streamline claims processes.
- Awareness and training programmes for farmers to increase understanding and uptake of insurance schemes.
- Public–private partnerships to design more comprehensive and affordable insurance products.

Threats

- Natural disasters and disease outbreaks can result in increased claims, driving up insurance costs.
- Changes in international and national regulations or policy frameworks may affect the stability and viability of the insurance market.

Challenges in implementing the shrimp crop insurance schemes

Key concerns faced by aquafarmers as insured policy holders

- **Record-keeping challenges:** Many farmers struggle to maintain detailed records of farming practices, often due to time constraints or a lack of awareness about the importance of documentation.
- **Low insurance literacy:** A significant number of shrimp farmers lack a clear understanding of insurance schemes, which limits their participation.

The Hon. Shri George Kurian, Minister of State, Ministry of Fisheries, Animal Husbandry and Dairying, Government of India, releasing new insurance product.

- **Need for comprehensive coverage:** Farmers seek broader and longer-term coverage, including protection for input costs and full compensation for losses. However, insurers generally cover only around 70% of the losses.
- **High premium rates:** Premiums for shrimp crop insurance typically range between 4% and 8.5%, which farmers consider too expensive.
- **Salvage value deductions:** Policies often deduct the estimated value of remaining stock from the final claim amount, placing an added financial burden on farmers.
- **Unilateral termination:** Insurance coverage is frequently terminated by insurers after a crop failure, raising concerns about continuity and trust.
- **Cumbersome procedures:** Farmers face difficulties navigating complex documentation, exclusions for named perils, and the requirement to notify insurers during emergency harvests.
- **Advocacy for subsidised coverage:** Given their significant contribution to national income, farmers are calling for more affordable, subsidised insurance options.

Strategies recommended for shrimp crop insurance schemes

Developing innovative insurance solutions for shrimp farmers requires a thorough understanding of the complexities of aquaculture operations across different regions. This includes recognising the diverse risks and challenges farmers face, as well as the technologies available to address them. Insurers must carefully assess factors such as site-specific characteristics, infrastructure, farm management practices, environmental conditions, disease prevalence, and surveillance systems.

Presenting this information in a structured, data-driven format allows producers to clearly convey their risk profile to insurers. This, in turn, supports the development of customised insurance products that reflect the specific needs of shrimp farming operations. By offering targeted coverage, insurers can help farmers manage risks more effectively, strengthening the resilience of the aquaculture sector and supporting its sustainable growth.

Major concerns faced by insurers

- **Shortage of technical expertise:** Many insurance companies lack fisheries specialists and have limited knowledge of modern aquaculture systems, making accurate claim assessment challenging.
- **Moral hazards and claim authenticity:** Insurers are concerned about the authenticity of claims and the risk of moral hazard, which could result in significant financial losses.
- **Quantifying climate and disease risks:** Accurately assessing the impact of extreme weather events, epidemics, and emerging diseases is difficult. This complicates risk modelling and the development of standardised premium rates.
- **Operational challenges:** High demand for skilled personnel, elevated operational costs, and the difficulty of collecting premiums from a large number of farmers create logistical and financial burdens.
- **Lack of trained assessors:** The shortage of qualified assessors hinders effective risk evaluation and the proper implementation of BMPs, increasing farms' vulnerability.
- **Diverse risk profiles:** The wide variation in risk profiles among farms makes it difficult to design standardised insurance products that meet the needs of all stakeholders.

- **Complex scheme management:** Administering the scheme—including premium collection and timely claims processing—adds significant complexity to insurance operations.

Strategies for safeguarding insurers' interests

Bankers and insurance officials should routinely review water quality reports submitted by farmers throughout the culture cycle. Particular attention must be paid to significant fluctuations in parameters such as dissolved oxygen, pH, and salinity. Determining whether these changes result from farm management practices or abrupt climatic variations is essential, as such shifts act as stressors and potential triggers for disease outbreaks.

These observations are vital for the effective implementation of shrimp crop insurance. To mitigate disease-related risks, insurance providers should require all insured farmers to adopt BMPs and follow established biosecurity measures.

Implementation of shrimp crop insurance in India

During its initial phase (1991–1995), shrimp aquaculture insurance in India encountered major setbacks due to outbreaks of WSSV. These outbreaks led to unsustainable compensation payouts and moral hazard issues globally. The programme failed largely due to inadequate risk assessment and poor classification of farmers, which discouraged insurers from further participation.

The situation changed in 2009 with the introduction of Specific Pathogen Free (SPF) *Penaeus vannamei* shrimp. This development renewed optimism and led countries such as India, Vietnam, and Bangladesh to revisit shrimp insurance, with products better tailored to support farmers under evolving industry conditions.

In India, ICAR-CIBA, in collaboration with the NFDB, led efforts to reintroduce shrimp crop insurance under the PMMSY. This initiative involved partnerships with both national and international insurance brokers, as well as public and private insurers, to re-establish crop insurance in the shrimp sector.

ICAR-CIBA provided technical support for the development of a new shrimp crop insurance product with OICL, through Alliance Insurance Brokers Private Limited, in 2020. Based on scientific input, the product was formally registered by OICL with the Insurance Regulatory and Development Authority of India (IRDAI) in 2022. It was launched nationally at ICAR-CIBA, Chennai, in February 2022.

Additionally, in 2023, ICAR-CIBA supported the AICL in developing a second shrimp insurance product, following the signing of a Memorandum of Understanding with NFDB in February 2023. ICAR-CIBA also undertook implementation of the PMMSY pilot project on crop insurance in Tamil Nadu, Andhra Pradesh, and Gujarat.

During 2023–24, OICL and AICL jointly insured a total of 588 hectares of shrimp farms in Andhra Pradesh and Tamil Nadu. The total insured input cost amounted to ₹147.7 million. Farm sizes ranged from 1 to 9 hectares, covering both small- and large-scale shrimp farming operations.

ICAR-CIBA Initiatives in Risk Management and Capacity Building

ICAR-CIBA has played a key role in strengthening risk management and loss assessment capabilities in shrimp farming through a range of targeted training programmes. Notable initiatives include:

- **Training Workshop on Risk Management**:
  Held from 1st–3rd March 2023, this workshop on "Risk Management in Shrimp Farming" was attended by 26 participants, primarily from the Agricultural Insurance Company, representing the insurance sector.

- **National Consultative Workshop on Aquaculture Insurance Product Development:**
  Organised on 13th April 2024, this workshop brought together around 50 delegates, including officials from the Ministry of Fisheries (Government of India), World Bank representatives, NFDB officials, major insurance companies, progressive farmers, and leading scientists.

- **Certificate Course on Risk Management, Survey, and Loss Assessment in Shrimp Farming:**
  Conducted in collaboration with ICAR-Central Institute of Fisheries Education (ICAR-CIFE), this five-day course was held at three locations:

  - ICAR-CIBA, Chennai (19–23 February 2024) with 40 participants
  - ICAR-CIFE, Mumbai (29 April–3 May 2024) with 22 participants
  - ICAR-CIFE, Kolkata (5–9 August 2024) with 45 participants

In total, 183 participants—including insurance professionals, industry experts, state fisheries officials, aquaculture consultants, farmers, and students—attended these programmes. These initiatives have been highly effective in raising awareness of risk management, shrimp crop insurance, and loss assessment. They have equipped participants with the necessary skills to serve as competent loss assessors and have contributed to strengthening the resilience of the shrimp farming sector.

Trail to progress – the pathway

Managing the complex risks inherent in aquaculture requires advanced underwriting expertise that combines in-depth knowledge of business operations with technical proficiency in shrimp and fish farming. The active involvement of key stakeholders and the establishment of a strong governance framework are essential for the long-term success and efficient implementation of aquaculture crop insurance schemes for both shrimp and fish farmers.

The aquaculture crop insurance initiative under the PMMSY seeks to mitigate risks for fishers and farmers, encourage investment, and enhance national food security. However, challenges such as limited data availability, low awareness, adverse selection, and administrative barriers continue to constrain its effectiveness.

In response, the Union Cabinet has approved the Pradhan Mantri Matsya Kisan Samridhi Sah-Yojana, a Central Sector Sub-scheme under PMMSY. This initiative aims to formalise the fisheries sector and support micro and small enterprises, with a total investment of over ₹60 billion for the period from FY 2023–24 to FY 2026–27, covering all States and Union Territories. A key focus of this scheme is the development of aquaculture crop insurance, for which standard operating procedures are currently being prepared.

Reinsurance—essentially insurance for insurers—plays a critical role by enabling insurers to transfer a portion of their risk and premiums to other entities. This approach helps to diversify risk exposure and provides an alternative to equity or debt financing, with reinsurers assuming responsibility for all covered losses.

In shrimp aquaculture, crop insurance typically covers only the shrimp stock, excluding farm infrastructure and related assets. Extending insurance coverage to include infrastructure and assets is essential for comprehensive risk management, helping to strengthen the resilience and long-term sustainability of shrimp farmers.

Creating a centralised database is crucial for the development of tailored insurance products. This database should include detailed information on aquaculture production systems, farm financial records, disease occurrences and treatments, as well as weather-related data. Agricultural insurance professionals and farmers should have access to this resource to facilitate informed decision-making.

The Ministry of Fisheries, Animal Husbandry and Dairying, Government of India, should establish a specialised team of aquaculture insurance experts. This team would provide technical support and training to agricultural insurers, covering critical areas essential to effective aquaculture risk management.

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